
MASTER'S DEGREE IN BIOMEDICAL ENGINEERING

Faculty of Sciences and Technology
University of Coimbra

# SOFTWARE FOR CLINICAL DATA INTERACTION

Dissertation presented to the Faculty of Sciences and Technology, Coimbra University in order to acquire the degree of Master in Biomedical Engineering, performed under the supervision of Eng. Paulo Barbeiro from BlueWorks© and advisory of Prof. Bruno Carbal from Department of Informatics Engineering, Faculty of Sciences and Technology, Coimbra University.

Pedro Gonçalves – Coimbra, 2013


Project developed at BlueWorks© - Medical Expert Diagnosis

*In dedication to my Mother*

"I am always doing that which I cannot do,
in order that I may learn how to do it"

*Pablo Picasso*

## Acknowledgements

This project would not have been possible without the support of many people, to whom I would like to express my deepest gratitude and consideration:

First of all, I would like to show my gratitude to the creator and supervisor of this project, Eng. Paulo Barbeiro, for his help and dedication to the project, for his advices and remarks and for his constant attempt to try and help me the best way he possible could.

Furthermore, I would like to express my gratitude to the project adviser, Prof. Bruno Cabral, for his help in overcoming the obstacles along the way and for being a light in the darkest hours.

To everyone at BlueWorks (and Quantific), I am due my appreciation for the warmfull welcoming. Regarding only this project, I would like to point out someone in particular, Eng. Armanda Santos, for her help towards software integration.

Last but not least, my deepest gratitude goes to my family and friends, for all their concern and support. An honorable mention is due to my mother, my life role model, for making my academic journey possible, for believing in me and to whom I dedicate my thesis. And, of course, to Sara Liliana, for being part of my life and for being there, whenever, wherever and whatever, always.

# Contents

# Figure List

# Table List

# Abbreviation List

| | |
|---|---|
| **AJAX** | Asynchronous JavaScript and XML |
| **API** | Application Programming Interface |
| **BW** | BlueWorks |
| **CSS** | Cascading Style Sheets |
| **DBMS** | Database Management System |
| **FTP** | File Tranfer Protocol |
| **HTTP** | Hypertext Transfer Protocol |
| **ICD** | International Classification of Diseases |
| **JPA** | Java Persistence API |
| **MP** | Monitoring Program |
| **MVC** | Model View Controller |
| **NHS** | National Health Service |
| **ORM** | Object Relational Mapping |
| **REST** | Representational State Transfer |
| **RPC** | Remote Procedure Call |
| **SOAP** | Simple Object Access Protocol |
| **SSL/TLS** | Secure Socket Layer/Transport Layer Security |
| **UML** | Unified Modeling Language |
| **WSDL** | Web Services Description Language |
| **XHTML** | Extensible HyperText Markup Language |
| **XML** | Extensible Markup Language |

# Abstract

Ophthalmology is one of many medical fields that suffer from a poor worldwide resource distribution. While Portugal has approximately 69 ophthalmologists *per* million inhabitants, there are dozens of countries with only 1 ophthalmologist *per* million inhabitants. It was this project's goal to build a prototype of a web application to better distribute these ophthalmic resources between countries. The application focused a potential business opportunity from BlueWorks, the creator and host of this project, to provide remote medical exam review to a specific country.

The application focused the monitoring program of patients. A monitoring program is a follow up of a disease or condition to evaluate how it is evolving, thus defining which exams will the patient be submitted to and the time gap between examinations. These exams must be evaluated trough a medical consultation with a physician; however, most of the times the disease/condition is stable or following the usual pattern for the disease/condition, which renders the consultation unnecessary. Therefore, these exams are to be evaluated by a foreign physician (using this web application) and he will report whether a consultation is required (due to abnormalities in the evolutionary path of the disease or condition) or it isn't (disease is stable), in order to try and reduce the work load from these countries with few ophthalmologists.

The application was developed using Jboss Seam, a Java WAF (Web Application Framework), deployed on Jboss AS (Application Server) and connected to the DBMS (Database Management System) PostreSQL. The exams were imported into the application (for further review by a foreign ophthalmologist) by integrating OphthalSuite, a software product from BlueWorks that acquires medical exams due to its compatibility with dozens of diagnostic equipment. The integration of OphthalSuite with this application was allowed by Web Service and FTP (File Transfer Protocol) technology.

By the end of this project, an application with all of the imposed requirements was accomplished. The final application was validated by submitting it to Scenario tests, based on said requirements.

# 1 Introduction

This first chapter addresses the motivations, entities and objectives behind the project. Firstly, the company that created and hosted the project is presented. The motivations and reasons to why was created are presented in the following section. Then, a section is dedicated to the business process of this project. Finally, the project objectives and the document structure of this thesis are described.

## 1.1 Host Entity

The following project was developed at BlueWorks – Medical Expert Diagnosis©, a Portuguese technological company whose main purpose is to create and develop technological solutions to aid in clinical practice, investigation and clinical trials [1].

### 1.1.1 OphthalSuite

OphthalSuite® is BlueWork's main product, a solution created to aid ophthalmologists in their daily tasks. With dozens of integrated diagnostic equipment, OphthalSuite® allows digital access to any acquired exam, in real time and with guaranteed image/video quality. Besides this exam acquisition/view core, OphthalSuite® is also equipped with Business Intelligence and request-response management features [2].

## 1.2 Motivation

Health System is an organization of people, institutions and resources to deliver health care services to meet the health needs of target populations [3]. The *National Health Service (NHS)* is the official name of the United Kingdom's Health System. In Portugal, the Health System is named *SNS – Serviço Nacional de Saúde.*

This project derives its purpose from a potential business opportunity discussed with BlueWorks© - to provide remote medical diagnosis to the United Kingdom. The United Kingdom has one of the lowest ophthalmologist-to-population *ratio* in the entire European Union – approximately 52 ophthalmologist per million inhabitants – and there are advantages in rerouting some of the work from the United Kingdom to other countries. Therefore, the *NHS* is interested in having foreign ophthalmologists seeing medical exams from Britain patients, in what is commonly called a reading center, and for a platform that allows them to do it.

The following graphic (Figure 1) displays the ophthalmology workforce European-wide [4]: the United Kingdom holds one of the lowest positions.

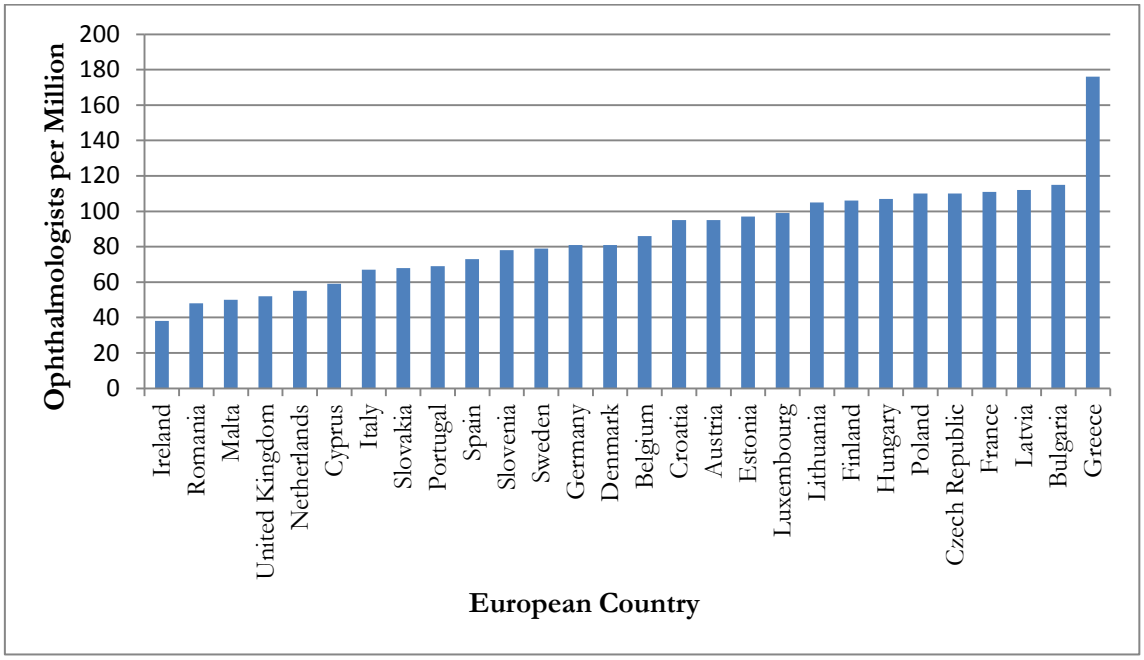


***Figure 1 - Graphic representation of ophthalmologists per million inhabitants in European countries.***

On the other hand, Portugal has approximately 69 ophthalmologists *per* million inhabitants [4], about 32% more ophthalmologists *per* inhabitant than Britain. These Portuguese ophthalmologists would be the ones to access this application and evaluate the exams for the United Kingdom.

Besides this need from the *NHS*, the reading-center could be used in other countries, for instance, Mozambique and Angola – about 1 ophthalmologist *per* million inhabitants. These African countries have a major need for ophthalmic consultation and this application can provide them with a remote one.

| Country | Ophthalmologists per Million |
|---|---|
| Angola, Botswana, Burkina Faso, Central African Republic, Comoros, Ethiopia, Gambia, Guinea-Bissau, Lesotho, Mozambique, Namibia, Papua New Guinea, Rwanda, Sierra Leone, Swaziland, Tanzania, Uganda, Zambia | 1 |
| Djibouti, Ghana, Guinea, Kenya, Liberia, Madagascar, Mali, Mauritania, Zimbabwe | 2 |
| Benin, Cambodia, Cameroon, Equatorial Guinea, Ivory Coast (Côte d'Ivoire), Myanmar, Nigeria, Sudan, Togo, Yemen | 3 |
| (…) | (…) |
| Bulgaria | 115 |
| Cuba | 136 |
| Greece | 176 |

***Table 1 - Worldwide countries with the most and the fewest ophthalmologists per million population***

The previous table (Table 1) holds the records for the highs and lows of ophthalmology workforce worldwide [4]: there are a huge number of countries with a deficit of ophthalmologists.

This application could also be used within the country, in order to share resources between different medical facilities, leading to a better overall performance. Although this project is focusing

ophthalmology, with further work it can be easily adapted to other medical specialties, allowing all the former advantages to be carried on to all medical fields.

Finally, building such an application would require integration with several diagnostic equipment in order to import medical exams; however, OphthalSuite is a software that already integrates several diagnostic equipment itself, being only required to integrate it in the application.

## 1.3 Business Process

In order to describe the project's business process, a set of definitions is required to designate its partakers:

- **Physician** is the health care provider who practices the profession of medicine. Since the application will be dedicated to ophthalmology, physician and ophthalmologist carry the same meaning.
- **Technician** is the health care professional that will be performing the medical exams. A technician can either be an optometrist or any other personnel able to perform the exams.

There are several diseases and conditions in ophthalmology that require monitoring to evaluate how the condition or disease is evolving. However, this regular evaluation only requires the patient's exams to be evaluated. This follow-up of a disease or condition will be referenced as a monitoring program.

- **Monitoring Program** is a specification to a follow-up of a disease or condition. Therefore, each monitoring program defines which exams should be performed and the time gap between them. Each accomplished set of medical exams will be called a session. Since the National Health System is responsible for the definition of these monitoring programs, they can change from country to country.

An afflicted patient must perform these required exams from time to time and a technician is required to do them; however, after the technician finishes the examination, the patient still needs to schedule a medical appointment with a consultant ophthalmologist to have these medical records evaluated. Most of the time, the evolution is following the usual patterns for the disease, and the consultation wasn't even required. Having a scarce ophthalmic consultant workforce, decreasing the number of these consultations is in the interests of the NHS.

The objective of this project is to create a similar online process: after the technician finishes all the exams, they are instead exported to the platform to be evaluated. This exam evaluation, however, is now carried out by foreign physicians. It is, now, necessary to implement new definitions:

- **Local Physician** is the physician from the country where there is a scarce of ophthalmologist consultants.
- **Remote Physician** is the foreign physician that will be accessing this web application in order to review the exams.

By evaluating the exams, the remote physician can determine whether the patient really needs a consultation or he doesn't, *i.e.*, whether the exam shows abnormal evolution for the disease or the disease is stable. If the disease is following unregular paths, the patient will still be forwarded to a local physician, but if it isn't, a consultation is not required, decreasing the number of consultations performed by the physicians in the United Kingdom.

There is also another entity that is connected to this application – patient services coordinator. A patient services coordinator is the link between the patient and the healthcare provider; he is required to manage personnel, patients and equipment to provide a transparent workflow within the facility. However, this entity will be external to the application, i.e., this prototype will not provide any integration or support for patient consultation/examination scheduling – that is the responsibility of the respective facility and patient service coordinator.

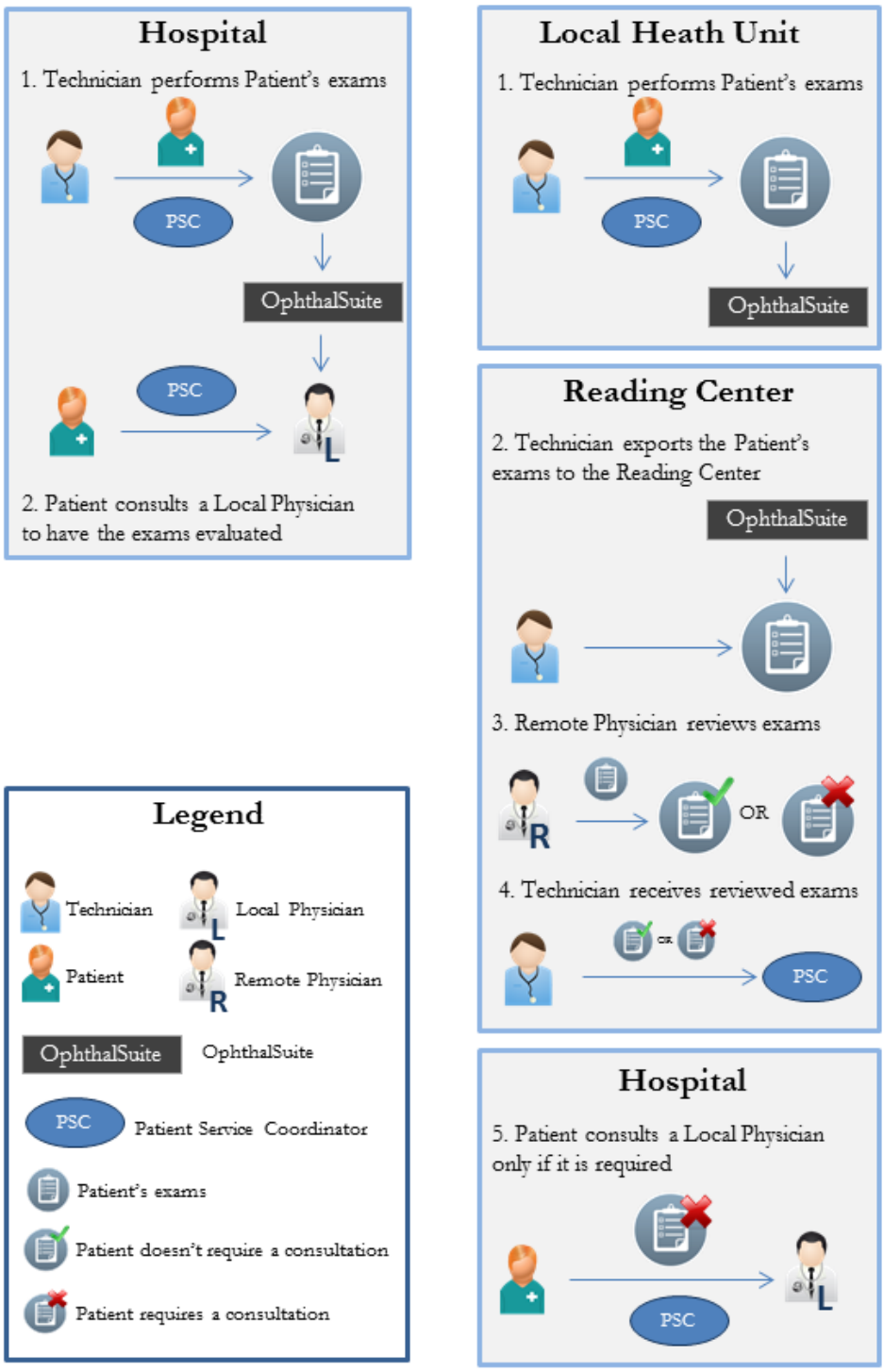


***Figure 2 - Business process differences from before (left side) to after (right side) the reading center implementation***

The previous figure displays the differences in the business workflow from before (left side) to after (right side) the reading center implementation.

## 1.4 Objectives

The present work defines the implementation and design of a web-based reading-center to allow remote medical diagnosis dedicated to the field of ophthalmology. More specifically, this application will aim the needs for ophthalmic consultation in the United Kingdom. The main goals of this project are:

- Define the application's requirements
  - What the application will do
  - How will the application work and behave
  - Who will intervene with the application and how
- Define, choose and study the necessary tools to create the application
- Create an application prototype according to the defined requirements
- Test the application prototype with Use Case Scenarios based on the defined requirements.

The objective of this project is not to create a deploy-ready application, but a working prototype to be improved by BlueWorks.

## 1.5 Document Structure

Once the background is set, the application's definition and implementation shall be addressed in the ongoing chapters, according to the following structure:

- **Chapter 2 - Planning:** This chapter will address how the project was structured and planned, what was done – regarding what was planned - and the associated implementation risks.
- **Chapter 3 – Requirement Analysis:** Functional, non-functional requirements and the application partakers will be address in this chapter.
- **Chapter 4 – Architecture:** Chapter dedicated to how the application should be structured and how it should behave.
- **Chapter 5 – Implementation:** The major implementations steps are described in this chapter; the requirement answers and architecture implementation will be briefly discussed.
- **Chapter 6 – Validation:** Functional requirements, non-functional requirements and architecture were validated by subjecting the application to the document tests presented in this chapter.
- **Chapter 7 – Conclusions:** This chapter will address the one year's work impact on the author. Additionally, being a prototype as it is, the application won't be ready to use; therefore, the future work is also presented in this chapter.

# 2 Planning

This chapter covers the project planning. The first section includes the project planning methodology: project major deadlines, management system and project interveners. The second section describes the project's risks and mitigations strategies.

## 2.1 Methodology

Firstly, the project interveners include the author, as the project developer, Eng. Paulo Barbeiro, as project supervisor, and Prof. Bruno Cabral, as project adviser.

JIRA [5], software for issue and project tracking, was the main management system used throughout the project development. However, the main deadlines are to be presented below:

| Step | Start | End | Days |
|---|---|---|---|
| Define the Project | 01/10/2012 | 31/10/2012 | 19 |
| Business rules | - | - | - |
| Business process | - | - | - |
| User cases and roles | - | - | - |
| Functional requirements | - | - | - |
| Non-Functional requirements | - | - | - |
| Prepare the Project | 01/11/2012 | 30/11/2012 | 17 |
| Learn how web applications may be created | 01/11/2012 | 08/11/2012 | 5 |
| Choose an application language | 12/11/1012 | 12/11/2012 | 2 |
| Choose a web application framework | 15/11/2012 | 21/11/2012 | 5 |
| Install the selected web application framework and application server | 22/11/2012 | 29/11/2012 | 5 |
| Create Database | 03/12/2012 | 22/12/2012 | 12 |
| Install a database management system | 03/12/2012 | 03/12/2012 | 1 |
| Create the application's database | 04/12/2012 | 17/12/2012 | 8 |
| Integrate the database with the application | 18/12/2012 | 20/12/2012 | 3 |
| Web Development/Software Engineering | 01/02/2013 | 28/02/2013 | 20 |
| Learn web development techniques | - | - | - |
| Learn the required APIs and software engineering techniques | - | - | - |
| Learn to use the web application framework | - | - | - |
| Learn how to create web interfaces | - | - | - |
| Create the Application | 1/03/2013 | 31/05/2013 | 54 |
| Local physician module (create interface, implement business rules and requirements, create and document tests) | 1/03/2013 | 12/03/2013 | 8 |

| | | | |
|---|---|---|---|
| Technician module (create interface, implement business rules and requirements, create and document tests, create web service client and ftp client) | 13/03/2013 | 09/04/2013 | 15 |
| Remote physician module (create interface, implement business rules and requirements, create and document testes, create image servlet) | 10/04/2013 | 23/04/2013 | 10 |
| Administrator module (create interface, implement business rules and requirements, create and document tests) | 24/04/2013 | 17/05/2013 | 11 |
| Security (authentication, authorization, encrypt passwords, implement https, create and document tests) | 20/05/2013 | 31/05/2013 | 10 |
| Write the Project Thesis | 3/06/2013 | 28/06/2013 | 20 |

***Table 2 - Project planning***

Throughout this project's lifecycle, the planning was entirely fulfilled. However, the time plan was ambitious regarding the amount of work and hours required to develop the application, which led to an extend of the deadline to the special period for thesis defense. As an example, developing an entire application, submitting it to tests, documentation and integrating it with all the required technologies couldn't be done in approximately 50 days, as suggested in the planning.

## 2.2 Implementation Risks

The implementation risks are to be addressed in this section; each risk is evaluated in a 3 option scale (low, medium, high) in terms of occurrence probability and project impact, and followed by a possible mitigation strategy.

**Risk 1 –** The application may contain bugs or unexpected code errors.

- **Occurrence Probability -** Low
- **Project Impact –** Medium
- **Mitigation Strategy –** The tests performed to the application should be as thorough as possible in order to prevent these unexpected bugs.

**Risk 2 -** The application may contain less correct solutions due to the developer's nonexistent experience and knowledge on the software engineering techniques and technologies.

- **Occurrence Probability –** High
- **Project Impact –** Medium
- **Mitigation Strategy –** Gather and consult documentation and practical examples regarding the technologies and techniques. Spend time learning and experimenting these technologies and techniques

# 3 Requirement Analysis

This chapter describes the functional and non-functional requirements of this application. Since these requirements will be separated by user role, the chapter will also cover the several users that will interact, and how, with the application, giving them roles and responsibilities.

## 3.1 User Roles and Responsibilities

Regarding this application, 4 user types have been defined and the user roles and responsibilities will be addressed according to this division.

### 3.1.1 Local Physician

Local Physician is the one that decides whether any of his patients will start the monitoring process of a certain disease using this application, inserting the respective patient in the application.

The local physician must define which monitoring program the patient will be assigned to and what is the initial status of the patient – the diseases and conditions the patient has when he enters the monitoring program. The local physician will only be seeing the patient again if any abnormality or sudden change to the patient's condition occurs throughout the monitoring process, *i.e.*, if a remote physician decides that the patient requires a full medical consultation, at which point he may update the patient's active diseases.

### 3.1.2 Technician

The technician will be performing the required medical exams to each patient and export them from the acquisition software to the application. After the evaluation on the new exams, the technician will then receive a notification relating the patient – the patient needs (or he doesn't) a full medical consultation – that he will redirect to the Patient Service Coordinators.

### 3.1.3 Remote Physician

On the other side of the platform, a remote physician will be comparing the current exams with the ones produced in the previous session. By comparing the 2 sessions, he has to determine if the patient requires a consultation. To reach this verdict, he will be provided with all the relevant information on the patient – age, current condition - and time gap between the two exam sessions.

A remote physician can only review exams from specific monitoring programs that he has been registered on.

### 3.1.4 Administrator

The system administrator is responsible for:

- Maintenance: Keep the application running, solve problems, etc.
- Data analysis: The data analysis comprehends both the overall performance of the system (*e.g.* total processes on hold, total processes diagnosed) and the singular performance (*e.g.* physician productivity).
- Billing information: Refers to the printing of information to aid the billing process.
- Accountability: Accountability is the ability to identify the authors of all modifications, insertions and deletions on the database.

The administrator will be inserting all registrations from technicians and physicians into the database – open registrations are not an option. He will also create the monitoring programs, since they have standard parameters defined by the Health System (exams required and time between sessions). Obviously, and within the contractual restrictions concerning patient confidentiality, the administrator has access to all information concerning patients, technicians, physicians and exams exported to diagnose.

## 3.2 Functional Requirements

Functional requirements describe the behavior of the system: what the system is supposed to accomplish. They may include technical details, data manipulation and processing or even calculations [6]. These requirements have been separated by user type (user role), allowing a better understanding of each user's permissions and functions. The most complex requirements are briefly explained after the requirement table of each user type.

### 3.2.1 Local Physician

| Functional Requirements | | Description |
|---|---|---|
| **FR1** | | **User must be able to insert a patient** |
| | FR1.1 | Patient must have first name, last name, country, birthdate, health system number and an "enabled" attribute |
| | FR1.2 | Patient must be automatically "enabled" on insert |
| | FR1.3 | Patient's country should be automatically assigned to the user's country |
| | FR1.4 | None of the input fields should be empty |
| | FR1.5 | All input fields must be character capped |
| | FR1.6 | Health system number must be valid and unique |
| | FR1.7 | Birthdate must be valid (between a valid gap) |
| **FR2** | | **User must be able to select a patient for editing** |
| | FR2.1 | Only local physicians from the institution from where the patient was inserted have access to the patient |
| | FR2.2 | Multiple patients can be selected at any time in different tabs |
| **FR3** | | **User must be able to request a patient modification on selected patient** |

| | | |
|---|---|---|
| | FR3.1 | Choose which field(s) to change and respective modification(s) |
| | FR3.2 | New Health system number must be valid and unique |
| | FR3.3 | None of the field should be empty |
| | FR3.4 | All input fields must be character capped |
| | FR3.5 | New Birthdate must be valid (between a valid gap) |
| | FR3.6 | A justification is required |
| | FR3.7 | Justification can't be empty and must be character capped |
| | FR3.8 | At least one field must be changed |
| | FR3.9 | Country must not be changeable |
| | FR3.10 | Patient cannot have more than 1 modification request on hold |
| **FR4** | | **User must be able to add monitoring program to selected patient** |
| | FR4.1 | Select one of the available monitoring programs |
| | FR4.2 | Available monitoring programs must be from the patient's country |
| | FR4.3 | Available monitoring programs must not be assigned to the patient already |
| | FR4.4 | "Disabled" patients can't have their monitoring programs changed |
| **FR5** | | **User must be able to remove monitoring program from selected patient** |
| | FR5.1 | Select one of the available monitoring programs |
| | FR5.2 | Available monitoring programs are the patient's current monitoring programs |
| | FR5.3 | A justification is required |
| | FR5.4 | "Disabled" patients can't have their monitoring programs changed |
| | FR5.5 | Justification can't be empty and must be character capped |
| **FR6** | | **User must able to add ICD classification to selected patient** |
| | FR6.1 | Select one of the available ICD classifications |
| | FR6.2 | Available ICD Classifications must not be assigned to the patient already |
| | FR6.3 | "Disabled" patients can't have their ICD Classifications changed |
| **FR7** | | **User must be able to remove ICD classification from selected patient** |
| | FR7.1 | Select one of the available ICD classifications |
| | FR7.2 | Available ICD Classifications are the patient's current ICD Classifications |
| | FR7.3 | A Justification is required |
| | FR7.4 | Justification can't be empty and must be character capped |
| | FR7.5 | "Disabled" patients can't have their ICD Classifications changed |
| **FR8** | | **User must be able to change/add text diagnosis of selected patient** |
| | FR8.1 | Text diagnosis can be empty |
| | FR8.2 | Text Diagnosis must be character capped |
| | FR8.3 | "Disabled" patients can't have their text diagnosis changed |

***Table 3 - Functional requirements related to the user type: local physician***

A local physician has to insert patients (FR1) and manage the patients that are currently in the application. Patients have an "enable" attribute to allow the complete disable of all patient related actions; this was ought to cover for patient decease or patient remove from the application. Patient modification requests (FR3) are used to overcome possible insertions mistakes. These requests must be approved by an administrator before they take effect; open editing of the patient's basic information had to be avoided to unsure patient identity at all times: one cannot simply change the entire patient information (NHS number, name…) trying to wrongly confuse the system. A patient can only have 1 modification request on hold at any given time: there is no point in asking a modification on information that was already marked to change.

In order to initiate the patient on a monitoring program, the local physician has to add him to one the available ones (FR4); although adding monitoring programs to one patient is the common workflow of the business process and doesn't require any justification to do so, removing them (FR5) is different: there should be an underlying reason to remove a monitoring program from a specific patient (mistake while adding monitoring programs, disease or condition will not be followed using this application anymore…) and this justification must be recorded on the removing action.

The patient's diagnostic information is based on 2 options: ICD classification (FR6 and FR7) and open text diagnosis (FR8). While text diagnosis is open for editing, the ICD classifications follow the same line of thoughts used in the monitoring program assign: adding doesn't require a justification while removing does.

### 3.2.2 Technician

| Functional Requirements | Description |
|---|---|
| **FR9** | **User must be able to insert a session to diagnose** |
| FR9.1 | Session must have a patient, a user (that inserted the session), a status, a monitoring program and a timestamp of when it was inserted |
| FR9.2 | Session's patient cannot be "disabled" |
| FR9.3 | Session's patient must be assigned to the session's monitoring program |
| FR9.4 | Session must have one exam for each exam type required by the monitoring program |
| FR9.5 | Exams must be acquired from OphthalSuite |
| FR9.6 | Exams must have exam type, exam date, external ID (exam ID from OphthalSuite), and the target eye (right, left, both, none) |
| FR9.7 | Each exam may have any number of results |
| FR9.8 | Results must have external ID (result ID from OphthalSuite), target eye (right, left, both, none) and size (height and width – for presentation concerns) |
| FR9.9 | Session can only be inserted a certain amount of time after the patient's last session (can have a tolerance), as defined by the monitoring program |
| FR9.10 | Additional info regarding the session can be inserted and must be character capped |
| FR9.11 | An insert option must be selected (to Review or Update) |
| FR9.12 | A session can only be inserted "to Review" if there is a previous session to compare to |
| FR9.13 | Exams and Results must be acquired from BlueWork's web service |
| FR9.14 | Images must be acquired form BlueWork's FTP server |
| **FR10** | **User must be able to review all session inserted by him** |
| FR10.1 | A list of each technician's inserted sessions must be presented to him |
| FR10.2 | There must also be a possibility to search for his sessions (all session attributes may be searchable) |
| FR10.3 | The result list must be sortable and filterable |
| FR10.4 | Each result may be expanded to show the entire associated information (session, patient, monitoring program and diagnosis information) |
| FR10.5 | A PDF report of each session status and related information may be downloaded |
| **FR12** | **User must be able to delete a session** |
| FR12.1 | A technician may delete one of his sessions within a limited time frame |

| | |
|---|---|
| FR12.2 | A justification is required and must be character capped |
| FR12.3 | Session can only be deleted if it has not been diagnosed or is being reviewed |

***Table 4 - Functional requirements related to the user type: technician***

Technicians are required to insert each patient's sessions into the application (FR9). Each session must be related to a patient and a monitoring program - the monitoring program defines the required exam types and the amount of time between the patient's sessions; therefore, the technician can only insert the session if the gap defined in the monitoring program has already passed from the patient's last session. The insert option (FR9.11) allow a technician to insert a session to be reviewed by a remote physician or to insert a session to update the patient's last exams; since a remote physician requires a previous session to compare exams, if there are no previous sessions to compare, a session must be inserted as an "Update".

The technician must be able to track the sessions that he inserted (FR10) and access to the session's current status and information (patient, monitoring program and diagnosis); this session information must be available in PDF format to allow a technician to redirect it to the patient coordinator services.

Although it's rare, a technician may make mistakes throughout the insert session process; to address this, a technician must be allowed to delete that session (FR12) within a limited time frame and if the session has not been diagnosed or it's not being reviewed.

### 3.2.3 Remote Physician

| Functional Requirements | Description |
|---|---|
| **FR13** | **User must be able to perform online diagnosis** |
| FR13.1 | A physician must be able to cycle through sessions available for diagnosis |
| FR13.2 | A physician can only review a session if he is assigned to that session's monitoring program |
| FR13.3 | Sessions must be given priority according to the time they were insert for diagnosis |
| FR13.4 | Sessions must be assigned to a physician while they are being diagnosed, to avoid multiple access to one session |
| FR13.5 | Physician must be provided with the session information (insertion date, additional info from technician, gap between current session and former session), patient information (birthdate and diagnosis) and monitoring program information (required exam types and gap between sessions) |
| FR13.6 | All sessions must have a former session to compare to |
| FR13.7 | Exams and results from former and current session must be sorted by exam type and by targeted eye for an easy comparison |
| FR13.8 | Exams must present the date of when they were acquired |
| FR13.9 | Physician must be able to enlarge a result (zoom) |
| FR13.10 | Physician must be able to diagnose a session by selecting whether the patient requires a medical consultation or not |
| FR13.11 | Additional info from the physician may be input and must be character capped |
| FR13.12 | A session may be skipped without being diagnosed, becoming available for diagnosis again |

***Table 5 - Functional requirements related to the user type: remote physician***

Considering he has all the required information (patient birthdate and diagnosis, gap between sessions…), the remote physician must diagnose a session (FR13) with one of the following: patient requires a consultation or he doesn't. In order to do this, the remote physician must compare the current exams with the previous ones, deciding whether the disease or condition is following regular paths or it isn't. In order to avoid multiple access to the same session (FR13.4), whenever a session is accessed by one physician, no other physician can access it; it must be available to diagnosis again if the physician decides to skip that session (FR13.12).

### 3.2.4 Administrator

| Functional Requirements | | Description |
|---|---|---|
| **FR14** | | **User must be able to insert an institution** |
| | FR14.1 | Institution must have name, city, address, ZIP code and country |
| | FR14.1 | Institution may belong to another institution |
| | FR14.2 | None of the fields should be empty and must be character capped |
| **FR15** | | **User must be able to edit an institution** |
| | FR15.2 | Institution's name, city, address and ZIP code and belonging institution may be modified |
| | FR15.3 | None of the fields could be empty and must be character capped |
| **FR16** | | **User must be able to insert a user** |
| | FR16.1 | User must have first name, last name, country, professional number, username, password and user type |
| | FR16.2 | All users except for remote physicians must have an institution |
| | FR16.3 | Institution's country must match the user's country |
| | FR16.4 | None of the fields could be empty and must be character capped |
| **FR17** | | **User must be able to edit a user** |
| | FR17.1 | First Name, last name, institution, country, professional number, username and password may be modified |
| | FR17.2 | Institution's country and user's country must match |
| | FR17.3 | None of the fields could be empty and must be character capped |
| | FR17.4 | Add/Remove monitoring programs from remote physicians |
| **FR18** | | **User must be able to insert a monitoring program** |
| | FR18.1 | Monitoring Program must have name, deadline to diagnosis, gap between sessions and country |
| | FR18.2 | The required exam types must be selected upon insertion |
| | FR18.3 | A monitoring program cannot be inserted with no exam types associated |
| | FR18.4 | None of the fields could be empty and must be character capped |
| **FR19** | | **User must be able to accept/reject patient modification requests** |
| | FR19.1 | A list of the available patient modification requests must be presented |
| | FR19.2 | Ability to accept/rejected a selected patient modification request |
| | FR19.3 | A justification may be inserted and must be character capped |
| **FR20** | | **User must be able to search data/logs** |
| | FR20.1 | All data must be searchable (patients, patient modifications requests, monitoring programs, users, notifications, sessions, exams, results, feedbacks and institutions) |

| | | |
|---|---|---|
| | FR20.2 | All logs must be searchable |
| | FR20.3 | Any data attribute may be used to perform the search |
| | FR20.4 | Any combination of attributes may be used to perform the search |
| | FR20.5 | Search result list must be filterable and sortable |
| | FR20.6 | Easy iteration through data and logs must be implemented |
| | FR20.7 | Result list must have a capped maximum size |
| **FR21** | | **User must be able to check system performance** |
| | FR21.1 | An overview on the system status and performance must be displayed |
| | FR21.2 | Must implement "Average wait time on sessions" |
| | FR21.3 | Must implement "Average time to review sessions" |
| | FR21.4 | Must implement "Overall session status" |
| | FR21.5 | Must implement "Overall 'consultation required' reviews" |
| | FR21.6 | Must implement "Average wait time on sessions by monitoring program" |
| | FR21.7 | Must implement "Average time to review session by monitoring program" |
| | FR21.8 | Must implement "Overall session status by monitoring program" |
| | FR21.9 | Must implement "Overall 'consultation required' reviews by monitoring program" |
| **FR22** | | **User must be able to see a billing report** |
| | FR22.1 | A billing report must be created on demand to aid in the billing process |
| | FR22.2 | A list of session inputs by institution must be presented |
| | FR22.3 | A list of session reviews by remote physician must be presented |
| | FR22.4 | Report must be rendered as a PDF for easy manipulation |
| | FR22.5 | Report must be created between inputted dates |
| **FR23** | | **User must be able to see system alarms** |
| | FR23.1 | Every day, at a low workflow hour, the application must run the data/logs to discover alarming trends |
| | FR23.2 | Alarm to remote physicians with average of 'require consultation' bigger than a value (percentage) |
| | FR23.3 | Alarm to remote physicians with average of 'doesn't require consultation' bigger than a value (percentage) |
| | FR23.4 | Alarm to remote physicians with average diagnosis time smaller than a value (seconds) |
| | FR23.5 | Alarm to technicians that are not reading his notification in a number of days |
| | FR23.6 | The values must be changeable at any time |
| | FR23.7 | The list of result must be presented |

***Table 6 - Functional requirements related to the user type: administrator***

An administrator is responsible to manage the system and insert/edit required data (institutions, users and monitoring programs – FR14, FR15, FR16, FR17 and FR19). Whenever a remote physician is inserted in the system to review sessions, he must be assigned to one or more monitoring programs – physicians may only have interest in following a restricted set of diseases, according to their fields of expertise.

It is important to check the system business performance (FR21): if all sessions are being diagnosed as "patient requires a consultation" or no session is being reviewed at all, the system will be completely pointless. Therefore, the following analysis must be available:

- **Average wait time on sessions** – How much a session must wait to be reviewed
- **Average time to review sessions** – How much time is put into the session review
- **Overall session status** – Percentage of sessions that were reviewed and not reviewed
- **Overall 'consultation required' reviews** – Percentage of sessions that were classified as 'requires a consultation' vs. 'doesn't require a consultation'
- **(…) by monitoring program –** All former analysis separated by monitoring program

A billing report must be available in PDF format to aid in the billing process (FR22). Number of session inputs by institution and number of session reviews by each remote physician is enough to meet the current business requirements; however, the billing process will most likely change (institutions may be charged a fixed price, institutions may only pay for each reviewed session, remote physicians may be paid a fixed price, etc…) – but these are market/billing decisions to be addressed later on and are out of the project's scope.

If, for instance, a remote physician decides to diagnose all sessions with 'require consultation' in order to discard all related responsibility and still be acknowledged as the reviewer, will render the application business and financially pointless; therefore, it's important to follow these malicious trends (FR23):

- **Average 'Require consultation' bigger than a value (percentage) –** Presents all remote physicians that have a percentage of 'require consultation' in their session reviews bigger than a certain percentage
- **Average 'Doesn't require consultation' bigger than a value (percentage) –** Presents all remote physicians that have a percentage of 'doesn't require consultation' in their session reviews bigger than a certain percentage
- **Average diagnosis time smaller than a value (seconds) –** Presents all remote physicians that spend an average time smaller than a value (in seconds) in their session reviews
- **Notifications not read (days) –** Presents notifications that have not been read in a certain amount of days. Not all notifications are required, only the technician's notifications related to session diagnosis.

### 3.2.5 General

| Functional Requirements | Description |
|---|---|
| **FR24** | **User must receive notifications regarding his actions or another user's related actions** |
| FR24.1 | Notification must be traced back to the action from where it was created |
| FR24.2 | Notifications must have a destination user, a timestamp of when it was created, a timestamp of when it was read, a notification text and a notification type |
| FR24.3 | A notification must be sent to the local physician when he inserts a patient (notification type: inserted patient) |
| FR24.4 | A notification must be sent to the local physician when he request a modification to a patient (notification type: request modification sent) |
| FR24.5 | A notification must be sent to the local physician when an administrator accepts/rejects his patient modification request (notification type: request modification accepted/rejected) |
| FR24.6 | A notification must be sent to the local physician when he adds/removes a |

| | |
|---|---|
| | monitoring program to/from a patient (notification type: monitoring program) |
| FR24.7 | A notification must be sent to the local physician when he adds/removes an ICD Classification to/from a patient (notification type: patient diagnosis) |
| FR24.8 | A notification must be sent to the local physician when he changes a patient's text diagnosis (notification type: patient diagnosis) |
| FR24.9 | A notification must be sent to the technician when he inserts a session (notification type: session exported) |
| FR24.10 | A notification must be sent to the technician when one of his sessions expires (notification type: session expired) |
| FR24.11 | A notification must be sent to the technician when he deletes a session (notification type: session deleted) |
| FR24.12 | A notification must be sent to the technician when one of his sessions is diagnosed (notification type: session review) |
| FR24.13 | A notification must be sent to the remote physician when he diagnoses a session (notification type: session review) |
| **FR25** | **Users must be able to create feedback messages to the Administration** |
| FR25.1 | Feedback messages must contain a timestamp of when they were sent, the users that sent and received the message and the message text. |
| FR25.2 | Any administrator can answer to these feedback messages |
| FR25.3 | Users can answer back to administrators |
| **FR26** | **Administrators must be able to create feedback messages to Users** |
| FR26.1 | Feedback messages must contain a timestamp of when they were sent, the user that sent and received the message and the message text |
| FR26.2 | Administrators have to identify the user they wish to contact |
| **FR27** | **Users must be able to change their passwords** |
| FR27.1 | New password cannot be equal to current or last used password |

***Table 7 - Functional requirements related to the user type: general***

Administrators apart, all users must have a notification box (FR25) to receive notifications regarding his actions or other user's related actions. Feedbacks (FR26 and FR27) are a basic way of communication between users and administrators.

## 3.3 Non-Functional Requirements

While functional requirements describe specific behaviors or functions expected from the application, non-functional requirements describe its quality, usability and efficacy. They are as much as important as functional requirements, especially when deciding the system architecture [7]. Non-functional requirements are often called quality attributes, non-behavioral requirements or constraints [8].

### 3.3.1 Security

Security relates to the system's ability to resist unauthorized access [9]. All the data in the system is very sensitive; therefore, it is of utmost importance that the data should only be accessed by users with the right permissions.

- **Login requirements**
  - All users must login to access the application

- All logins must be registered
- Login time must be registered
- Blocked users cannot login

➢ **Password requirements**
- Passwords must be encrypted
- Passwords length must be restricted

➢ **Inactivity Timeouts**
- After 10 minutes of inactivity, a user must be log out

➢ **Permissions**
- Not all users have access to the same areas of the application; therefore, each user type must only have permission to his area. Functional requirements are divided by user roles (user types) to simplify the reader's comprehension of each user's permissions and possible actions.

➢ **Protocol**
- HTTPS

### 3.3.2 Accountability

By working with sensitive data, the application must be able to answer to the following questions regarding all user performed action:

- Who performed the action
- What was the action
- When was the action

BlueWorks cannot be hold responsible for a misdiagnosis or an incorrect imported session. Therefore, the responsibility must lie with the user that performed such action; this demands the recording of all user actions, when they occurred and what they have modified.

➢ **Audit characteristics**
- Audit logs must have timestamp (date and time)
- Audit logs must have user that performed the action
- Audit logs must have the information about the changed/inserted data

➢ **Audit actions**
- Inserting a patient
- Removing/Adding ICD Classifications to a patient
- Removing/Adding monitoring programs to a patient
- Changing a patient's text diagnosis
- Requesting patient modifications
- Inserting sessions to review
- Deleting sessions
- Diagnosing a session
- Inserting institutions
- Editing institutions
- Inserting users
- Editing users

- Removing/Adding monitoring programs to a user
- Accepting/Rejecting patient modification requests
- Creating/Answering feedbacks
- Creating/Reading notifications
- Logging in

### 3.3.3 Usability

Quality attribute related to the ease of use of the application [9].

- Tips must be provided to the user for an easy understanding of what it may be done one each web page.
- Whenever there is an error, the user must be informed about what went wrong and why.
- The application must be in English.

### 3.3.4 Integrity

Integrity is the ability to maintain correctness among all pieces of data [10]. Being the data sensitive, corruption of data or misleading information must be avoided.

- **Fault Trapping**
  - When a technician imports exams to the application to insert a session, if a fail should occur during the import process the session must not be inserted and the user must be informed of such
- **Data Integrity**
  - Any action must be accompanied by its respecting accountability log. If one should fail, the other must fail as well
  - While exams are being imported to the application, should one of the exams fail and none must be saved
  - If a physician logs out after he has been assigned a session, this session must become available for diagnosis again
  - The data presented to the user must be consistent with the data on the database. If this data should change, every consequent action regarding this data must fail
    - One cannot add/remove an ICD Classification to/from a patient after it has been added/removed
    - One cannot add/remove a monitoring program to/from a patient after it has been added/removed
    - One cannot add modification request to a patient after another modification request has been added
    - One cannot change a patient's text diagnosis after it has been changed
    - One cannot do any action regarding the patient after it has been set to "disabled"
    - One cannot insert a session to a patient after he's been added a session
    - One cannot insert a session to a patient after he's been set to "disabled"
    - One cannot delete a session after it has been deleted
    - One cannot delete a session after it has been diagnosed or being reviewed
    - One cannot be assigned a session after it has been assigned

- One cannot be assigned a session after it has been deleted
- One cannot diagnose or skip a session that is no longer assigned to him
- One cannot diagnose a session after the related patient information has changed (patient basic information or diagnosis)
- One cannot modify a user or institution after it has been modified
- One cannot add/remove one monitoring programs to/from a remote physician after it has been added/removed
- One cannot accept/reject a patient modification request after it has been accepted/rejected
- One cannot answer to a feedback after it has been answered

## 3.4 Limitations and Assumptions

Limitations and Assumptions of the project are presented here. Limitations reflect the barriers imposed while assumptions reflect what was assumed in order to create the application.

### 3.4.1 Limitations

| Limitation | Description |
|---|---|
| **L1** | Although the application may be adapted to any medical field, it will be focused to ophthalmology, becoming limited to this medical field |
| **L2** | Although the application may be adapted to any country, it will be in English and assuming GMT time zone |
| **L3** | The application will only be working with the acquisition software OphthalSuite© |
| **L4** | The application will only accept exams in image format |

### 3.4.2 Assumptions

| Assumption | Description |
|---|---|
| **A1** | Export errors are very rare - if they happen, the session has to be deleted and reinserted within a limited time frame |
| **A2** | A physician won't suddenly change his opinion - modifications to diagnosis are not allowed |
| **A3** | The monitoring programs are standards of each country and won't change |

# 4 Architecture

Throughout this chapter, the architectural model will be presented. The objective of such is to define how the project should be structured and what should be the behavior of the application. After the definition of the desired behavior and structure of the application, the implementation becomes easier.

## 4.1 UML – Unified Modeling Language

The Unified Modeling Language (UML) is a standard modeling language to document, construct and visualize object-oriented software-intensive systems [11]. Web applications, like this one, are software-intensive systems and UML becomes the choice of language to model them [12].

UML has 14 types of diagrams divided in two categories: structural, that reflects the static structure of the system, and behavioral, that reflects the system's dynamic behavior [13].

## 4.2 Web Application's Architecture

Web development is a complex world. Although it is not this work's objective to set the reader up to build his own web application, it is important to know a few basic definitions.

There are many ways for one to create web applications; one of them is to use a web application framework. It is not practical to develop every new web application from the ground because some core functionalities are identical across different applications and there is no need to build them over and over again [14]. A web application framework is a software framework designed to help developers build web applications by providing core functionalities like user session management, data persistence and templating systems [15].

Although web application framework's architecture may vary from one another, many of them use the MVC design pattern to separate the model (data and business rules) from the view (representation of data) and from the controller (logical connection from the user to the business services, manages requests and how to respond to these requests) [16]. This approach decreases the duplication of code and makes the application easier to modify and test. Additionally, the people responsible for the content (application developers) or for the presentation of this content (web designers) have very different skills and agendas; by separating the view from the content, it is possible to prevent the programmer and the designer to "step on each other" while maintaining or

modifying the same module [14]. Other than that, this approach is taken as "good practice" among web application developers [15].

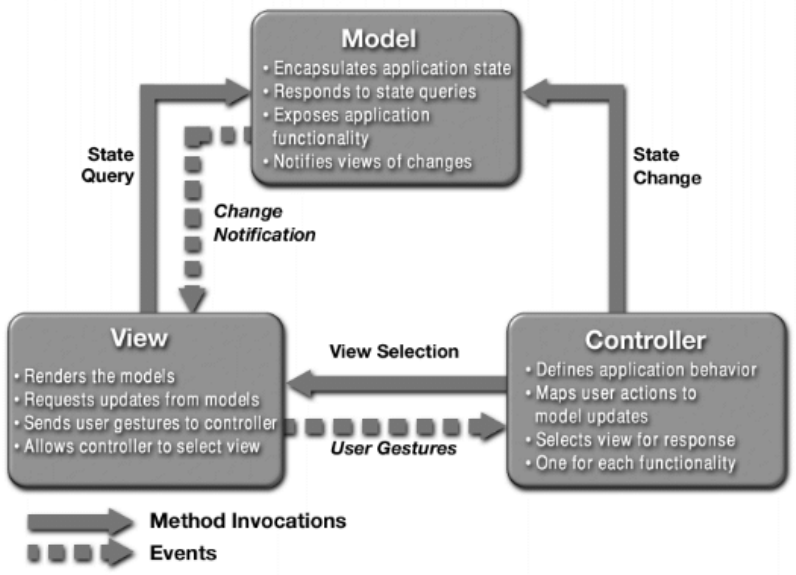


***Figure 3 - MVC design pattern for web applications. Adapted from [17]***

### 4.2.1 View

The view represents the application's interface: it requests the state from the model so it can generate the output to display to the user. It is the contact point with the user, by displaying the information and by informing the controller of user inputs and actions [17]. The view typically contains the following elements:

- Server-side templating: a web publishing toll to create web pages [18].
- CSS style sheet: a language to define the presentation semantics (look and formatting) [19].

### 4.2.2 Controller

The controller defines the applications behavior: when informed about the user's actions or inputs, it sends requests to the model for it to change its state; it also selects the view that is to be displayed [17]. The typical elements:

- Client side scripting (like JavaScript).
- HTTP request processing.

### 4.2.3 Model

The model is the state of the application: the data management and business rules. The model is independent from the view since multiple views may inquire the model about its state and present it in its own way. The model also follows instructions from the controller to change its state [17] .

- Data Access Components (Entity Classes): provide an abstraction of the database so the data may be easily managed, persisted, deleted or updated

- Business Components (Session Beans): the business rules are implemented in these components. These components are responsible for retrieval, processing, transformation, and management of application data.

## 4.3 External Architecture

The following figure represents the application's physical architecture; the MVC design pattern was implemented in the diagram:

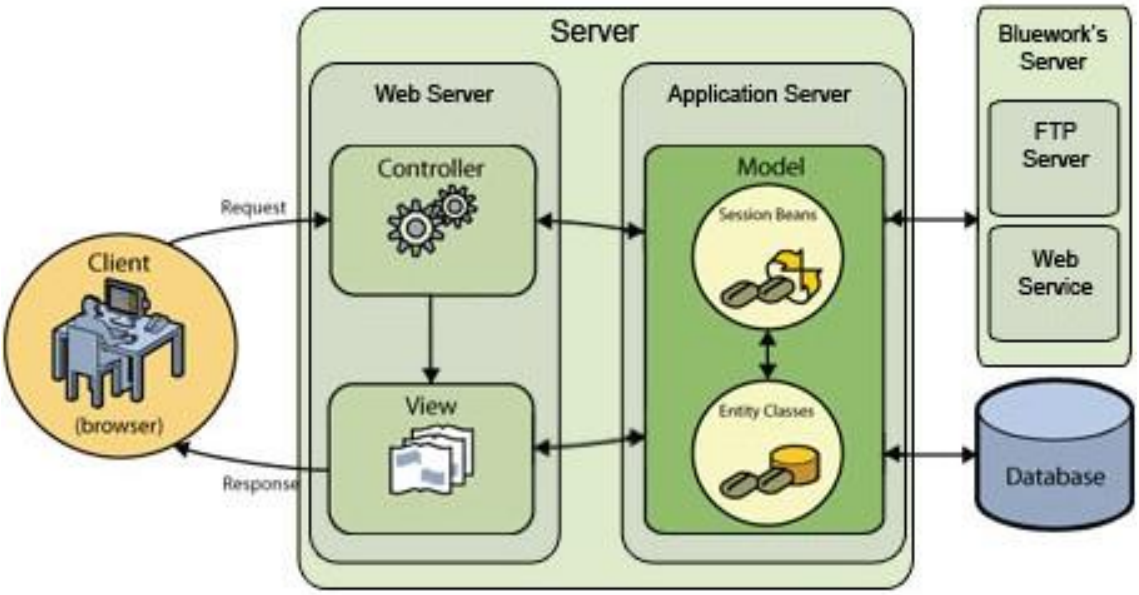


***Figure 4 - Application architecture with MVC design pattern. Adapted from [20]***

### 4.3.1 Client

A web application is an application that uses the web browser as a client. The client requests services/pages from the server and then renders the response and presents it to the user.

### 4.3.2 Server

A server is a machine that holds the application, it can be divided in:

#### 4.3.2.1 Web Server

Web servers are responsible for handling http requests/responses and for containing and delivering web content like web pages or images [21]

#### 4.3.2.2 Application Server

Application servers are pieces of software that host the application, displaying the business logic. They provide connection pooling (connection to the database), transaction management, messaging, persistence, etc. [22].

### 4.3.3 Bluework's Server

The application must connect to Bluework's server to acquire the required exams.

### 4.3.4 Database

A database is an organized structure of data. The application must connect to the database in order to retrieve, update, persist or delete data.

## 4.4 Internal Architecture

This section will briefly describe the application's internal architecture, separated by user roles.

UML activity diagrams will be used to demonstrate the architectural workflow of the application. These are UML behavioral diagrams intended to model both computational and organizational processes (workflow) to demonstrated user activities and actions [23].

The application's structural architecture is defined by the selected framework, which is, how to define the data access entities, security components, etc.; however, this structure is related to the MVC design pattern. More information on the subject will be addressed in Chapter 5 (Implementation). However, one can define the application's behavior to be implemented using the selected framework. The following sections define the system's behavior using UML activity diagrams. For organization concerns, these are separated by user role and by activity itself. Moreover, each activity is separated in 3 swimlanes. These swimlanes are not related to any architectural structure, they are just organizational components introduced to a better understanding of the application's behavior; however, it is possible to relate the Interface swinlane to the View (since it contains the web pages) and the Application swinlane with the Model (since it contains the business logic, data entities and connections to the external resources) while the Controller oversees both, controlling page redirects and controlling the model updates and actions.

- **User (Local Physician/Remote Physician/Administrator/Technician):** This swimlane represents user actions and options.
- **Interface:** Represents what is presented to the user.
- **Application:** Represents the application's business processes, data manipulation, data storage, etc.

Only the first activity will be presented in the main body of this thesis, the remainder is displayed in Appendix 8.1 (Appendix A - UML Activity Diagrams). Such decision is due to space and objectivity concerns; however, the understanding of this application's behavior is crucial to understand this project.

### 4.4.1 Local Physician

#### 4.4.1.1 Activity: Insert Patient

The following activity diagram reflects the application's desired behavior on patient insertion. The user must be displayed a page where he can enter the desired patient information (**Insert Patient Page**). This information must be checked for:

- **Input Fields:** No field should be empty. Input field are character capped.
- **NHS Number:** NHS Number must go through an algorithm to check its validity.
- **Birthdate:** Birthdate must be valid according to a person's average lifespan.

Afterwards, the application should create the required data and send it to the database:

- **Patient:** Patient to be inserted. The information is retrieved from the input field and from the user (patient's country is assigned to the user's country); the patient is automatically set to "enabled" on insert.
- **Notification:** Notification to be sent to the local physician.
- **Log:** Accountability information.

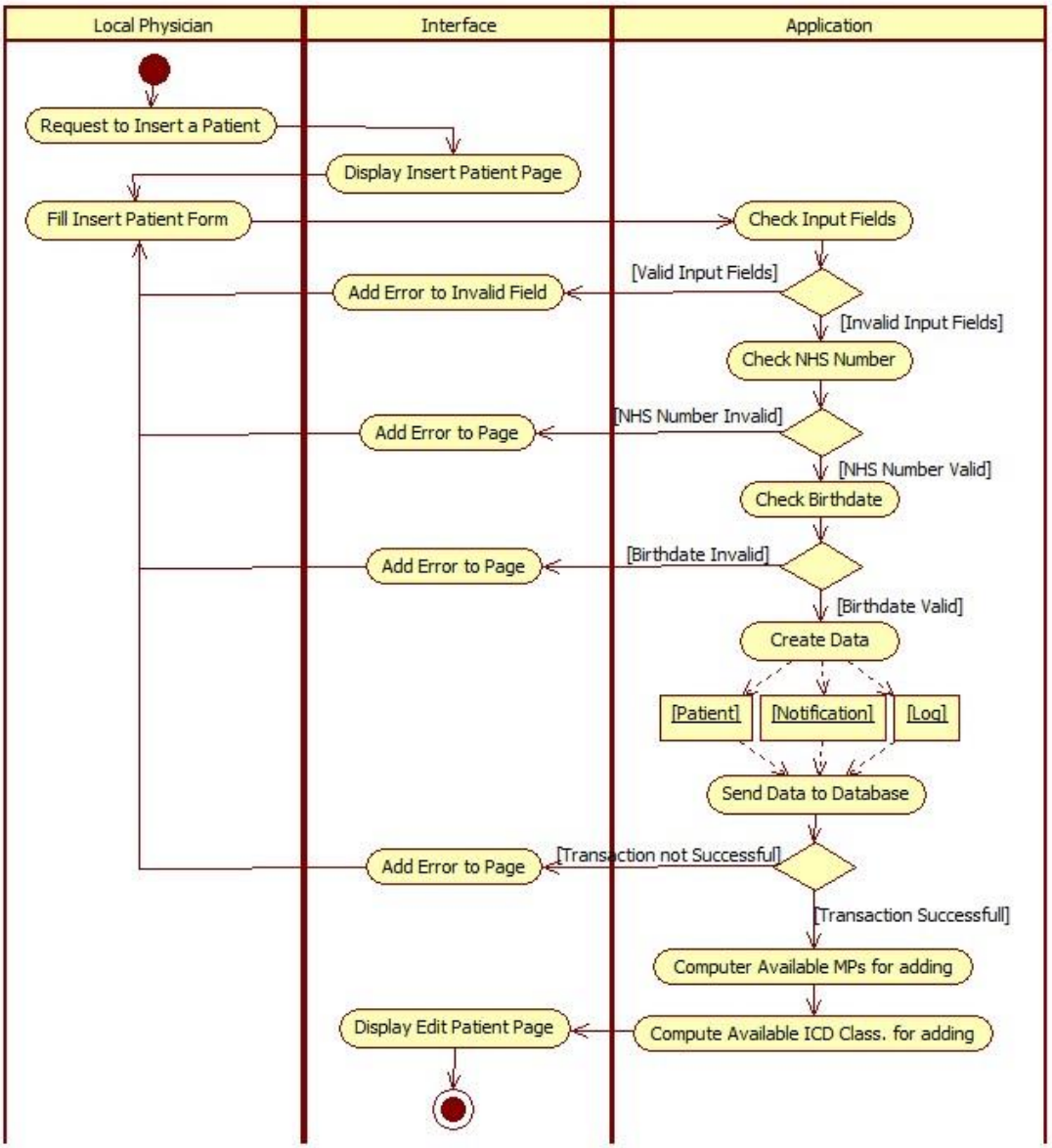


***Figure 5 - UML activity diagram for user role: local physician and activity: insert patient***

If everything gets inserted correctly, the application should redirect to the edit patient page:

- **Edit Patient Page:** Page (or set of pages) that display the patient information in order to be edited. It must contain:
    - **Patient basic information –** NHS Number, first/last name, birthdate, enabled/disabled and country.
    - **Patient's assigned MPs** – Monitoring programs assigned to the patient.
    - **Patient's assigned ICD Classifications** – ICD Classifications assigned to the patient.
    - **Available MPs for adding** – Monitoring programs from the patient's country that he isn't already assigned to.
    - **Available ICD Classifications for adding** – ICD Classifications the patient isn't already assigned to.
    - **Patient's Text Diagnosis** – Free text diagnosis.

The [Transaction not Successful] option should account for database rollbacks. In this case, the patient to be inserted is already in the database.

# 5 Implementation

In this chapter, it will be described the implementation phase. Due to space limitation, it is not possible to address every step that has been completed in detail. Thus, only the most influential decisions and actions will be explained.

## 5.1 Technology Selection

### 5.1.1 WAF – Web Application Framework

The implementation comprehends the selection of a framework to use; the selection mechanism is described below.

#### 5.1.1.1 Language

There are several languages used in the internet domain – e.g. PHP, Ruby, Scala, Java and C++ –, each one with its advantages and disadvantages.

PHP, for instance, is widely used due to its simplicity, huge repository of documentation and easy syntax; however, it has security issues which makes it unfit to this web application.

C++ is used when performance is the main criteria, which in this case, it is not.

Ruby, Scala and Java are more suited to this application since they are preferred when the web application demands security and robustness without significant diminishing on performance; Ruby has less security than Java and Scala which directs the decision between Scala and Java. This security comes from the automated garbage collector and "exceptions".

Although Scala has small advantages over Java, such as compactness, the Java language was selected to build this application since it is much more popular – there is a lot of consultation material and frameworks available – and the developer already has a significant background on Java; these two factors can largely improve the final results of this project [24].

#### 5.1.1.2 Java Web Development Frameworks

There are numerous web application frameworks for Java; in order to choose the right one, most of them had to be analyzed. It was taken a particular interest in the following features:

- **Security framework:** the data in the application is confidential and sensitive; having a strong security framework is essential
- **MVC framework:** MVC architecture is a "good practice" and allows a good separation between content and presentation; although the developer for both parts is only one, it may not be so in the future of this project
- **Popularity/Community:** the developer has no experience or knowledge in web development/software engineering – having a large documentation and community to help is crucial

Although a lot of frameworks were analyzed, some examples of the most popular and discarded frameworks are displayed below:

- **Struts2** [25], for instance, one of the most popular, is a framework with a very simple architecture, which makes it very elegant and extensible [26].This framework is used for web applications that do not have high security demands (the security model of this framework is very weak) and will have complex forms and dynamic front-end pages [27].
- **Java Server Faces (JSF)** [28] is a framework to be used in medium to complex enterprise web application where full control over the front-end is not a requirement [26]. It also doesn't support REST or security very well [29].
- **Spring MVC** [30] is easy to test and integrates with many views options. It has great security [26]; however, it has no built in AJAX support and it's too flexible, leading to a huge learning step and to intensive configuration [27].
- **Wicket** [31] and **Stripes** [32] have a low popularity: While Wicket has an active community but very weak documentation, focusing only the more basic features, Stripes has a small community and it's not currently actively developed [27].

After consulting with senior members from ISA (Intelligent Sensing Anywhere), **Jboss Seam** [33] was the chosen framework to create the application. This framework is a powerful open source web application framework that integrates technologies such as Java Server Faces (JSF), AJAX, Java Persistence (JPA), Enterprise Java Beans (EJB 3.0), Business Process Management (BPM) and Java Authentication and Authorization Service (JAAS). It has a strong security module and an active community. On top of all that, Seam has PDF and graph creation features, which are helpful to create the application. [29].

### 5.1.2 Application Server

Application servers are pieces of software that host the application, handling operations between users and the application itself. They provide connection pooling (connection to the database), transaction management, messaging, persistence, etc. [22].

#### 5.1.2.1 Java Application Server

Java application servers provide Java EE platform APIs and standard Java EE services, leading to an easy application development [34]. **Jboss AS** (Jboss Application Server) [35] was used throughout this project.

## 5.2 Seam Development

The application was developed using the Jboss Seam framework. This framework uses an MVC design pattern, which allows one to [36]:

- **Design the views:** the views were designed using Facelets [37] (an open source web template system that uses XHTML to create web pages) and RichFaces UI components (panels, tables, menus, etc.).
- **Design the components:** From the business components (holding the business logic) to security components (like authentication), components to connect to web services and ftp servers and components to define servlets. Everything is to be implemented through Seam components; in fact, Seam provides a set of pre-implemented components to aid the developer in his task (for instance, "observers" may be used to inform a component when other has performed an action).
- **Design the controller:** Although a cut of the controller is implemented by the framework (like handling http requests – the idea of a framework is to pre-implement features that are common in all application and this is one of them), it is still the developer's job to implement the application's behavior: web page redirects, which actions are called from which button click, among others.

## 5.3 Database

A brief database overview will be presented below. For a deep insight, consult the database's conceptual model on appendix 8.4 (Appendix D – Database Conceptual Model).

Applications need data, but more important than having raw data is having an organized collection of data that has structure, relationships and it's easy to access and manage – this is a database. By allowing the data to have a built-in structure, it becomes easy to search for data, sort this data, create meaningful reports and avoid data repetition [38] [39].

### 5.3.1 Database Management System (DBMS)

DBMSs are applications designed to interact with the user, other applications and the database itself, allowing the manipulation and administration of databases. Manipulation includes data definition (create and modifying the data structure), data insertions/deletions/updates/ modifications and retrieval of the data; administration relates to the monitoring of data by enforcing data security, maintaining data integrity or recovering data after failure [38]. PostgreSQL [40] is the open source DBMS used for this project.

### 5.3.2 ICD10 – International Classification of Diseases (10th revision).

The patient can have his diagnosis classified using this standard; therefore, ICD10 must be integrated in the application, more specifically, in the database.

The International Classification of Diseases (ICD) is the World Health Organization's (WHO) "standard diagnostic tool for epidemiology, health management and clinical purposes" [41], being the standard for classifying diseases, health problems, symptoms, among others.

In short, the International Classification of Diseases is organized in Chapters, Blocks and Codes which led to the three database hierarchical tables: ICD_Chapter, ICD_Block and ICD_Code. The script to insert the data in these tables was acquired from the WHO's website [41].

### 5.3.3 Accountability Logs

Knowing if data was changed, when it was changed and by whom it was changed it's important, if not mandatory, on any application. Being this a medical application as it is, responsibility is of utmost importance: it is required, at any time, to identify the users responsible for any data change or insertion.

There are two main approaches when designing audit tables which are briefly describe bellow [42] [43]:

- **Base Table Copy** – The so called "traditional" approach. One table is created for each table requiring auditing. This audit table's design is similar to the table that is going to be audited: it has the same schema plus three additional fields:
  - **Changed By** – The change's author.
  - **Changed Date** – The change's date.
  - **Deleted** (optional) – If the change was a deletion.

  This table will hold a record showing the state of each data record of the audited table – such allows one to see an overtime history of a single record (for instance, a patient). Such approach requires more disk space (some data fields will be repeated) but showing the overtime history of a data record becomes easy.
  This approach is widely used and works best when data changes are infrequent because the amount of over space is largely compensated by search performance.
- **Amorphous Table** – Instead of saving the overtime state of a record in the audited table, one can simply save the change. To do this, along with the **Changed By**, **Change Date** and **Deleted** (optional), this table will have to identify:
  - **Changed Column** – Audited table's column changed.
  - **Changed Record** – Audited table's record changed.
  - **Change** – The modification. It can be done by using the new value, old value or both.

  Since this audit table has a generic schema, all database changes can be stored in one audit table; however, it is required an extra field:
  - **Changed Table** – Audited table were the change was made.

  If changes to a table are frequent, this is the common approach because it avoids the repeated fields created in the previous one. In this approach however, displaying a state of a record at a certain time becomes very hard and requires data processing.

Database table decisions to answer to the accountability requirements (3.3.2 - Accountability) are given bellow:

- **Inserting institution** and **Editing institution**: Both are being mapped in a single copy table; changes are not frequent (institution's name, city, address, ZIP and belonging institution are rarely changed).
- **Inserting users** and **Editing users**: Both are being mapped in a single copy table; changes are not frequent (user's first name, last name, username, professional number and "blocked" attribute are rarely changed). The password, however, may change frequently

and creating a new record in the audit table for each password change is inefficient; therefore, these changes will be recorded in a separate table. This table will hold the password changed, password change, change date and change author.

- **Inserting Patient:** A patient's initial state will be recorded in a copy table; there will be a record for each patient.
- **Removing/Adding ICD classifications to a patient:** An audit table is used to keep a record on a patient's ICD classifications overtime. The implemented fields are: change date, change author, change action (added or removed), changed patient and which ICD code added/removed.

  If the change action is a remove, the justification text is saved in a different table: this is because empty fields should be avoided (only "removing" requires a justification).
- **Removing/Adding monitoring programs to a patient or user:** Implementation is similar to the one above (Removing/Adding ICD classification to a patient).
- **Changing a patient's text diagnosis:** A patient's text diagnosis is not recorded in the patient table (along with his NHS number, name, etc.); it is recorded is a separate table especially designed to hold this data. Therefore, the changes to this text diagnosis are recorded in a copy table: the repetition of fields is not an issue since the audited table only holds the text diagnosis.
- **Requesting patient modifications** and **Accepting/Rejecting patient modification requests:** Patient modification requests are logged in a copy table (same attributes of the patient table) in order to store the asked modification and whether it was rejected or accepted. This table contains a change status (rejected, accepted or on hold), change date, change accept/reject date, change author, change accepter/rejecter, change justification, change accept/reject justification and changed record (patient).
- **Inserting sessions to review** and **Deleting sessions:** Sessions are immutable; therefore, one table is enough to store all the required information: session's author (technician), session's patient, insertion date, session's monitoring program, technician's additional information and session's status (reviewed, not reviewed, on review, deleted or on hold). Since deleting a session requires a justification, the deleting action is audited in a separate table with the fields: delete date, delete justification and deleted record (session).
- **Diagnosing a session:** There is a table to keep an audit trail of session reviews (diagnosis). As usual, the fields are: diagnosis date, diagnosis author (remote physician) and diagnosed record (session); additionally, there is a field to store the diagnosis time, diagnosis additional information and diagnosis decision (requires consultation or it doesn't).
- **Creating/Answering feedbacks:** Feedbacks are immutable; such allows one to store all data in one table: feedback message author, feedback message date, feedback message text and feedback message answered (if this feedback message is an answer to another message).
- **Creating/Reading notifications:** A single table is enough to store notification date, notification read date, notification text, notification type and notification addressee.
- **Logging in:** Logging in the application's web site is recorded in a table whose fields are as follow: login author, login date and, additionally, login time.

## 5.4 Data Entities

The entity classes (see 4.2.3 – Model) to abstract the database had to be created. This section briefly introduces the reader to the technology used to do so.

Java Persistence API (JPA) is an ORM Java programming language specification, being ORM (Object Relational Mapping) a programming technique that converts data between incompatible systems [44]. Therefore, JPA becomes the joint point where object-based entities are converted from Java runtime environment to a relational database [36].

The object-based entities are Java objects that work as connectors between the application and the underlying database, transporting and holding the data. As a simplified practical example:

- Database:
  - Table named *Patient*
  - 2 columns (*Patient NHS*, *Patient Birthdate*)
  - One-to-Many relationship to *Sessions* (Means that one patient may have several sessions while a session can only have one patient)
- Entity Object:
  - Entity named *Patient*
  - 2 attributes (*Patient NHS*, *Patient Birthdate*)
  - List of *Session* entity objects.


***Figure 6 - Database abstraction using Java Persistence. Adapted from [36]***

## 5.5 Web Service

Applications can be written in different programing languages or run under different operating systems. Therefore, in order to communicate between themselves they need to use a common standard. A Web Service is communication method that ensures interoperability machine-to-machine over the internet, using open standards like SOAP/XML [45].

BlueWorks approach to integrate EMR (Electronic Medical Record) software with OphthalSuite is through a Web Service. This Web Service was implemented using .Net Framework Remoting [46].

### 5.5.1 Methods

The client (this application) consumed two methods provided by Bluework's Web Service:

- **GetExamsByPatientHealthNumberByDate (***Patient NHS Number***,** *Date***) –** Returns a list of exams performed at *Date* from *Patient NHS Number*.
  - **Exam:** Although each exam is returned with a lot of information – both patient, equipment used and exam itself – only the following fields are used or saved:

- **examId –** Stored in database as the external exam ID.
- **examTypeId –** The exam table in this application's database has a field for external exam type ID that is compared with this returned attribute.
- **examDate** – Stored in the database as exam date. This attribute is returned with hours, minutes and seconds, which could be useful.
- **examEye –** The eye table in this application's database has a field for external eye type ID that is compared with this returned attribute.

- **GetExamImagesByExamIdRequest (***Exam ID***) –** Returns a list of images (results) from an *Exam ID*.
  - **Image:** Used or saved fields:
    - **imgId –** Stored in database as external result ID.
    - **imgPath –** Image path used to retrieve the image with FTP. After acquiring and saving the image, the new file path is stored in the database (this will be discussed in 5.6.2 – FTP – File Transfer Protocol).
    - **imgPixWidth –** Image's pixel width is stored in the database for presentation purposes.
    - **imgPixHeight –** Image's pixel height is stored in the database for presentation purposes.
    - **isFTPSaved –** It is useful to know if the image is acquirable from FTP server.

### 5.5.2 Web Service Consumption

The main issue with consuming BlueWork's Web Service is due to the SOAP messages exchanged. In short, there are 4 SOAP message types:

- RPC/Literal
- RPC/Encoded
- Document/Literal
- Document/Encoded.

Defining the web service's WSDL style (RPC vs. Document) it's not important because the problem stands with the encoding type:

- **Literal –** The SOAP message body follows a standard XML schema, which is included in the web service's WSDL document. Therefore, by accessing the WSDL, the client knows exactly how the message is formatted.
- **Encoded –** The SOAP message body doesn't follow a standard XML schema; however, the message still follows a specific format that the client is expected to already know.

BlueWork's WSDL is encoded (more specifically, RPC/encoded). If the same web service framework were to be used in the client generation, this shouldn't be a problem; however, since encoded SOAP messages are not formatted with a standard XML schema, there are slight interpreting differences between different programming languages and web service frameworks – which are both the case. Moreover, the WS-I (Web Services Interoperability Organization) ruled out, on August 2003, the usage of SOAP encoding with web services, recommending the usage of RPC/Literal or Document/Literal [47] [48] [49].

Since RPC/encoded is outdated, the most recent technologies used to create and consume web-services may not support it. For instance, JAX-WS (Java API for XML Web Services), the Java EE platform API for web services, doesn't support these types of web services.

But there are a few workarounds to this problem: one of them is to use JAX-RPC (Java API for XML based RPC), the antecessor of JAX-WS [50] [51]. In order to achieve this, it was used Apache Axis 1.4 framework, which implements JAX-RPC. This technology is, however, outdated (last release on April 22, 2006 [52]) and, in the meantime, has been replaced by Axis2 – which is also incompatible with RPC/encoded.

Using Apache Axis 1.4 and after a few struggles with .NET vs. J2EE environment incompatibilities, like native data types, it was possible to integrate, within this application, a web service client that will fetch the required exams and respective results.

## 5.6 Displaying/Saving Images

The images results are saved but not in the database. The database only stores the path of where the image is; the image is saved to the server's disk. The database can support images; however, most of the times, it is not recommended to do so since, in addition to performance issues, database storage is usually more expensive than file storage system – and a big cut of the application's data will be these image results [53].

### 5.6.1 Image Servlet

It is not possible to access local files from any web page; therefore, in order to present the stored images, a servlet is required. Moreover, even if the images were to be saved in the database, it's good practice to use servlets to load these images from the database and stream them to the web page [54].

Servlets are server running Java classes used for extending and enhancing the capabilities of a web server. This technology can be used to process/store data submitted from a web page or even to provide dynamic content like database results [55] [56].

A servlet was integrated in the application to acquire the requested images using the image path stored in the database.

### 5.6.2 FTP – File Transfer Protocol

From BlueWork's web service, one can acquire exam and result's metadata. However, the respective image results will be acquired from BlueWork's FTP server.

FTP (File Transfer Protocol) is a network protocol used to transfer files between hosts; it uses a TCP-based (Transmission Control Protocol) network, like the Internet, and is built on a client-server architecture [57].

An FTP client was successfully integrated in the application. On demand, this client connects to BlueWork's FTP server, using private credentials, and retrieves the required images. Apache Commons Net ™, a library that implements the client side of many basic Internet protocols [58], was used to achieve such end.

### 5.6.3 File Transactions

After acquiring image files from BlueWork's FTP server, the application will save them to disk; however, if a single file fails to be saved (or acquired), any other previously saved files will stay in disk or, in other words, file access it's not transactional.

To get around this problem, Apache Commons Transaction ™ was used. This library contains implementations of classes commonly used in transactional Java programming, like transactional collections and transactional file access [59].

## 5.7 Security

This section describes the security features implemented in the application.

### 5.7.1 Authentication and Authorization

Authentication, also known as "logging in", is the act of confirming the identity of a person. Being this a secure application, in order to perform any action, the user must authenticate. By authenticating, the user is given an identity and a role; this role is one of the four user types (technician, local physician, remote physician or administrator). The user role is to ensure that any user may only access or change information according to his role in the application; this is known as authorization. The application's authentication and authorization security features are implemented in two ways:

- **Page Security –** Each page is secured according to user role (authorization) and to whether the user is logged in (authentication). Except for the home page, all pages are login secured – an unregistered user cannot request them from the server, and authorization secured – a local physician cannot access web pages designed to be accessed by an administrator, for instance.
- **Component Security –** Similar to page security, but implemented on the application's components. The same authentication and authorization features are present.

As described in Chapter 3 (Requirement Analysis), each login is registered in the database with the respective user, login timestamp and login time.

### 5.7.2 HTTP Secure

HTTPS is the result of layering the traditional HTTP protocol on top of the SSL/TLS protocol, adding the security features of the last to standard HTTP. SSL/TLS, or Secure Socket Layer/Transport Layer Security, is a security technology that uses a pair of keys – public and private key – to establish an encrypted connection; since any piece of information encrypted by one of the keys can only be decrypted using the other, it is reasonably guaranteed that one is communication with the web site that he is intending to communicate with, thus preventing eavesdropping or man-in-the-middle security attacks [60] [61].

The application server was configured to serve the application in HTTPS, thus preventing several security attacks and ensuring the user that any inserted information will be transmitted using a secure and encrypted connection.

### 5.7.3 Encrypted Passwords

User passwords are personal information - they are the user's assurance of privacy - and no one, not even the administrators, should have access to them; for this reason, almost all web applications encrypt their user's passwords.

#### 5.7.3.1 Encryption Techniques

Password may be encrypted in one of two techniques:

- Two-way techniques: allows one to encrypt and decrypt a password.
- One-way techniques: allows one to encrypt a password; decryption is not possible.

Although two-way techniques might be useful in some applications [62], this is not the case because there is absolutely no reason for a password being decrypted. Additionally, if someone gains access to the encryption password, all user passwords will be revealed. Therefore, one-way techniques, also called digest techniques, are the standard and the most common technique [63].

Since one-way techniques do not allow an encrypted password (password hash or password digest) to be decrypted, user authentication is enabled by comparing password hashes, not passwords itself – digest algorithms guarantee that two equal inputs will get equal digest, but not the other way around. MD5 (MD stands for 'Message Digest'), the digest algorithm implement in this application, is one of the most used one-way algorithms [63].

Digest algorithms are security mechanisms alone, but there are standard additional techniques to make them even harder to hack.

#### 5.7.3.2 Salting Passwords

A salt is a byte sequence added to the password before digesting, creating a completely different hash than the password alone would create. Although adding a fixed salt (the same in each password digest) is a valid approach, it's not advisable; a variable salt should be added instead (each time a password is hashed, a new salt is randomly generated) [63]. Adding a random salt when digesting a password assures that 2 equal passwords will have different hashes, thus disenabling hacking techniques like lookup tables (a hacking technique were passwords and respective hashes are searched in the entire database looking for a match) [64]. Obviously, whenever a new password is digested, the generated random salt must be saved along with the hash in the database, for subsequent password validation.

Before digesting, a random salt containing 8 random bytes was prepended to the password.

#### 5.7.3.3 Iterating and Password Length

Iterating is the action of digesting a password (or salted password), creating a hash, and then, digest the hash, again and again. Such technique can render brute force and dictionary attacks to computational nightmares. These two techniques rely on trying passwords and checking whether they match [64]:

- **Brute Force:** Tries every possible combination of characters up to a given length.
- **Dictionary:** Tries a file containing words, phrases, common passwords, username combinations or any other character combination that may be likely to be a password.

By having to iterate the hashing algorithm a certain number of times for each password try, the amount of time required to check every possible combination or potential password may be too consuming for the attack to be worthwhile. The same holds true for password lengths: the longer the password is, the larger is the amount of possible character combinations.

User passwords were digestedly iterated 1000 times and the minimum password length was capped at 9 characters.

## 5.8 Data Integrity

Data integrity is one of the described non-functional requirements. This section briefly describes the techniques behind the data integrity implementation.

### 5.8.1 Database Transactions

A database transaction defines a unit of work performed within a DBMS and must be ACID [65]:

- **A**tomic **–** a series of operations either all or none occur
- **C**onsistent – doesn't violate any integrity constraint during execution
- **I**solated – operations become visible to concurrent operations after the transaction finishes
- **D**urable – operations of transactions that have committed become permanent

Applications with databases make use of such technique to persist and change their data. This technique allows the application to undoubtedly record the user responsible for any data change or data insert:

- Whenever a user performs an action, the corresponding data change/insertion, accountability log and notification are persisted to the database in the same transaction, making sure that if one should fail, all others will.

### 5.8.2 Data Concurrency

The following scenario tries to explain why data concurrency is an issue to be avoided.

A component from the application retrieves a piece of data from the database (into a data entity – see section 5.4 - Data Entities), a patient for instance; after changing this data, the component sends it back to the database; however, if this data has been changed in-between these two actions (retrieving from and persisting to the database), the new data will still be persisted, replacing the former change. This is an example of a data concurrency problem that must be avoided.

In order to avoid it, applications usually lock their data. There are two ways to do this:

- **Pessimist Locking:** In pessimist locking, a lock on the data object is acquired before the editing. By acquiring this lock on the data object, it becomes unavailable to be edited (or even read) by any other entity other than the one that requested the lock. When the data object is sent back to the database, the lock is released. Such approach is not so common in web application because it requires database resources (the database must know which data is locked) and a transaction to the database must be held open throughout the entire editing process [66].

- **Optimistic Locking:** Optimistic locking, the most common and recommended solution, assumes that the data won't be changed between the read and the write of data. Instead of acquiring a lock on the data, disabling anything that changes the data, it simply checks if the data has been changed between the read from and the write to the database by using a version:
    - **Version:** An extra attribute in each database table were the concurrency issues are to be avoided. This attribute holds a version number for each data row (object); whenever the object is changed, the version is incremented.

  Each data object retrieved from the database holds a version number. If this version is different when the application tries to persist the edited object, it means that the object has been changed by another source, and the transaction doesn't go through [66].

In this application, optimistic locking is used to check if a certain data has been changed. The Java Persistence API provides support for such locking, by identifying the version attribute and how the version incrementing must occur. A logical explanation to each non-functional requirement is given below:

**Non-Functional Requirement(s)**:

- One cannot add/remove an ICD Classification to/from a patient after it has been added/removed.
- One cannot add/remove a monitoring program to/from a patient after it has been added/removed
- One cannot add modification request to a patient after another modification request has been added
- One cannot do any action regarding the patient after it has been set to "disabled"
- One cannot insert a session to a patient after he's been added a session
- One cannot insert a session to a patient after he's been set to "disabled"

**Solution:**

Each patient holds a version. Performing any of the following actions will check and increment the patient's version:

- Add/Remove ICD Classification
- Add/Remove monitoring program
- Add modification request to a patient
- Accept modification request of a patient (thus changing patient information)
- Inserting a session to a patient

Therefore, if any should occur in between the read from and write to the database of any of the same actions, the last will fail.

**Example:** A technician wishes to add a session to a patient. The following chain of events defines the action:

- Application retrieves the patient (along with his version) from the database.
- Technician "creates" a session by adding its information and by attaching the exams and results.

- Application attaches the session to the selected patient and sends all of the data to the database (session, notification and accountability log). The patient versions are compared and one of the following happens:
    - Same versions: no action has been performed on the patient; the transaction continues accordingly and the patient's version is incremented.
    - Different versions: any action had been performed on the patient (like adding a session to it) and the transaction fails.

**Non-Functional Requirement(s)**:

- One cannot add/remove one monitoring programs to/from a remote physician after it has been added/removed

**Solution:** Similar to the first; however, adding or removing monitoring programs from or to the user checks and increments the user's version.

**Non-Functional Requirement(s)**:

- One cannot change a patient's text diagnosis after it has been changed
- One cannot delete a session after it has been deleted
- One cannot delete a session after it has been diagnosed or being reviewed
- One cannot be assigned a session after it has been assigned
- One cannot be assigned a session after it has been deleted
- One cannot diagnose a session after it has been detached from the user
- One cannot modify a user or institution after it has been modified
- One cannot answer to a feedback after it has been answered
- One cannot accept/reject a patient modification request after it has been accepted/rejected

**Solution:** Each of the following data objects holds a version and performing any of the actions described will check and increment the respective data object's version:

- **Versioned data:** Patient's text diagnosis
    - **Action:** Change patient's text diagnosis
- **Versioned data:** Session
    - **Action:** Delete session
    - **Action:** Diagnose session
    - **Action:** Attach session to a remote physician for diagnosis
    - **Action:** Detach session from remote physician (becoming available for diagnosis again)
- **Versioned data:** User
    - **Action:** Modify user
- **Versioned data:** Feedback
    - **Action:** Answer feedback
- **Versioned data:** Patient modification requests
    - **Action:** Accepting/Rejecting modification requests
- **Versioned data:** Institution
    - **Action:** Modify Institution

**Example:** A technician wishes to delete a session. The following chain of events describes the action:

- The application retrieves the session (along with its version) from the database.
- The technician fills out the required justification for deleting a session.
- The application sends the new data to the database (edited session, notification and accountability log). The session versions are compared and one of the following happens:
    - Same versions: no action performed on the session; the transaction continues accordingly and the session's version is incremented
    - Different versions: another actions has been performed on the session (like attaching it to a physician for diagnosis) and the transaction fails

**Non-Functional Requirement(s)**:

- One cannot diagnose a session after the related patient information has changed (patient basic information or diagnosis)

**Solution:** When a session is being diagnosis, the patient and related information (ICD classifications and diagnosis) are retrieved from the database. When committing a diagnosis, the patient and text diagnosis's version are checked (but not incremented) to see whether any has changed.

## 5.9 Time scheduler

In order to run the alarm checks on the database (see 3.2.43.1.4 Requirement Analysis – Functional Requirements - Administrator), Quartz was integrated in the application; Quartz is an open-source software designed for job scheduling [67].

The application is currently checking all the required information for the alarms at 5 am. The information that needs to be retrieved from the database is enunciated in 3.2.4 (Requirement Analysis – Functional Requirements – Administrator).

# 6 Validation

Chapter dedicated to validation, reviewing the documented tests the application was submitted to and some screenshots of the application.

## 6.1 Data Entities Testing

Java Persistence was used to create a database abstraction (data entities). These data entities had to be tested by defining each data object's attributes and relationships and trying to save them into the database. For instance, the following patient:

| Pat_FName | Pat_LName | Pat_BirthDate | Pat_HNumber | Pat_Enabled |
|---|---|---|---|---|
| **Patient1** | Patient1 | 24-11-1975 | 225968 | true |

***Table 8 - Data object to be persisted in the database***

This data object's insertion is tested by running a java file that creates the object with its attributes and the respective relationships and saves it to the database. Then, the data object is retrieved from the database (with its attributes and relationships) and displayed on console. Each data object is identified in the testing file by its **bold** attribute.

- **File:** File that runs the test
- **Entity:** Type of data entity tested
- **Test:** What is being tested
- **Description:** Description of the test (which specific data objects and relationships)
- **Result on Java Console:** the display that validates the test

| File | Entity | Test | Description | Result on Java Console |
|---|---|---|---|---|
| insertPatient | Patient | Insert | Insert **Patient1** | **Patient1**'s Attributes |
| | | Reference to Country | **Patient1** in **United Kingdom** | Patient from: **United Kingdom** |

***Table 9 - File test to insert the data object "Patient1"***

The remainder of the data objects and tests are to be found in appendix 8.3 (Appendix C – Data Entities Testing).

## 6.2 Scenario Testing

Scenario testing is a type of testing activity that uses scenarios: hypothetical actions/situations. The tests are implemented by describing how the application should behave on a specific scenario and by registering whether the application matched, or it didn't, the expectation. Additionally, if there is any interface message associated with the application's response, it must be documented.

As an example, the scenarios and tests on those scenarios for inserting a patient are presented in the following table:

- **Module:** Theoretical separation for defining each general activity.
- **Scenario:** Scenario identifier.
- **Scenario Description:** Defines the scenario.
- **Test:** Test identifier.
- **Test Description:** Defines the test.
- **Result:** Test result (Ok/Non Ok).
- **Interface Message:** The application's response to each scenario, if any.

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Insert Patient | S039 | User clicks the "Insert new Patient" link in the /selectPatient.xhtml page | T039 | Check if redirects to /insertPatient.xhtml | Ok | NA |
| | S040 | User inserts invalid NHS Number | T040 | Check if insert patient action failed | Ok | NHS Number {nhsNumber} is Invalid |
| | S041 | User inserts NHS Number that already exists | T041 | Check if insert patient action failed | Ok | Patient with NHS Number {nhsNumber} already exists |
| | S042 | User doesn't fill the NHS Number field or fills it with blank spaces | T042 | Check if insert patient action failed | Ok | value is required |
| | S043 | User doesn't fill the First Name field or fills it with blank spaces | T043 | Check if insert patient action failed | Ok | value is required |
| | S044 | User tries to insert a First Name bigger than 50 characters | T044 | Check if input box is limited to 50 characters | Ok | NA |
| | S045 | User doesn't fill the Last Name field or filled with blank spaces | T045 | Check if insert patient action failed | Ok | value is required |
| | S046 | User tries to insert a Last Name bigger than 50 characters | T046 | Check if input box is limited to 50 characters | Ok | NA |
| | S047 | User inserts Birthdate after 9 months ago | T047 | Check if insert patient action failed | Ok | Birthdate invalid |
| | S048 | Users inserts Birthdate before 120 years ago | T048 | Check if insert patient action failed | Ok | Birthdate invalid |
| | S049 | Valid insert patient | T049 | Check if patient was correctly inserted in the database | Ok | Patient with NHS Number {nhsNumber} inserted |
| | | | T050 | Check if log was correctly inserted in the database | Ok | |
| | | | T051 | Check if a notification was correctly sent to the | Ok | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | user | | |
| | | | T052 | Check if redirects to /editPatient.xhtml with the inserted patient's info | Ok | |
| | S050 | Two users try to insert the same patient | T053 | Check if only one takes effect, while the other is rejected | Ok | Patient with NHS Number {patHnumber} was inserted |
| | | | | | | Patient with NHS Number {patHnumber} already exists |

***Table 10 - Scenario testing for inserting a patient***

For organization concerns, the testing was divided in user roles and can be found on appendix 8.5 (Appendix E – Scenario Testing). A total of 731 scenarios and 1107 tests have been submitted to the application.

## 6.3 Application Demonstration

This section demonstrates a few examples from the developed application.

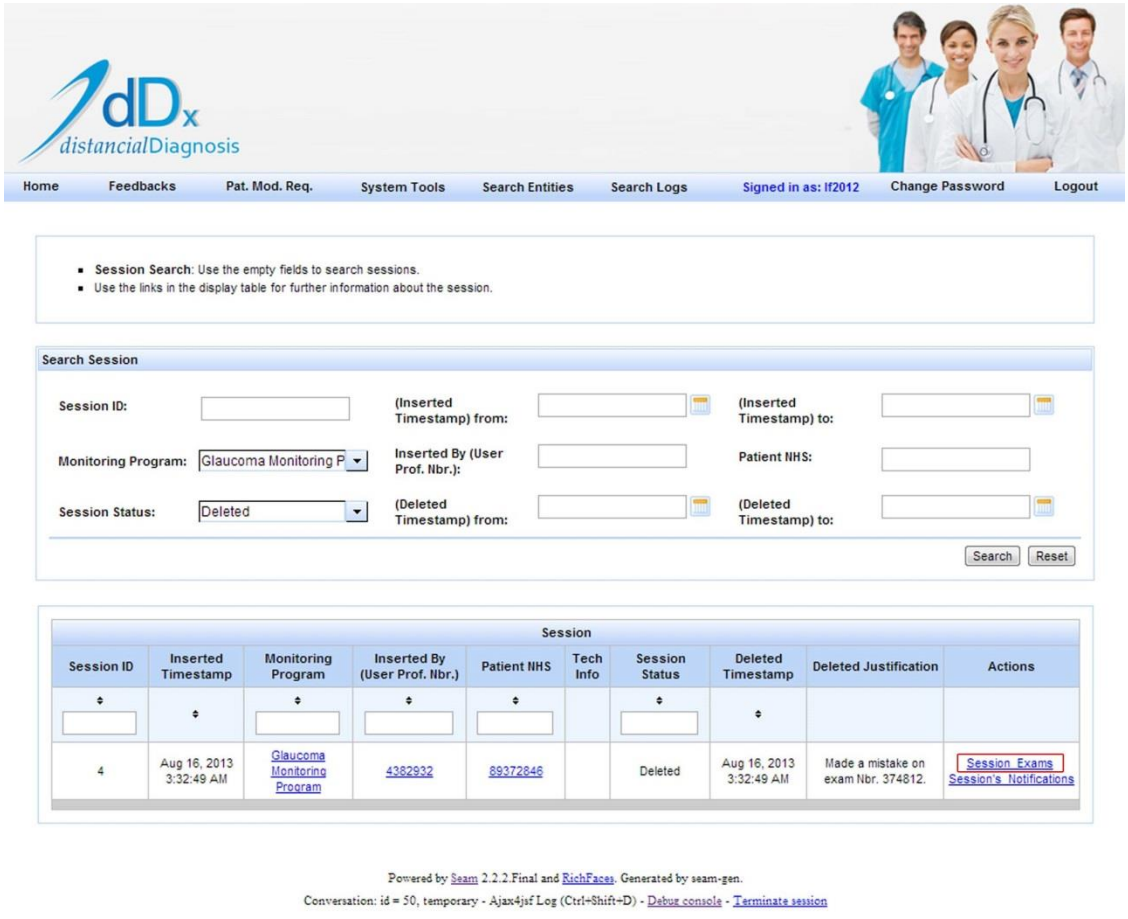


***Figure 7 - Administrator's search page for sessions. By clicking in the link inside the red box, the administrator will be redirected to the search page for exams with the displayed exams of the selected session.***

The previous figure represents the search page for sessions in the administrator module. This example allows the reader to better understand the Administrator Search Map displayed on 8.2 (Appendix B – Administrator Search Map). By comparing this figure with the table provided in the Administrator Search Map, it becomes easy to understand all the specified fields and why they are marked with S (Searchable), D (Displayed), S (Sortable), F (Filtered) or a link. As an example of a link, if a user clicks "Session Exams" (red box), he will be redirected to the search page for exams with the exams of the selected session displayed (Figure 8).

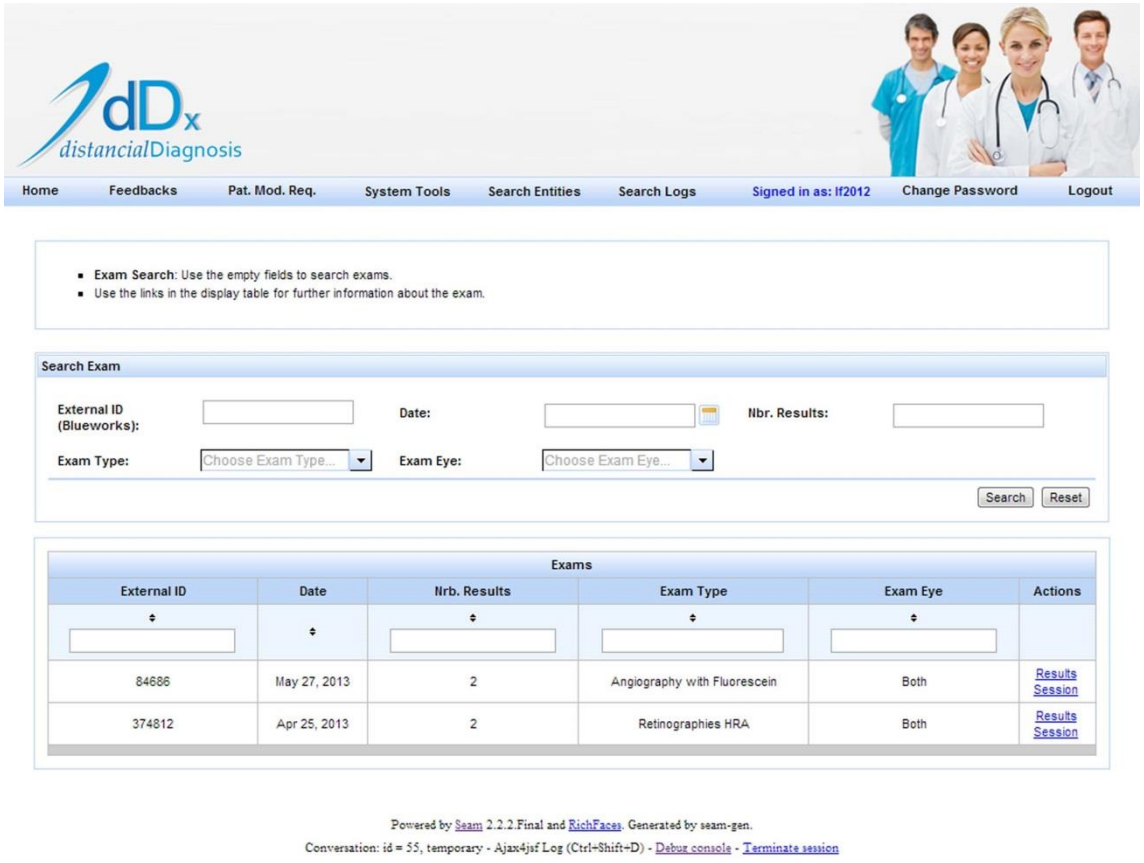


***Figure 8 - Administrator's search page for exams. The result table was populated by clicking "Session Exams" link (see Figure 7).***

The next example demonstrates the application's interface for session reviews by remote physicians. All of the relevant information regarding the patient and the session is displayed. The current session is comparable with the previous session through a side-by-side panel with cyclable tabs for exam types and target eye and a scroll to cycle trough the results of each exam. Each image may be enlarged by 300% on a scrollable modal panel.

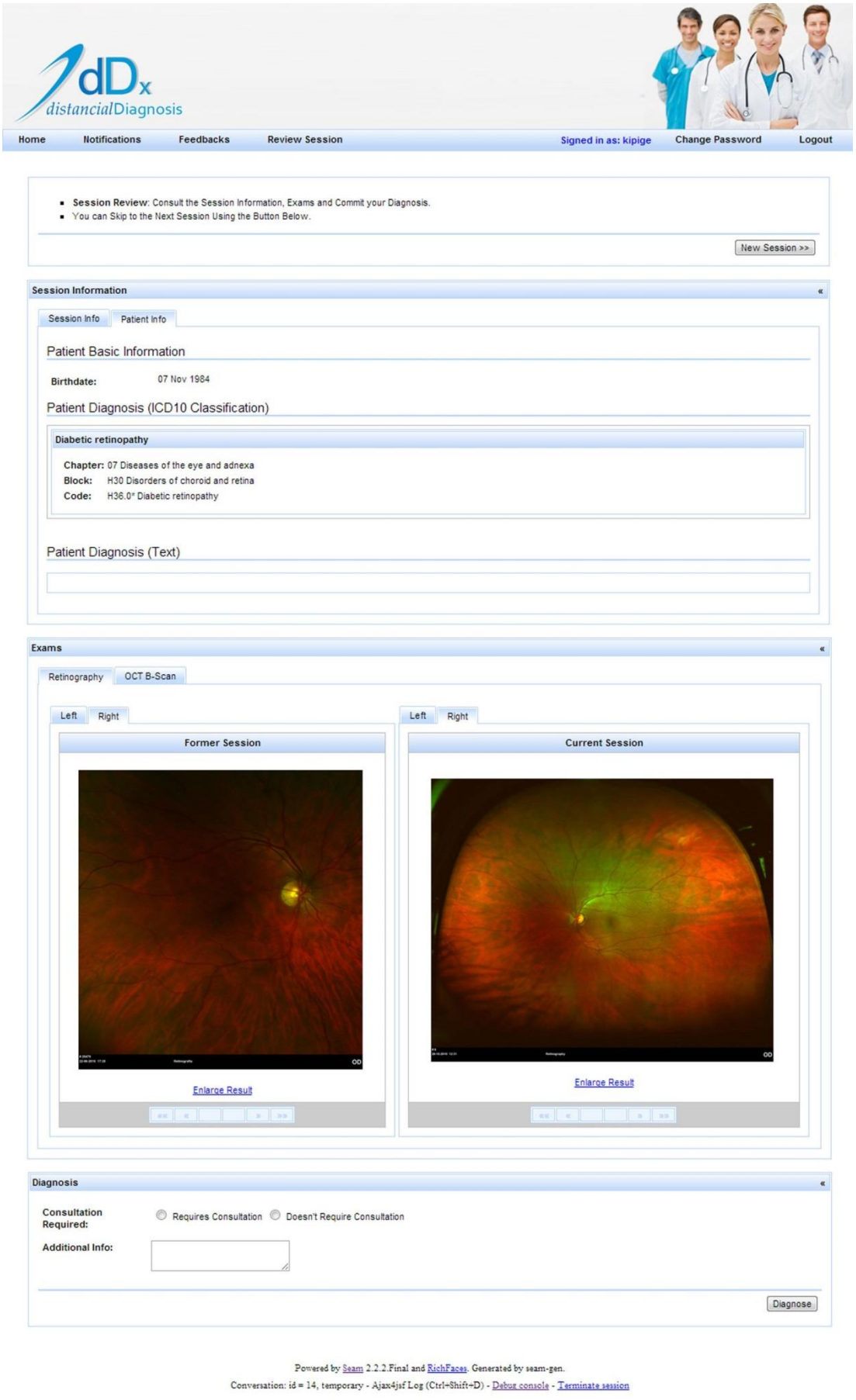


***Figure 9 - Remote physician's web page for session review***

# 7 Conclusions

Chapter dedicated to the final considerations regarding this project. By the end of this project, an application containing all the required features had been correctly implemented. All the initial bold objectives and goals have been equally matched as a result of a long period of research and practice in all the mentioned technologies (and a few more).

## 7.1 Personal Considerations

Having such narrow knowledge and experience in the field of software engineering, one could ask no more than a project completely focused on the subject as the final step to become a Master in Clinical Informatics and Bioinformatics in Biomedical Engineering. Not only the practical experience in all the new technologies was retrieved from this entire year, but all the development steps and techniques (planning, documenting, testing, documenting again, etc…) that renders the enterprise world as a whole new experience to an academic student – which I owe to BlueWorks.

## 7.2 Future Work

Being a prototype as it is, the application is not ready to be used; this chapter holds some consideration to be accounted for in the final development process.

Starting off with the business rules and requirements, which have been created along with BlueWorks and the enterprise's knowledge on the business flow of a patient's monitoring programs, they may need to be refined and improved to fit the expectations of a future client. Moreover, the application may be adapted to be used within the same country (for a better resource usage) or even to cover different medical areas, which may lead to changes in the business rules and requirements.

The application itself needs to be reviewed: due to the developer's lack of experience, the application may contain:

- **Code errors**: Although the application has been exhauslty tested (1107 tests) there might be unexpected code bugs.
- **Security leaks:** The application was designed and implemented to be secure; however, there might be exploitable security breaches that need to be found.

The application was tested alone based on the requirements; however, the application's response and performance to several requests simultaneously or to a big database needs to be tested.

# 8 Appendix

## 8.1 Appendix A - UML Activity Diagrams

### 8.1.1 Local Physician

#### 8.1.1.1 Activity: Select patient

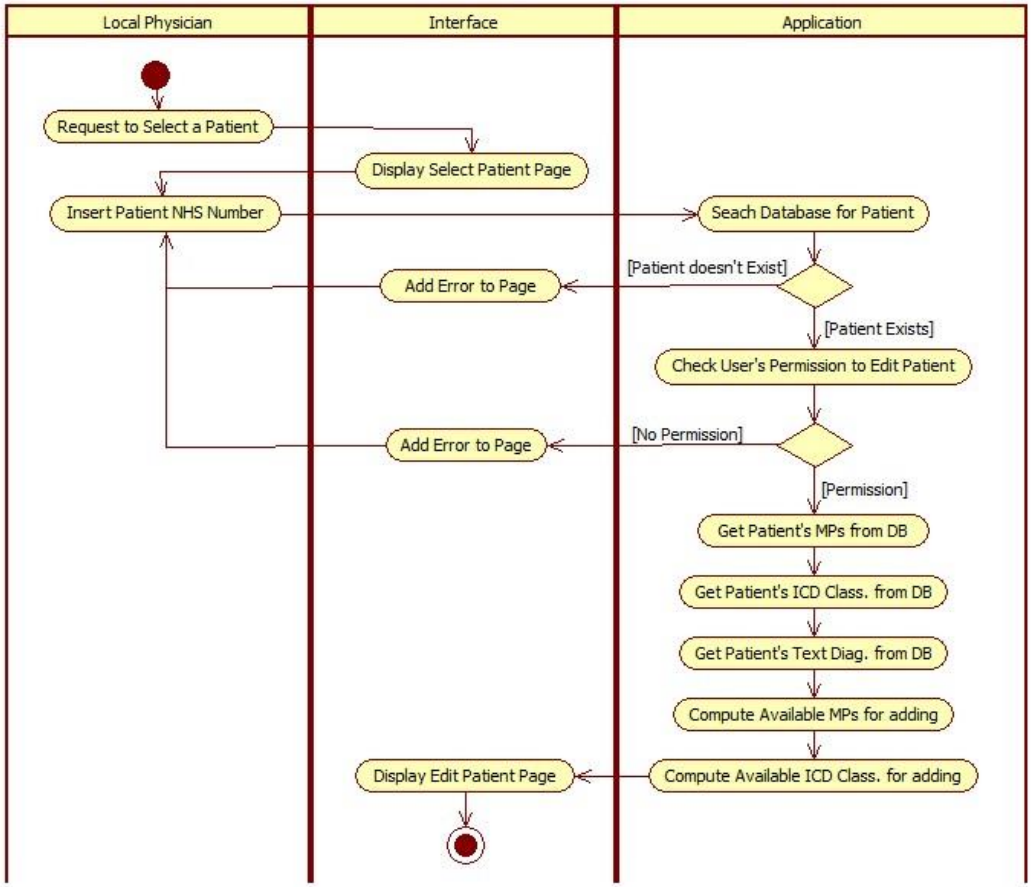


***Figure 10 - UML activity diagram for user role: local physician and activity: select patient***

In order to select a patient, the local physician must enter the patient's NHS number. After the permission check (patient must have been inserted from the requester's institution), the edit patient page – defined in 4.4.1.1 (Activity: Insert Patient) - must be displayed.

Whether by inserting a patient or selecting one, the local physician is presented the edit patient page. The following sections represent the application's behavior starting of this page. If a patient is disabled, one is allowed to see this edit patient page but not to change any information.

#### 8.1.1.2 Activity: Add MP/ICD Classification to Patient

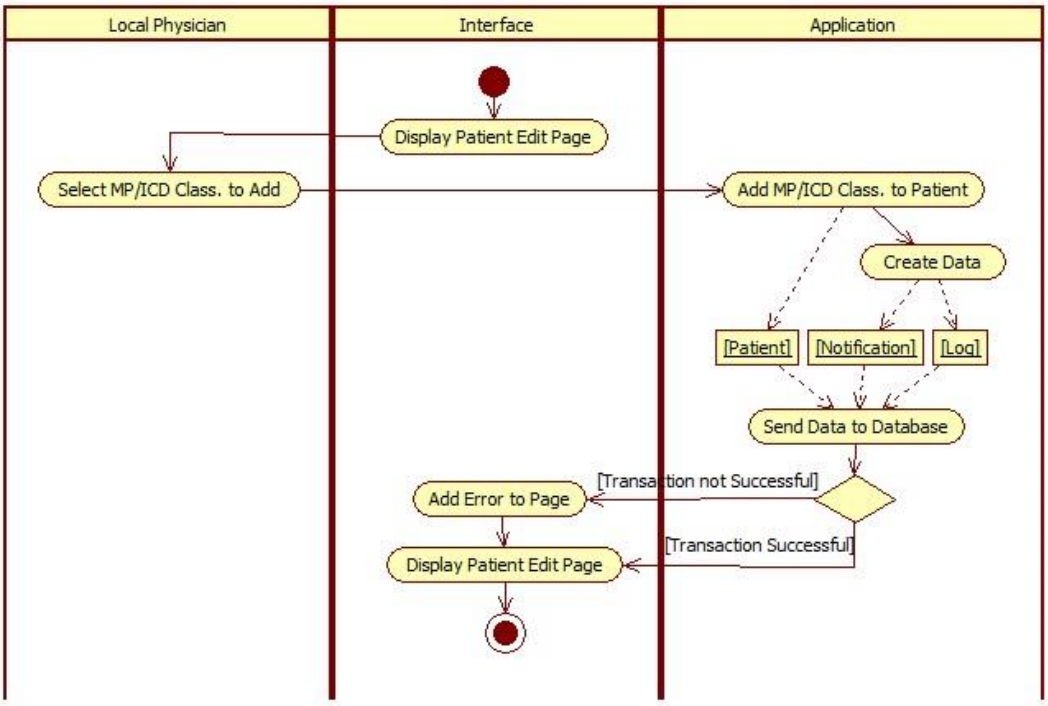


***Figure 11 - UML activity diagram for user role: local physician and activity: add monitoring program or ICD classification***

Adding monitoring programs or ICD classification to a Patient will be addressed in the same diagram since they have similar behaviors: After selecting the MP or ICD Classification to add, the application should assign it to the patient and create the notification and log; afterwards, this data should be sent to the database.

The [Transactional not Successful] represents the non-functional requirements:

- One cannot add an ICD Classification to/from a patient after it has been added
- One cannot add a monitoring program to/from a patient after it has been added
- One cannot do any action regarding the patient after it has been set to "disabled"

#### 8.1.1.3 Activity: Remove MP/ICD Classification from Patient

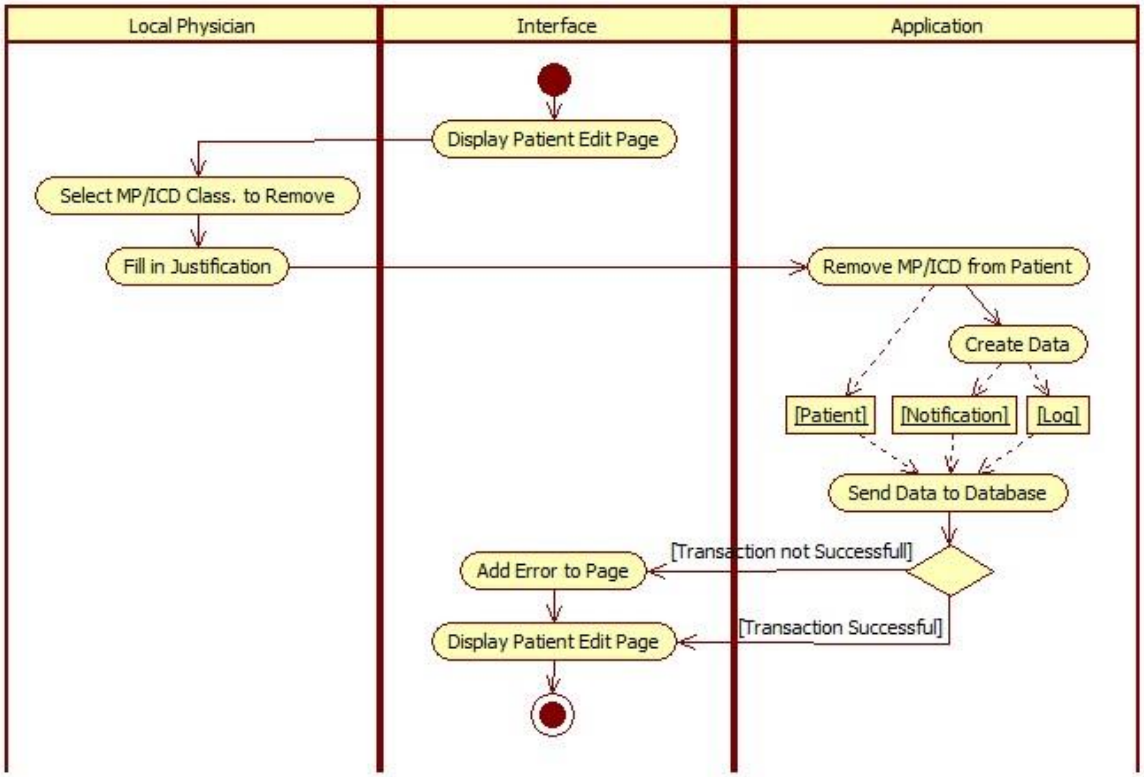


***Figure 12 - UML activity diagram for user role: local physician and activity: remove monitoring program or ICD classification***

Similar to the one above; however, a justification is required to perform the action.

The [Transaction not Successful] represents the non-functional requirements:

- One cannot remove an ICD Classification to/from a patient after it has been removed
- One cannot remove a monitoring program to/from a patient after it has been removed
- One cannot do any action regarding the patient after it has been set to "disabled"

#### 8.1.1.4 Activity: Change Patient's Text Diagnosis

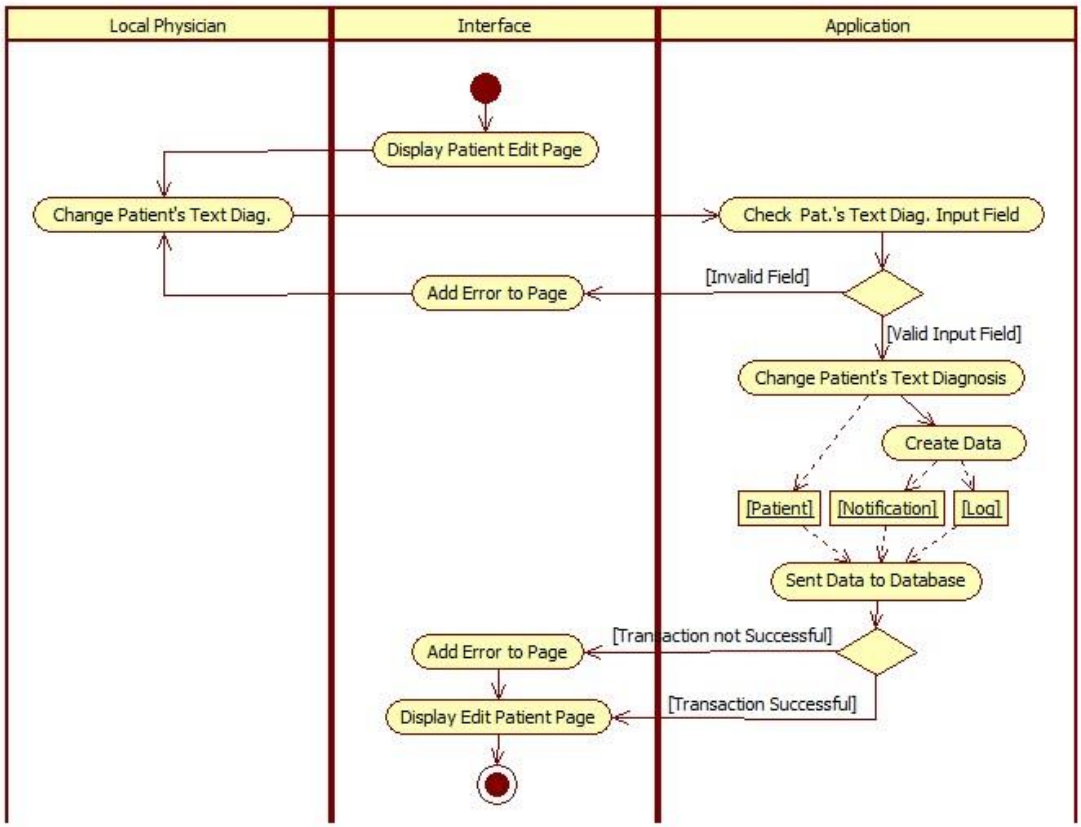


***Figure 13 - UML activity diagram for user role: local physician and activity: change patient's text diagnosis***

A local physician should be able to change a patient's text diagnosis. After sending the new text diagnosis to the application, it should verify the input field and send the new data to the database along with the notification and the accountability log.

- **Patient Text Diagnosis Input Field:** It must be checked for character cap and for similarity with the patient's current text diagnosis (it must be different).

The [Transaction not Successful] represents the non-functional requirements:

- One cannot change a patient's text diagnosis after it has been changed
- One cannot do any action regarding the patient after it has been set to "disabled"

#### 8.1.1.5 Activity: Request a Patient Modification

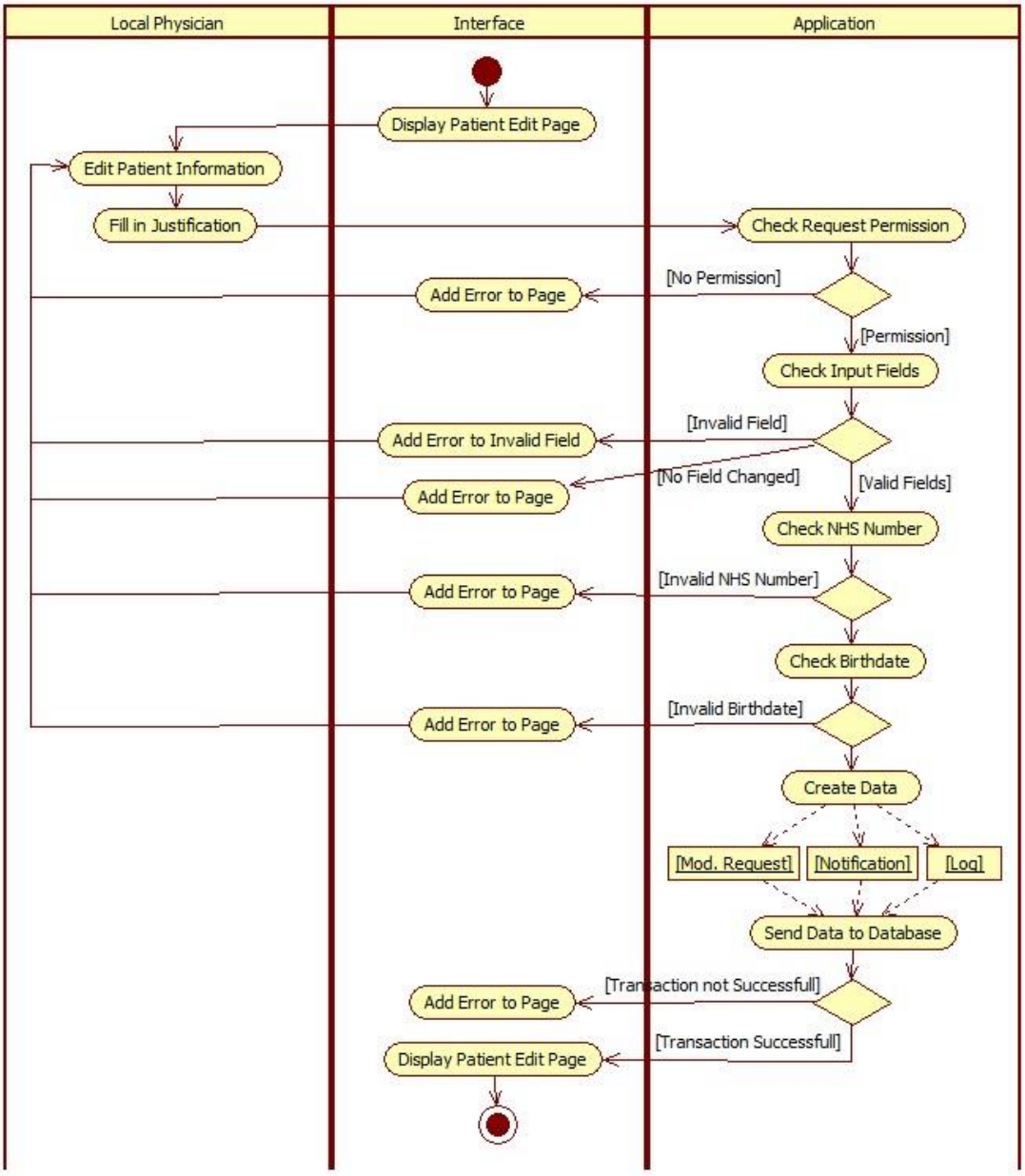


***Figure 14 - UML activity diagram for user role: local physician and activity: request patient modification***

The local physician must be allowed to change the displayed patient information. The application must validate this new data in a similar process described in Activity: Insert Patient (4.4.1.1). Additionally, the following actions were added:

- **Fill in Justification** – A non-empty justification is required.
- **Check Fields** – One or more of the input fields must differ from the actual patient information.
- **Check Request Permission** – One patient can only have one modification request at any time.

After all permissions and data checks, the data is created and sent to the database:

- **Modification Request -**The patient is not changed; a data structure holding the required changes must be sent and saved into the database.
- **Notification -** Notification to be sent to the local physician.
- **Log –** Accountability information.

The [Transaction not Successful] represent the non-functional requirement:

- One cannot add modification request to a patient after another modification request has been added
- One cannot do any action regarding the patient after it has been set to "disabled"

### 8.1.2 Technician

#### 8.1.2.1 Insert Session

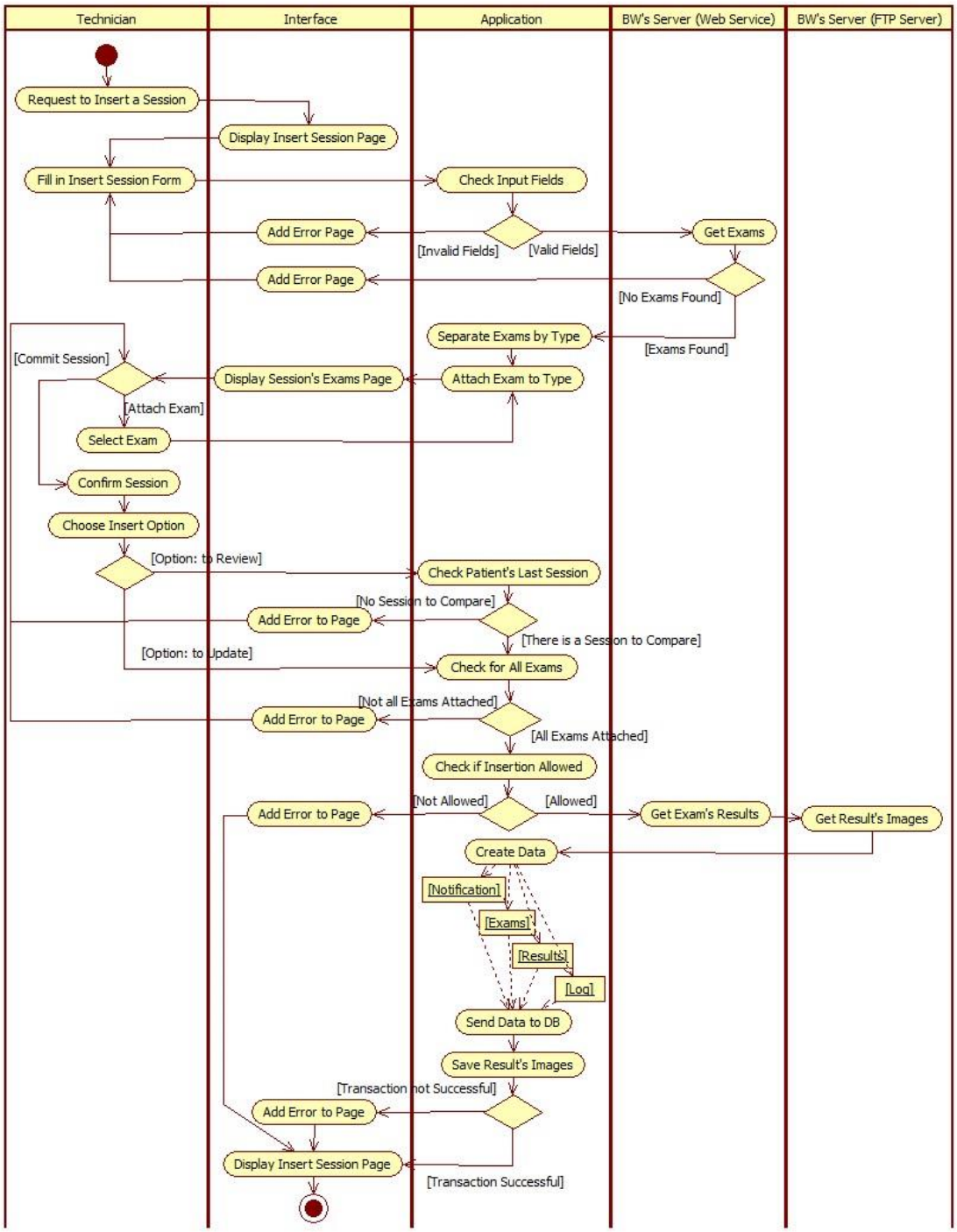


***Figure 15 - UML activity diagram for user role: technician and activity: insert session***

In order to insert a new session, the technician must be redirected to a page (Insert Session Page) where he can input the required data to access BlueWork's Web Service:

- **Patient's NHS Number** – Patient the session will be assigned to.
- **Monitoring Program** – Session's monitoring program.

- **Exams Date –** Date of when the exams were acquired.

After the following validity checks, the application should connect to BlueWork's web service in order to acquire the required exams.

- Empty fields (Empty NHS Number, unselected monitoring program, unselected date of exams)
- Patient doesn't exist (Invalid NHS number) or is "disabled"
- Patient is not assigned to selected monitoring program

These exams should be arranged before they get displayed in the Session's Exams page:

- **Session's Exams Page:** Each session requires an exam for each type of exam specified in the monitoring program. Therefore, this page must display one section for each exam type and the exams acquired from the web service shall be sorted inside these sections. If there is only one exam in one section, it should be automatically attached to the session; if there is more than one, it's up to the user to select and attach one exam from the section to the session.

The user must select one option ("to Review" or "to Update") when he confirms the session. Once again, if a session is set "to Review", the patient must have a previous session - the remote physician needs to compare this session with the previous one. Afterwards, the session is checked for all exams (each exam type must have one attached exam) and if the session is allowed to be inserted (a session can only be inserted a certain amount of time after the patient's last session, depending on the monitoring program). Finally, the accountability log, the notification, the exams, the results and their respective images are saved.

The [Transaction not Successful] represents the non-functional requirements:

- One cannot insert a session to a patient after he's been added a session
- One cannot insert a session to a patient after he's been set to "disabled"

#### 8.1.2.2 Activity: View Imported Sessions

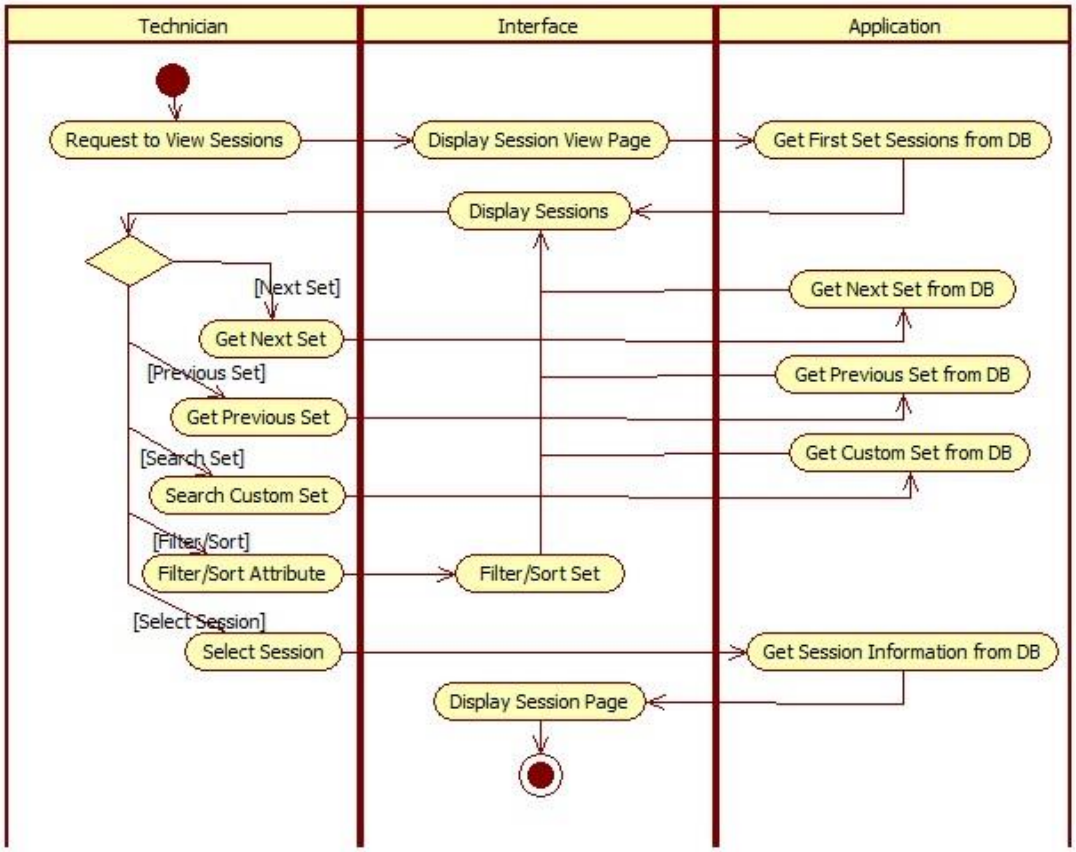


***Figure 16 - UML activity diagram for uer role: technician and activity: view imported sessions***

Any technician can only view session that he has imported. When he accesses the Session View Page, a set of the last imported sessions will be presented.

- **Session View Page:** Page to show a list of sessions, along with their basic attributes (import date, session status, monitoring program name, patient NHS number).

From this page, he can ask for the Next Set/Previous Set (if there are any) or search by a Custom Set (by searching one or more of the session's attributes). At any time, the presented list may be filtered or sorted by any of the session's attributes. Selecting one session from the session list will redirect the technician to the Session Page:

- **Session Page:** Complete session information (session, patient, monitoring program and diagnosis full information).

#### 8.1.2.3 Activity: Delete Session

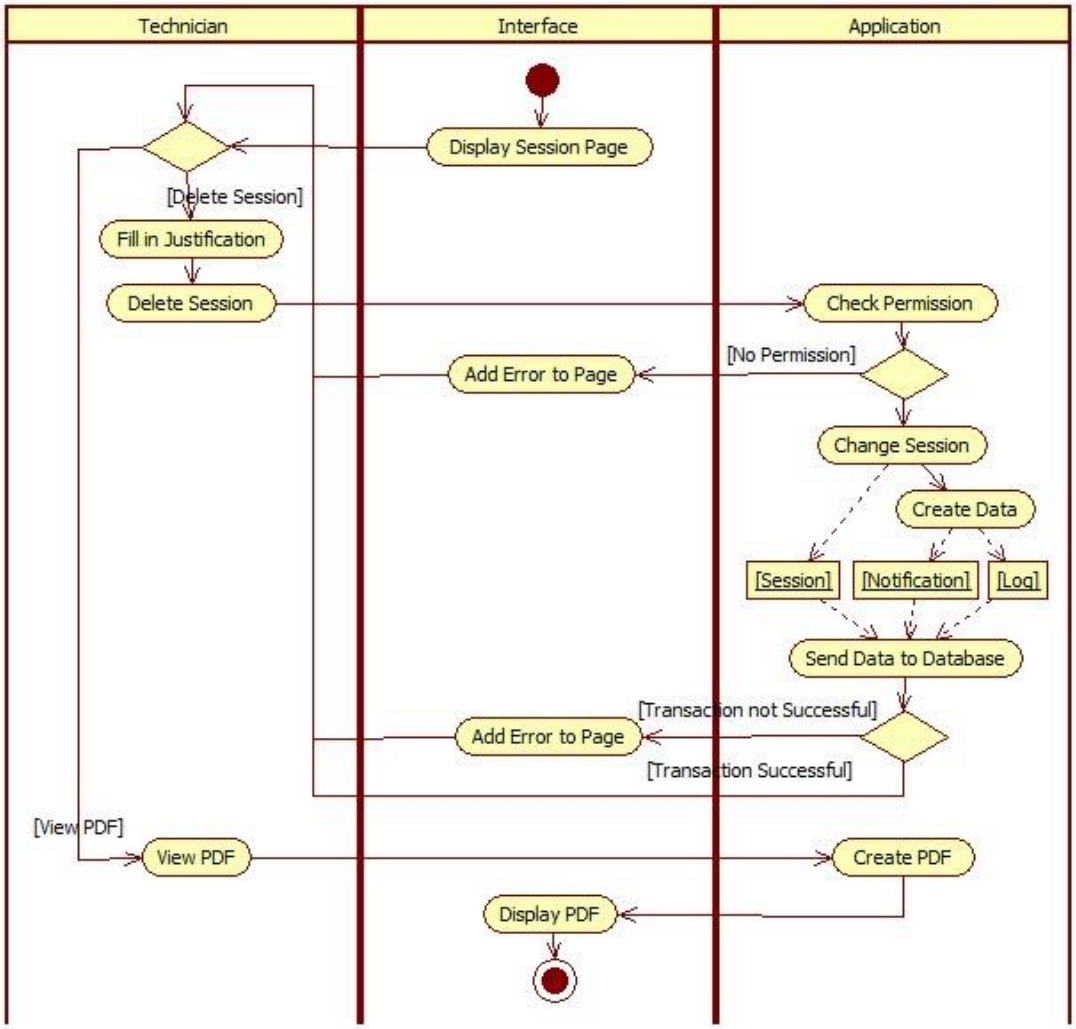


***Figure 17 - UML activity diagram for user role: technician and activity: delete session***

From the Session Page, a technician can either download a PDF containing all the information or try and delete a session. On session delete, after the permission checks, the data is changed (the session isn't really deleted, only gets a status change to "Deleted" and can no longer be used for diagnosis or for comparison) and created (notification and accountability log) and sent to the database. The permission checks include:

- Session cannot be already deleted.
- Session cannot be in diagnosis or diagnosed.
- Session cannot be deleted after a certain period of time of its creation.

The [Transaction not Successful] represents the non-functional requirements:

- One cannot delete a session after it has been deleted
- One cannot delete a session after it has been diagnosed or being reviewed

### 8.1.3 Remote Physician

#### 8.1.3.1 Activity: Review Session

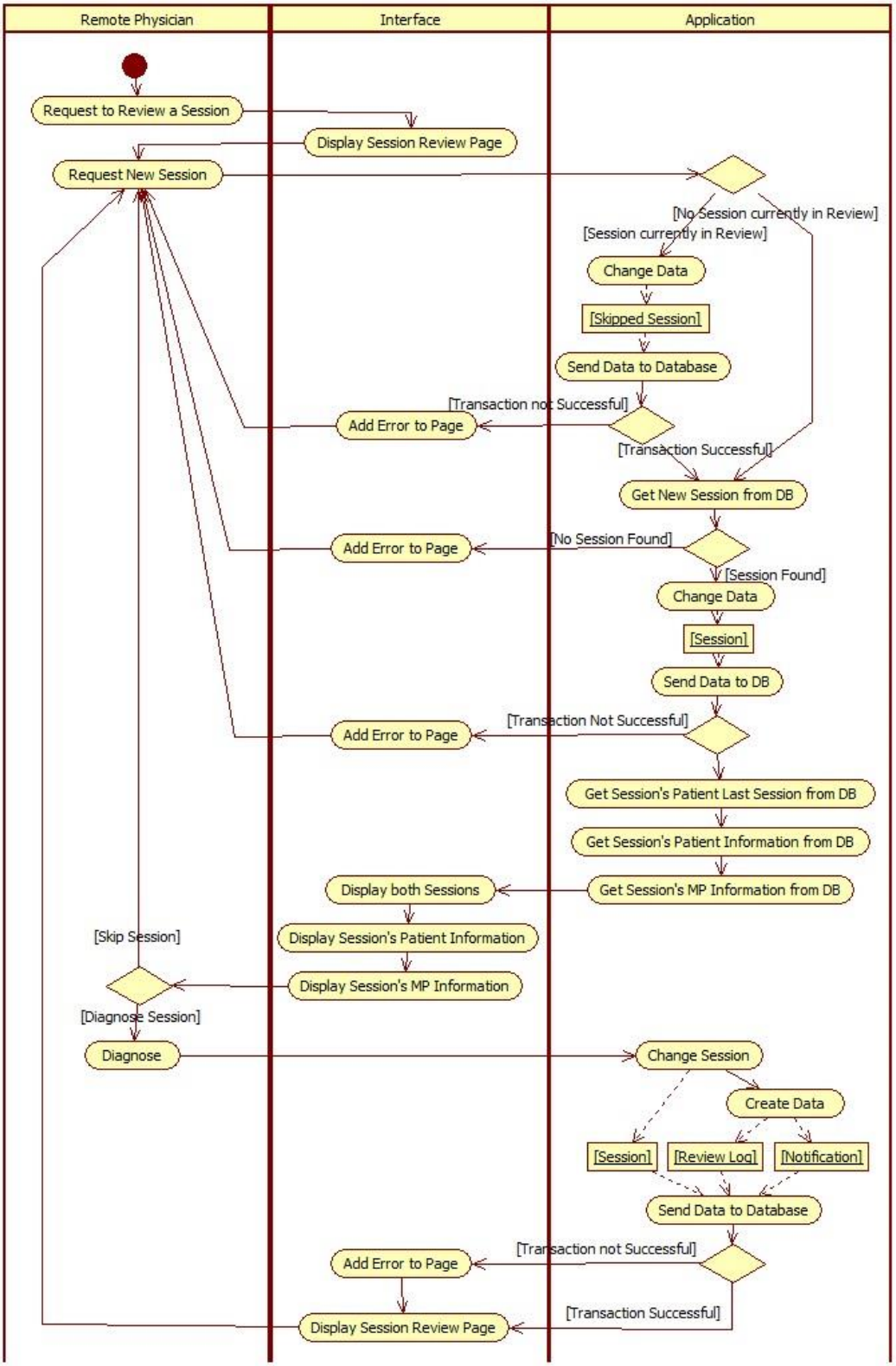


***Figure 18 - UML activity diagram for user role: remote physician and activity: review session***

In order to review a session, the remote physician will access the Session Review Page:

- **Session Review Page:** This page must contain all required session information, including patient and monitoring program information. The current session and previous session's exams and results must be presented side by side, sorted out by exam type and targeted eye, for an easy exam comparison.

A remote physician may request a new session to diagnose and the server may provide him with one if there is a session to review that matches one of the physician's monitoring programs. The server must always select the oldest unreviewed session and only a session that is not being reviewed (with "session status" attribute "onHold"). Afterwards, the server will change the "session status" attribute in the database to "onReview" (to try and avoid multiple access to the same session). The respective [Transaction not Successful] represents the non-functional requirement:

- One cannot be assigned a session after it has been assigned
- One cannot be assigned a session after it has been deleted

If the session correctly assigned to the physician ("session attribute" correctly set to "onReview"), the application now acquire and process all the required information (former session's exams and results, patient information and monitoring programs information) in order to be presented in the Session Review Page.

The physician may now diagnose the session by inputting a diagnosis (consultation is or is not required, additional text information) and by commit such diagnosis. The application will then save the information to the database (changed session – with "session status" changed to "Reviewed", review log and notification). The [Transaction not Successful] represents the non-functional requirements:

- One cannot diagnose or skip a session that is no longer assigned to him
- One cannot diagnose a session after the related patient information has changed (patient basic information or diagnosis)

The physician may also skip a session after he has been assigned one. The "session status" of the skipped session must be changed to "onHold" so it may be reviewed by another physician. The [Transaction not Successful] represents the non-functional requirement:

- One cannot diagnose or skip a session that is no longer assigned to him

### 8.1.4 Administrator

#### 8.1.4.1 Activity: Search Data/Logs

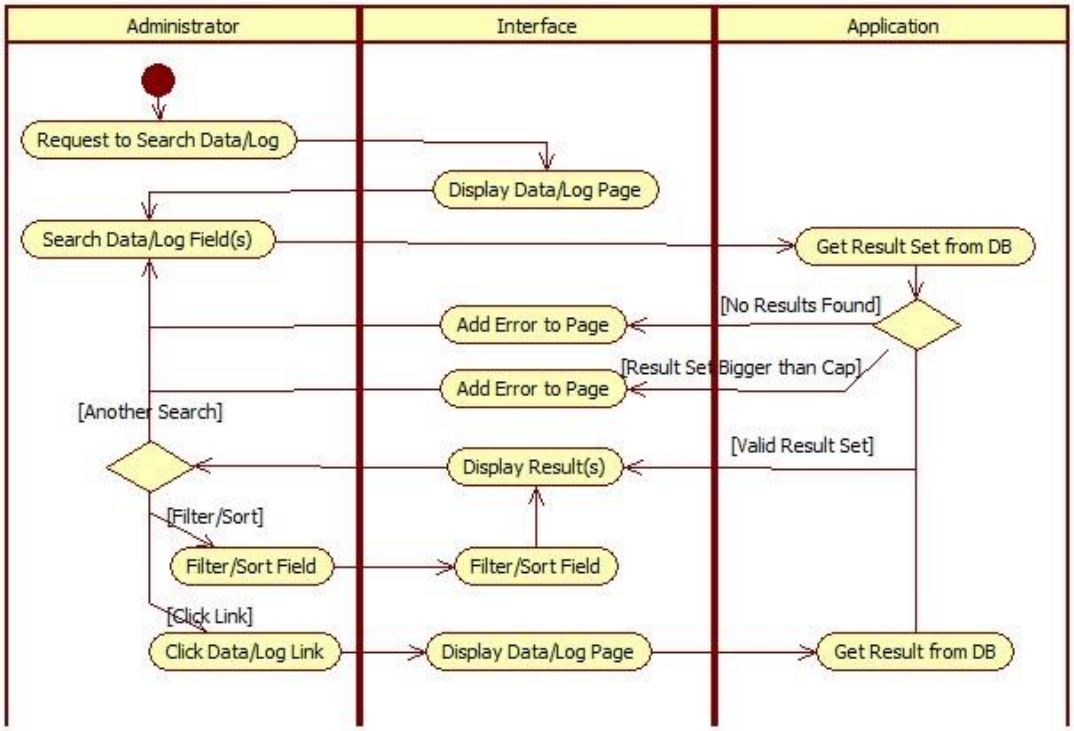


***Figure 19 - UML activity diagram for user role: administrator and activity: search data/log***

This section allows the administrator to search all data and logs currently in the database. Each data or log type must have its own page:

- **Data/Log Page –** Web page for each data entity or data log. It must contain input boxes or combo boxes that the administrator will use to search the respective data.

Any combination of input/combo boxes can be used to search for data or logs; this information will then be presented on the page if the number of results is smaller than a cap. The result list may be filtered or sorted.

Providing a good way to cycle through the entire application data is essential; therefore, a set of links must be implemented to connect this information. Such approach will allow an administrator to infinitely cycle between data and logs without the need to use the search field. For a deep insight on which pages serve which data/log, available searches, filters, sorts and links consult annex 8.2 (Administrator Search Map).

#### 8.1.4.2 Activity: Insert Data

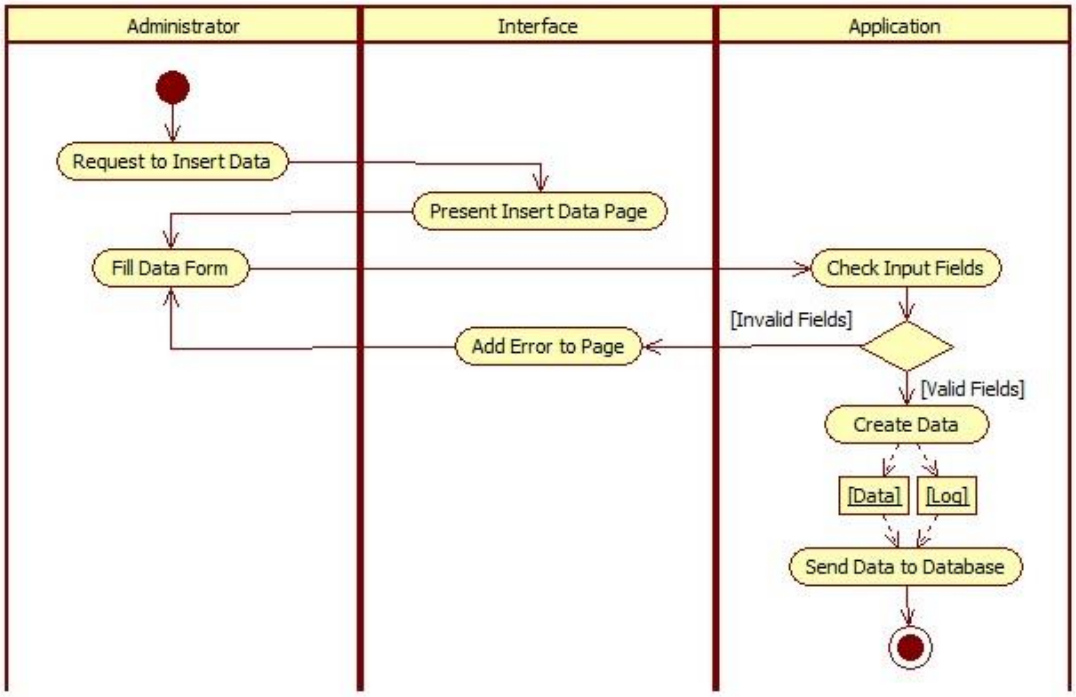


***Figure 20 - UML activity diagram for user role: administrator and activity: insert data***

Monitoring programs, users and institutions will be inserted by administrators. After filling the form to insert a one of these entities, the fields must be checked, in the server, for:

- Empty fields
- Character caps

- **User**
  - Non-number in "user professional number"
  - "User type" and "country" not selected
  - "Institution" not selected for non-"remote physician" (this physician may not have institution)
  - User's country different from institution's country
- **Institution**
  - "Country" not selected
  - Non-number in "belongs to (institution ID)"
  - Non-existing "belong to (institution ID)"
- **Monitoring Program**
  - Deadline to diagnosis too big for gap between sessions (the deadline to diagnose a session must be smaller than the gap between sessions and give room for a physician to report this an undiagnosed session before the patient performs his next session)
  - Non-number in "deadline to diagnosis" or "gap between sessions"
  - "Country" or no "exam types" selected

Afterwards, both data and accountability log will be sent to the database.

#### 8.1.4.3 Activity: Edit Data

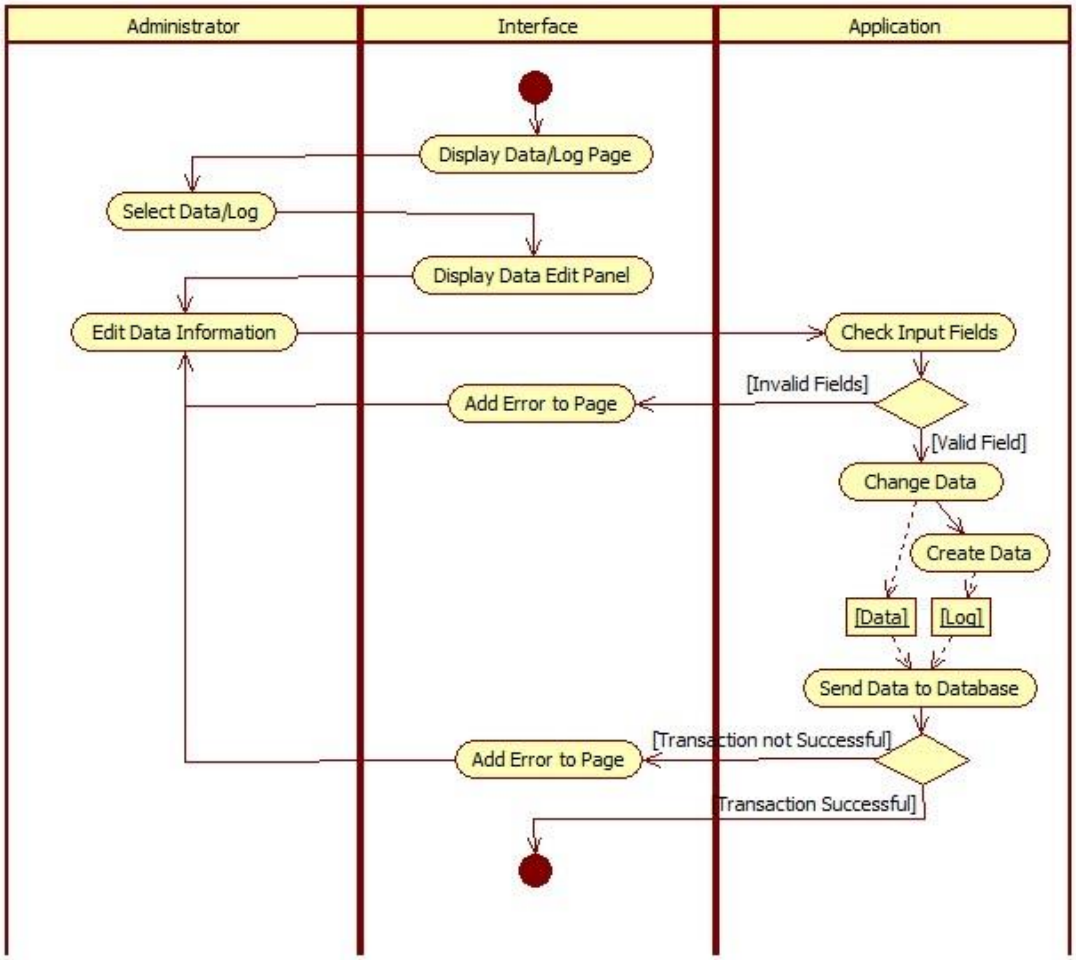


***Figure 21 - UML activity diagram for user role: administrator and activity: edit data***

To edit users and institutions, the administrator must select one from the respective data page which should open an edit panel on that same page.

The new data (after alteration) must go through the same restrictions applied on insertion (Activity: Insert Data - 8.1.4.2). Additionally, there must be a restriction to check if any changes were actually made.

The administrator may also change a user's password, in which he is presented with the input fields "new password" and "confirm new password". These fields are check for:

- 'New password' must match 'confirm new password'.
- 'New password' must differ from 'current password'.
- 'New password' must differ from 'last password'.
- 'New password' must have between 5-20 characters.

If the new data went through all these validity checks, it will be sent to the database along with the accountability log. The [Transaction not Successful] represents the non-functional requirement:

- One cannot modify a user or institution after it has been modified

If the user is a remote physician, the administrator may open an additional panel with a list shuttle that manages said remote physician's monitoring programs. If any alterations were made to the physician's monitoring programs, the new data and accountability log are also sent to the database.

#### 8.1.4.4 Activity: Accept/Reject Patient Modification Requests

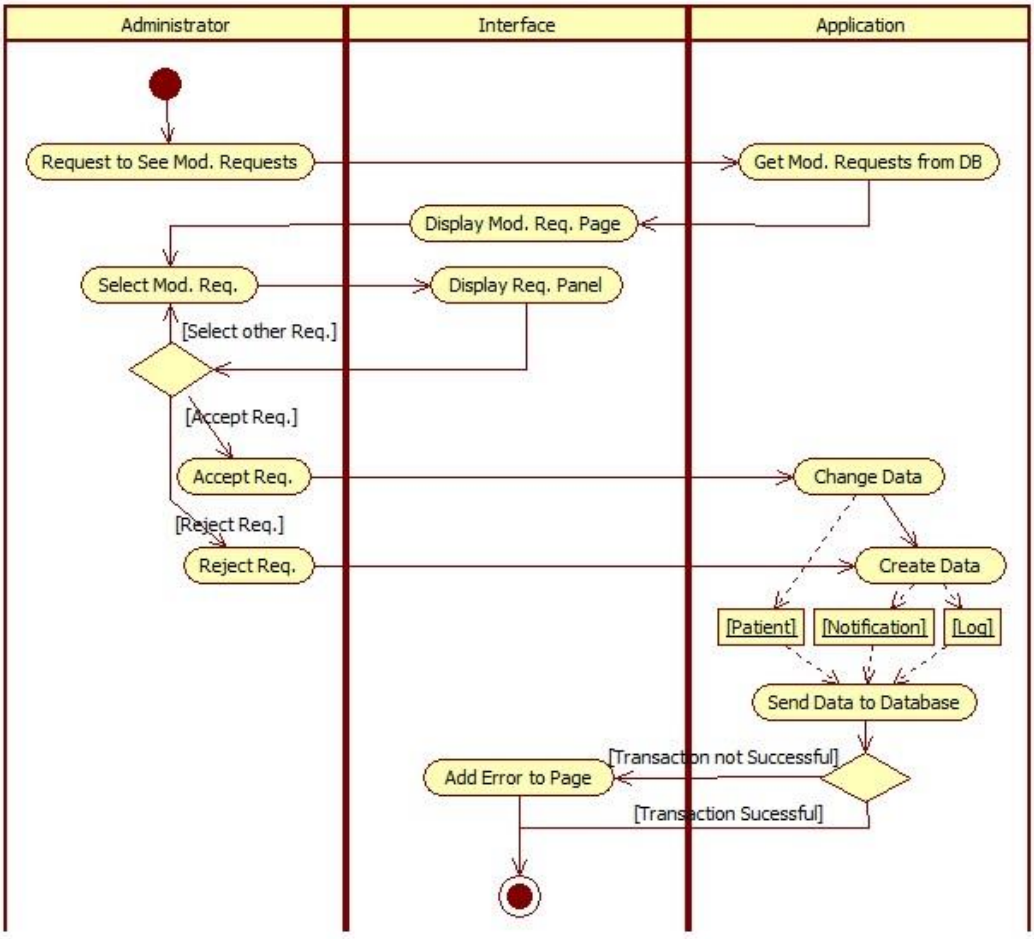


***Figure 22 - UML activity diagram for user role: administrator and activity: accept/reject patient modification requests***

On request, the administrator is presented the patient modification requests that are on hold:

- **Modification Request Page** – Contains a list of all patient modification requests correctly on hold and a panel to display the currently selected modification request.

By selecting any of them, a panel should open with the required modification, the patient current information and with the requester's information. The administrator must select one of two options (accept or reject) and he may add additional info to why the request was accepted/rejected. Whether the patient should be changed or not, a notification must be sent to the requester and an accountability log must be created.

The [Transaction not Successful] represents the non-functional requirement:

- One cannot accept/reject a patient modification request after it has been accepted/rejected

#### 8.1.4.5 Activity: System Performance

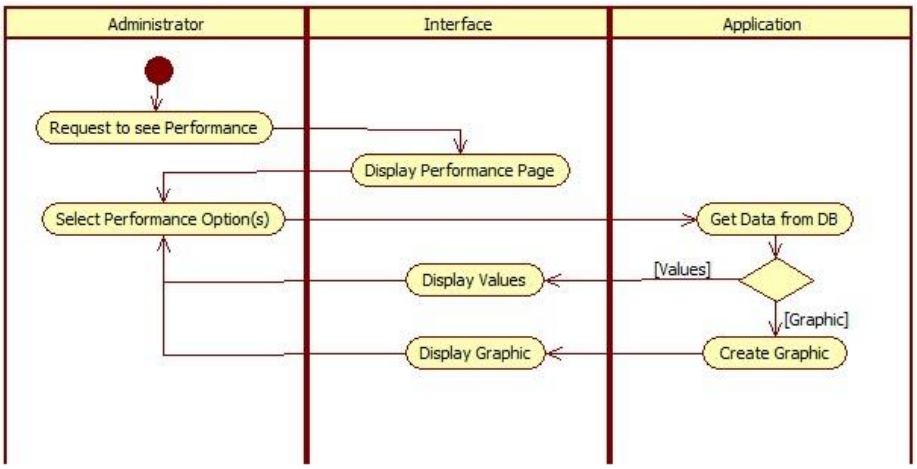


***Figure 23 - UML activity diagram for user tole: administrator and activity: system performance***

Checking system performance is one of the provided administrator tools.

- **Performance Page** – Where administrators select one or more performance check options. This page also presents the requested values and graphics.

The available performance check options are:

- **Average wait time on sessions** – How much a session must wait to be reviewed
- **Average time to review sessions** – How much time is put into the session review
- **Overall session status** – Percentage of sessions that were reviewed and not reviewed
- **Overall 'consultation required' reviews** – Percentage of sessions that were classified as 'requires a consultation' vs. 'doesn't require a consultation'
- **(…) by monitoring program –** All former analysis separated by monitoring program

#### 8.1.4.6 Activity: Alarms

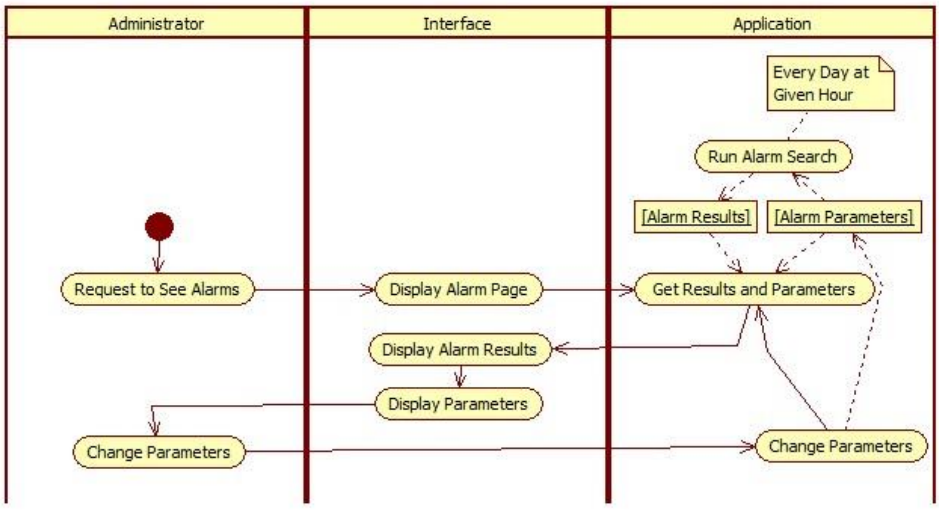


***Figure 24 - UML activity diagram for user role: administrator and activity: alarms***

Alarm search must occur every day at a low workflow hour using the alarm parameters set. The administrator can, at any times, access the results or change these parameters.

- **Alarm Page –** Displays the (changeable) parameters used in the search and the alarm results.

The alarming trends monitored are the ones enunciated in the following list. The parameters allowed to change are the values referenced in this list.

- **Average 'Require consultation' bigger than a value (percentage) –** Presents all remote physicians that have a percentage of 'require consultation' in their session reviews bigger than a certain percentage
- **Average 'Doesn't require consultation' bigger than a value (percentage) –** Presents all remote physicians that have a percentage of 'doesn't require consultation' in their session reviews bigger than a certain percentage
- **Average diagnosis time smaller than a value (seconds) –** Presents all remote physicians that spend an average time smaller than a value (in seconds) in their session reviews
- **Notifications not read (days) –** Presents notifications that have not been read in a certain amount of days. Not all notifications are required, only the technician's notifications related to session diagnosis.

#### 8.1.4.7 Activity: Billing Report

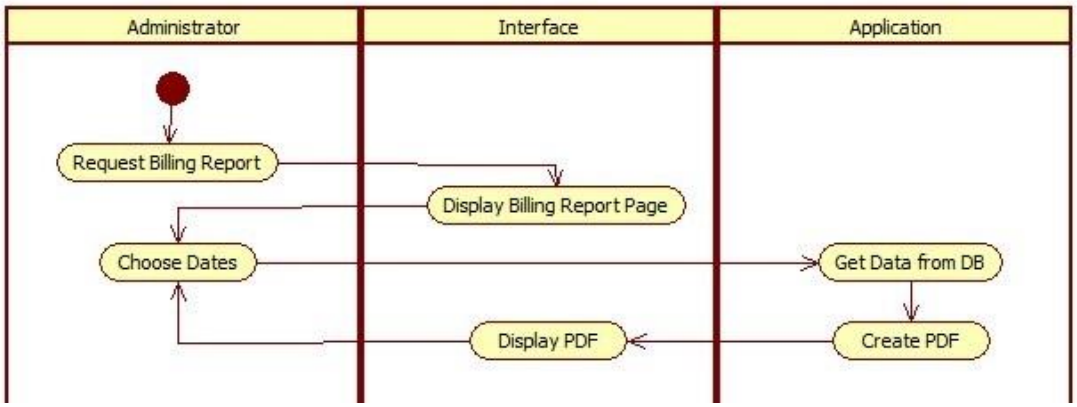


***Figure 25 - UML activity diagram for user role: administrator and activity: billing report***

- **Billing Report Page** – Page that allows an administrator to insert the dates for the billing report. The billing report will then have the billing information from in-between these dates.

### 8.1.5 General

#### 8.1.5.1 Activity: Notifications

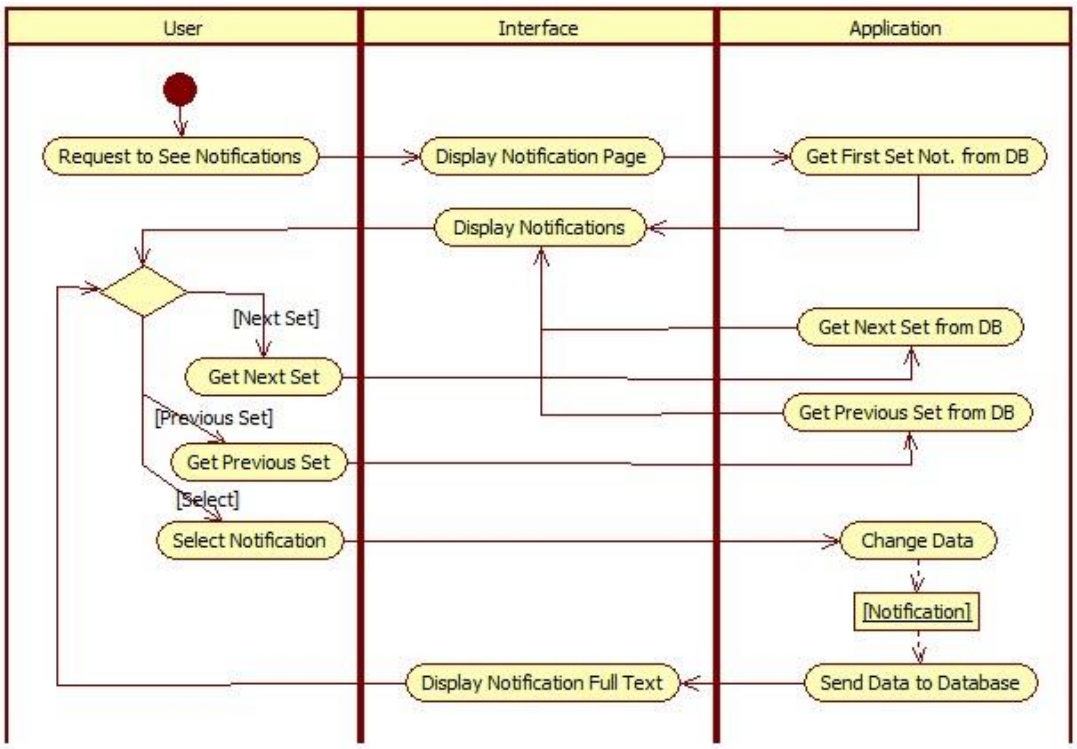


***Figure 26 - UML activity diagram for user role: general and activity: notifications***

Apart from administrators, all users should receive notifications of their actions or related user's actions:

- **Notification Page:** Page to display a user's notification list (with notification type and creation timestamp). Must also contain a panel to display a notification's full text once it's selected; upon selection, the notification must be checked as "read".

For performance concerns, when a user enters his Notification Page, only a set of the last notifications is presented. He can, then, cycle between sets or select a particular notification, which will change the notification to read, sent it to the database and present the notification's full text to the user.

#### 8.1.5.2 Activity: Feedbacks

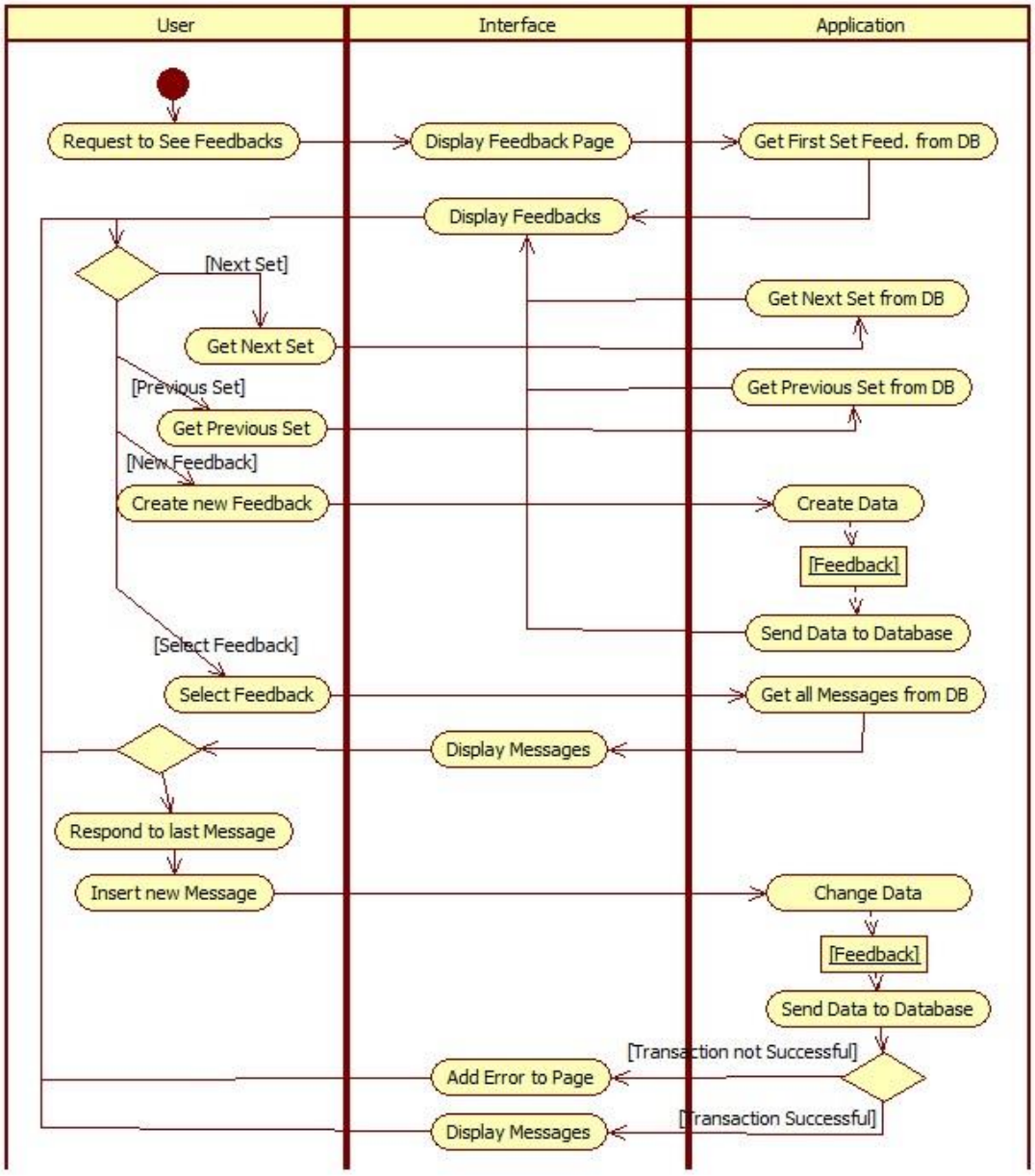


***Table 11 - UML activity diagram for user role: general and activity: feedbacks***

A feedback consists in all message exchanges from one specific user to another. Therefore, one feedback from one user to another may contain several messages (each message responding to the previous one).

- **Feedback Page:** Page to display the user's feedbacks. If the user is an administrator, he has access not just to his feedbacks but to all unresponded feedbacks. Must contain a panel to display all of the feedback's messages once one feedback is selected. If the user isn't the sender of the selected feedback's last message, he may respond with another message. It must also contain a panel for the user to create a new feedback message; if the user is an administrator, he must insert the ID of user that he wishes to send the message to.

For performance concerns, not all feedbacks are retrieved from the database when the user accesses the Feedback Page; instead, the last feedbacks are presented and the user may request the following feedbacks. After responding to a feedback's last message, the feedback is changed (a new message is added) and sent to the database; if the responding user is an administrator and the respective feedback was previously un-responded, the feedback becomes now his and no other administrator has access to it. The [Transaction not Successful] represent the non-functional requirement:

- One cannot answer to a feedback after it has been answered

#### 8.1.5.3 Activity: Change Password

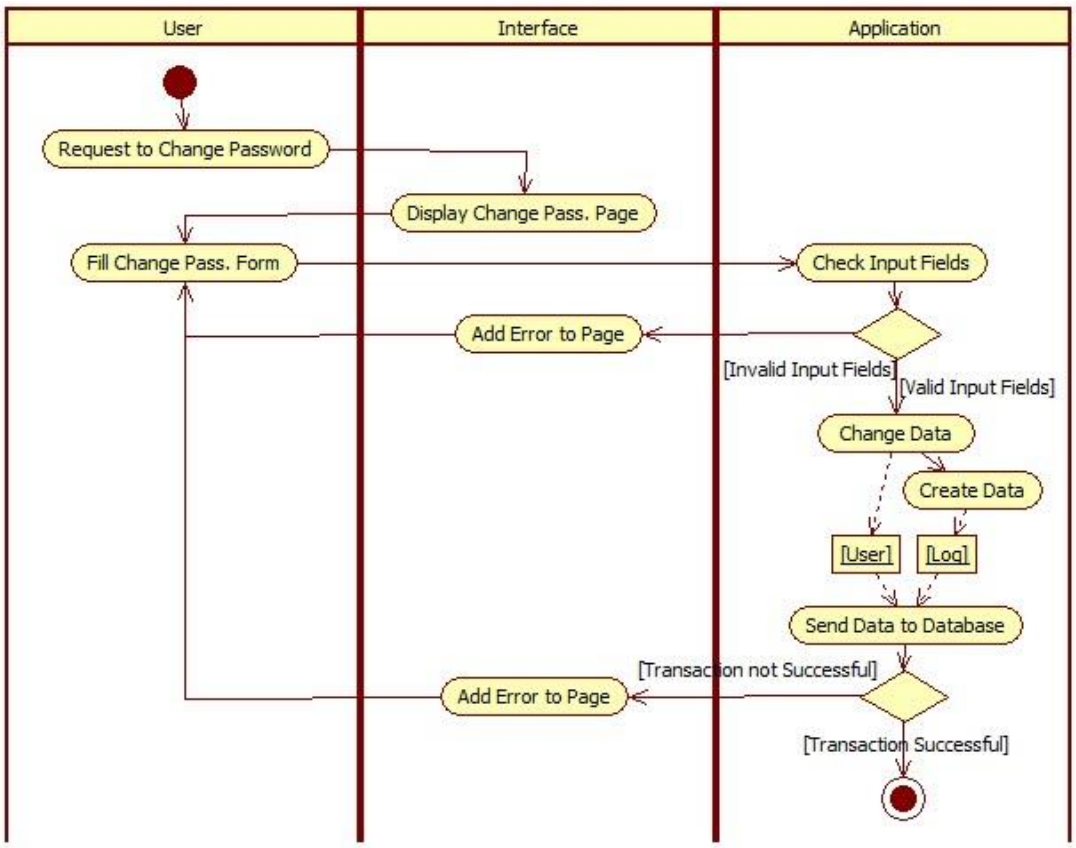


***Table 12 - UML activity diagram for user role: general and activity: change password***

- **Change Password Page:** Page to input 3 fields ('current password', 'new password' and 'confirm new password').

The input fields are checked for the following restrictions:

- 'Current password' must be correct.
- 'New password' must match 'confirm new password'.
- 'New password' must differ from 'current password'.
- 'New password' must differ from 'last password'.
- 'New password' must have between 5-20 characters.

The [Transaction not Successful] represents the non-functional requirement:

- One cannot modify a user after it has been modified

## 8.2 Appendix B - Administrator Search Map

This map represents the possible ways to cycle between data/log pages, what are the available search fields in each search web page and what is displayed in the result table of each web page:

- **S (Search)** – Fields marked with **S** are available for search in the respective web page.
- **D (Display) –** Fields marked with **D** are displayed in the result table.
- **S (Sort) –** Fields marked with **S** are sortable in the result table.
- **F (Filter) –** Fields marked with **F** are filterable in the result table.
- **Link –** Fields that contains a link, to what page the link redirects and what is presented in that page.

| Page | Field | Rational | S | Result Table | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | D | S | F | Link | |
| | | | | | | | Page | Result List |
| searchPatient | NHS Number | Patient's NHS | X | X | X | X | | |
| | First Name | Patient's First Name | X | X | X | X | | |
| | Last Name | Patient's Last Name | X | X | X | X | | |
| | Country | Patient's Country | X | X | X | X | | |
| | Birthdate | Patient's Birthdate | X | X | X | | | |
| | Actions | Patient's Insertion Log | | X | | | searchInsPat | Patient's Insertion Log |
| | | Patient's ICD Classification Log | | | | | searchIcdLog | Patient's ICD Classifications Log |
| | | Patient's Text Diagnosis Log | | | | | searchTextDiag | Patient's Text Diagnosis Log |
| | | Patient's Monitoring Programs Log | | | | | searchMPatLog | Patient's Monitoring Program Log |
| | | Patient's Monitoring Programs | | | | | searchMP | Patient's Monitoring Programs |
| | | Patient's Modification Requests Log | | | | | searchModPat | Patient's Modification Request Log |
| | | Patient's Sessions | | | | | searchSession | Patient's Sessions |
| searchMP | MP Name | MP's Name | X | X | X | X | | |
| | Deadline (Days) | Deadline (Days) | X | X | X | X | | |
| | Gap (Months) | Gap (Months) | X | X | X | X | | |
| | Inserted By (User Prof. Nbr.) | User that inserted the MP | X | X | X | X | searchUser | User that inserted the MP |
| | Inserted Timestamp | When was the MP inserted | X | X | X | | | |
| | MP Country | MP's Country | X | X | X | X | | |
| | Exam Types | MP's Exam Types | | X | | | | |
| searchUser | User Prof. Nbr. | User's Prof. Number | X | X | X | X | | |
| | User ID | User's ID | X | X | X | X | | |
| | User First Name | User's First Name | X | X | X | X | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | User Last Name | User's Last Name | X | X | X | X | | |
| | User Country | User's Country | X | X | X | X | | |
| | User Type | User's Type | X | X | X | X | | |
| | Bloqued | User Bloqued/Not Bloqued | X | X | X | | | |
| | Username | User's Username | X | X | X | X | | |
| | User Institution | User's Institution | X | X | X | X | | |
| | Actions | Sent Feedbacks | | X | | | searchFeedback | User's Sent Feedbacks |
| | | User's Log | | | | | searchUserLog | User's Changes Log |
| | | User's Logins | | | | | searchLogin | User's Login Record |
| | | (Not Administrator) User's Notifications | | | | | searchNotification | User's Notifications |
| | | (L. Physician) Patient Insertions Log | | | | | searchInsPat | User's Inserted Patients |
| | | (L. Physician) Patient ICD Classifications Log | | | | | searchIcdLog | User's Patient ICD Classifications |
| | | (L. Physician) Patient MP Assign Log | | | | | searchMPatLog | User's Patient MP Assigns |
| | | (L. Physician) Patient Text Diagnosis | | | | | searchTextDiag | User's Patient Text Diagnosis |
| | | (L. Physician) Patient Modification Requests | | | | | searchPatMod | User's Patient Mod. Requests |
| | | (Admin) Institution Log | | | | | searchInstLog | User's Changed Institutions |
| | | (Admin) Physician MP Assign Log | | | | | searchMPhysLog | User's Physician MP Assigns |
| | | (Admin) User Log (As Modifier) | | | | | searchUserLog | User's User Changes |
| | | (Admin) Pat. Mod. Req. (As Accepter) | | | | | searchPatMod | User's Accepted/Rejected Req. |
| | | (Admin) MP Insertions | | | | | searchMP | User's Inserted MPs |
| | | (Technician) Exported Sessions | | | | | searchSession | User's Exported Sessions |
| | | (R. Physician) Reviewed Sessions | | | | | searchSessRev | User's Reviewed Sessions |
| | | (R. Physician) Physician's MPs | | | | | searchMP | User's MPs |
| | | (R. Physician) Phyician's MP Log | | | | | searchMPhysLog | User's MP Log |
| searchNotification | Notification ID | Notification ID | X | X | X | X | | |
| | Notification Read | Notification was/wasn't read | X | | | | | |
| | Notification Type | Notification Type | X | X | X | X | | |
| | Notification Text | Notification Text | | X | | | | |
| | Sent to (User) | User that received the Notification | X | X | X | X | searchUser | User that received the Notification |
| | Sent Timestamp | When was the Notification sent | X | X | X | | | |
| | Read Timestamp | When was the Notification read | X | X | X | | | |
| searchExam | External ID (Blueworks) | Exam's External ID | X | X | X | X | | |
| | Date | Exam's Date | X | X | X | | | |
| | Nbr. Results | Number of Results | X | X | X | X | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Exam Type | Exam Type | X | X | X | X | | |
| | Exam Eye | Exam Eye | X | X | X | X | | |
| | Actions | Exam's Results | | X | | | searchResults | Exam's Results |
| | | Exam's Session | | | | | searchSession | Exam's Session |
| searchFeedback | Feedback ID | Feedback ID | X | X | X | X | | |
| | Feedback Message | Feedback Message | | X | | | | |
| | Sent Timestamp | When was the Feedback sent | X | X | X | | | |
| | Answer to (Feedback) | Feedback it responds to | X | X | X | X | searchFeedback | Feedback it responds to |
| | Answered by (Feedback) | Feedback that responds to it | X | X | X | X | searchFeedback | Feedback that responds to it |
| | Sent by (User) | User that sent the Feedback | X | X | X | X | searchUser | User that sent the Feedback |
| | Sent to (User) | User that received the Feedback | X | X | X | X | searchUser | User that received the Feedback |
| searchResults | ID (External - Blueworks) | Result's External ID (from Blueworks) | X | X | X | X | | |
| | Exam (External - Blueworks) | Result's External Exam ID (from Blueworks) | X | X | X | X | searchExam | Exam of the Result |
| | Result Eye | Result's Eye | X | X | X | X | | |
| searchInstitution | Institution ID | Institution's ID | X | X | X | X | | |
| | Institution Name | Institution's Name | X | X | X | X | | |
| | Institution Address | Institution's Address | X | X | X | X | | |
| | Institution City | Institution's City | X | X | X | X | | |
| | Institution ZIP | Institution's Zip | X | X | X | X | | |
| | Institution Country | Institution's Country | X | X | X | X | | |
| | Belongs to (Institution ID) | Belongs to which Institution | X | X | X | X | | |
| | Actions | Institutions that belong to this | | X | | | searchInstitution | Institutions that belong to this |
| | | Institution's Log | | | | | searchInstLog | Institution's Log |
| | | Institution's Users | | | | | searchUser | Institution's Users |
| searchSession | Session ID | Session's ID | X | X | X | X | | |
| | Inserted Timestamp | When was the Session inserted | X | X | X | | | |
| | Monitoring Program | Session's Monitoring Program | X | X | X | X | searchMP | Session's Monitoring Program |
| | Inserted By (User Prof. Nbr.) | User that inserted the Session | X | X | X | X | searchUser | User that inserted the Session |
| | Patient NHS | Patient evaluated in the Session | X | X | X | X | searchPatient | Patient evaluated in the Session |
| | Tech Info | Technician's Info about the Session | | X | | | | |
| | Session Status | Session Status | X | X | X | X | | |
| | Deleted Timestamp | When and if was the Session deleted | X | X | X | | | |
| | Deleted Justification | Justification for deletion | | X | | | | |
| | Actions | Session's Exams | | X | | | searchExam | Session's Exams |
| | | Session's Notifications | | | | | searchNotification | Notifications regarding this |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Session |
| | | Session Review | | | | | searchSessionRev | Session Diagnosis |
| searchSessionRev | Physician Prof. Nbr. | Reviewer's Prof. Nbr. | X | X | X | X | searchUser | Reviewer's Prof. Nbr. |
| | Session ID | Reviewed Session ID | X | X | X | X | searchSession | Reviewed Session ID |
| | Review Timestamp | When was the Session reviewed | X | X | X | | | |
| | Needs Consultation | Patient needs/doesn't need consultation | X | X | X | X | | |
| | Physician Info | Information inserted by Physician | | X | | | | |
| | Review Time | Time to Review | X | X | X | | | |
| | Notification | Notification sent on review action | | X | | | searchNotification | Notification sent on review action |
| searchIcdLog | Physician Prof. Nbr. | Physician who Classified | X | X | X | X | searchUser | Physician who Classified |
| | Action | Added or Removed ICD Code | X | X | X | X | | |
| | Patient NHS | Whose Patient | X | X | X | X | searchPatient | Whose Patient Classified |
| | ICD Code | ICD Code | X | X | X | X | | |
| | ICD Code Desc. | ICD Code Desc. | | X | X | X | | |
| | ICD Block | ICD Block | X | X | X | X | | |
| | ICD Block Desc. | ICD Block Desc. | | X | X | X | | |
| | ICD Chapter | ICD Chapter | X | X | X | X | | |
| | ICD Chapter Desc. | ICD Chapter Desc. | | X | X | X | | |
| | Notification | Notification sent on ICD Classification action | | X | | | searchNotification | Not. sent on Classification action |
| | Justification | Why was ICD Code removed | | X | | | | |
| | Log Timestamp | When was the Patient Classified | X | X | X | | | |
| searchTextDiag | Physician Prof. Nbr. | Physcian who altered the Diagnosis | X | X | X | X | searchUser | Physician who Diagnosed |
| | Patient NHS | Whose Patient | X | X | X | X | searchPatient | Whose Patient Diagnosed |
| | Text Diagnosis | Text Diagnosis | | X | | | | |
| | Notification | Notification sent on Diagnosis action | | X | | | searchNotification | Not. sent on Diagnosis action |
| | Log Timestamp | When was the Diagnosis altered | X | X | X | | | |
| searchMPatLog | Physician Prof. Nbr. | Physican who assigned MP | X | X | X | X | searchUser | Physician who assigned MP |
| | Action | Added or Removed MP | X | X | X | X | | |
| | Patient NHS | Whose Patient | X | X | X | X | searchPatient | Whose Patient assigned to MP |
| | Monitoring Program | Which Monitoring Program | X | X | X | X | searchMP | Which Monitoring Program |
| | Justification | Why was MP removed | | X | | | | |
| | Notification | Notification sent on MP assign | | X | | | searchNotification | Notification sent on MP assign |
| | Log Timestamp | When was the MP assigned | X | X | X | | | |
| searchMPhysLog | Administrator Prof. Nbr. | Administrator who assigned MP | X | X | X | X | searchUser | Administrator who assigned MP |
| | Action | Added or Removed MP | X | X | X | X | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Physician Prof. Nbr. | Whose Physician | X | X | X | X | searchUser | Whose Physician assigned to MP |
| | Monitoring Program | Which Monitoring Program | X | X | X | X | searchMP | Which Monitoring Program |
| | Log Timestamp | When was the MP assigned | X | X | X | | | |
| searchInsPat | Patient NHS | Inserted Patient | X | X | X | X | searchUser | Whose Patient inserted |
| | Inserted By (User Prof. Nbr.) | User that inserted the patient | X | X | X | X | searchUser | User that inserted the Patient |
| | Inserted NHS Number | Inserted NHS Number | X | X | X | X | | |
| | Inserted First Name | Inserted First Name | X | X | X | X | | |
| | Inserted Last Name | Inserted Last Name | X | X | X | X | | |
| | Inserted Country | Inserted Country | X | X | X | X | | |
| | Inserted Birthdate | Inserted Birthdate | X | X | X | | | |
| | Inserted Timestamp | Inserted Timestamp | X | X | X | | | |
| | Notification | Notification sent on insertion action | | X | | | searchNotification | Notification sent on insertion action |
| searchUserLog | User Prof. Nbr. | User Prof. Nbr. | X | X | X | X | searchUser | User Prof. Nbr. |
| | Log User Prof. Nbr. | Logged Prof. Nbr. | X | X | X | X | | |
| | Inserted By (User Prof. Nbr.) | Administrator that altered the User | X | X | X | X | searchUser | Administrator that altered the User |
| | Log First Name | Logged First Name | X | X | X | X | | |
| | Log Last Name | Logged Last Name | X | X | X | X | | |
| | Log Country | Logged Country | X | X | X | X | | |
| | Log User Type | Logged User Type | X | X | X | X | | |
| | Log Institution | Logged Institution | X | X | X | X | searchInstitution | Logged Institution |
| | Log Bloqued | Logged Bloqued | X | X | X | | | |
| | Log Username | Logged Username | X | X | X | X | | |
| | Log Timestamp | When was the User altered | X | X | X | | | |
| searchInstLog | Institution ID | Logged Institution | X | X | X | X | searchInstitution | Logged Institution |
| | Altered By (User Prof. User) | User that altered the Institution | X | X | X | X | searchUser | User that altered the Institution |
| | Log Inst. Country | Logged Country | X | X | X | X | | |
| | Log Inst. Name | Logged Name | X | X | X | X | | |
| | Log Inst. Address | Logged Address | X | X | X | X | | |
| | Log Inst. City | Logged City | X | X | X | X | | |
| | Log Inst. ZIP | Logged ZIP | X | X | X | X | | |
| | Belongs to (Inst. ID) | Logged Belonging Institution | X | X | X | X | searchInstitution | Logged Belonging Institution |
| | Log Timstamp | Logged Timestamp | X | X | X | | | |
| searchLogin | User Prof. Nbr. | Logged In User | X | X | X | X | searchUser | Logged in User |
| | Login Timestamp | When the User logged in | X | X | X | | | |
| | Login Time | How long was the User logged in | X | X | X | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| searchPatMod | Request ID | Request ID | X | X | X | X | | |
| | Patient NHS | Patient's NHS Nbr. | X | X | X | X | searchPatient | Requested Patient |
| | Requester Prof. Nbr. | User that Requested the Mod. | X | X | X | X | searchUser | User that Requested the Mod. |
| | Admin Prof. Nbr. | Administrator that Accep./Rej. the Mod. | X | X | X | X | searchUser | Admin. that Accep./Rej. the Mod. |
| | Req. NHS Number | Requested NHS Number | X | X | X | X | | |
| | Req. First Name | Requested First Name | X | X | X | X | | |
| | Req. Last Name | Requested Last Name | X | X | X | X | | |
| | Req. Birthdate | Requested Birthdate | X | X | X | | | |
| | Req. Timestamp | Pat Mod. Request Timestamp | X | X | X | | | |
| | Accept/Rej. Timestamp | Pat Mod. Accept/Rej. Timestamp | X | X | X | | | |
| | Pat. Modification Status | Pat. Modification Status | X | X | X | X | | |
| | Req. Justification | Request Justification | | X | | | | |
| | Accept/Rej. Justification | Accept/Rej Justification | | X | | | | |
| | Req. Notification | Notification Sent on Request | | X | | | searchNotification | Notification Sent on Request |
| | Resp. Notification | Notification Sent on Accep./Rej. | | X | | | searchNotification | Notification Sent on Accep./Rej. |

***Table 13 - Administrator search map***

## 8.3 Appendix C - Data Entities Testing

### 8.3.1 Data Objects

| Country_Name |
|---|
| **United Kingdom** |
| **Portugal** |

| Institution_Name | Institution_City | Institution_Address | Institution_ZIP |
|---|---|---|---|
| **BlueWorks** | Coimbra | Rua D. Manuel I, 78 | 3030-320 |
| **Main_Hospital** | Main_HCity | Main_HAddress | Main_HZIP |
| **Hospital** | HCity | Haddress | HZIP |

| UserType_Descrip |
|---|
| **Remote Physician** |
| **Local Physician** |
| **Administrator** |
| **Technician** |

| User_ FName | User_ LName | User_ PNumber | User_ Username | User_ Password | User_ LastPassword | User_ Bloqued |
|---|---|---|---|---|---|---|
| **Admin1** | Admin1 | 874375 | user1 | pass1 | null | false |
| **LPhysician1** | LPhysician1 | 232546 | user2 | pass2 | null | false |
| **RPhysician1** | RPhysician1 | 465738 | user3 | pass3 | null | false |
| **Technician1** | Technician1 | 574382 | user4 | pass4 | null | false |

| Pat_FName | Pat_LName | Pat_BirthDate | Pat_HNumber | Pat_Enabled |
|---|---|---|---|---|
| **Patient1** | Patient1 | 24-11-1975 | 225968 | true |

| Feedback_Message | Feedback_Last |
|---|---|
| **Feedback1** | true |
| **Feedback2** | false |

| Notification_Type_Name |
|---|
| **Inserted Patient** |
| **Request Mod Sent** |
| **Request Mod Accepted** |
| **Request Mod Rejected** |
| **Patient Diagnosis** |
| **Session Review** |
| **Session Exported** |
| **Diagnosis Achieved** |
| **Deadline Expired** |
| **Session Deleted** |
| **Monitoring Program** |

| Notification_Text | Not_Read |
|---|---|
| **Inserted Patient1** | false |
| **Req Mod Sent1** | false |
| **Req Mod Accepted1** | false |
| **Req Mod Rejected1** | false |
| **Patient Diagnosis1** | false |
| **Patient Diagnosis2** | false |
| **Session Review1** | false |
| **Session Exported1** | false |
| **Diagnosis Achieved1** | false |
| **Deadline Expired1** | false |
| **Session Deleted1** | false |
| **Monitoring Program1** | false |

| Pat_Mod_Status |
|---|
| **onHold** |

| Accepted |
|---|
| Rejected |

| | PatMod Req_ Justification | PatMod Req_ FName | PatMod Req_ LName | PatMod Req_ Birthday | PatMod Req_ HNumber | PatMod Req_ Enabled | PatModReq_ Admin Justification |
|---|---|---|---|---|---|---|---|
| PatModReq1 | PatModReqJust | Patient1 | Patient1Mod | 24-11-1975 | 225968 | true | null |

| IcdCode | IcdBlock | IcdChapter |
|---|---|---|
| Primary open-angle glaucoma | Glaucoma | Diseases of the eye and adnexa |

| Action_Description |
|---|
| Added |
| Removed |

| Log_ICD_Pat_Just |
|---|
| Log ICD2Pat Justification1 |

| Text_Diagnostic |
|---|
| Patient has Disease1 |

| | Login_Time |
|---|---|
| Login1 | 02:23:23 |

| MP_Name | MP_Gap_Months | MP_Deadline_Days |
|---|---|---|
| Monitoring Program1 | 2 | 30 |

| Examtype_Name |
|---|
| Retinography |

| Log_MP2pati_Just |
|---|
| LogMP2Pat Justification1 |

| Session_Status_Description |
|---|
| onHold |
| Reviewed |
| onReview |
| NotReviewed |
| Update |
| Deleted |

| | Session_Tech_Info |
|---|---|
| **Session1** | Info from Technician1 |

| Deleted_Session_Just |
|---|
| **Deleted Session Justification1** |

| Eye_Name | Eye_BwId |
|---|---|
| **Left** | 1 |
| **Right** | 2 |
| **None** | 4 |
| **Both** | 3 |

| | Exam_BwId | Exam_NrResults | Exam_TimeDate |
|---|---|---|---|
| **Exam1** | 5 | 1 | 27-03-2011 12:24 |

| | Result_bwId | Result_Path | Result_Width | Result_Height |
|---|---|---|---|---|
| **Result1** | 33 | /topath | 100 | 100 |

| | SessionReviewed_ DiagnosisTime | SessionReviewed_ Consultation | SessionReviewed_ PhysInfo |
|---|---|---|---|
| **Session Reviewed1** | 00:23:26 | false | Info from Phys1 |

| | Password_From | Password_To |
|---|---|---|
| **Password Change1** | Pass1 | Pass2 |

***Table 14 - Data entities objects table***

### 8.3.2 Testing File

| File | Entity | Test | Description | Result on Java Console |
|---|---|---|---|---|
| insertSequence | SequenceTable | Insert | Insert Sequence Counter for Country Table | Country Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Instituition | Institution Counter and Initial Count |
| | | Insert | Insert Sequence Counter for User Table | User Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Patient Table | Patient Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Feedback Table | Feedback Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogInstitution Table | LogInstitution Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogUser | LogUser Counter and Initial Count |

| | | | | |
|---|---|---|---|---|
| | | | Table | |
| | | Insert | Insert Sequence Counter for NotificationType Table | NotificationType Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Notification Table | Notification Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Insert Patient Table | Insert Patient Counter and Initial Count |
| | | Insert | Insert Sequence Counter for UserType Table | UserType Counter and Initial Count |
| | | Insert | Insert Sequence Counter for PatModStatus Table | PatModStatus Counter and Initial Count |
| | | Insert | Insert Sequence Counter for ModPatReq Table | ModPatReq Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Action Table | Action Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogIcdPat Table | LogIcdPat Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogIcdPatJust Table | LogIcdPatJust Counter and Initial Count |
| | | Insert | Insert Sequence Counter for TextDiagnosis Table | TextDiagnosis Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Login Table | Login Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogTextDiagPatient Table | LogTextDiagPatient Counter and Initial Count |
| | | Insert | Insert Sequence Counter for MonitoringProgram Table | Monitoring Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogMP2Patient Table | LogMP2Patient Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogMP2Physician Table | LogMP2Physician Counter and Initial Count |
| | | Insert | Insert Sequence Counter for ExamType Table | ExamType Counter and Initial Count |
| | | Insert | Insert Sequence Counter for LogMP2PatJust Table | LogMP2PatJust Counter and Initial Count |
| | | Insert | Insert Sequence Counter for SessionStatus Table | SessionStatus Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Session Table | Session Counter and Initial Count |

| | | | | |
|---|---|---|---|---|
| | | Insert | Insert Sequence Counter for DeletedSession Table | DeletedSession Counter and Initial Count |
| | | Insert | Insert Sequence Counter for WarningJustification Table | WarningJustification Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Eye Table | Eye Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Exam Table | Exam Counter and Initial Count |
| | | Insert | Insert Sequence Counter for Result Table | Result Counter and Initial Count |
| | | Insert | Insert Sequence Counter for SessionReviewedByPhys Table | SessionReviewedByPhys Counter and Initial Count |
| | | Insert | Insert Sequence Counter for PasswordChanges Table | PasswordChanges Counter and Initial Count |
| insertCountry | Country | Insert | Insert **Portugal** | **Portugal**'s Attributes |
| | | Insert | Insert **United Kingdom** | **United Kingdom**'s Attributes |
| insertInstitution | Institution | Insert | Insert **Blueworks** | **Blueworks**'s Attributes |
| | | Reference to Country | **Blueworks** in **Portugal** | Institution from: **Portugal** |
| | | Reference to Institution | **Blueworks** belongs to (none) | Institution belongs to: (empty) |
| | | Reference to Institutions | Which Institutions belong to **Blueworks** | Institution has: (empty) |
| | | Insert | Insert **Main_Hospital** | **Main_Hospital**'s Attributes |
| | | Reference to Country | **Main_Hospital** in **United Kingdom** | Institution from: from **United Kingdom** |
| | | Reference to Institution | **Main_Hospital** belongs to (none) | Institution belongs to: (empty) |
| | | Reference to Institutions | Which Institutions belong to **Main_Hospital** | Institution has: **Hospital** |
| | | Insert | Insert **Hospital** | **Hospital**'s Attributes |
| | | Reference to Country | **Hospital** in **United Kingdom** | Institution from: **United Kingdom** |
| | | Reference to Institution | **Hospital** belongs to **Main_Hospital** | Institution belongs to: **Main_Hospital** |
| | | Reference to Institutions | Which Institutions belong to **Hospital** | Institution has: (empty) |
| insertUserType | UserType | Insert | Insert **Remote Phsycian** | **Remote Physician**'s Attributes |
| | | Insert | Insert **Local Physician** | **Local Physician**'s Attributes |
| | | Insert | Insert **Administrator** | **Administrator**'s Attributes |
| | | Insert | Insert **Technician** | **Technician**'s Attributes |
| insertUser | User | Insert | Insert **Admin1** | **Admin1**'s Attributes |
| | | Reference to Country | **Admin1** in Portugal | User from: **Portugal** |

| | | | | |
|---|---|---|---|---|
| | | Reference to Institution | **Admin1** in Blueworks | User from: **Blueworks** |
| | | Reference to UserType | **Admin1** is Type **Administrator** | UserType: **Administrator** |
| | | Insert | Insert **LPhysician1** | **LPhysicians1**'s Attributes |
| | | Reference to Country | **LPhysician1** in **United Kingdom** | User from: **United Kingdom** |
| | | Reference to Institution | **LPhysician1** in **Main_Hospital** | User from: **Main_Hospital** |
| | | Reference to UserType | **LPhysician1** is Type **Local Physician** | UserType: **Local Physician** |
| | | Insert | Insert **RPhysician1** | **RPhysicians1**'s Attributes |
| | | Reference to Country | **RPhysician1** in **Portugal** | User from: **Portugal** |
| | | Reference to Institution | **RPhysician1** in (none) | User from: (empty) |
| | | Reference to UserType | **RPhyscian1** is Type **Remote Physician** | UserType: **Remote Physician** |
| | | Insert | Insert **Technician1** | **Technician1**'s Attributes |
| | | Reference to Country | **Technician1** in **United Kingdom** | User from: United Kingdom |
| | | Reference to Institution | **Technician1** in **Hospital** | User from: **Hospital** |
| | | Reference to UserType | **Technician1** is Type **Technician** | UserType: **Technician** |
| insertPatient | Patient | Insert | Insert **Patient1** | **Patient1**'s Attributes |
| | | Reference to Country | **Patient1** in **United Kingdom** | Patient from: **United Kingdom** |
| insertFeedback | Feedback | Insert | Insert **Feedback1** | **Feedback1**'s Attributes |
| | | Reference to User | **Feedback1** sent by **RPhysician1** | From: **RPhyscian1** |
| | | Reference to User | **Feedback1** sent to (none) | To: (empty) |
| | | Reference to Feedback | **Feedback1** responds to (none) | In Response To: (empty) |
| | | Insert | Insert **Feedback2** | **Feedback2**'s Attributes |
| | | Reference to User | **Feedback2** sent by **Admin1** | From: **Admin1** |
| | | Reference to User | **Feedback2** sent to **RPhysician1** | To: **RPhysician1** |
| | | Reference to Feedback | **Feedback2** responds to **Feedback1** | In Response To: **Feedback1** |
| insert LogInstitution | LogInst | Insert | Insert Log for **Hospital** | **Hospital**'s Attributes |
| | | Reference to Institution | Log of **Hospital** | Related to: **Hospital** |
| | | Reference to Institution | **Hospital** inserted belonging to **Main_Hospital** | Belongs to: **Main_Hospital** |
| | | Reference to User | **Hospital** inserted by **Admin1** | Inserted by: **Admin1** |
| | | Reference to Country | **Hospital** inserted in **United Kingdom** | Inserted in: **United Kingdom** |
| insertLogUser | LogUser | Insert | Insert Log for **RPhysician1** | **RPhysician1**'s Attributes |

| | | | | |
|---|---|---|---|---|
| | | Reference to User | Log of **RPhysician1** | Related to: **RPhysician1** |
| | | Reference to Institution | **RPhysician1** inserted belonging to (none) | Belongs to: (empty) |
| | | Reference to User | **RPhysician1** inserted by **Admin1** | Inserted by: **Admin1** |
| | | Reference to Country | **RPhysician1** inserted in **Portugal** | Inserted in: **Portugal** |
| | | Reference to UserType | **RPhysician1** inserted as **Remote Physician** | UserType: **Remote Physician** |
| insertNotType | NotificationType | Insert | Insert **Inserted Patient** | **Inserted Patient**'s Attributes |
| | | Insert | Insert **Request Mod Sent** | **Request Mod Sent**'s Attributes |
| | | Insert | Insert **Request Mod Accepted** | **Request Mod Accepted**'s Attributes |
| | | Insert | Insert **Request Mod Rejected** | **Request Mod Rejected**'s Attributes |
| | | Insert | Insert **Patient Diagnosis** | **Patient Diagnosis**'s Attributes |
| | | Insert | Insert **Session Review** | **Session Review1**'s Attributes |
| | | Insert | Insert **Session Exported** | **Session Exported**'s Attributes |
| | | Insert | Insert **Diagnosis Achieved** | **Diagnosis Achieved**'s Attributes |
| | | Insert | Insert **Deadline Expired** | **Deadline Expired**'s Attributes |
| | | Insert | Insert **Session Deleted** | **Session Deleted**'s Attributes |
| | | Insert | Insert **Monitoring Program** | **Monitoring Program**'s Attributes |
| insert Notification | Notification | Insert | Insert **Insert Patient1** | **Insert Patient1**'s Attributes |
| | | Reference to NotificationType | **Insert Patient1** is Type **Inserted Patient** | NotificationType: **Inserted Patient** |
| | | Reference to User | **Insert Patient1** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Req Mod Sent1** | **Req Mod Sent1**'s Attributes |
| | | Reference to NotificationType | **Req Mod Sent1** is Type **Request Mod Sent** | NotificationType: **Request Mod Sent** |
| | | Reference to User | **Req Mod Sent1** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Req Mod Accepted1** | **Req Mod Accepted1**'s Attributes |
| | | Reference to NotificationType | **Req Mod Accepted1** is Type **Request Mod Accepted** | NotificationType: **Request Mod Accepted** |
| | | Reference to User | **Req Mod Accepted1** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Patient Diagnosis1** | **Patient Diagnosis1**'s Attributes |
| | | Reference to NotificationType | **Patient Diagnosis1** is Type **Patient Diagnosis** | NotificationType: **Patient Diagnosis** |
| | | Reference to User | **Patient Diagnosis1** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Patient Diagnosis2** | **Patient Diagnosis2**'s Attributes |

| | | | | |
|---|---|---|---|---|
| | | Reference to NotificationType | **Patient Diagnosis2** is Type **Patient Diagnosis** | NotificationType: **Patient Diagnosis** |
| | | Reference to User | **Patient Diagnosis2** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Session Review1** | **Session Review1**'s Attributes |
| | | Reference to NotificationType | **Session Review1** is Type **Session Review** | NotificationType: **Session Review** |
| | | Reference to User | **Session Review1** sent to **RPhysician1** | To: **RPhysician1** |
| | | Insert | Insert **Req Mod Rejected1** | **Req Mod Rejected1**'s Attributes |
| | | Reference to NotificationType | **Req Mod Rejected1** is Type **Request Mod Rejected** | NotificationType: **Request Mod Rejected** |
| | | Reference to User | **Req Mod Rejected1** sent to **LPhysician1** | To: **LPhysician1** |
| | | Insert | Insert **Session Exported1** | **Session Exported1**'s Attributes |
| | | Reference to NotificationType | **Session Exported1** is Type **Session Exported** | NotificationType: **Session Exported** |
| | | Reference to User | **Session Exported1** sent to **Technician1** | To: **Technician1** |
| | | Insert | Insert **Session Deleted1** | **Session Deleted1**'s Attributes |
| | | Reference to NotificationType | **Session Deleted1** is Type **Session Deleted** | NotificationType: **Session Deleted** |
| | | Reference to User | **Session Deleted1** sent to **Technician1** | To: **Technician1** |
| | | Insert | Insert **Diagnosis Achieved1** | **Diagnosis Achieved1**'s Attributes |
| | | Reference to NotificationType | **Diagnosis Achieved1** is Type **Diagnosis Achieved** | NotificationType: **Diagnosis Achieved** |
| | | Reference to User | **Diagnosis Achieved1** sent to **Technician1** | To: **Technician1** |
| | | Insert | Insert **Deadline Expired1** | **Deadline Expired1**'s Attributes |
| | | Reference to NotificationType | **Deadline Expired1** is Type **Deadline Expired** | NotificationType: **Deadline Expired** |
| | | Reference to User | **Deadline Expired1** sent to **Technician1** | To: **Technician1** |
| | | Insert | Insert **Monitoring Program1** | **Monitoring Program1**'s Attributes |
| | | Reference to NotificationType | **Monitoring Program1** is Type **Monitoring Program** | NotificationType: **Monitoring Program** |
| | | Reference to User | **Monitoring Program1** sent to **LPhysician1** | To: **LPhysician1** |
| insertLog Patient | InsertedPatient | Insert | Insert Log for **Patient1** | **Patient1**'s Attributes |
| | | Reference to Patient | Log of **Patient1** | Related to: **Patient1** |
| | | Reference to User | **Patient1** inserted by **LPhysician1** | Inserted by: **LPhysician1** |
| | | Reference to Notification | **Insert Patient1** Sent uppon Insertion of | Related to: **Insert Patient1** |

| | | | | |
|---|---|---|---|---|
| | | | **Patient1** | |
| | | Reference to Country | **Patient1** inserted in **United Kingdom** | Inserted in: **United Kingdom** |
| insertPat ModStatus | PatModStatus | Insert | Insert **onHold** | **onHold**'s Attributes |
| | | Insert | Insert **Accepted** | **Accepted**s Attributes |
| | | Insert | Insert **Rejected** | **Rejected**'s Attributes |
| insertModPatReq | ModPatRequest | Insert | Insert **PatModReq1** | **PatModReq1**'s Attributes |
| | | Reference to Patient | Log of **Patient1** | Related to: **Patient1** |
| | | Reference to User | **PatModReq1** requested by **LPhysician1** | Requested by: **LPhysician1** |
| | | Reference to User | **PatModReq1** reviewed by (none) | Reviewed by: (empty) |
| | | Reference to Notification | **PatModReq1** created **Req Mod Sent1** | Sent Notification: **Req Mod Sent1** |
| | | Reference to Notification | **PatModReq1** created (none) | Accepted/Rejected Notification: (empty) |
| | | Reference to PatModStatus | **PatModReq1** is **onHold** | Status: **onHold** |
| insertPat2ICD | Patient (+ IcdCode) | Reference to IcdCode | **Patient1** has **Primary open-angle glaucoma** | Disease: **Primary open-angle glaucoma** |
| | IcdCode (+ IcdBlock) | Reference to IcdBlock | **Primary open-angle glaucoma** is in Block **Glaucoma** | Block of Disease: **Glaucoma** |
| | IcdBlock (+ IcdChapter) | Reference to IcdChapter | **Glaucoma** is in Chapter **Diseases of the eye and adnexa** | Chapter of Block: **Diseases of the eye and adnexa** |
| insertAction | Action | Insert | Insert **Added** | **Added**'s Attributes |
| | | Insert | Insert **Removed** | **Removed**'s Attributes |
| insertPat2 ICDLog | LogIcdPat | Insert | Insert Log for **Patient1** has **Primary open-angle glaucoma** | Log's Attributes |
| | | Reference to Patient | **Patient1** has the Disease | Patient: **Patient1** |
| | | Reference to IcdCode | Disease is **Primary open-angle glaucoma** | Disease: **Primary open-angle glaucoma** |
| | | Reference to User | **LPhysician1** Added the Disease to **Patient1** | Added/Removed by: **LPhysician1** |
| | | Reference to Action | The Disease was **Added** to **Patient1**'s Profile | Action: **Added** |
| | | Reference to Notification | **Patient Diagnosis1** Sent due to this Operation | Notification: **Patient Diagnosis1** |
| insertPat2 ICDLogJust | LogIcdPatJust | Insert | Insert **Log ICD2Pat Justification1** | **Log ICD2Pat Justification1**'s Attributes |
| | | Reference to LogIcdPat | Justification for **Patient1** having **Primary open-angle glaucoma** | Log: **Patient1** has **Primary open-angle glaucoma** |
| insertTextDiag | TextDiagnosi | Insert | Insert **Patient has Disease1** | **Patient has Disease1**'s Attributes |
| | | Reference to Patient | **Patient has Disease** is the Diagnosis for **Patient1** | Related to: **Patient1** |
| insertText | LogTextDiagPatient | Insert | Insert Log for **Patient** | **Patient has Disease1**'s |

| | | | | |
|---|---|---|---|---|
| DiagLog | | | **has Disease1** | Attributes |
| | | Reference to Patient | Log of **Patient1** | Related to: **Patient1** |
| | | Reference to User | **LPhysician1** Diagnosed **Patient1** | Diagnosed by: **LPhysician1** |
| | | Reference to Notification | **Patient Diagnosis2** Sent due to this operation | Notification: **Patient Diagnosis2** |
| insertLogin | Login | Insert | Insert **Login1** | **Login1**'s Attributes |
| | | Reference to User | Login of **Technician1** | Related to: **Technician1** |
| insertMP | MonitoringProgram | Insert | Insert **Monitoring Program1** | **Monitoring Program1**'s Attributes |
| | | Reference to User | **Monitoring Program1** inserted by **Admin1** | Inserted by: **Admin1** |
| | | Reference to Country | **Monitoring Program1** inserted in **United Kingdom** | Inserted in: **United Kingdom** |
| insertMP2Pat | Patient (+ MonitoringProgram) | Reference to MonitoringProgram | **Patient1** is in **Monitoring Program1** | Patient in: **Monitoring Program1** |
| insertMP2 Physician | User (+ MonitoringProgram) | Reference to MonitoringProgram | **RPhysician1** is in **Monitoring Program1** | Physician in: **Monitoring Program1** |
| insertMP2 PatLog | LogMpPatient | Insert | Insert Log for **Patient1** in **Monitoring Program1** | Log's Attributes |
| | | Reference to Patient | **Patient1** in Monitoring Program | Related to: **Patient1** |
| | | Reference to MonitoringProgram | Patient in **Monitoring Program1** | Patient in: **Monitoring Program1** |
| | | Reference to User | **LPhysician1** Added the Patient | Added/Removed by: **LPhysician1** |
| | | Reference to Action | Patient was **Added** to the Monitoring Program | Action: **Added** |
| | | Reference to Notification | **Monitoring Program1** sent due to this Operation | Notification Sent: **Monitoring Program1** |
| insertMP2 PhysLog | LogMpPhysician | Insert | Insert Log for **RPhysician1** in **Monitoring Program1** | Log's Attributes |
| | | Reference to User | **RPhysician1** in Monitoring Program | Related to: **RPhysician1** |
| | | Reference to MonitoringProgram | User in **Monitoring Program1** | Physician in: **Monitoring Program1** |
| | | Reference to User | **Admin1** Added the Rphysician | Added/Removed by: **Admin1** |
| | | Reference to Action | RPhysician was **Added** to the Monitoring Program | Action: **Added** |
| insertExam Type | Examtype | Insert | Insert **Retinography** | **Retinography**'s Attributes |
| insertMP2 ExamType | MonitoringProgram (+ Examtype) | Reference to ExamType | **Monitoring Program1** has **Retinography** | MP has: **Retinography** |
| insertMP2 PatLogJust | LogMp2patiJust | Insert | Insert **LogMP2Pat Justification1** | **LogMP2Pat Justification1**'s Attributes |
| | | Reference to LogMpPatient | Justification for **Patient1** being in **Monitoring Program1** | Log: **Patient1** is in **Monitoring Program1** |
| insertStatus | SessionStatus | Insert | Insert **onHold** | **onHold**'s Attributes |

| | | | | |
|---|---|---|---|---|
| | | Insert | Insert **Reviewed** | **Reviewed**'s Attributes |
| | | Insert | Insert **NotReviewed** | **NotReviewed**'s Attributes |
| | | Insert | Insert **Update** | **Update**'s Attributes |
| | | Insert | Insert **onReview** | **onReview**'s Attributes |
| | | Insert | Insert **Deleted** | **Deleted**'s Attributes |
| insertSession | Session | Insert | Insert **Session1** | **Session1**'s Attributes |
| | | Reference to User | **Technician1** inserted **Session1** | Inserted by: **Technician1** |
| | | Reference to Patient | **Patient1** in **Session1** | Patient: **Patient1** |
| | | Reference to SessionStatus | **Session1** is **onHold** | Status: **onHold** |
| | | Reference to MonitoringProgram | **Session1** is in **Monitoring Program1** | Monitoring Program: **Monitoring Program1** |
| | | Reference to User | **Session1** diagnosed by (none) | Diagnosed by: (empty) |
| insertSession 2Not | Session (+ Notification) | Reference to Notification | **Session Exported1** Sent due to this Operation | Notification: **Session Exported1** |
| | | Reference to Notification | **Session Deleted1** Sent due to this Operation | Notification: **Session Deleted1** |
| insertDeleted Session | DeletedSession | Insert | Insert **Deleted Session Justification1** | **Deleted Session Justification1**'s Attributes |
| | | Reference to Session | **Session1** was deleted | Related to Session_ID: 1 |
| insertEye | Eye | Insert | Insert **Left** | **Left**'s Attributes |
| | | Insert | Insert **Rigth** | **Rigth**'s Attributes |
| | | Insert | Insert **None** | **None**'s Attributes |
| | | Insert | Insert **Both** | **Both**'s Attributes |
| insertExam | Exam | Insert | Insert **Exam1** | **Exam1**'s Attributes |
| | | Reference to ExamType | **Exam1** is type **Retinography** | Examtype: **Retinography** |
| | | Reference to Eye | **Exam1** covers **Left Eye** | Eye: **Left** |
| | | Reference to Session | **Exam1** belongs to **Session1** | Exam belongs to: **Session1** |
| insertResults | Result | Insert | Insert **Result1** | **Result1**'s Attributes |
| | | Reference to Exam | **Result1** from **Exam1** | Related to Exam_ID: 1 |
| | | Reference to Eye | **Result1** for **Left** Eye | Eye: **Left** |
| insertSession Reviewed | SessionReviewed ByPhys | Insert | Insert **Session Reviewed1** | **Session Reviewed1**'s Attributes |
| | | Reference to Session | **Session1** Reviewed | Related Session_ID: 1 |
| | | Reference to User | **RPhysician1** Reviewed Session | Reviewed by: **RPhysician1** |
| | | Reference to Notification | **Session Review1** Sent due to this Operation | Notification: **Session Review1** |
| insertPassword Change | PasswordChange | Insert | **Insert Password Change1** | **Password Change1**'s Attributes |
| | | Reference to User | **RPhysician1** had Password Changed | Password from: **RPhysician1** |
| | | Reference to User | **Admin1** Changed the | Changed by: **Admin1** |

| | | | | |
|---|---|---|---|---|
| | | | Password | |

***Table 15 - Data entities testing files table***

## 8.4 Appendix D - Database Conceptual Model

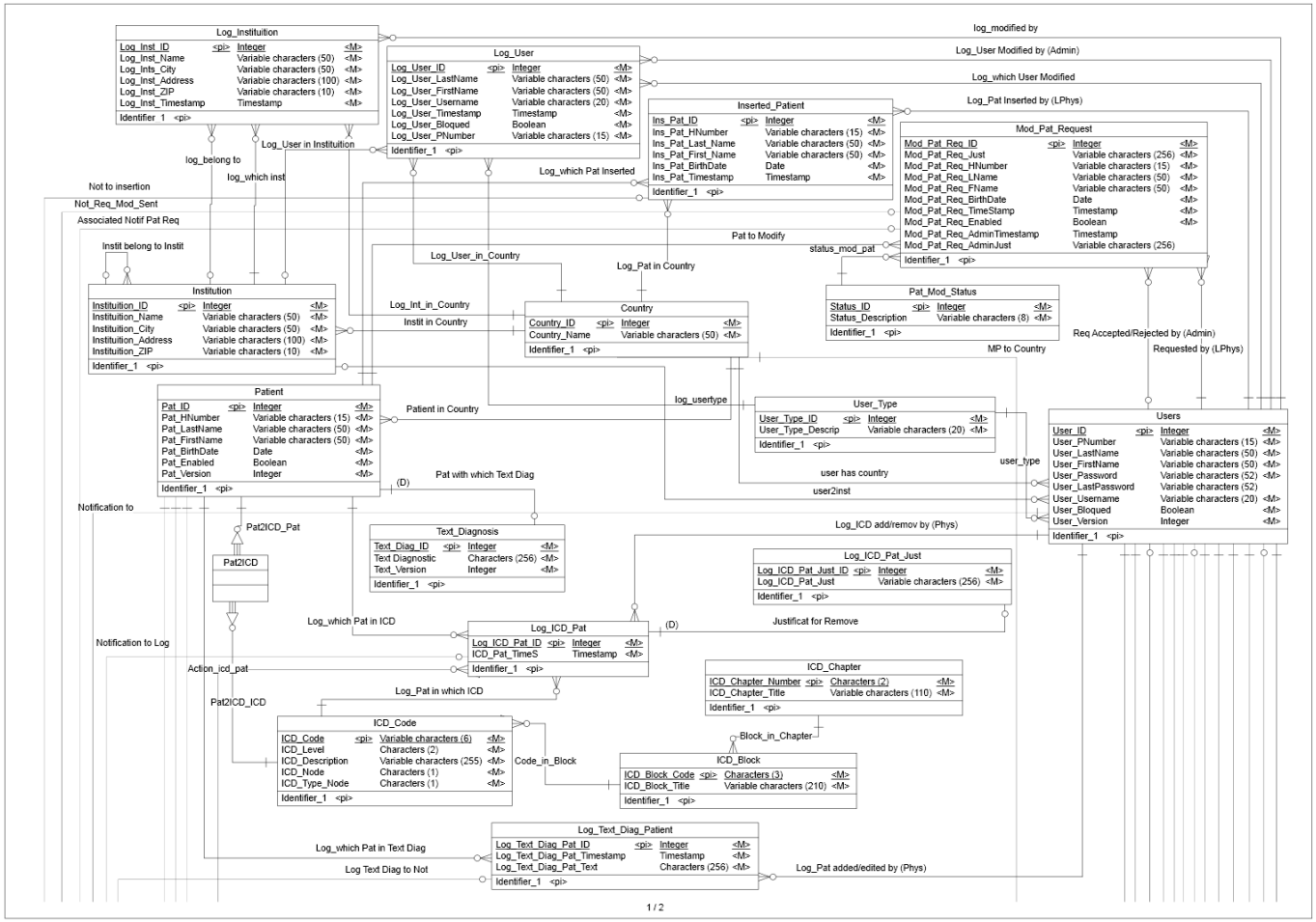


***Figure 27 - Database conceptual model 1/2***

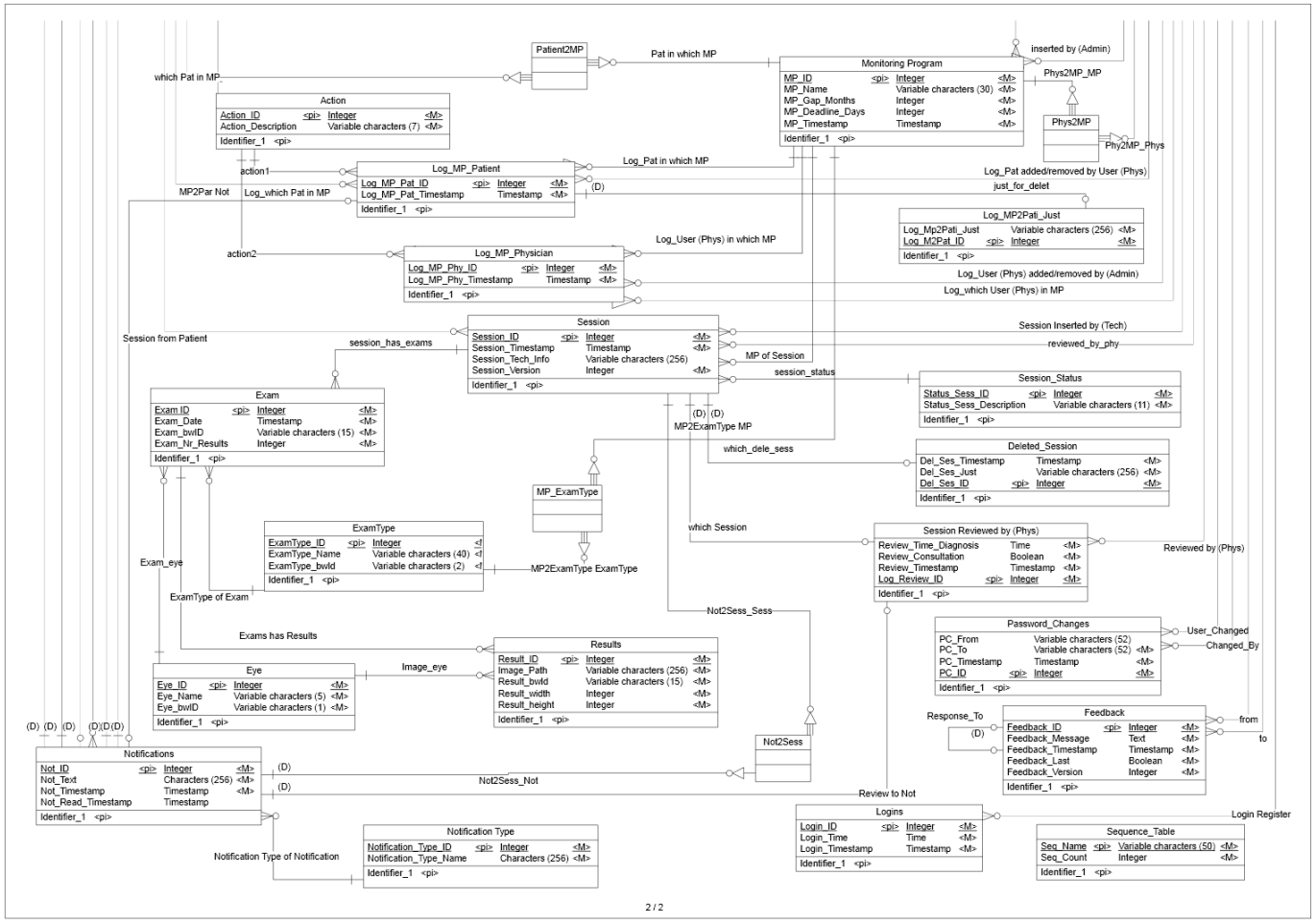


***Figure 28 - Database conceptual model 2/2***

## 8.5 Appendix E - Scenario Testing

### 8.5.1 Local Physician

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Page Access Security | S001 | User tries to access /addICD.xhtml without logging in | T001 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S002 | User tries to access /addMP.xhtml without logging in | T002 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S003 | User tries to access /alterPatient.xhtml without logging in | T003 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S004 | User tries to access /alterTextDiag.xhtml without logging in | T004 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S005 | User tries to access /editPatient.xhtml without logging in | T005 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S006 | User tries to access /insertPatient.xhtml without logging in | T006 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S007 | User tries to access /removeICD.xhtml without logging in | T007 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S008 | User tries to access /removeMP.xhtml without logging in | T008 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S009 | User tries to access /selectPatient.xhtml without logging in | T009 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S010 | User tries to acess /addICD.xhtml without a patient being selected | T010 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S011 | User tries to acess /addMP.xhtml without a patient being selected | T011 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S012 | User tries to acess /alterPatient.xhtml without a patient being selected | T012 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S013 | User tries to acess /alterTextDiag.xhtml without a patient being selected | T013 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S014 | User tries to acess /editPatient.xhtml without a patient being selected | T014 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S015 | User tries to acess /removeICD.xhtml without a patient being selected | T015 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S016 | User tries to acess /removeMPxhtml without a patient being selected | T016 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S017 | User tries to acess /addICD.xhtml without clicking the respective button | T017 | Check if allowed and page information loaded correctly | Ok | NA |
| | S018 | User tries to acess /addMP.xhtml without clicking the respective button | T018 | Check if allowed and page information loaded correctly | Ok | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S019 | User tries to acess /alterPatient.xhtml without clicking the respective button | T019 | Check if allowed and page information loaded correctly | Ok | NA |
| | S020 | User tries to acess /alterTextDiag.xhtml without clicking the respective button | T020 | Check if allowed and page information loaded correctly | Ok | NA |
| | S021 | User tries to acess /removeICD.xhtml without ICD Classification being selected | T021 | Check if allowed and page information is not displayed | Ok | No ICD Classification selected |
| | S022 | User tries to acess /removeMPxhtml without a patient being selected | T022 | Check if allowed and page information is not displayed | Ok | No Monitoring Program selected |
| | S023 | User tries to acess /alterPatient.xhtml without using the "Request a Modification to the Patient" button | T023 | Check if allowed and page information is not displayed | Ok | Wrong Intitialization |
| | S024 | Non-"Local Physician" tries to access /addICD.xhtml | T024 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S025 | Non-"Local Physician" tries to access /addMP.xhtml | T025 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S026 | Non-"Local Physician" tries to access /alterPatient.xhtm | T026 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S027 | Non-"Local Physician" tries to access /alterTextDiag.xhtml | T027 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S028 | Non-"Local Physician" tries to access /editPatient.xhtml | T028 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S029 | Non-"Local Physician" tries to access /insertPatient.xhtml | T029 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S030 | Non-"Local Physician" tries to access /removeICD.xhtml | T030 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S031 | Non-"Local Physician" tries to access /removeMP.xhtml | T031 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S032 | Non-"Local Physician" tries to access /selectPatient.xhtml | T032 | Check if not allowed | Ok | You don't have permission to access this resource |
| Component Security | S033 | User tries to call any method from component "insertPatient" without logging in | T033 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S034 | User tries to call any method from component "patientManager" without logging in | T034 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S035 | User tries to any method from call component "selectPatient" without logging in | T035 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S036 | Non-"Local Physician" tries to call any method from component "insertPatient" | T036 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S037 | Non-"Local Physician" tries to call any method from component "patientManager" | T037 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S038 | Non-"Local Physician" tries to call any method from component | T038 | Check if not allowed | Ok | You don't have permission to access |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | "selectPatient" | | | | this resource |
| Insert Patient | S039 | User clicks the "Insert new Patient" link in the /selectPatient.xhtml page | T039 | Check if redirects to /insertPatient.xhtml | Ok | NA |
| | S040 | User inserts invalid NHS Number | T040 | Check if insert patient action failed | Ok | NHS Number {nhsNumber} is Invalid |
| | S041 | User inserts NHS Number that already exists | T041 | Check if insert patient action failed | Ok | Patient with NHS Number {nhsNumber} already exists |
| | S042 | User doesn't fill the NHS Number field or filled with blank spaces | T042 | Check if insert patient action failed | Ok | value is required |
| | S043 | User doesn't fill the First Name field or filled with blank spaces | T043 | Check if insert patient action failed | Ok | value is required |
| | S044 | User tries to insert a First Name bigger than 50 characters | T044 | Check if input box is limited to 50 characters | Ok | NA |
| | S045 | User doesn't fill the Last Name field or filled with blank spaces | T045 | Check if insert patient action failed | Ok | value is required |
| | S046 | User tries to insert a Last Name bigger than 50 characters | T046 | Check if input box is limited to 50 characters | Ok | NA |
| | S047 | User inserts Birthdate after 9 months ago | T047 | Check if insert patient action failed | Ok | Birthdate invalid |
| | S048 | Users inserts Birthdate before 120 years ago | T048 | Check if insert patient action failed | Ok | Birthdate invalid |
| | S049 | Valid insert patient | T049 | Check if patient was correctly inserted in the database | Ok | Patient with NHS Number {nhsNumber} inserted |
| | | | T050 | Check if log was correctly inserted in the database | Ok | |
| | | | T051 | Check if a notification was correctly sent to the user | Ok | |
| | | | T052 | Check if redirects to /editPatient.xhtml with the inserted patient's info | Ok | |
| | S050 | Two users try to insert the same patient | T053 | Check if only one taked effect, while the other is rejected | Ok | Patient with NHS Number {patHnumber} was inserted |
| | | | | | | Patient with NHS Number {oatHnumber} already exists |
| Select Patient | S051 | User clicks the "Patients" link in the Menu | T054 | Check if redirects to /selectPatient.xhtml | Ok | NA |
| | S052 | User searchs inexisting patient | T055 | Check if search action failed | Ok | Patient with NHS Number {nhsNumber} doesn't exist |
| | S053 | User searchs patient that was not inserted from his facility | T056 | Check if search action failed | Ok | You don't have permission to edit patient with NHS Number {nhsNumber} |
| | S054 | Valid search patient (none of the C above) | T057 | Check if redirects to /editPatient.xhtml with the patient info | Ok | NA |
| | S055 | User opens new tab of "Patients" link in the Menu and searches | T058 | Check if redirects to /selectPatient.xhtml, even if | Ok | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | another valid patient | | a patient is already selected | | |
| | | | T059 | Check if he can mantain this two tabs open without changing information between tabs | Ok | NA |
| | | | T060 | Check if he can add/remove diagnosis or monitoring programs in each tab | Ok | NA |
| | | | T061 | Check if he can send modification requests of each patient | Ok | NA |
| Edit Patient | S056 | User is redirected to /editPatient.xhtml from select or insert actions | T062 | Check if patient basic information is displayed correctly | Ok | NA |
| | | | T063 | Check if the patient's monitoring programs are displayed correctly | Ok | |
| | | | T064 | Check if the patient's ICD classifications are displayed correctly | Ok | |
| | | | T065 | Check if the patient's text diagnosis is displayed correcty | Ok | |
| | | | T066 | Check if the patient's text diagnosis is null when the string is empty | Ok | |
| | S057 | User clicks in the "Request a Modification to this Patient" button in the Patient Information tab | T067 | Check if redirects to /alterPatient.xhtml | Ok | Patient already has another Modification Request on Hold |
| | S058 | | T068 | (Patient already has one Request on Hold) Check if doesn't redirect to /alterPatient.chtml | Ok | |
| | S059 | User clicks in the "Add Monitoring Program" button in the Monitoring Program tab | T069 | Check if redirects to /addMP.xhtml | Ok | NA |
| | S060 | User clicks in the "Remove" button of any of the patient's monitoring programs | T070 | Check if redirects to /removeMP.xhtml | Ok | NA |
| | S061 | User clicks in the "Add ICD Classification" button in the Diagnosis tab | T071 | Check if redirects to /addICD.xhtml | Ok | NA |
| | S062 | User clicks in the "Remove" button of any of the patient's ICD classification | T072 | Check if redirects to /addICD.xhtml | Ok | NA |
| | S063 | User clicks in the "Edit" button in the Diagnosis tab | T073 | Check if redirects to /alterTextDiag.xhtml | Ok | NA |
| Alter Patient | S064 | User is redirected to /alterPatient.xhtml from button in /editPatient.xhtml | T074 | Check if patient information is correctly loaded | Ok | NA |
| | S065 | User inserts new invalid NHS Number | T075 | Check if alteration action failed | Ok | NHS Number {nhsNumber} is Invalid |
| | S066 | User inserts new NHS Number that already exists | T076 | Check if alteration action failed | Ok | Patient with NHS Number {nhsNumber} already exist |
| | S067 | User leaves NHS Number field empty or filled with blank spaces | T077 | Check if alteration action failed | Ok | value is required |
| | S068 | User leaves First Name field empty or filled with blank spaces | T078 | Check if alteration action failed | Ok | value is required |

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| | S069 | User tries to insert a new First Name bigger than 50 characters | T079 | Check if input box is limited to 50 characters | Ok | NA |
| | S070 | User leaves Last Name field empty or filled with blank spaces | T080 | Check if alteration action failed | Ok | value is required |
| | S071 | User tries to insert a new Last Name bigger than 50 characters | T081 | Check if input box is limited to 50 characters | Ok | NA |
| | S072 | User leaves Birthdate field empty | T082 | Check if alteration action failed | Ok | value is required |
| | S073 | User inserts Birthdate after 9 months ago | T083 | Check if alteration action failed | Ok | Birthdate invalid |
| | S074 | Users inserts Birthdate before 120 years ago | T084 | Check if alteration action failed | Ok | Birthdate invalid |
| | S075 | User leaves Justification field empty or filled with blank spaces | T085 | Check if alteration action failed | Ok | value is required |
| | S076 | User tries to enter a justification bigger than 255 characters | T086 | Check if alteration action failed | Ok | Length must be between 0 and 255 |
| | S077 | User doesn't change any fields | T087 | Check if alteration action failed | Ok | No changes detected |
| | S078 | User makes a valid alteration | T088 | Check if confirmation view is displayed | Ok | NA |
| | | | T089 | Check if the unchanged fields don't show in the confirmation view | Ok | |
| | | | T090 | Check if the changed fields show up in the confirmation view | Ok | |
| | S079 | User clicks the "Cancel" button | T091 | Check if redirects to /editPatient.xhtml and the alteration information is removed from memory | Ok | NA |
| | S080 | User clicks the "Reset" button | T092 | Check if all the alteration information is removed from memory | Ok | NA |
| | S081 | User clicks the "Back to Edit" button while in the confirmation view | T093 | Check if confirmation view isn't displayed and the alteration information is stored | Ok | NA |
| | S082 | User clicks the "Commit" button while in the confirmation view | T094 | Check if the request is correctly inserted in the database | Ok | Modification request of Patient with NHS Number {nhsNumber} sent |
| | | | T095 | Check if a notification was correctly sent to the user | Ok | NA |
| | | | T096 | Check if redirects to /editPatient.xhtml | Ok | |
| | S083 | User clicks "Commit" after another User changed the Patient (MP, ICD or Modification Request) | T097 | Check if the alteration action failed | Ok | Patient Information was Changed by Another user, please try again. |
| | | | T098 | Check if redirects to /editPatient.xhtml | Ok | |
| | | | T099 | Check if altered information is updated | Ok | |
| Add Monitoring Program | S084 | User is redirected to /addMP.xhtml from the button in the /editPatient.xhtml | T100 | Check if the available monitoring programs are only those from the patient's country | Ok | NA |
| | | | T101 | Check if patient information is correctly loaded | Ok | |

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| | | | T102 | Check if the available monitoring programs are only those who the patient doesn't aready have | Ok | |
| | S085 | User clicks the "Add" button of one of the available monitoring programs | T103 | Check if the monitoring program is correclty added to the patient in the database | Ok | {mpName} added to Patient with NHS Number {nhsNumber} |
| | | | T104 | Check if a log was correctly inserted in the database | Ok | |
| | | | T105 | Check if a notification was correctly sent to the user | Ok | |
| | | | T106 | Check if redirects to /editPatient.xhtml and the patient's monitoring programs are updated | Ok | |
| | | | T107 | Check if the available monitoring for further adding are updated | Ok | |
| | S086 | User clicks the "Add" button in a disabled Patient | T108 | Check if add action failed | Ok | Patient is Disabled |
| | S087 | User clicks the "Cancel" button | T109 | Check if redirects to /editPatient.xhtml | Ok | NA |
| | S088 | User clicks the "Add" button after another User changed the Patient (MP, ICD or Modification Request) | T110 | Check if the add action failed | Ok | Patient Information was Changed by Another user, please try again. |
| | | | T111 | Check if redirects to /editPatient.xhtml | Ok | |
| | | | T112 | Check if altered information is updated | Ok | |
| Add ICD Classification | S089 | User is redirected to /addICD.xhtml from the button in the /editPatient.xhtml | T113 | Check if patient information is correctly loaded | Ok | NA |
| | | | T114 | Check if ICD Chapters are correctly loaded | Ok | |
| | | | T115 | Check if the available ICD Classifications are only those who the patient doesn't aready have | | |
| | S090 | User selects one chapter and clicks the "Blocks" button | T116 | Check if ICD Chapter was selected and the Blocks are correctly loaded | Ok | NA |
| | S091 | User clicks "Blocks" button without selecting a Chapter | T117 | Check if selecting action failed | Ok | NA |
| | S092 | User clicks the "Back to Chapter" button | T118 | Check if ICD Chapter can be selected again | Ok | NA |
| | S093 | User selects one block and clicks the "Codes" button | T119 | Check if ICD Block was selected and the Codes are correctly loaded | Ok | NA |
| | | | T120 | Check if the available ICD Codes are only those who the patient doesn't aready have | Ok | |
| | S094 | User clicks "Codes" button without selecting a block | T121 | Check if selecting action failed | Ok | NA |
| | S095 | User clicks the "Back to Blocks" button | T122 | Check if ICD Block can be selected again | Ok | NA |
| | S096 | User selects a Code and clicks the "Add" button | T123 | Check if the ICD Code is correctly added to the Patient in the database | Ok | ICD Code: {icdCode} added to Patient with NHS Number: {nhsNumber} |
| | | | T124 | Check if a log was correctly inserted in the | Ok | |

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| | | | | database | | |
| | | | T125 | Check if a notification was correctly sent to the user | Ok | |
| | | | T126 | Check if redirects to /editPatient.xhtml and the patient's Diagnosis is updated | Ok | |
| | | | T127 | Check if the previous choices are removed from memory | Ok | |
| | S097 | User clicks the "Add" button in a disabled Patient | T128 | Check if add action failed | Ok | Patient is Disabled |
| | S098 | User clicks the "Cancel" button | T129 | Check if redirects to /editPatient.xhtml and the choices are removed from memory | Ok | NA |
| | S099 | User clicks the "Add" button after another User changed the Patient (MP, ICD or Modification Request) | T130 | Check if the add action failed | Ok | Patient Information was Changed by Another user, please try again. |
| | | | T131 | Check if redirects to /editPatient.xhtml | Ok | |
| | | | T132 | Check if altered information is updated | Ok | |
| Remove Monitoring Program | S100 | User is redirected to /removeMP.xhtml by selecting a program to remove from /editPatient.xhtml | T133 | Check if the patient information is correctly loaded | Ok | NA |
| | S101 | | T134 | Check if the selected monitoring program information is correctly loaded | Ok | |
| | S102 | User doesn't fill the justification or fill it with blank spaces | T135 | Check if removing action failed | Ok | value is required |
| | S103 | User tries to enter a justification bigger than 255 characters | T136 | Check if alteration action failed | Ok | Length must be between 0 and 255 |
| | S104 | User fills the justification field and clicks the "Remove" button | T137 | Check if the monitoring program is correctly removed from the patient in the database | Ok | {mpName} removed from Patient with NHS Number: {nhsNumber} |
| | | | T138 | Check if a log was correctly inserted in the database | Ok | |
| | | | T139 | Check if a notification was correctly sent to the user | Ok | |
| | | | T140 | Check if redirects to /editPatient.xhtml and the patient's monitoring programs are updated | Ok | |
| | | | T141 | Check if the justification and selected monitoring program were removed from memory | Ok | |
| | | | T142 | Check if the available monitoring programs for adding are updated | Ok | |
| | S105 | User clicks the "Remove" button in a disabled Patient | T143 | Check if remove action failed | Ok | Patient is Disabled |
| | S106 | User clicks the "Cancel" button | T144 | Check if redirects to /editPatient.xhtml | Ok | NA |
| | S107 | User clicks the "Add" button after another User changed the | T145 | Check if the add action failed | Ok | Patient Information was Changed by |

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| | | Patient (MP, ICD or Modification Request) | T146 | Check if redirects to /editPatient.xhtml | Ok | Another user, please try again. |
| | | | T147 | Check if altered information is updated | Ok | |
| Remove ICD Classification | S108 | User is redirected to /removeICD.xhtml by selecting ICD classification to remove from /editPatient.xhtml | T148 | Check if the patient information is correctly loaded | Ok | NA |
| | S109 | | T149 | Check if the selected ICD classification information is correctly loaded | Ok | |
| | S110 | User doesn't fill the justification or fill it with blank spaces | T150 | Check if removing action failed | Ok | value is required |
| | S111 | User tries to enter a justification bigger than 255 characters | T151 | Check if alteration action failed | Ok | Length must be between 0 and 255 |
| | S112 | User fills the justification field and clicks the "Remove" button | T152 | Check if the ICD classification is correctly removed from the patient in the database | Ok | ICD Code: {icdCode} removed from Patient with Nhs Number: {nhsNumber} |
| | S113 | | T153 | Check if a log was correctly inserted in the database | Ok | |
| | S114 | | T154 | Check if a notification was correctly sent to the user | Ok | |
| | S115 | | T155 | Check if redirects to /editPatient.xhtml and the patient's ICD classifications are updated | Ok | |
| | S116 | | T156 | Check if the justification and selected ICD classification were removed from memory | Ok | |
| | S117 | | T157 | Check if the available ICD classifications for adding are updated | Ok | |
| | S118 | User clicks the "Remove" button in a disabled Patient | T158 | Check if remove action failed | Ok | Patient is Disabled |
| | S119 | User clicks the "Cancel" button | T159 | Check if redirects to /editPatient.xhtml | Ok | NA |
| | S120 | User clicks the "Remove" button after another User changed the Patient (MP, ICD or Modification Request) | T160 | Check if the remove action failed | Ok | Patient Information was Changed by Another user, please try again. |
| | | | T161 | Check if redirects to /editPatient.xhtml | Ok | |
| | | | T162 | Check if altered information is updated | Ok | |
| Edit Text Diagnosis | S121 | User is redirected to /alterTextDiag.xhtml from the "Edit" button in the /editPatient.xhtml | T163 | Check if the patient information is correctly loaded | Ok | NA |
| | S122 | | T164 | Check if the text diagnosis is correctly loaded | Ok | |
| | S123 | | T165 | Check if the text diagnosis is null when the string is empty | Ok | |
| | S124 | | T166 | Check if the input box is loaded with the current text diagnosis. | Ok | NA |
| | S125 | User inserts leaves the text diagnosis unchanged or adds blank spaces | T167 | Check if alteration action failed | Ok | No changes detected |

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| | S126 | User tries to enter a text diagnosis bigger than 255 characters | T168 | Check if alteration action failed | Ok | Length must be between 0 and 255 |
| | S127 | User makes a valid change in the patient's text diagnosis and clicks "Confirm" button | T169 | Check if the text diagnosis was correctly updated in the database | Ok | Text Diagnosis of Patient with NHS: {nhsNumber} changed |
| | S128 | | T170 | Check if a notification was correctly sent to the user | Ok | |
| | S129 | | T171 | Check if a log was correctly inserted in the database | Ok | |
| | S130 | | T172 | Check if redirects to /editPatient.xhtml and the patient diagnosis is updated | Ok | |
| | S131 | User clicks the "Reset" button | T173 | Check if input box is loaded with the current text diagnosis | Ok | NA |
| | S132 | User clicks "Confirm" on a Disabled Patient | T174 | Check if alteration action failed | Ok | Patient is Disabled |
| | S133 | User clicks the "Cancel" button | T175 | Check if redirects to /editPatient.xhtml | Ok | NA |
| | S134 | User clicks the "Confirm" button after another User changed the patient's text diagnosis | T176 | Check if the alteration action failed | Ok | Text Diagnosis was Changed by Another user, please try again. |
| | | | T177 | Check if redirects to /editPatient.xhtml | Ok | |
| | | | T178 | Check if altered information is updated | Ok | |

***Table 16 - Scenario testing for user role: local physician***

### 8.5.2 Technician

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Page Security | S135 | User tries to access /exportSession.xhtml without logging in | T179 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S136 | User tries to access /session.xhtml without logging in | T180 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S137 | User tries to access /sessionView.xhtml without logging in | T181 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S138 | User tries to acsess /exportSession.xhtml without the required information (patient, monitoring program and exam date) | T182 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S139 | User tries to access /sessionView.xhtml without selecting a Session | T183 | Check if not allowed and redirect to home page | Ok | The conversation ended, timed out or was processing another request |
| | S140 | Non-"Technician" tries to access /session.xhtml | T184 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S141 | Non-"Technician" tries to access /sessionView.xhtml | T185 | Check if not allowed | Ok | You don't have permission to access this resource |

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| | S142 | Non-"Technician" tries to access /exportSession.xhtml | T186 | Check if not allowed | Ok | You don't have permission to access this resource |
| Component Security | S143 | User tries to call any method from componenet "connectWS" without logging in | T187 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S144 | User tries to call any method from componenet "sessionDelete" without logging in | T188 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S145 | User tries to call any method from componenet "sessionExportManager" without logging in | T189 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S146 | User tries to call any method from componenet "sessionManager" without logging in | T190 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S147 | Non-"Technician" tries to call any method from component "connectWS" | T191 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S148 | Non-"Technician" tries to call any method from component "sessionDelete" | T192 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S149 | Non-"Technician" tries to call any method from component "sessionExportManager" | T193 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S150 | Non-"Technician" tries to call any method from component "sessionManager" | T194 | Check if not allowed | Ok | You don't have permission to access this resource |
| Session | S151 | User clicks in the "Session" link in the Menu and there is no current list of sessions | T195 | Check if redirects to /session.xhtml | Ok | NA |
| | | | T196 | Check if the 10 latest exported sesions are presented | Ok | |
| | | | T197 | Check if the sessions displayed are only the ones that the current user exported | Ok | |
| | | | T198 | Check if former filter values are droped | Ok | |
| | S152 | User clicks in the "Session" link in the Menu and there is already a list of sessions | T199 | Check if redirects to /session.xhtml | Ok | NA |
| | S153 | User adds no fields to the search and clicks "Search" | T200 | Check if the 10 latest exported sesions are presented | Ok | NA |
| | S154 | | T201 | Check if the sessions displayed are only the ones that the current user exported | Ok | |
| | S155 | | T202 | Check if former filter values are droped | Ok | NA |
| | S156 | User tries to add a non-number in "Session ID" field | T203 | Check if search action failed | Ok | Inserted Session ID is not a number. |
| | S157 | User tries to add a valid "Session ID" field | T204 | Check if "Session ID" field is added to the search | Ok | NA |
| | S158 | User tries to add "(Inserted Timestamp) From:" to the search | T205 | Check if "(Inserted Timestamp) From:" field is added to the search | Ok | NA |
| | S159 | User tries to add "(Inserted Timestamp) to:" to the search | T206 | Check if "(Inserted Timestamp) to:" field is added to the search | Ok | NA |

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| | S160 | User tries to add "Monitoring Program" to the search | T207 | Check if "Monitoring Program" field is added to the search | Ok | NA |
| | S161 | User tries to add "Patient NHS" to the search | T208 | Check if "Patient NHS" field is added to the search | Ok | NA |
| | S162 | User tries to add "Session Status" to the search | T209 | Check if "Session Status" field is added to the search | Ok | NA |
| | S163 | User adds one or more fields to the search and click "Search" | T210 | Check if the 10 latest exported sesions that match the search are presented | Ok | NA |
| | | | T211 | Check if the sessions displayed are only the ones that the current user exported | Ok | |
| | | | T212 | Check if former filter values are droped | Ok | |
| | S164 | User clicks "Reset" button | T213 | Check if redirects to /session.xhtml | Ok | NA |
| | | | T214 | Check if the 10 latest exported sesions are presented | Ok | |
| | | | T215 | Check if the sessions displayed are only the ones that the current user exported | Ok | |
| | | | T216 | Check if former filter values are droped | Ok | |
| | S165 | User clicks "Next" button | T217 | Check if 10 more session are presented | Ok | NA |
| | S166 | User clicks "Previous" button | T218 | Check if the previous 10 sessions are presented | Ok | NA |
| | S167 | User tries to search for Session ID | T219 | Check if information is displayed correctly | Ok | NA |
| | S168 | User tries to order by Session ID | T220 | Check if information is displayed correctly | Ok | NA |
| | S169 | User tries to order by Timestamp | T221 | Check if information is displayed correctly | Ok | NA |
| | S170 | User tries to search for Monitoring Program | T222 | Check if information is displayed correctly | Ok | NA |
| | S171 | User tries to order by Monitoring Program | T223 | Check if information is displayed correctly | Ok | NA |
| | S172 | User tries to search for Patient NHS | T224 | Check if information is displayed correctly | Ok | NA |
| | S173 | User tries to order by Patient NHS | T225 | Check if information is displayed correctly | Ok | NA |
| | S174 | User tries to search for Session Status | T226 | Check if information is displayed correctly | Ok | NA |
| | S175 | User tries to order by Session Status | T227 | Check if information is displayed correctly | Ok | NA |
| | S176 | User tries to search for Diagnostician | T228 | Check if information is displayed correctly | Ok | NA |
| | S177 | User tries to order by Diagnostician | T229 | Check if information is displayed correctly | Ok | NA |
| | S178 | User tries to search/order two or more fields at the same time | T230 | Check if both information is filtered | Ok | NA |

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| | S179 | User selects one session from the session list | T231 | Check if redirects to /sessionView.xhtml with the session info | Ok | NA |
| | S180 | User opens new tab of "Session" link in the Menu and selects another session from the session list | T232 | Check if redirects to /sessionView.xhtml, even if a another session is already selected | Ok | NA |
| | | | T233 | Check if he can mantain this two tabs open without changing information between tabs | Ok | |
| | | | T234 | Check if he can delete session in each tab | Ok | |
| | S181 | (export Session) User leaves NHS field empty or with blank spaces | T235 | Check if export action failed | Ok | value is required |
| | S182 | (export Session) User inserts an inexisting NHS Number | T236 | Check if search action failed | Ok | Patient with NHS Number {nhsNumber} doesn't exist |
| | S183 | (export Session) User doesn't select a monitoring program | T237 | Check if search action failed | Ok | value is required |
| | S184 | (export Session) User doesn't select a date | T238 | Check if search action failed | Ok | value is required |
| | S185 | (export Session) User selects a monitoring program not assigned to the selected patient | T239 | Check if search action failed | Ok | Patient with NHS Number {nhsNumber} is not asigned to that monitoring Program. |
| | S186 | (export Session) User selects a date where there are no exams | T240 | Check if search action failed | Ok | No exams found for such date |
| | S187 | (export Session) User makes a valid search to export a session | T241 | Check if redirects to /exportSession.xhtml with the information from the Web Service | Ok | NA |
| | S188 | (export Session) User opens new tab of "Session" link in the Menu and makes a valid search to export a session | T242 | Check if redirects to /exportView.xhtml, even if a another session is being exported | Ok | NA |
| | | | T243 | Check if he can mantain this two tabs open without changing information between tthem | Ok | |
| | | | T244 | Check if he can attach exams on each tab | Ok | |
| | | | T245 | Check if he can add session info on each tab | Ok | |
| | | | T246 | Check if he can commit the session to export on each tab | Ok | |
| Session View | S189 | User is redirected to /sessionView.xhtml from the session list in /session.xhtml | T247 | Check if patient basic information is displayed correctly | Ok | NA |
| | | | T248 | Check if the monitoring program/exam types are displayed correctly | Ok | |
| | | | T249 | Check if the session info is displayed correctly | Ok | |
| | | | T250 | Check if the delete option is able only if session is "onHold" or "Update" | Ok | |
| | | | T251 | Check if there is a timestamp showing iwhen session was deleted, if already deleted | Ok | NA |

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| S190 | User clicks the "Back" button | T252 | Check if redirected to /session.xhtml and all the info of the session is discarted | Ok | NA |
| S191 | User clicks in the "Get as PDF" link | T253 | Check if redirects to /sessionReport.xhtml | Ok | NA |
| | | T254 | Check if a pdf is created | Ok | |
| | | T255 | Check if the data is correctly loaded | Ok | |
| | | T256 | Check if a section "Session Delete" appears if the session has been deleted | Ok | |
| | | T257 | Check if a section "Diagnosis" appears if the session has been reviewed | Ok | |
| S192 | User tries to delete this session leaving the justification field empty or with blank spaces | T258 | Check if delete action failed | Ok | value is required |
| S193 | User tries to insert a justification bigger than 255 characters | T259 | Check if delete action failed | Ok | Length must be between 0 and 255 |
| S194 | User tries to delete a session that is not "onHold" or "Update" | T260 | Check if delete action failed | Ok | This session cannot be deleted |
| S195 | User tries to delete a session 24 hours after its submission | T261 | Check if delete action failed | Ok | Sessions can only be deleted 24 hours after submission |
| S196 | User fills the justification field and clicks the "Delete" button | T262 | Check if the session is correctly set to "deleted" in the database | Ok | You deleted Session ID: {sessionId} |
| | | T263 | Check if the justification is inserted in the database | Ok | |
| | | T264 | Check if a notification was correctly sent to the user | Ok | |
| | | T265 | Check if the session info was updated in /sessionView.xhtml | Ok | |
| | | T266 | Check if the session info was update in the session list in /session.xhtml | Ok | |
| S197 | User tries to delete the session after a Physician has just started his review | T267 | Check if delete action failed | Ok | This session was altered by another user, please try again later. |
| | | T268 | Check if session status is updated | Ok | |
| | | T269 | Check if delete option is enabled | Ok | |
| | | T270 | Check if session was updated in the session list in /session.xhtml | Ok | |
| S198 | User tries to delete the session after its been deleted on another tab | T271 | Check if delete action failed | Ok | This session was altered by another user, please try again later. |
| | | T272 | Check if session status is updated | Ok | |
| | | T273 | Check if delete option is enabled | Ok | |
| | | T274 | Check if session was updated in the session list in /session.xhtml | Ok | |

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| Export Session | S199 | User is redirected to /exportSession.xhtml by selecting a valid patient and date for exams | T275 | Check if the patient basic information is correctly displayed | Ok | NA |
| | | | T276 | Check if the monitoring program/exam types are displayed correctly | Ok | |
| | | | T277 | Check if there is a section for each exam type required (depends on the montoring program) | Ok | |
| | | | T278 | Check if the exams are correctly placed in each exam type section | Ok | |
| | | | T279 | (Only one exam in na exam type section) Check if the exam is automatically attached to the exam type | Ok | |
| | | | T280 | (More than one exam in an exam type section) Check if there is a list of all available exams to attach | Ok | |
| | | | T281 | (No exam attached to an exam type section) Check if there is a red warning informing of this situation | Ok | |
| | | | T282 | Check if the list of "Import Options" is correctly loaded | Ok | |
| | S200 | User attaches an exam to an exam type section when none is attached | T283 | Check if the exam gets attached | Ok | NA |
| | | | T284 | Check if the exam disappears form the available exam list | Ok | |
| | | | T285 | Check if the warning message about the no attached exams disappears | Ok | |
| | S201 | User attaches an exam to an exam type section when another one is attached | T286 | Check if the new exam gets attached | Ok | NA |
| | | | T287 | Check if the old exam reappears on the available exam list | Ok | |
| | S202 | User tries to insert additional information to the session bigger than 255 character | T288 | Check if export action failed | Ok | Length must be between 0 and 255 |
| | S203 | User clicks the "Back" button | T289 | Check if redirected to /session.xhtml and all the info of the exams is removed from memory | Ok | NA |
| | S204 | User tries to "Commit" without attaching one exam to each exam type | T290 | Check if export action failed | Ok | One exam much be attached to each exam type |
| | S205 | User tries to "Commit" without selecting na export option | T291 | Check if export action failed | Ok | value is required |
| | S206 | User tries to "Commit" and the patient is disabled | T292 | Check if export action failed | Ok | Patient is Disabled |
| | S207 | User tires to "Commit" a session to review and there is no session to compare (Update, Reviewed, NotReviewed) | T293 | Check if export action failed | Ok | There is no session to compare, please insert this session as na "Update" |

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| | S208 | User tries to export a session before he is allowed | T294 | Check if export action failed | Ok | You can add another session on {alloweddate} |
| | S209 | User clicks the "Commit" button and the export is valid | T295 | Check if redirects to /session.xhtml and all the info from the export is removed from memory | Ok | You exported a session for patient {patientid} |
| | | | T296 | Check if the session is correctly inserted in the database | Ok | |
| | | | T297 | Check if the aditional info from the technician is inserted in the database (if this info was added) | Ok | |
| | | | T298 | Check if the exams are correctly inserted in the database | Ok | |
| | | | T299 | Check if all the image result are saved in the server | Ok | |
| | | | T300 | Check if the paths to the image results are correctly inserted in the database | Ok | |
| | | | T301 | Check if a notification was correctly sent to the user | Ok | |
| | | | T302 | Check if the session info was update in the session list in /session.xhtml | Ok | |
| | S210 | User clicks the "Commit" button after antoher User exported a Session to the Patient | T303 | Check if export action failed | Ok | Something bad happened, please try again |
| | | | T304 | Check if redirects to /session.xhtml and all the info from the export is removed from memory | Ok | |
| | | | T305 | Check if the session list is updated on the side where it was allowed | Ok | |

***Table 17 - Scenario testing for user role: technician***

### 8.5.3 Remote Physician

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Page Access Security | S211 | User tries to access /sessionReview.xhtml without logging in | T306 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S212 | Non-"Remote Physician" tries to access /sessionReview.xhtml | T307 | Check if not allowed | Ok | You don't have permission to access this resource |
| Component Security | S213 | User tries to call any method from componenet "sessionReview" without logging in | T308 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S214 | Non-"Remote Physician" tries to call any method from component "sessionReview" | T309 | Check if not allowed | Ok | You don't have permission to access this resource |

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|---|---|---|---|---|---|---|
| Review Session | S215 | User clicks "Review Session" link in the Menu | T400 | Check if redirect to /sessionReview.xhtml | Ok | Ok |
| | S216 | User click "New Session" and doesn't have any assigned MP | T401 | Check if assign action failed | Ok | You are not assigned to any Monitoring Program |
| | S217 | User clicks "New Session" and there aren't sessions to review | T402 | Check if assign action failed | Ok | No Sessions to Review |
| | S218 | User clicks "New Session" and there are sessions to review | T403 | Check if a session is assigned to the User | Ok | NA |
| | | | T404 | Check if this session is the one waiting for longer | Ok | |
| | | | T405 | Check if the session belongs to one of the User's MPs | Ok | |
| | | | T406 | Check if the session to compare belongs to the same patient | Ok | |
| | | | T407 | Check if the session to compare is the last one that was Updated/Reviewed/NotReviewed | Ok | |
| | | | T408 | Check if this session's status is updated to the database as "onReview" | Ok | |
| | | | T409 | Check if all the Information (Session and Patient) is correctly loaded | Ok | |
| | | | T410 | Check if there is a tab for each exam type | Ok | |
| | | | T411 | Check if the there is a tab for each exammined eye type inside of each exam type | Ok | |
| | | | T412 | Check if the results from both sessions are correctly displayed inside of each tab | Ok | |
| | S219 | User clicks "Review Session" link and was already assigned a session | T413 | Check if current session is not replaced or deleted | Ok | NA |
| | S220 | User clicks "New Session", was already assigned a session and there are sessions to review | T414 | Check if session is updated in the database as "onHold" | Ok | NA |
| | | | T415 | Check if this session isn't assigne to this User again (until User logs out) | Ok | |
| | | | T416 | Check if session is replaced by a new session | Ok | |
| | | | T417 | Check if all tests form scenario SX hold true for the new session | Ok | |
| | S221 | User clicks "New Session", was already assigned a session and there are no sessions to review | T418 | Check if session is updated in the database as "onHold" | Ok | NA |
| | | | T419 | Check if session information is discarted | Ok | |
| | | | T420 | Check if assign of new session failed | Ok | |
| | S222 | User clicks "New Session" and is assigned a session that has just | T421 | Check if assign session action failed | Ok | Something bad happened, please try |

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| | | been assigned to another User | T422 | Check if all session information is discarted | Ok | again |
| | S223 | User clicks "New Session" and is assigned a session that has just been deleted by a Technician | T423 | Check if assign session action failed | Ok | Something bad happened, please try again |
| | | | T424 | Check if all session information is discarted | Ok | |
| | S224 | User logs out after he's been assigned a session | T425 | Check if session is updated in the database as "onHold" | Ok | NA |
| | S225 | User's Login times out after he's been assigned a session | T426 | Check if session is updated in the database as "onHold" | Ok | NA |
| | S226 | User tries to commit a diagnosis on the session without selecting "Need/Doesn't Need Consultation" | T427 | Check if diagnose action failed | Ok | NA |
| | S227 | User commits a diagnosis on the current session | T428 | Check if the assigned session is updated in the database as "Reviewed" | Ok | Session ID: {sessionId} has been diagnosed |
| | | | T429 | Check if a review log is correctly inserted in the database | Ok | |
| | | | T430 | Check if a Notification is sent to the Reviewer | Ok | |
| | | | T431 | Check if a Notification is sent to the session Exporter | Ok | |
| | | | T432 | Check if all info from session or diagnosis is discarted | Ok | |
| | S228 | User tries to commit a diagnosis or skip a session that is no longer assigned to him | T433 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T434 | Check if the the currently assigned session (if any) is presented | Ok | |
| | | | T435 | Check if info from previous uncommited diagnosis is discarted | Ok | |
| | S229 | User tries to commit a diagnosis on a session after the Patient's basic information has changed | T436 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T437 | Check if session is updated in the database as "onHold" | Ok | |
| | | | T438 | Check if all session information is discarted | Ok | |
| | S230 | User tries to commit a diagnosis on a session after the Patient's ICD Classifications have changed | T439 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T440 | Check if session is updated in the database as "onHold" | Ok | |
| | | | T441 | Check if all session information is discarted | Ok | |
| | S231 | User tries to commit a diagnosis on a session after the Patient's Text Diagnosis have changed | T442 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T443 | Check if session is updated in the database as "onHold" | Ok | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | T444 | Check if all session information is discarted | Ok | |
| | S232 | User tries to commit a diagnosis on a session after the Patient's Monitoring Programs have changed | T445 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T446 | Check if session is updated in the database as "onHold" | Ok | |
| | | | T447 | Check if all session information is discarted | Ok | |
| | S233 | User clicks in "Enlarge" in any of the results | T448 | Check if the image appears on a popup, 300% larger | Ok | NA |
| | | | T449 | Check if popup does never exceed the size of the page | Ok | |
| | | | T450 | Check if there is a vertical scroll to display the entire image | Ok | |

***Table 18 - Scenario testing for user role: remote physician***

### 8.5.4 Administrator

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Page Security | S234 | User tries to access /searchPatient.xhtml without logging in | T451 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S235 | User tries to access /searchNotification.xhtml without logging in | T452 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S236 | User tries to access /searchUser.xhtml without logging in | T453 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S237 | User tries to access /searchFeedback.xhtml without logging in | T454 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S238 | User tries to access /searchExam.xhtml without logging in | T455 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S239 | User tries to access /searchResults.xhtml without logging in | T456 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S240 | User tries to access /searchMP.xhtml without logging in | T457 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S241 | User tries to access /searchInstitution.xhtml without logging in | T458 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S242 | User tries to access /searchSession.xhtml without logging in | T459 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S243 | User tries to access /searchSessionRev.xhtml without logging in | T460 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S244 | User tries to access /searchIcdLog.xhtml without logging in | T461 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S245 | User tries to access /searchTextDiag.xhtml without logging in | T462 | Check if not allowed and redirect to login page | Ok | Please log in first |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S246 | User tries to access /searchMPatLog.xhtml without logging in | T463 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S247 | User tries to access /searchMPhysLog.xhtml without logging in | T464 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S248 | User tries to access /searchInsPat.xhtml without logging in | T465 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S249 | User tries to access /searchInstLog.xhtml without logging in | T466 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S250 | User tries to access /searchUserLog.xhtml without logging in | T467 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S251 | User tries to access /patModReq.xhtml without logging in | T468 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S252 | User tries to access /alarm.xhtml without logging in | T469 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S253 | User tries to access /billing.xhtml without logging in | T470 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S254 | User tries to access /billingReport.xhtml without logging in | T471 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S255 | User tries to access /performance.xhtml without logging in | T472 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S256 | Non-"Administrator" tries to access /billing.xhtml | T473 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S257 | Non-"Administrator" tries to access /alarm.xhtml | T474 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S258 | Non-"Administrator" tries to access /billingReport.xhtml | T475 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S259 | Non-"Administrator" tries to access /performance.xhtml | T476 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S260 | "Admnistrator" tries to access /notificationManager.xhtml | T477 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S261 | Non-"Administrator" tries to access /searchExam.xhtml | T478 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S262 | Non-"Administrator" tries to access /searchFeedback.xhtml | T479 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S263 | Non-"Administrator" tries to access /searchIcdLog.xhtml | T480 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S264 | Non-"Administrator" tries to access /searchInsPat.xhtml | T481 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S265 | Non-"Administrator" tries to access /searchInstitution.xhtml | T482 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S266 | Non-"Administrator" tries to access /searchInstLog.xhtml | T483 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S267 | Non-"Administrator" tries to access /searchLogin.xhtml | T484 | Check if not allowed | Ok | You don't have permission to access this resource |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S268 | Non-"Administrator" tries to access /searchMPatLog.xhtml | T485 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S269 | Non-"Administrator" tries to access /searchMPhysLog.xhtml | T486 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S270 | Non-"Administrator" tries to access /searchMP.xhtml | T487 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S271 | Non-"Administrator" tries to access /searchNotification.xhtml | T488 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S272 | Non-"Administrator" tries to access /searchPatient.xhtml | T489 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S273 | Non-"Administrator" tries to access /searchPatMod.xhtml | T490 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S274 | Non-"Administrator" tries to access /searchResults.xhtml | T491 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S275 | Non-"Administrator" tries to access /searchSession.xhtml | T492 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S276 | Non-"Administrator" tries to access /searchSessionRev.xhtml | T493 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S277 | Non-"Administrator" tries to access /searchTextDiag.xhtml | T494 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S278 | Non-"Administrator" tries to access /searchUser.xhtml | T495 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S279 | Non-"Administrator" tries to access /searchUserLog.xhtml | T496 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S280 | Non-"Administrator" tries to access /patModReq.xhtml | T497 | Check if not allowed | Ok | You don't have permission to access this resource |
| Component Security | S281 | User tries to call any method from component "billing" without logging in | T498 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S282 | User tries to call any method from component "performance" without logging in | T499 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S283 | User tries to call any method from component "searchExam" without logging in | T500 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S284 | User tries to call any method from component "searchFeedback" without logging in | T501 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S285 | User tries to call any method from component "searchIcdLog" without logging in | T502 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S286 | User tries to call any method from component "searchInsPat" without logging in | T503 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S287 | User tries to call any method from component "searchInstitution" without logging in | T504 | Check if not allowed and redirect to login page | Ok | Please log in first |

| | | | | | |
|---|---|---|---|---|---|
| S288 | User tries to call any method from component "searchInstLog" without logging in | T505 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S289 | User tries to call any method from component "searchLogin" without logging in | T506 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S290 | User tries to call any method from component "searchMPatLog" without logging in | T507 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S291 | User tries to call any method from component "searchMPhysLog" without logging in | T508 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S292 | User tries to call any method from component "searchMP" without logging in | T509 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S293 | User tries to call any method from component "searchNotification" without logging in | T510 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S294 | User tries to call any method from component "searchPatient" without logging in | T511 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S295 | User tries to call any method from component "searchPatMod" without logging in | T512 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S296 | User tries to call any method from component "searchResults" without logging in | T513 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S297 | User tries to call any method from component "searchSession" without logging in | T514 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S298 | User tries to call any method from component "searchSessionRev" without logging in | T515 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S299 | User tries to call any method from component "searchTextDiag" without logging in | T516 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S300 | User tries to call any method from component "searchUser" without logging in | T517 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S301 | User tries to call any method from component "searchUserLog" without logging in | T518 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S302 | User tries to call any method from component "patModReq" without logging in | T519 | Check if not allowed and redirect to login page | Ok | Please log in first |
| S303 | Non-"Administrator" tries to call any method from component "billing" | T520 | Check if not allowed | Ok | You don't have permission to access this resource |
| S304 | Non-"Administrator" tries to call any method from component "performance" | T521 | Check if not allowed | Ok | You don't have permission to access this resource |
| S305 | Non-"Administrator" tries to call any method from component "processor" | T522 | Check if not allowed | Ok | You don't have permission to access this resource |
| S306 | Non-"Administrator" tries to call any method from component "searchExam" | T523 | Check if not allowed | Ok | You don't have permission to access this resource |
| S307 | Non-"Administrator" tries to call any method from component "searchFeedback" | T524 | Check if not allowed | Ok | You don't have permission to access this resource |

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|---|---|---|---|---|---|---|
| | S308 | Non-"Administrator" tries to call any method from component "searchIcdLog" | T525 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S309 | Non-"Administrator" tries to call any method from component "searchInsPat" | T526 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S310 | Non-"Administrator" tries to call any method from component "searchInstitution" | T527 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S311 | Non-"Administrator" tries to call any method from component "searchInstLog" | T528 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S312 | Non-"Administrator" tries to call any method from component "searchLogin" | T529 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S313 | Non-"Administrator" tries to call any method from component "searchMPatLog" | T530 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S314 | Non-"Administrator" tries to call any method from component "searchMPhysLog" | T531 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S315 | Non-"Administrator" tries to call any method from component "searchMP" | T532 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S316 | Non-"Administrator" tries to call any method from component "searchNotification" | T533 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S317 | Non-"Administrator" tries to call any method from component "searchPatient" | T534 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S318 | Non-"Administrator" tries to call any method from component"searchPatMod" | T535 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S319 | Non-"Administrator" tries to call any method from component "searchResults" | T536 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S320 | Non-"Administrator" tries to call any method from component "searchSession" | T537 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S321 | Non-"Administrator" tries to call any method from component "searchSessionRev" | T538 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S322 | Non-"Administrator" tries to call any method from component "searchTextDiag" | T539 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S323 | Non-"Administrator" tries to call any method from component "searchUser" | T540 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S324 | Non-"Administrator" tries to call any method from component "searchUserLog" | T541 | Check if not allowed | Ok | You don't have permission to access this resource |
| | S325 | Non-"Administrator" tries to call any method from component "patModReq" | T542 | Check if not allowed | Ok | You don't have permission to access this resource |
| Search Patient | S326 | User clicks the "Patients " link in the "Data" Menu | T543 | Check if redirects to /searchPatient.xhtml | Ok | NA |
| | | | T544 | Check if resets former searches and filter values | Ok | NA |
| | | | T545 | Check if all combo boxes are loaded correcty | Ok | NA |

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|---|---|---|---|---|---|---|
| | S327 | User inserts one or more values into any of the available search fields* | T546 | Check if all the added value(s) are added to the search | Ok | NA |
| | S328 | User adds no search fields and clicks "Search" | T547 | Check if search action failed | Ok | All search fields are empty |
| | S329 | User adds one or more search fields and clicks "Search" | T548 | Check if the result list is displayed correctly | Ok | NA |
| | | | T549 | Check if former filter fields are deleted | Ok | NA |
| | S330 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T550 | Check if search action failed | Ok | Too much results, refine your search |
| | S331 | User adds one or more search fields, clicks "Search" and the result list is empty | T551 | Check if search action failed | Ok | No Results found |
| | S332 | User filters the result list by any of the available filter fields* | T552 | Check if the list if filtered | Ok | NA |
| | S333 | User sort the result list by any of the available sort fileds* | T553 | Check if the list is sorted | Ok | NA |
| | S334 | User filters and sorts several fields at the same time | T554 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S335 | User click any of the links displayed in the result table | T555 | Check if directs to the correct page* | Ok | NA |
| | | | T556 | Check if the correct data is loaded* | Ok | NA |
| | | | T557 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S336 | User clicks the "Reset" button | T558 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Monitoring Program | S337 | User clicks the "Monitoring Programs " link in the "Data" Menu | T559 | Check if redirects to /searchMP.xhtml | Ok | NA |
| | | | T560 | Check if resets former searches and filter values | Ok | NA |
| | | | T561 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S338 | User inserts one or more values into any of the available search fields* | T562 | Check if all the added value(s) are added to the search | Ok | NA |
| | S339 | User inserts a non number in "Deadline (Days)" search field | T563 | Check if search action failed | Ok | Inserted Deadline/Gap is not a number |
| | S340 | User inserts a non number in "Gap (Months)" search field | T564 | Check if search action failed | Ok | Inserted Deadline/Gap is not a number |
| | S341 | User adds no search fields and clicks "Search" | T565 | Check if search action failed | Ok | All search fields are empty |
| | S342 | User adds one or more search fields and clicks "Search" | T566 | Check if the result list is displayed correctly | Ok | NA |
| | | | T567 | Check if former filter fields are deleted | Ok | NA |
| | S343 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T568 | Check if search action failed | Ok | Too much results, refine your search |
| | S344 | User adds one or more search fields, clicks "Search" and the result list is empty | T569 | Check if search action failed | Ok | No Results found |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S345 | User filters the result list by any of the available filter fields* | T570 | Check if the list if filtered | Ok | NA |
| | S346 | User sort the result list by any of the available sort fileds* | T571 | Check if the list is sorted | Ok | NA |
| | S347 | User filters and sorts several fields at the same time | T572 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S348 | User click any of the links displayed in the result table | T573 | Check if directs to the correct page* | Ok | NA |
| | | | T574 | Check if the correct data is loaded* | Ok | NA |
| | | | T575 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S349 | User clicks the "Reset" button | T576 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Insert Monitoring Program | S350 | User leaves "MP Name" field empty | T577 | Check if insert action failed | Ok | value is required |
| | S351 | User tries to insert an MP Name bigger than 30 characters | T578 | Check if input field is limited to 30 characters | Ok | NA |
| | S352 | User tries to insert a Deadline to Diagnosis too big for the Gap between Sessions | T579 | Check if insert action failed | Ok | Deadline for Diagnosis is too big for the Session Gap. |
| | S353 | User leaves "MP Deadline" field empty | T580 | Check if insert action failed | Ok | value is required |
| | S354 | User inserts a non-number in "MP Deadline" field | T581 | Check if insert action failed | Ok | Inserted Deadline/Gap is not a number |
| | S355 | User leaves "MP Gap" field empty | T582 | Check if insert action failed | Ok | value is required |
| | S356 | User inserts a non-number in "MP Gap" field | T583 | Check if insert action failed | Ok | Inserted Deadline/Gap is not a number |
| | S357 | User doesn't select a Country | T584 | Check if insert action failed | Ok | value is required |
| | S358 | User doesnt add a single Exam Type | T585 | Check if insert action failed | Ok | At least one Exam Type is required |
| | S359 | User makes a valid insertion | T586 | Check if the monitoring program was correctly inserted in the database | Ok | Monitoring Program Added |
| | | | T587 | Check if the combo box to search MPs was updated | Ok | NA |
| | | | T588 | Check if all info from inserted Monitoring Program is dropped | Ok | NA |
| | S360 | User clicks the "Reset" button | T589 | Check if all insert information is dropped | Ok | NA |
| Search User | S361 | User clicks the "Users" link in the "Data" Menu | T590 | Check if redirects to /searchUser.xhtml | Ok | NA |
| | | | T591 | Check if resets former searches and filter values | Ok | NA |
| | | | T592 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S362 | User inserts one or more values into any of the available search fields* | T593 | Check if all the added value(s) are added to the search | Ok | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S363 | User adds no search fields and clicks "Search" | T594 | Check if search action failed | Ok | All search fields are empty |
| | S364 | User adds one or more search fields and clicks "Search" | T595 | Check if the result list is displayed correctly | Ok | NA |
| | | | T596 | Check if former filter fields are deleted | Ok | NA |
| | | | T597 | Check if "User's Notifications" link only appears to non Administrators | Ok | NA |
| | | | T598 | Check if "Patient Icd Classifications Log" only appear to Local Physicians | Ok | NA |
| | | | T599 | Check if "Patient Insertions Log" only appears to Local Physicians | Ok | NA |
| | | | T600 | Check if "Patient MP Assign Log" only appears to Local Physicians | Ok | NA |
| | | | T601 | Check if "Patient Text Diagnosis Log" only appears to Local Physicians | Ok | NA |
| | | | T602 | Check if "Patient Modification Requests" only appears to Local Physicians | Ok | NA |
| | | | T603 | Check if "Institution Log" only appears to Administrators | Ok | NA |
| | | | T604 | Check if "Physician MP Assign Log" only appears to Administrators | Ok | NA |
| | | | T605 | Check if "User Log (As Modifier)" only appears to Administrators | Ok | NA |
| | | | T606 | Check if "Pat. Mod. Req. (As Accepter)" only appears to Administrators | Ok | NA |
| | | | T607 | Check if "MP Insertions" only appears to Administrators | Ok | NA |
| | | | T608 | Check if "Exported Sessions" only appears to Technicians | Ok | NA |
| | | | T609 | Check if "Reviewed Sessions" only appears to Remote Physicians | Ok | NA |
| | | | T610 | Check if "Physician's MP Log" only appears to Remote Physicians | Ok | NA |
| | | | T611 | Check if "Edit" button appears on every row of the table | Ok | NA |
| | | | T612 | Check if "Edit Monitoring Programs" appears on rows of "Remote Physicians" | Ok | NA |
| | S365 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T613 | Check if search action failed | Ok | Too much results, refine your search |

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| | S366 | User adds one or more search fields, clicks "Search" and the result list is empty | T614 | Check if search action failed | Ok | No Results found |
| | S367 | User filters the result list by any of the available filter fields* | T615 | Check if the list if filtered | Ok | NA |
| | S368 | User sort the result list by any of the available sort fileds* | T616 | Check if the list is sorted | Ok | NA |
| | S369 | User filters and sorts several fields at the same time | T617 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S370 | User click any of the links displayed in the result table | T618 | Check if directs to the correct page* | Ok | NA |
| | | | T619 | Check if the correct data is loaded* | Ok | NA |
| | | | T620 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S371 | User click the "Edit" button in the display table | T621 | Check if a new panel is displayed to edit the respective User | OK | NA |
| | | | T622 | Check if the User info is correctly loaded | Ok | NA |
| | | | T623 | Check if any former "Edit Monitoring Programs" Panel is dropped | Ok | NA |
| | S372 | User clicks the "Edit Monitoring Programs" button in the display table | T624 | Check if a new panel is displayed to edit the Monitoring Programs of the User | Ok | NA |
| | | | T625 | Check if the User's Monitoring Programs are correctly loaded | Ok | NA |
| | | | T626 | Check if any former "Edit User" Panel is dropped | Ok | NA |
| | S373 | User clicks the "Send Feedback" button in the display table | T627 | Check if redirects to /feedbackManager.xhtml | Ok | NA |
| | | | T628 | Check if the User ID is already setted in the "to User" field | Ok | NA |
| | | | T629 | Check if former selected Feedbacks are discarted | Ok | NA |
| | S374 | User clicks the "Reset" button | T630 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Insert User | S375 | User leaves "User Professional Number" field empty | T631 | Check if insert action failed | Ok | value is required |
| | S376 | User tries to insert a User Professional Number bigger than 15 characters. | T632 | Check if input field is limited to 15 characters | Ok | NA |
| | S377 | User tries to insert a non-number in "User Professional Number" field | T633 | Check if insert action failed | Ok | Inserted User Professional Number is not a number |
| | S378 | User leaves "User First Number" field empty | T634 | Check if insert action failed | Ok | value is required |
| | S379 | User tries to insert a User First Name bigger than 50 characters. | T635 | Check if input field is limited to 50 characters | Ok | NA |
| | S380 | User leaves "User Last Number" field empty | T636 | Check if insert action failed | Ok | value is required |

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| | S381 | User tries to insert a User Last Name bigger than 50 characters. | T637 | Check if input field is limited to 50 characters | Ok | NA |
| | S382 | User leaves "Username" field empty | T638 | Check if insert action failed | Ok | value is required |
| | S383 | User tries to insert a Username bigger than 20 characters. | T639 | Check if input field is limited to 20 characters | Ok | NA |
| | S384 | User leaves "Password" field empty | T640 | Check if insert action failed | Ok | value is required |
| | S385 | User tries to insert a Password bigger than 20 characters. | T641 | Check if input field is limited to 20 characters | Ok | NA |
| | S386 | User doesn't choose a "User Type" | T642 | Check if insert action failed | Ok | value is required |
| | S387 | User doesn't choose a "User Country" | T643 | Check if insert action failed | Ok | value is required |
| | S388 | User doesn't choose an "Institution" | T644 | Check if insert action failed | Ok | value is required |
| | S389 | User tries to insert a non-"Remote Physician" User Type without an Instituion | T645 | Check if insert action failed | Ok | That User Type requires an Institution |
| | S390 | User insert a User Country different than the Institution's Country | T646 | Check if insert action failed | Ok | User's Country and Institution's Country do not match. |
| | S391 | User makes a valid insertion | T647 | Check if the User was correctly inserted in the database | Ok | User with Professional Number: {userPnumber} Inserted. |
| | | | T648 | Check if a Log was correctly inserted in the database | Ok | NA |
| | | | T649 | Check if all info from Inserted User is dropped | Ok | NA |
| | S392 | User clicks the "Reset" button | T650 | Check if all insert information is dropped | Ok | NA |
| Edit User | S393 | User leaves "User Professional Number" field empty | T651 | Check if edit action failed | Ok | value is required |
| | S394 | User tries to insert a User Professional Number bigger than 15 characters. | T652 | Check if input field is limited to 15 characters | Ok | NA |
| | S395 | User tries to insert a non-number in "User Professional Number" field | T653 | Check if edit action failed | Ok | Inserted User Professional Number is not a number |
| | S396 | User leaves "User First Number" field empty | T654 | Check if edit action failed | Ok | value is required |
| | S397 | User tries to insert a User First Name bigger than 50 characters. | T655 | Check if input field is limited to 50 characters | Ok | NA |
| | S398 | User leaves "User Last Number" field empty | T656 | Check if edit action failed | Ok | value is required |
| | S399 | User tries to insert a User Last Name bigger than 50 characters. | T657 | Check if input field is limited to 50 characters | Ok | NA |
| | S400 | User leaves "Username" field empty | T658 | Check if edit action failed | Ok | value is required |
| | S401 | User tries to insert a Username bigger than 20 characters. | T659 | Check if input field is limited to 20 characters | Ok | NA |
| | S402 | User leaves "Password" field empty | T660 | Check if edit action failed | Ok | value is required |

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| | S403 | User tries to insert a Password bigger than 20 characters. | T661 | Check if input field is limited to 20 characters | Ok | NA |
| | S404 | User tries to edit a a non-"Remote Physician" User Type without an Instituion | T662 | Check if edit action failed | Ok | That User Type requires an Institution. |
| | S405 | User edits a User Country different than the Institution's Country (and vice-versa) | T663 | Check if edit action failed | Ok | User's Country and Institution's Country do not match. |
| | S406 | User doesn't make any changes to the User and commits. | T664 | Check if edit action failed | Ok | No Changes were detected. |
| | S407 | User makes a valid edition | T665 | Check if the User was correctly changed in the database | Ok | User with Professional Number: {userPnumber} altered |
| | | | T666 | Check if a Log was correctly inserted in the database | Ok | NA |
| | | | T667 | Check if the Edit User Panel is dropped | Ok | NA |
| | S408 | User clicks the "Reset" button | T668 | Check if all changes to the User's info are dropped | Ok | NA |
| | S409 | User clicks the "Cancel" button | T669 | Check if the Edit User Panel is dropped | Ok | NA |
| | S410 | (Change Password) User inserts new password smaller than 5 characters | T670 | Check if edit action failed | Ok | New password must be between 5 and 20 characters |
| | S411 | (Change Password) User inserts new password bigger than 20 characters | T671 | Check if edit action failed | Ok | New password must be between 5 and 20 characters |
| | S412 | (Change Password) User inserts new password equals to current password | T672 | Check if edit action failed | Ok | New password equals current password |
| | S413 | (Change Password) User inserts new password equals to last password | T673 | Check if edit action failed | Ok | New password equals last password |
| | S414 | (Change Password) User inserts new password different from confirm password | T674 | Check if edit action failed | Ok | Passwords don't match |
| | S415 | (Change Password) User inserts valid new password | T675 | Check if User is correctly changed in the database | Ok | NA |
| | | | T676 | Check if a Log was correctly inserted in the database | Ok | |
| | S416 | User tries to "commit" after the user has been changed by another user | T677 | Check if edit action failed | Ok | User Info was changed by another user |
| Edit User's Monitoring Programs | S417 | User adds/removes Monitoring Programs to the respective User and clicks commit | T678 | Check the User's Monitoring Programs are updated in the database | Ok | User's Monitoring Program's Updated |
| | | | T679 | Check if a log is correctly inserted in the database for each added/removed Monitoring Program | Ok | NA |
| | | | T680 | Check if the Edit Monitoring Program info is dropped | Ok | NA |
| | S418 | User clicks "Reset" button | T681 | Check if all changes to the User's Monitoring Programs are dropped | Ok | NA |

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| | S419 | User clicks "Cancel" button | T682 | Check if the Edit Monitoring Programs Panel is dropped | Ok | NA |
| Search Notification | S420 | User clicks the "Notifications " link in the "Data" Menu | T683 | Check if redirects to /searchNotification.xhtml | Ok | NA |
| | | | T684 | Check if resets former searches and filter values | Ok | NA |
| | | | T685 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S421 | User inserts one or more values into any of the available search fields* | T686 | Check if all the added value(s) are added to the search | Ok | NA |
| | S422 | User inserts a non number in "Notification ID" search field | T687 | Check if search action failed | Ok | Inserted Notification ID is not a number |
| | S423 | User adds no search fields and clicks "Search" | T688 | Check if search action failed | Ok | All search fields are empty |
| | S424 | User adds one or more search fields and clicks "Search" | T689 | Check if the result list is displayed correctly | Ok | NA |
| | | | T690 | Check if former filter fields are deleted | Ok | NA |
| | S425 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T691 | Check if search action failed | Ok | Too much results, refine your search |
| | S426 | User adds one or more search fields, clicks "Search" and the result list is empty | T692 | Check if search action failed | Ok | No Results found |
| | S427 | User filters the result list by any of the available filter fields* | T693 | Check if the list if filtered | Ok | NA |
| | S428 | User sort the result list by any of the available sort fileds* | T694 | Check if the list is sorted | Ok | NA |
| | S429 | User filters and sorts several fields at the same time | T695 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S430 | User click any of the links displayed in the result table | T696 | Check if directs to the correct page* | Ok | NA |
| | | | T697 | Check if the correct data is loaded* | Ok | NA |
| | | | T698 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S431 | User clicks the "Reset" button | T699 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Exam | S432 | User clicks the "Exams " link in the "Data" Menu | T700 | Check if redirects to /searchExam.xhtml | Ok | NA |
| | | | T701 | Check if resets former searches and filter values | Ok | NA |
| | | | T702 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S433 | User inserts one or more values into any of the available search fields* | T703 | Check if all the added value(s) are added to the search | Ok | NA |
| | S434 | User inserts a non number in "Nbr. Results" search field | T704 | Check if search action failed | Ok | Inserted Nrb. Results is not a number |

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| | S435 | User adds no search fields and clicks "Search" | T705 | Check if search action failed | Ok | All search fields are empty |
| | S436 | User adds one or more search fields and clicks "Search" | T706 | Check if the result list is displayed correctly | Ok | NA |
| | | | T707 | Check if former filter fields are deleted | Ok | NA |
| | S437 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T708 | Check if search action failed | Ok | Too much results, refine your search |
| | S438 | User adds one or more search fields, clicks "Search" and the result list is empty | T709 | Check if search action failed | Ok | No Results found |
| | S439 | User filters the result list by any of the available filter fields* | T710 | Check if the list if filtered | Ok | NA |
| | S440 | User sort the result list by any of the available sort fileds* | T711 | Check if the list is sorted | Ok | NA |
| | S441 | User filters and sorts several fields at the same time | T712 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S442 | User click any of the links displayed in the result table | T713 | Check if directs to the correct page* | Ok | NA |
| | | | T714 | Check if the correct data is loaded* | Ok | NA |
| | | | T715 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S443 | User clicks the "Reset" button | T716 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Feedback | S444 | User clicks the "Feedback " link in the "Data" Menu | T717 | Check if redirects to /searchFeedback.xhtml | Ok | NA |
| | | | T718 | Check if resets former searches and filter values | Ok | NA |
| | S445 | User inserts one or more values into any of the available search fields* | T719 | Check if all the added value(s) are added to the search | Ok | NA |
| | S446 | User inserts a non number in "Feedback ID" search field | T720 | Check if search action failed | Ok | Inserted Feedback ID is not a number |
| | S447 | User inserts a non number in "Answer to (Feedback ID)" search field | T721 | Check if search action failed | Ok | Inserted Feedback ID is not a number |
| | S448 | User inserts a non number in "Answered by (Feedback ID)" search field | T722 | Check if search action failed | Ok | Inserted Feedback ID is not a number |
| | S449 | User adds no search fields and clicks "Search" | T723 | Check if search action failed | Ok | All search fields are empty |
| | S450 | User adds one or more search fields and clicks "Search" | T724 | Check if the result list is displayed correctly | Ok | NA |
| | | | T725 | Check if former filter fields are deleted | Ok | NA |
| | S451 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T726 | Check if search action failed | Ok | Too much results, refine your search |
| | S452 | User adds one or more search fields, clicks "Search" and the result list is empty | T727 | Check if search action failed | Ok | No Results found |

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| | S453 | User filters the result list by any of the available filter fields* | T728 | Check if the list if filtered | Ok | NA |
| | S454 | User sort the result list by any of the available sort fileds* | T729 | Check if the list is sorted | Ok | NA |
| | S455 | User filters and sorts several fields at the same time | T730 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S456 | User click any of the links displayed in the result table | T731 | Check if directs to the correct page* | Ok | NA |
| | | | T732 | Check if the correct data is loaded* | Ok | NA |
| | | | T733 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S457 | User clicks the "Reset" button | T734 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Results | S458 | User clicks the "Results " link in the "Data" Menu | T735 | Check if redirects to /searchResults.xhtml | Ok | NA |
| | | | T736 | Check if resets former searches and filter values | Ok | NA |
| | S459 | User inserts one or more values into any of the available search fields* | T737 | Check if all the added value(s) are added to the search | Ok | NA |
| | S460 | User adds no search fields and clicks "Search" | T738 | Check if search action failed | Ok | All search fields are empty |
| | S461 | User adds one or more search fields and clicks "Search" | T739 | Check if the result list is displayed correctly | Ok | NA |
| | | | T740 | Check if former filter fields are deleted | Ok | NA |
| | S462 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T741 | Check if search action failed | Ok | Too much results, refine your search |
| | S463 | User adds one or more search fields, clicks "Search" and the result list is empty | T742 | Check if search action failed | Ok | No Results found |
| | S464 | User filters the result list by any of the available filter fields* | T743 | Check if the list if filtered | Ok | NA |
| | S465 | User sort the result list by any of the available sort fileds* | T744 | Check if the list is sorted | Ok | NA |
| | S466 | User filters and sorts several fields at the same time | T745 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S467 | User click any of the links displayed in the result table | T746 | Check if directs to the correct page* | Ok | NA |
| | | | T747 | Check if the correct data is loaded* | Ok | NA |
| | | | T748 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S468 | User clicks the "Reset" button | T749 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Institution | S469 | User clicks the "Institution" link in the "Data" Menu | T750 | Check if redirects to /searchInstitution.xhtml | Ok | NA |
| | | | T751 | Check if resets former searches and filter values | Ok | NA |

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| | S470 | User inserts one or more values into any of the available search fields* | T752 | Check if all the added value(s) are added to the search | Ok | NA |
| | S471 | User inserts a non number in "Institution ID" search field | T753 | Check if search action failed | Ok | Inserted Institution ID is not a number |
| | S472 | User adds no search fields and clicks "Search" | T754 | Check if search action failed | Ok | All search fields are empty |
| | S473 | User adds one or more search fields and clicks "Search" | T755 | Check if the result list is displayed correctly | Ok | NA |
| | | | T756 | Check if former filter fields are deleted | Ok | NA |
| | | | T757 | Check if "Edit" button appears on every row of the table | Ok | NA |
| | S474 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T758 | Check if search action failed | Ok | Too much results, refine your search |
| | S475 | User adds one or more search fields, clicks "Search" and the result list is empty | T759 | Check if search action failed | Ok | No Results found |
| | S476 | User filters the result list by any of the available filter fields* | T760 | Check if the list if filtered | Ok | NA |
| | S477 | User sort the result list by any of the available sort fileds* | T761 | Check if the list is sorted | Ok | NA |
| | S478 | User filters and sorts several fields at the same time | T762 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S479 | User click any of the links displayed in the result table | T763 | Check if directs to the correct page* | Ok | NA |
| | | | T764 | Check if the correct data is loaded* | Ok | NA |
| | | | T765 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S480 | User click the "Edit" button in the display table | T766 | Check if a new panel is displayed to edit the respective Institution | Ok | NA |
| | | | T767 | Check if the Institution info is correctly loaded | Ok | NA |
| | S481 | User clicks the "Reset" button | T768 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Insert Institution | S482 | User leaves "Institution Name" field empty | T769 | Check if insert action failed | Ok | value is required |
| | S483 | User tries to insert a Institution Name bigger than 50 characters. | T770 | Check if input field is limited to 50 characters | Ok | NA |
| | S484 | User leaves "Institution Address" field empty | T771 | Check if insert action failed | Ok | value is required |
| | S485 | User tries to insert a Institution Address bigger than 100 characters. | T772 | Check if input field is limited to 100 characters | Ok | NA |
| | S486 | User leaves "Institution City" field empty | T773 | Check if insert action failed | Ok | value is required |
| | S487 | User tries to insert a Institution City bigger than 50 characters. | T774 | Check if input field is limited to 50 characters | Ok | NA |

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| | S488 | User leaves "Institution ZIP" field empty | T775 | Check if insert action failed | Ok | value is required |
| | S489 | User tries to insert a Institution ZIP bigger than 10 characters. | T776 | Check if input field is limited to 10 characters | Ok | NA |
| | S490 | User doesn't choose a "Country" | T777 | Check if insert action failed | Ok | value is required |
| | S491 | User tries to insert a non-number in "Belongs to (Institution ID)" | T778 | Check if insert action failed | Ok | Inserted Institution ID is not a number |
| | S492 | User tries to insert a non-existing Institution in "Belongs to (Institution ID)" | T779 | Check if insert action failed | Ok | Institution with ID: {instId} doesn't exist |
| | S493 | User makes a valid insertion | T780 | Check if the Institution was correctly inserted in the database | Ok | User with Professional Number: {userPnumber} Inserted. |
| | | | T781 | Check if a Log was correctly inserted in the database | Ok | NA |
| | | | T782 | Check if all info from Inserted Institution is dropped | Ok | NA |
| | S494 | User clicks the "Reset" button | T783 | Check if all info from Inserted Institution is dropepd | Ok | NA |
| Edit Institution | S495 | User leaves "Institution Name" field empty | T784 | Check if edit action failed | Ok | value is required |
| | S496 | User tries to insert a Institution Name bigger than 50 characters. | T785 | Check if input field is limited to 50 characters | Ok | NA |
| | S497 | User leaves "Institution Address" field empty | T786 | Check if edit action failed | Ok | value is required |
| | S498 | User tries to insert a Institution Address bigger than 100 characters. | T787 | Check if input field is limited to 100 characters | Ok | NA |
| | S499 | User leaves "Institution City" field empty | T788 | Check if edit action failed | Ok | value is required |
| | S500 | User tries to insert a Institution City bigger than 50 characters. | T789 | Check if input field is limited to 50 characters | Ok | NA |
| | S501 | User leaves "Institution ZIP" field empty | T790 | Check if edit action failed | Ok | value is required |
| | S502 | User tries to insert a Institution ZIP bigger than 10 characters. | T791 | Check if input field is limited to 10 characters | Ok | NA |
| | S503 | User tries to insert a non-number in "Belongs to (Institution ID)" | T792 | Check if edit action failed | Ok | Inserted Institution ID is not a number |
| | S504 | User tries to insert a non-existing Institution in "Belongs to (Institution ID)" | T793 | Check if edit action failed | Ok | Institution with ID: {instId} doesn't exist |
| | S505 | User doesn't make any changes to the Institution and commits. | T794 | Check if edit action failed | Ok | No Changes were detected. |
| | S506 | User tries to insert the Edited Institution in "Belongs to (Institution ID)" | T795 | Check if edit action failed | Ok | An Institution can't belong to itself |
| | S507 | User makes a valid edition | T796 | Check if the Institution was correctly changed in the database | Ok | Institution with ID: {instId} altered |
| | | | T797 | Check if a Log was correctly inserted in the database | Ok | NA |

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| | | | T798 | Check if the Edit Institution Panel is dropped | Ok | NA |
| | S508 | User clicks the "Reset" button | T799 | Check if all changes to the Institution's info are dropped | Ok | NA |
| | S509 | User clicks the "Cancel" button | T800 | Check if the Edit Institution Panel is dropped | Ok | NA |
| Search Session | S510 | User clicks the "Sessions" link in the "Data" Menu | T801 | Check if redirects to /searchSession.xhtml | Ok | NA |
| | | | T802 | Check if resets former searches and filter values | Ok | NA |
| | | | T803 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S511 | User inserts one or more values into any of the available search fields* | T804 | Check if all the added value(s) are added to the search | Ok | NA |
| | S512 | User inserts a non number in "Session ID" search field | T805 | Check if search action failed | Ok | Inserted Institution ID is not a number |
| | S513 | User adds no search fields and clicks "Search" | T806 | Check if search action failed | Ok | All search fields are empty |
| | S514 | User adds one or more search fields and clicks "Search" | T807 | Check if the result list is displayed correctly | Ok | NA |
| | | | T808 | Check if former filter fields are deleted | Ok | NA |
| | | | T809 | Check if the link "Session Review" only appears if the session was diagnosed | Ok | NA |
| | | | T810 | Check if the "Delete" information only appears if the session was deleted | Ok | NA |
| | S515 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T811 | Check if search action failed | Ok | Too much results, refine your search |
| | S516 | User adds one or more search fields, clicks "Search" and the result list is empty | T812 | Check if search action failed | Ok | No Results found |
| | S517 | User filters the result list by any of the available filter fields* | T813 | Check if the list if filtered | Ok | NA |
| | S518 | User sort the result list by any of the available sort fileds* | T814 | Check if the list is sorted | Ok | NA |
| | S519 | User filters and sorts several fields at the same time | T815 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S520 | User click any of the links displayed in the result table | T816 | Check if directs to the correct page* | Ok | NA |
| | | | T817 | Check if the correct data is loaded* | Ok | NA |
| | | | T818 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S521 | User clicks the "Reset" button | T819 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search | S522 | User clicks the "Session Review" link in the "Data" Menu | T820 | Check if redirects to /searchSessionRev.xhtml | Ok | NA |

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| Session Review | | | T821 | Check if resets former searches and filter values | Ok | NA |
| | | | T822 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S523 | User inserts one or more values into any of the available search fields* | T823 | Check if all the added value(s) are added to the search | Ok | NA |
| | S524 | User inserts a non number in "Review Time" search field | T824 | Check if search action failed | Ok | Inserted review times are not numbers |
| | S525 | User adds no search fields and clicks "Search" | T825 | Check if search action failed | Ok | All search fields are empty |
| | S526 | User adds one or more search fields and clicks "Search" | T826 | Check if the result list is displayed correctly | Ok | NA |
| | | | T827 | Check if former filter fields are deleted | Ok | NA |
| | S527 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T828 | Check if search action failed | Ok | Too much results, refine your search |
| | S528 | User adds one or more search fields, clicks "Search" and the result list is empty | T829 | Check if search action failed | Ok | No Results found |
| | S529 | User filters the result list by any of the available filter fields* | T830 | Check if the list if filtered | Ok | NA |
| | S530 | User sort the result list by any of the available sort fileds* | T831 | Check if the list is sorted | Ok | NA |
| | S531 | User filters and sorts several fields at the same time | T832 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S532 | User click any of the links displayed in the result table | T833 | Check if directs to the correct page* | Ok | NA |
| | | | T834 | Check if the correct data is loaded* | Ok | NA |
| | | | T835 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S533 | User clicks the "Reset" button | T836 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search ICD Classification Log | S534 | User clicks the "Patient's ICD Classifications " link in the "Log" Menu | T837 | Check if redirects to /searchIcdLog.xhtml | Ok | NA |
| | | | T838 | Check if resets former searches and filter values | Ok | NA |
| | | | T839 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S535 | User inserts one or more values into any of the available search fields* | T840 | Check if all the added value(s) are added to the search | Ok | NA |
| | S536 | User doesn't select one "ICD Chapter" and clicks "Blocks" | T841 | Check if search action failed | Ok | Select one Chapter from the list |
| | S537 | User selects one "ICD Chapter" and clicks "Search" | T842 | Check if the "ICD Chapter" is added to the search | Ok | NA |
| | S538 | User selects one "ICD Chapter" and clicks "Blocks" | T843 | Check if the "ICD Block" list is loaded correctly | Ok | NA |
| | | | T844 | Check if the "ICD Chapter" list and "Block" | Ok | NA |

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| | | | | button are disabled | | |
| | | | T845 | Check if the "ICD Block" list "Back to Chapters" and "Codes" button are enabled | Ok | NA |
| | S539 | User doesn't select an "ICD Block" and clicks "Search" button | T846 | Check if only "ICD Chapter" is added to the search | Ok | NA |
| | S540 | User clicks "Back to Chapters" button | T847 | Check if "ICD Chapter" list and "Blocks" button are enabled | Ok | NA |
| | | | T848 | Check if "ICD Block" list, "Back to Chapters" and "Codes" buttons are disabled | Ok | NA |
| | | | T849 | Check if any choice in "ICD Blocks" is discarted | Ok | NA |
| | S541 | User doesn't select an "ICD Block" and clicks "Codes" button | T850 | Check if search action failed | Ok | Select a Block from the list |
| | S542 | User select an "ICD Block" and clicks "Codes" button | T851 | Check if the "ICD Codes" list is loaded correctly | Ok | NA |
| | | | T852 | Check if the "ICD Block" list "Blocks" and "Back to Chapter" buttons are disabled | Ok | NA |
| | | | T853 | Check if the "ICD Codes" list and "Back to Blocks" button are enabled | Ok | NA |
| | S543 | User select an "ICD Block" and clicks "Search" button | T854 | Check if "ICD Block" is added to the search | Ok | NA |
| | S544 | User desn't select an "ICD Code" and clicks "Search" button | T855 | Check if only "ICD Block" is added to the search | Ok | NA |
| | S545 | User clicks "Back to Blocks" button | T856 | Check if "ICD Block" list, "Code" and "Back to Chapter" buttons are enabled | Ok | NA |
| | | | T857 | Check if "ICD Codes" list and "Back to Blocks" button are disabled | Ok | NA |
| | | | T858 | Check if any choice in "ICD Codes" is discarted | Ok | NA |
| | S546 | User select an "ICD Clock" and clicks "Search" button | T859 | Check if "ICD Code" is added to the search | Ok | NA |
| | S547 | User adds no search fields and clicks "Search" | T860 | Check if search action failed | Ok | All search fields are empty |
| | S548 | User adds one or more search fields and clicks "Search" | T861 | Check if the result list is displayed correctly | Ok | NA |
| | | | T862 | Check if former filter fields are deleted | Ok | NA |
| | S549 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T863 | Check if search action failed | Ok | Too much results, refine your search |
| | S550 | User adds one or more search fields, clicks "Search" and the result list is empty | T864 | Check if search action failed | Ok | No Results found |
| | S551 | User filters the result list by any of the available filter fields* | T865 | Check if the list if filtered | Ok | NA |
| | S552 | User sort the result list by any of the available sort fileds* | T866 | Check if the list is sorted | Ok | NA |

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| | S553 | User filters and sorts several fields at the same time | T867 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S554 | User click any of the links displayed in the result table | T868 | Check if directs to the correct page* | Ok | NA |
| | | | T869 | Check if the correct data is loaded* | Ok | NA |
| | | | T870 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S555 | User clicks the "Reset" button | T871 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Text Diagnosis Log | S556 | User clicks the "Patient's Text Diagnosis" link in the "Log" Menu | T872 | Check if redirects to /searchTextDiag.xhtml | Ok | NA |
| | | | T873 | Check if resets former searches and filter values | Ok | NA |
| | S557 | User inserts one or more values into any of the available search fields* | T874 | Check if all the added value(s) are added to the search | Ok | NA |
| | S558 | User adds no search fields and clicks "Search" | T875 | Check if search action failed | Ok | All search fields are empty |
| | S559 | User adds one or more search fields and clicks "Search" | T876 | Check if the result list is displayed correctly | Ok | NA |
| | | | T877 | Check if former filter fields are deleted | Ok | NA |
| | S560 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T878 | Check if search action failed | Ok | Too much results, refine your search |
| | S561 | User adds one or more search fields, clicks "Search" and the result list is empty | T879 | Check if search action failed | Ok | No Results found |
| | S562 | User filters the result list by any of the available filter fields* | T880 | Check if the list if filtered | Ok | NA |
| | S563 | User sort the result list by any of the available sort fileds* | T881 | Check if the list is sorted | Ok | NA |
| | S564 | User filters and sorts several fields at the same time | T882 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S565 | User click any of the links displayed in the result table | T883 | Check if directs to the correct page* | Ok | NA |
| | | | T884 | Check if the correct data is loaded* | Ok | NA |
| | | | T885 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S566 | User clicks the "Reset" button | T886 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Patient's Monitoring Programs Log | S567 | User clicks the "Patient's Monitoring Programs" link in the "Log" Menu | T887 | Check if redirects to /searchMPatLog.xhtml | Ok | NA |
| | | | T888 | Check if resets former searches and filter values | Ok | NA |
| | S568 | | T889 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S569 | User inserts one or more values into any of the available search | T890 | Check if all the added value(s) are added to the | Ok | NA |

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| | | fields* | | search | | |
| | S570 | User adds no search fields and clicks "Search" | T891 | Check if search action failed | Ok | All search fields are empty |
| | S571 | User adds one or more search fields and clicks "Search" | T892 | Check if the result list is displayed correctly | Ok | NA |
| | | | T893 | Check if former filter fields are deleted | Ok | NA |
| | S572 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T894 | Check if search action failed | Ok | Too much results, refine your search |
| | S573 | User adds one or more search fields, clicks "Search" and the result list is empty | T895 | Check if search action failed | Ok | No Results found |
| | S574 | User filters the result list by any of the available filter fields* | T896 | Check if the list if filtered | Ok | NA |
| | S575 | User sort the result list by any of the available sort fileds* | T897 | Check if the list is sorted | Ok | NA |
| | S576 | User filters and sorts several fields at the same time | T898 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S577 | User click any of the links displayed in the result table | T899 | Check if directs to the correct page* | Ok | NA |
| | | | T900 | Check if the correct data is loaded* | Ok | NA |
| | | | T901 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S578 | User clicks the "Reset" button | T902 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Physician's Monitoring Programs Log | S579 | User clicks the "Physician's Monitoring Programs" link in the "Log" Menu | T903 | Check if redirects to /searchMPhysLog.xhtml | Ok | NA |
| | | | T904 | Check if resets former searches and filter values | Ok | NA |
| | | | T905 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S580 | User inserts one or more values into any of the available search fields* | T906 | Check if all the added value(s) are added to the search | Ok | NA |
| | S581 | User adds no search fields and clicks "Search" | T907 | Check if search action failed | Ok | All search fields are empty |
| | S582 | User adds one or more search fields and clicks "Search" | T908 | Check if the result list is displayed correctly | Ok | NA |
| | | | T909 | Check if former filter fields are deleted | Ok | NA |
| | S583 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T910 | Check if search action failed | Ok | Too much results, refine your search |
| | S584 | User adds one or more search fields, clicks "Search" and the result list is empty | T911 | Check if search action failed | Ok | No Results found |
| | S585 | User filters the result list by any of the available filter fields* | T912 | Check if the list if filtered | Ok | NA |
| | S586 | User sort the result list by any of the available sort fileds* | T913 | Check if the list is sorted | Ok | NA |

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| | S587 | User filters and sorts several fields at the same time | T914 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S588 | User click any of the links displayed in the result table | T915 | Check if directs to the correct page* | Ok | NA |
| | | | T916 | Check if the correct data is loaded* | Ok | NA |
| | | | T917 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S589 | User clicks the "Reset" button | T918 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Inserted Patient's Log | S590 | User clicks the "Patient Insertions" link in the "Log" Menu | T919 | Check if redirects to /searchInsPat.xhtml | Ok | NA |
| | | | T920 | Check if resets former searches and filter values | Ok | NA |
| | S591 | | T921 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S592 | User inserts one or more values into any of the available search fields* | T922 | Check if all the added value(s) are added to the search | Ok | NA |
| | S593 | User adds no search fields and clicks "Search" | T923 | Check if search action failed | Ok | All search fields are empty |
| | S594 | User adds one or more search fields and clicks "Search" | T924 | Check if the result list is displayed correctly | Ok | NA |
| | | | T925 | Check if former filter fields are deleted | Ok | NA |
| | S595 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T926 | Check if search action failed | Ok | Too much results, refine your search |
| | S596 | User adds one or more search fields, clicks "Search" and the result list is empty | T927 | Check if search action failed | Ok | No Results found |
| | S597 | User filters the result list by any of the available filter fields* | T928 | Check if the list if filtered | Ok | NA |
| | S598 | User sort the result list by any of the available sort fileds* | T929 | Check if the list is sorted | Ok | NA |
| | S599 | User filters and sorts several fields at the same time | T930 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S600 | User click any of the links displayed in the result table | T931 | Check if directs to the correct page* | Ok | NA |
| | | | T932 | Check if the correct data is loaded* | Ok | NA |
| | | | T933 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S601 | User clicks the "Reset" button | T934 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search User Log | S602 | User clicks the "Users" link in the "Log" Menu | T935 | Check if redirects to /searchUserLog.xhtml | Ok | NA |
| | | | T936 | Check if resets former searches and filter values | Ok | NA |
| | | | T937 | Check if all combo boxes are loaded correcty | Ok | NA |

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| | S603 | User inserts one or more values into any of the available search fields* | T938 | Check if all the added value(s) are added to the search | Ok | NA |
| | S604 | User adds no search fields and clicks "Search" | T939 | Check if search action failed | Ok | All search fields are empty |
| | S605 | User adds one or more search fields and clicks "Search" | T940 | Check if the result list is displayed correctly | Ok | NA |
| | | | T941 | Check if former filter fields are deleted | Ok | NA |
| | S606 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T942 | Check if search action failed | Ok | Too much results, refine your search |
| | S607 | User adds one or more search fields, clicks "Search" and the result list is empty | T943 | Check if search action failed | Ok | No Results found |
| | S608 | User filters the result list by any of the available filter fields* | T944 | Check if the list if filtered | Ok | NA |
| | S609 | User sort the result list by any of the available sort fileds* | T945 | Check if the list is sorted | Ok | NA |
| | S610 | User filters and sorts several fields at the same time | T946 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S611 | User click any of the links displayed in the result table | T947 | Check if directs to the correct page* | Ok | NA |
| | | | T948 | Check if the correct data is loaded* | Ok | NA |
| | | | T949 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S612 | User clicks the "Reset" button | T950 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Institution Log | S613 | User clicks the "Institutions" link in the "Log" Menu | T951 | Check if redirects to /searchInstLog.xhtml | Ok | NA |
| | | | T952 | Check if resets former searches and filter values | Ok | NA |
| | | | T953 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S614 | User inserts one or more values into any of the available search fields* | T954 | Check if all the added value(s) are added to the search | Ok | NA |
| | S615 | User inserts a non number in "Institution ID" search field | T955 | Check if search action failed | Ok | Inserted Institution ID is not a number |
| | S616 | User inserts a non number in "Belongs to (Inst. ID)" search field | T956 | Check if search action failed | Ok | Inserted Institution ID is not a number |
| | S617 | User adds no search fields and clicks "Search" | T957 | Check if search action failed | Ok | All search fields are empty |
| | S618 | User adds one or more search fields and clicks "Search" | T958 | Check if the result list is displayed correctly | Ok | NA |
| | | | T959 | Check if former filter fields are deleted | Ok | NA |
| | S619 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T960 | Check if search action failed | Ok | Too much results, refine your search |
| | S620 | User adds one or more search fields, clicks "Search" and the result | T961 | Check if search action failed | Ok | No Results found |

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| | | list is empty | | | | |
| | S621 | User filters the result list by any of the available filter fields* | T962 | Check if the list if filtered | Ok | NA |
| | S622 | User sort the result list by any of the available sort fileds* | T963 | Check if the list is sorted | Ok | NA |
| | S623 | User filters and sorts several fields at the same time | T964 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S624 | User click any of the links displayed in the result table | T965 | Check if directs to the correct page* | Ok | NA |
| | | | T966 | Check if the correct data is loaded* | Ok | NA |
| | | | T967 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S625 | User clicks the "Reset" button | T968 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Search Login Log | S626 | User clicks the "Logins" link in the "Log" Menu | T969 | Check if redirects to /searchLogin.xhtml | Ok | NA |
| | | | T970 | Check if resets former searches and filter values | Ok | NA |
| | S627 | User inserts one or more values into any of the available search fields* | T971 | Check if all the added value(s) are added to the search | Ok | NA |
| | S628 | User inserts a non number in "Login Time" search field | T972 | Check if search action failed | Ok | Inserted Login Times are not numbers |
| | S629 | User adds no search fields and clicks "Search" | T973 | Check if search action failed | Ok | All search fields are empty |
| | S630 | User adds one or more search fields and clicks "Search" | T974 | Check if the result list is displayed correctly | Ok | NA |
| | | | T975 | Check if former filter fields are deleted | Ok | NA |
| | S631 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T976 | Check if search action failed | Ok | Too much results, refine your search |
| | S632 | User adds one or more search fields, clicks "Search" and the result list is empty | T977 | Check if search action failed | Ok | No Results found |
| | S633 | User filters the result list by any of the available filter fields* | T978 | Check if the list if filtered | Ok | NA |
| | S634 | User sort the result list by any of the available sort fileds* | T979 | Check if the list is sorted | Ok | NA |
| | S635 | User filters and sorts several fields at the same time | T980 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S636 | User click any of the links displayed in the result table | T981 | Check if directs to the correct page* | Ok | NA |
| | | | T982 | Check if the correct data is loaded* | Ok | NA |
| | | | T983 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S637 | User clicks the "Reset" button | T984 | Check if all search fields, filter fields and result list are deleted | Ok | NA |

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| Search Patient Modification Request | S638 | User clicks the "Patient Modification Requests" link in the "Log" Menu | T985 | Check if redirects to /searchPatMod.xhtml | Ok | NA |
| | | | T986 | Check if resets former searches and filter values | Ok | NA |
| | | | T987 | Check if all combo boxes are loaded correcty | Ok | NA |
| | S639 | User inserts a non-number in "Request ID" field | T988 | Check if search action failed | Ok | Inserted Request ID is not a number |
| | S640 | User inserts one or more values into any of the available search fields* | T989 | Check if all the added value(s) are added to the search | Ok | NA |
| | S641 | User adds no search fields and clicks "Search" | T990 | Check if search action failed | Ok | All search fields are empty |
| | S642 | User adds one or more search fields and clicks "Search" | T991 | Check if the result list is displayed correctly | Ok | NA |
| | | | T992 | Check if former filter fields are deleted | Ok | NA |
| | S643 | User adds one or more search fields, clicks "Search" and the result list is bigger than the cap | T993 | Check if search action failed | Ok | Too much results, refine your search |
| | S644 | User adds one or more search fields, clicks "Search" and the result list is empty | T994 | Check if search action failed | Ok | No Results found |
| | S645 | User filters the result list by any of the available filter fields* | T995 | Check if the list if filtered | Ok | NA |
| | S646 | User sort the result list by any of the available sort fileds* | T996 | Check if the list is sorted | Ok | NA |
| | S647 | User filters and sorts several fields at the same time | T997 | Check if the list is correctly filtered and sorted | Ok | NA |
| | S648 | User click any of the links displayed in the result table | T998 | Check if directs to the correct page* | Ok | NA |
| | | | T999 | Check if the correct data is loaded* | Ok | NA |
| | | | T1000 | Check if all former search and filter fields on the new page are deleted | Ok | NA |
| | S649 | User clicks the "Reset" button | T1001 | Check if all search fields, filter fields and result list are deleted | Ok | NA |
| Patient Modification Requests | S650 | User clicks the "Pat. Mod. Req." in the Menu | T1002 | Check if redirects to /patModReq.xhtml and the list of 'onHold' Requests is correctly loaded | Ok | NA |
| | | | T1003 | Check if previous selected request is discarted | Ok | |
| | S651 | User clicks the "Pat. Mod. Req." in the Menu and there are no Requests on Hold | T1004 | Check if redirects to /patModReq.xhtml | Ok | No Patient Modification Requests |
| | S652 | User clicks the "Select" button on any of the Requests | T1005 | Check if a new panel appears with the full info on the request | Ok | NA |
| | S653 | User tries to commit a veredict without selecting na option (Accepted/Rejected) | T1006 | Check if commit action failed | Ok | NA |
| | S654 | User Accepts/Rejects a Patient Modification Request | T1007 | Check if the Patient Modification Request is correctly updated in the database | Ok | Patient Modification Request Answered |

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| | | | T1008 | Check if a Notification was sent to the Requester | Ok | |
| | | | T1009 | (If Accepted) Check if the Patient was correctly updated in the database | Ok | |
| | | | T1010 | Check if the selected Request and the veredict info are discarted | Ok | |
| | | | T1011 | Check if the Request list is updated | Ok | |
| | S655 | User tries to commit a veredict after another request has been selected | T1012 | Check if commit action failed | Ok | Something bad happened, please try again |
| | | | T1013 | Check if the currently selected request is displayed | Ok | |
| | S666 | User tries to commit a veredict on a Request after its been discarted | T1014 | Check if commit action failed | Ok | NA |
| | S667 | User tries to commit a veredict on a Request after another User das already commited. | T1015 | Check if commit action failed | Ok | Another User changed the same data, please try again. |
| | S668 | User clicks in the link of the User that requested the Modification | T1016 | Check if directs to /searchUser.xhtml | Ok | NA |
| | | | T1017 | Check if the correct User data is loaded | OK | |
| | | | T1018 | Check if all former search and filter fields on the new page are deleted | Ok | |
| | S669 | User clicks in the link of the Patient that was requested to change | T1019 | Check if directs to /searchPatient.xhtml | Ok | NA |
| | | | T1020 | Check if the correct Patient data is loaded | OK | |
| | | | T1021 | Check if all former search and filter fields on the new page are deleted | Ok | |
| System Performance | S670 | User clicks "Performace Analysis" in the "System Tools" in the "Menu" | T1022 | Check if redirects to /performance.xhtml | Ok | NA |
| | S671 | User selects "Average Wait Time on Sessions" | T1023 | Check if its added to the Performance requests | Ok | NA |
| | S672 | User selects "Average Time to Review Sessions" | T1024 | Check if its added to the Performance requests | Ok | NA |
| | S673 | User selects " Overall Session Status" | T1025 | Check if its added to the Performance requests | Ok | NA |
| | S674 | User selects "Overall 'Consultation Required' Reviews" | T1026 | Check if its added to the Performance requests | Ok | NA |
| | S675 | User selects "Average Wait Time on Sessions by Monitoring Program" | T1027 | Check if its added to the Performance requests | Ok | NA |
| | S676 | User selects "Average Time to review Session by Monitoring Program" | T1028 | Check if its added to the Performance requests | Ok | NA |
| | S677 | User selects "Overall Session Status by Monitoring Program" | T1029 | Check if its added to the Performance requests | Ok | NA |
| | S678 | User selects "Overall 'Consultation Required' Reviews by | T1030 | Check if its added to the Performance requests | Ok | NA |

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| | | Monitoring Program" | | | | |
| | S679 | User clicks "Check Performance" button | T1031 | Check if all selected performance requests are performed | Ok | NA |
| | | | T1032 | Check if former performance requests are discarted | Ok | |
| | | | T1033 | Check if the data is correctly calculated | Ok | |
| | | | T1034 | Check if the data is correctly displayed | Ok | |
| Billing Report | S680 | User clicks "Billing Report" in the "System Tools" in the "Menu" | T1035 | Check if redirects to /billingReport.xhtml | Ok | NA |
| | S681 | User tries to get the Billing Report without selecting "From" or "To" Date | T1036 | Check if action failed | Ok | value is required |
| | S682 | User selects both Dates and clicks "get Billing Report" | T1037 | Check if a pdf is loaded | Ok | NA |
| | | | T1038 | Check if the data is correctly calculated and displayed | Ok | |
| Alarms | S683 | User clicks the "Alarms" in the "System Tools" in the "Menu" | T1039 | Check if redirect to /alarm.xhtml | Ok | NA |
| | | | T1040 | Check if the values are set to default, if they were never changed | Ok | |
| | | | T1041 | Check if the last alarm results are correctly displayed | Ok | NA |
| | S684 | User clicks "set to Default" | T1042 | Check if values are set to default | Ok | NA |
| | S685 | User tries to change "Alarm if 'Requires Consultation' bigger than" to a non-number | T1043 | Check if input action failed | Ok | Boolean True Percentage is not a number |
| | S686 | User tries to change "Alarm if ' Doesn't Require Consultation' bigger than" to a non-number | T1044 | Check if input action failed | Ok | Boolean False Percentage is not a number |
| | S687 | User tries to change "Alarm if Average Diagnosis Time smaller than" to a non-number | T1045 | Check if input action failed | Ok | Average Time to Diagnosis is not a number |
| | S688 | User tries to change "Alarm if  Notification Not Read in" to a non-number | T1046 | Check if input action failed | Ok | Days to Read is not a number |
| | S689 | User changes "Alarm if 'Requires Consultation' bigger than" | T1047 | Check if the next alarm search runs with the new value | Ok | NA |
| | S690 | User changes "Alarm if ' Doesn't Require Consultation' bigger than" | T1048 | Check if the next alarm search runs with the new value | OK | NA |
| | S691 | User changes "Alarm if Average Diagnosis Time smaller than" | T1049 | Check if the next alarm search runs with the new value | OK | NA |
| | S692 | User changes "Alarm if  Notification Not Read in" | T1050 | Check if the next alarm search runs with the new value | Ok | NA |

***Table 19 - Scenario testing for user role: administrator***

### 8.5.5 General

| Module | Scenario | Scenario Description | Test | Test Description | Result | Interface Message |
|---|---|---|---|---|---|---|
| Page Security | S693 | User tries to access /changePass.xhtml without logging in | T1051 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S694 | User tries to access /notificationManager.xhtml without logging in | T1052 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S695 | User tries to access /feedbackManager.xhtml without logging in | T1053 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S696 | "Admnistrator" tries to access /notificationManager.xhtml | T1054 | Check if not allowed | OK | You don't have permission to access this resource |
| Component Security | S697 | User tries to call any method from componenet "changePass" without logging in | T1055 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S698 | User tries to call any method from component "feedbackManager" without logging in | T1056 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S699 | User tries to call any method from component "notificationManager" without logging in | T1057 | Check if not allowed and redirect to login page | Ok | Please log in first |
| | S700 | "Administrator" tries to call any method from component "notificationManager" | T1058 | Check if not allowed | Ok | You don't have permission to access this resource |
| Login | S701 | User clicks in the "login" link in the Menu | T1059 | Check if redirects to /login.xhtml | Ok | NA |
| | S702 | User tries to login in to different tabs | T1060 | Check if not allowed | Ok | You are already logged in, please log out first if you wish to log in again |
| | S703 | User inserts wrong password | T1061 | Check if login failed | Ok | Login Failed, Wrong password |
| | S704 | User tries to login while blocked | T1062 | Ckeck if login failed | Ok | Login Failed, This user is blocked |
| | S705 | Valid login | T1063 | Check if login successful | Ok | Welcome! {username} |
| Logout | S706 | User clicks the "logout" link in the Menu | T1064 | Check of redirects to /home.xhtml page | Ok | NA |
| | | | T1065 | Check if logout successful | Ok | |
| | | | T1066 | Check if login timestamp was registered in the database | Ok | |
| | | | T1067 | Check if login time was correclty registered in the database | Ok | |
| | S707 | User doesn't do any action for 10 minutes | T1068 | Check if Session expired | Ok | Your Session Expired, please Log In again |
| | | | T1069 | Check if login timestamp was registered in the | Ok | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | database | | |
| | | | T1070 | Check if login time was correclty registered in the database | Ok | |
| Change Password | S708 | User clicks the "Change Password" link in the Menu | T1071 | Check if redirects to /changePass.xhtml | Ok | NA |
| | S709 | User inserts wrong current password | T1072 | Check if change password action failed | Ok | Wrong Password |
| | S710 | User inserts the confirm new password different from the new password | T1073 | Check if change password action failed | Ok | Passwords don't match |
| | S711 | User inserts the new password equal to the current password | T1074 | Check if change password action failed | Ok | New password equals current password |
| | S712 | User inserts the new password equal to the last password | T1075 | Check if change password action failed | Ok | New password equals last password |
| | S713 | User inserts new password with number of characters below 5 | T1076 | Check if change password action failed | Ok | Password must be bigger than 5 characters |
| | S714 | User tries to insert a new password bigger than 20 characters | T1077 | Check if input box is limited to 20 characters | Ok | NA |
| | S715 | Valid password change and clicks "Change" | T1078 | Check if user's password was correctly updated in the database | Ok | Password changed |
| | | | T1079 | Check if a log was correctly inserted | Ok | |
| | | | T1080 | Check if user's last password was correctly updated in the database | Ok | |
| | S716 | User clicks "Change" after the User Info has been changed by another Uer | T1081 | Check if change password action failed | Ok | User Info was changed by another User |
| Notifications | S717 | User clicks the "Notifications" link in the Menu | T1082 | Check if redirected to /notificationManager.xhtml and the list of Notifications is correctly loaded | Ok | NA |
| | S718 | User clicks the "Notifications" link in the Menu and he has no notifications | T1083 | Check if redirected to /notificationManager.xhtml | Ok | No Notifications |
| | S719 | User clicks "Next" button | T1084 | Check if more 10 Notifications are displayed | Ok | NA |
| | S720 | User clicks "Previous" button | T1085 | Check if the previous 10 Notification are displayed | Ok | NA |
| | S721 | User makes any action that creates a notification and clicks the "Notification" link in the Menu | T1086 | Check if the list is updated with the new notification | Ok | NA |
| | S722 | User clicks the "Select" button on any of the notifications | T1087 | Check if the notification's full view appears on top of the page | Ok | NA |
| | | | T1088 | Check if the notification is checked as "Read" in the list | Ok | |
| | | | T1089 | Check if the new "Read" state of the notification is correctly updated in the database | Ok | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Feedbacks | S723 | User clicks the "Feedback" link in the Menu | T1090 | Check if redirected to /feedbackManager.xhtml | Ok | NA |
| | | | T1091 | Check if a list of the 10 last feedbacks are correctly displayed | Ok | |
| | | | T1092 | Check if feedbacks displayed are only from or to the current user | Ok | |
| | | | T1093 | (Administrator) Check if feedbacks without destinatary are also presented | Ok | |
| | | | T1094 | Check if the previously selected feedback is discarted | Ok | |
| | S724 | User clicks the "Feedback" link in the Menu and there are no feedbacks | T1095 | Check if redirected to /feedbackManager.xhtml | Ok | No Feedbacks |
| | S725 | User clicks "Next" button | T1096 | Check if 10 more feedbacks are displayed | Ok | NA |
| | | | T1097 | Check if the previously selected feedback is discarded | Ok | NA |
| | S726 | User clicks "Previous" button | T1098 | Check if the previous 10 feedbacks are displayed | Ok | NA |
| | | | T1099 | Check if the previously selected feedback is discarded | Ok | NA |
| | S727 | (Not Administrator) User creates a new feedback message | T1100 | Check if the feedback is correctly inserted in the Database | Ok | Feedback created |
| | | | T1101 | Check if the feedback list is reloaded with the new feedback | Ok | |
| | | | T1102 | Check if the previously selected feedback is discarded | Ok | |
| | S728 | (Administrator) User tries to create a new feedback message without entering the destinatary | T1103 | Check if create feedback action failed | Ok | NA |
| | S729 | (Administrator) User tries to create a new feedback message to a non-existing user | T1104 | Check if create feedback action failed | Ok | Such User doesn't exist |
| | S730 | (Administrator) User tries to create a new feedback message by entering a non-number "User ID" | T1105 | Check if create feedback action failed | Ok | Inserted User ID is not a number |
| | S731 | (Administrator) User creates a new Feedback message | T1106 | Check if the feedback is correctly inserted in the Database | Ok | Feedback created |
| | | | T1107 | Check if the feedback list is reloaded with the new feedback | Ok | |
| | | | T1108 | Check if the previously selected feedback is discarded | Ok | |
| | S732 | User clicks the "Select" button on any of the feedbacks | T1109 | Check is a new panel appears with all feedback messages | Ok | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | T1110 | Check if a "Respond" field appears only if he wasn't the last one to reply | Ok | |
| | S733 | User tries to answer to a feedback leaving the input field empty | T1111 | Check if respond action failed | OK | NA |
| | S734 | User answers to a feedback | T1112 | Check if the feedback message is correctly inserted in the Database | Ok | Feedback answered |
| | | | T1113 | Check if the feedback list is updated with the new feedback message | Ok | |
| | | | T1114 | Check if the previously selected feedback is discarded | OK | |
| | S735 | Use tries to answers to a feedback after another feedback being selected | T1115 | Check if respond action failed | OK | Something bad happened, please try again |
| | | | T1116 | Check if the currently selected feedback is displayed | Ok | |
| | S736 | User tries to answer to a feedback after this being discarded | T1117 | Check if respond action failed | Ok | NA |
| | S737 | (Administrator) User clicks in the link of the User that Sent/Received the feedback | T1118 | Check if directs to /searchUser.xhtml | Ok | NA |
| | | | T1119 | Check if the correct User data is loaded | OK | |
| | | | T1120 | Check if all former search and filter fields on the new page are deleted | Ok | |
| | S738 | (Administrator) User tries to respond to a feedback after another User has already responded | T1121 | Check if respond action failed | OK | Another User changed the same data, please try again. |

***Table 20 - Scenario testing for user role: general***

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