Astrée Eve Milena Bergeal Chevalier
Francisco Dario Sanchez
Gaia Vettori

Célia Muriel Emilie Jaffré
Ali Shadman Yazdi
Manon Alexandra Rose-Marie Vignier
Politecnico di Milano2022

Final Report

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I- Aim of the work

Depression and bipolar disorder will be discussed along with their symptoms and treatments.

Monitoring of patients with disorders can greatly facilitate follow-up and improve quality of life. It can also help to reduce stress, the consequences of which can be serious in some patients.

The objective of this project is to build a platform intended to help the monitoring and management of patients suffering from depression and bipolar disorder by specialized practitioners.

A proposal will be introduced of a database system for monitoring health parameters and therapies and management of visits of exams.

II- System Design

1- ***Context analysis***

Depressive disorders are common among the general population, with a prevalence of around 2% for major depression and 1% for bipolar disorder. The prevalence for women is 2 to 3 times higher than for men. Recent studies have reported a decrease in the age of onset for mental disorders during past decades, reflecting a higher rate of affected subjects.

Depression and bipolar disorders were recognized as conditions affecting humans since ancient times, as documented by Hippocrates in 400 B.C., were originally classified as "melancholia" which had a broader meaning that included all forms of quiet insanity. The term depression in the modern literature first appeared in the 19th century in Jackson's works and indicated a state of sadness, of "lowering" of spirits.

Kraepelin laid the foundation for modern psychiatry with his work classifying psychiatric disorders. The patients he worked with were affected by "psychoses", a severe illness that required patients to be hospitalized and it was believed that it was caused by biological affections. While psychoanalysts, such as Freud, and Abraham thought that all disorders were psychogenic (generated by the mind because of external stress) and mainly dedicated their efforts to work with milder disorders, then called "neuroses".

Adolf Meyer was the first to propose all types of psychiatric disorders as biological affections caused by psychological stress unifying both organic and psychological factors.

Nowadays, the official classification for psychiatric diseases:

- The ICD-10 (Classification of mental and behavioral disorders. Clinical descriptions and diagnostic guidelines).
- DSM-IV (Diagnostic and statistical manual of mental disorders 4th edition).

These classifications divide mental disorders into two main groups: depressive (or unipolar) disorders and bipolar disorders. The latter being an alternation of manic episodes and periods of unipolar disorder. Episodes can be further classified by severity, psychotic, and remission specifiers.

Mental disorders are diagnosed based on heterogenous symptoms that usually are not unique for the pathologies of interest, currently no biomarkers can validate a diagnosis.

Both classifications associate eight symptoms to depression, five of which are enough to have a diagnosis if they are prevalent for at least two weeks. Requirements for bipolar diagnosis are met when

patients have the same symptoms associated to depression and alternate with maniac episodes. There are two "core symptoms": depressed mood and loss of interest or pleasure.
Additional symptoms include appetite loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, loss of confidence or worthlessness, reduced concentration,
Suicidal thoughts.

Studies have shown that as the disorder progresses, the number of symptoms increases.
Western medicine studies focused in mood changes on depressed patients and monitored their biological variables such as: sleep quality, heart rate and blood pressure, psychomotor disfunctions, weight variations among others. Less tangible symptoms were assessed qualitatively with questionnaires.

Treatment for these disorders shall act on three levels. Increasing physical activity so present symptoms won't progress to other symptoms. Start appropriate pharmacotherapy. Common drugs prescribed for mentally disordered subjects are mood stabilizers, anti-depressants, anti-psychotics and anti-anxiety, or a combination of those. Alternative therapies can be ordered, if no favorable patient evolution is observed, such as electroconvulsive therapy. To monitor patient's evolution and possible side effects, having follow-ups with patients is imperative. Frequent monitoring is to be conducted on different biological parameters; measurements can be done at a laboratory, a hospital, a pharmacy or even at home, to verify no dysfunction is present. For women, knowing whether if they are pregnant or not is important. Follow-ups are needed to assess if a crisis is about to occur and immediately act upon. It's been proven that the risk of recurrence increases with an increasing number of untreated episodes.

Consequently, practitioners should be able to keep track of everything that is happening, to get all measurements the patient has to send, as fast as possible. Treating mental disorders is essential because they entail family distress and conflict, impaired cognitive development on young children, in cases of postpartum depression, and the strikingly increased risk of suicide. Recent studies have showcased the impact on functioning abilities and found out that patients with depression scored like those with advanced coronary artery disease, and lower than those with hypertension, diabetes mellitus, and arthritis. This impairment coupled with a high prevalence and a frequent early onset, led a group of World Health Organization researchers to conclude that unipolar major depression is the leading cause of disability worldwide.
Recent studies and reviews confirm the high rates of mental disorders in many general medical conditions, such as myocardial infarction, Parkinson's disease, Huntington's disease, Alzheimer's disease, and stroke.

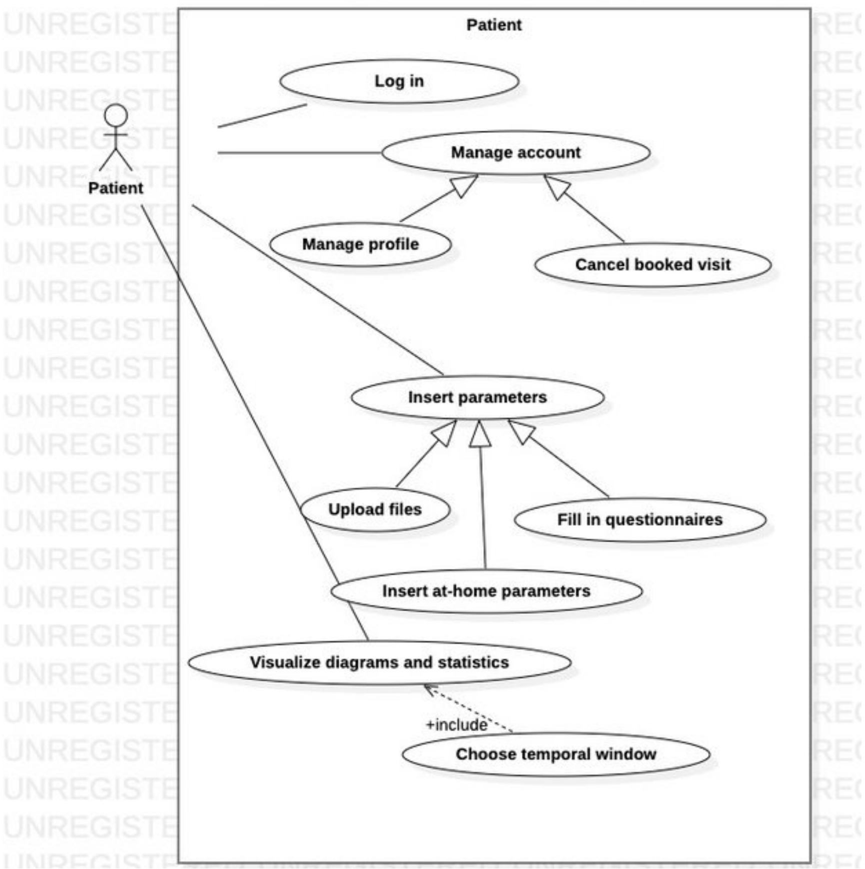
2- ***Modeling and describing system in UML***

- *Use case diagram*

Defined main users are Patient, Specialized Practitioner, and Technical Administrator.

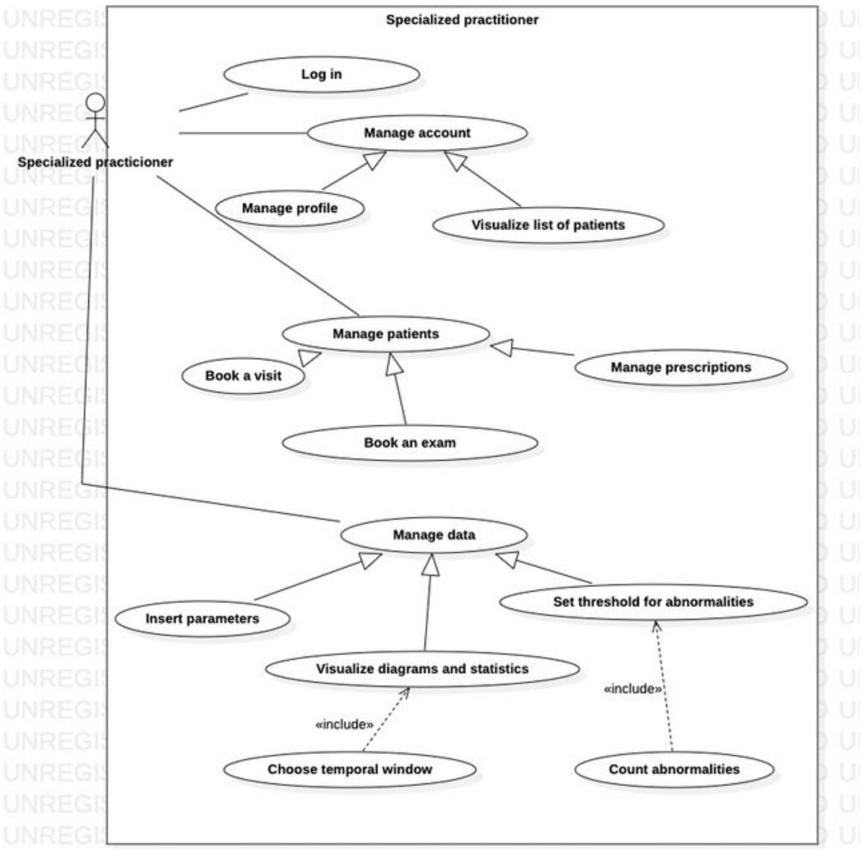
Patient Use case:

Title	Patient use case
Description	List of all activities the patient can realize
Objective	Managing account, inserting parameters, visualizing diagrams
Main Actor	Patient
Pre-condition	The patient is logoff
Post-condition	Patient has uploaded parameters and visualized data
Basic scenario	1. Log in 2. Manage account: Manage profile 3. Insert parameters: Insert at-home parameters 4. Visualize diagrams and statistics
Alternate scenario	2a. Cancel booked visit 3a. Upload files 3b. Fill in questionnaires


Patient
Log in
Patient
Manage account
Manage profile
Cancel booked visit
Insert parameters
Upload files
Fill in questionnaires
Insert at-home parameters
Visualize diagrams and statistics
+include
Choose temporal window

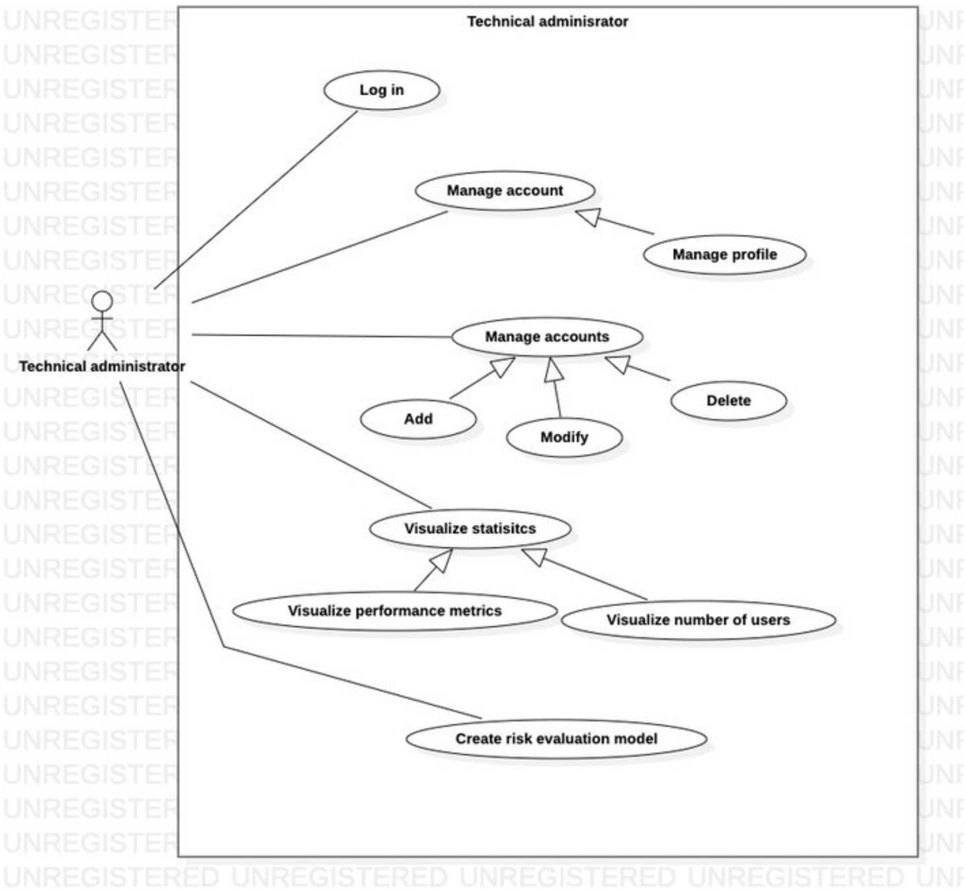
Specialized Practitioner Use case:

Title	Specialized practitioner use case
Description	Description of all the activities the practitioner can realize
Objective	Manage account, insert parameters, book visit or exam
Main Actor	Doctor
Pre-condition	The doctor is disconnected
Post-condition	The practitioner has uploaded parameters, booked a visit or visualized statistics
Basic scenario	1.Log in 2. Manage account: manage profile 3. Manage patients: book a visit for a patient 4. Manage data: insert parameters from visit
Alternate scenario	2a. Manage account: visualize list of patients 3a. Manage patients: book an exam for a patient 3b. Manage patients: manage prescription for a patient 4a. Manage data: visualize diagrams and statistics from past data and choose a temporal window to select specific time period 4b. Manage data: set threshold for abnormalities and count the abnormalities detected in the collected data


Specialized practitioner
Specialized practicioner
Log in
Manage account
Manage profile
Visualize list of patients
Manage patients
Book a visit
Manage prescriptions
Book an exam
Manage data
Insert parameters
Set threshold for abnormalities
Visualize diagrams and statistics
«include»
«include»
Choose temporal window
Count abnormalities
UNREGISTERED

Technical Administrator Use case:

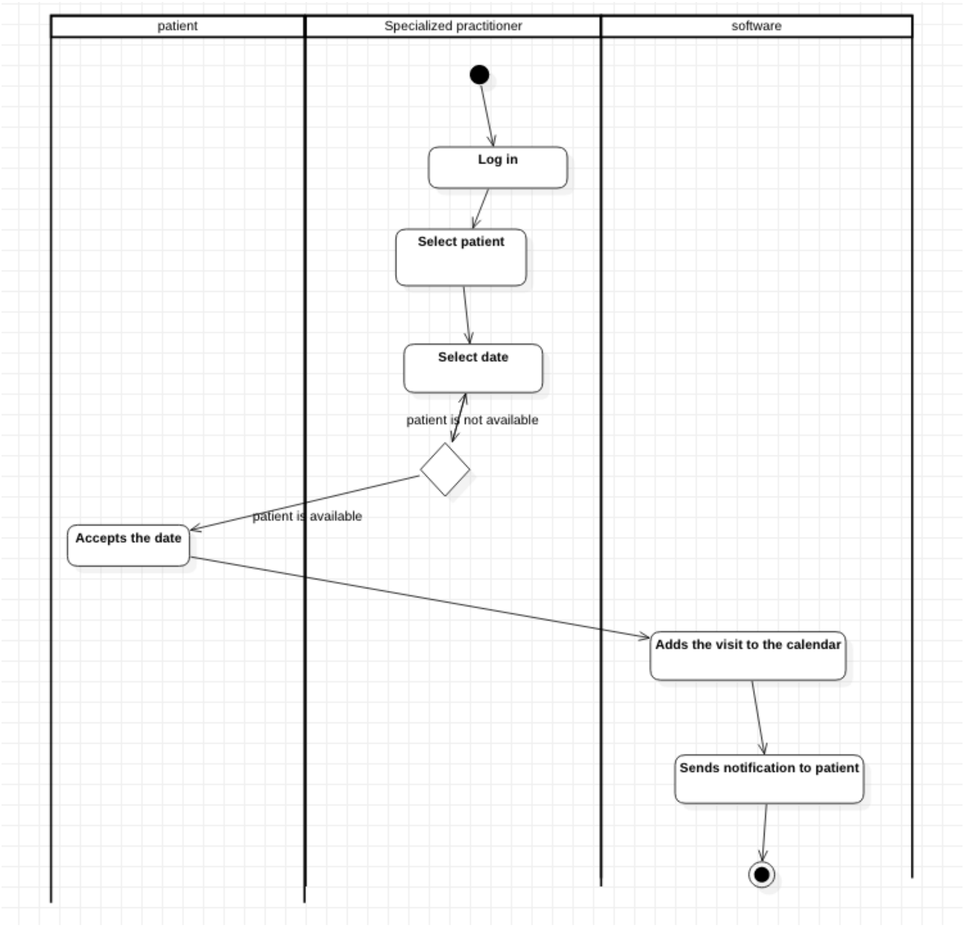
Title	Technical Administrator use case
Description	Description of all the activities the technical administrator can do
Objective	The technical administrators can visualize their profile, register new account and create risk model
Main Actor	Technical administrator
Pre-condition	The technical administrator is disconnected
Post-condition	New users are registered, risk evaluation models are created
Basic scenario	1.Log in 2. Visualize profile 3. Manage accounts: add account 4. Visualize statistics: visualize performance metrics 5. Create risk evaluation models
Alternate scenario	3a. Manage accounts: modify account 3b. Manage accounts: delete account 4a. Visualize statistics: visualize number of users


Technical adminisrator
Log in
Manage account
Manage profile
Manage accounts
Technical administrator
Add
Modify
Delete
Visualize statisitcs
Visualize performance metrics
Visualize number of users
Create risk evaluation model

- *Activity diagrams*

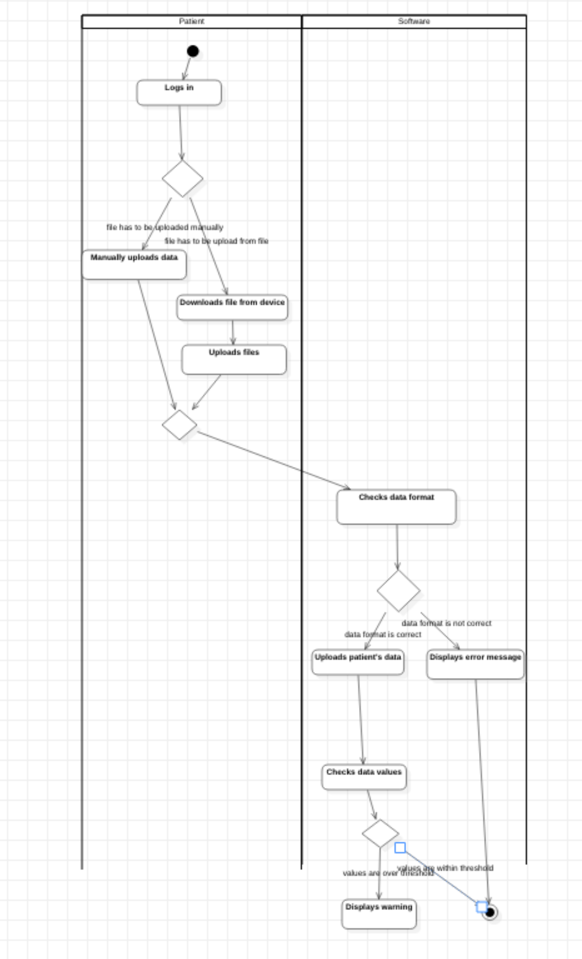
Activity diagram: Booking visit

Title	Booking visit
Main actor	Specialized practitioner
precondition	patient and specialized practitioner are already registered
postcondition	The database has a new visit that is visible by the specialized practitioner ant patient concerned
Main case scenario	1. Specialized practitioner login 2. Specialized practitioner select patient 3. Specialized practitioner select date 4. patient accepts the date 5. software adds visit to the calendar 6. software sends notification to patient
Alternate scenarios	3.a. patient is not available, select another date


patient
Specialized practitioner
software
Log in
Select patient
Select date
patient is not available
patient is available
Accepts the date
Adds the visit to the calendar
Sends notification to patient

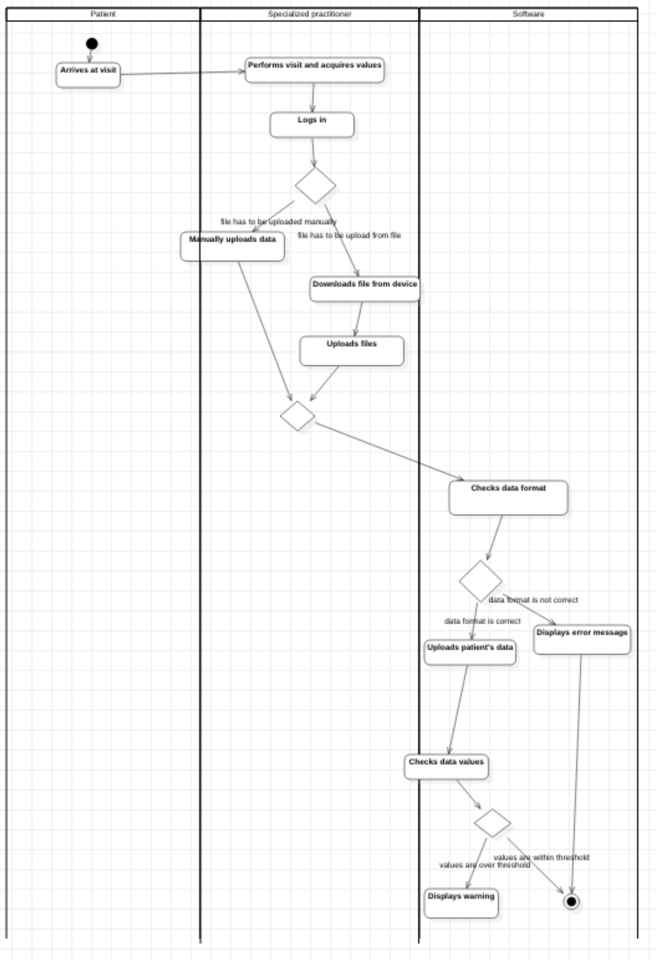
Activity diagram: Uploading at-home parameters

Title	Patient uploads at-home parameters
Main actor	patient
precondition	Patient is already registered, has collected the data
postcondition	The database has a new set of data regarding the patient
Main case scenario	1. Patient log in 2. Patient manually uploads data 3. Software checks data format 4. Software uploads patient's data 5. Software checks data values
Alternate scenarios	2.a. The data must be uploaded from file: Patient downloads file from device and uploads files 3.a. Data format is incorrect: Software displays error message 5.a. Data values are over threshold: Software displays warning


Patient
Software
Logs in
file has to be uploaded manually
file has to be upload from file
Manually uploads data
Downloads file from device
Uploads files
Checks data format
data format is not correct
data format is correct
Uploads patient's data
Displays error message
Checks data values
values are within threshold
values are over threshold
Displays warning

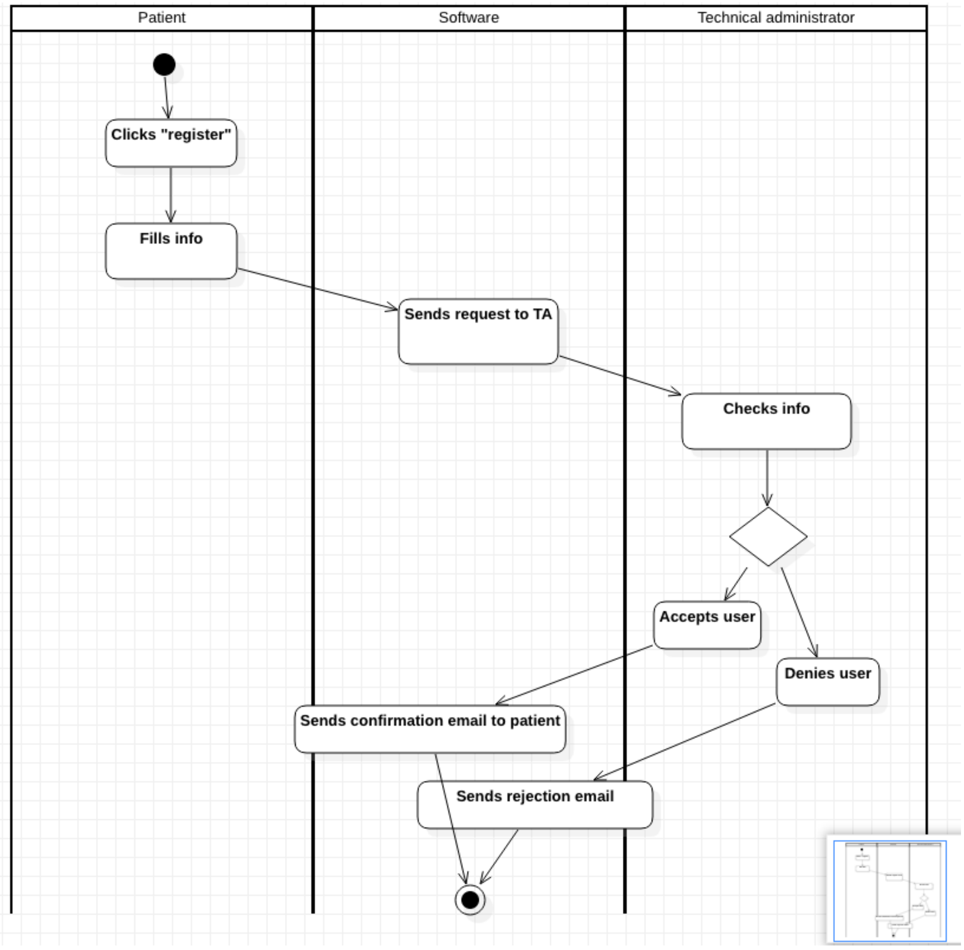
Activity diagram: Uploading at-hospital parameters

Title	Specialized practitioner uploads at-hospital parameters
Main actor	Specialized practitioner
precondition	Patient has a scheduled visit with Specialized practitioner
postcondition	The database has a new set of data regarding the patient
Main case scenario	1. Patient arrives at visit 2. Specialized practitioner performs the visit with the patient and acquires values 3. Specialized practitioner logs in 4. Specialized practitioner manually uploads data 5. Software checks data format 6. Software uploads patient’s data 7. Software checks data values
Alternate scenarios	4.a. The data must be uploaded from file: Specialized practitioner downloads file from device and uploads it 5.a. Data format is incorrect: Software displays error message 7.a. Data values are over threshold: Software displays warning


Patient
Specialized practitioner
Software
Arrives at visit
Performs visit and acquires values
Logs in
file has to be uploaded manually
file has to be upload from file
Manually uploads data
Downloads file from device
Uploads files
Checks data format
data format is not correct
data format is correct
Uploads patient's data
Displays error message
Checks data values
values are within threshold
values are over threshold
Displays warning

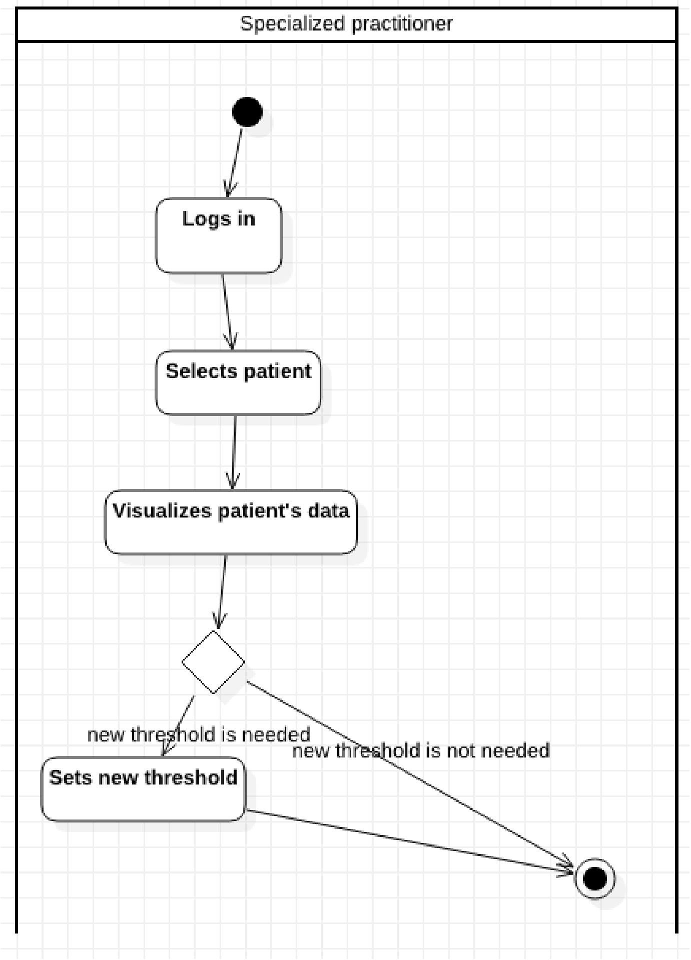
Activity diagram: Registering new patient

Title	registering a next patient into the database
Main actor	Patient, technical administrator and software
precondition	A new patient must be registered in database
postcondition	the database has a new profile for a patient which the patient can manage for specific activities
Main case scenario	1. Patient clicks « register » 2. Patient fills his info (name, surname, fiscal code, birthdate…) 3. Patient validates his info 4. Software sends request to the technical administrator 5. Technical administrator checks the patient's info 6. The technical administrator accepts the user 7. The software sends a confirmation email to the patient
Alternate scenarios	6.a. Technical administrator denies user 6.b. Software sends a rejection email to the patient


Patient
Software
Technical administrator
Clicks "register"
Fills info
Sends request to TA
Checks info
Accepts user
Denies user
Sends confirmation email to patient
Sends rejection email

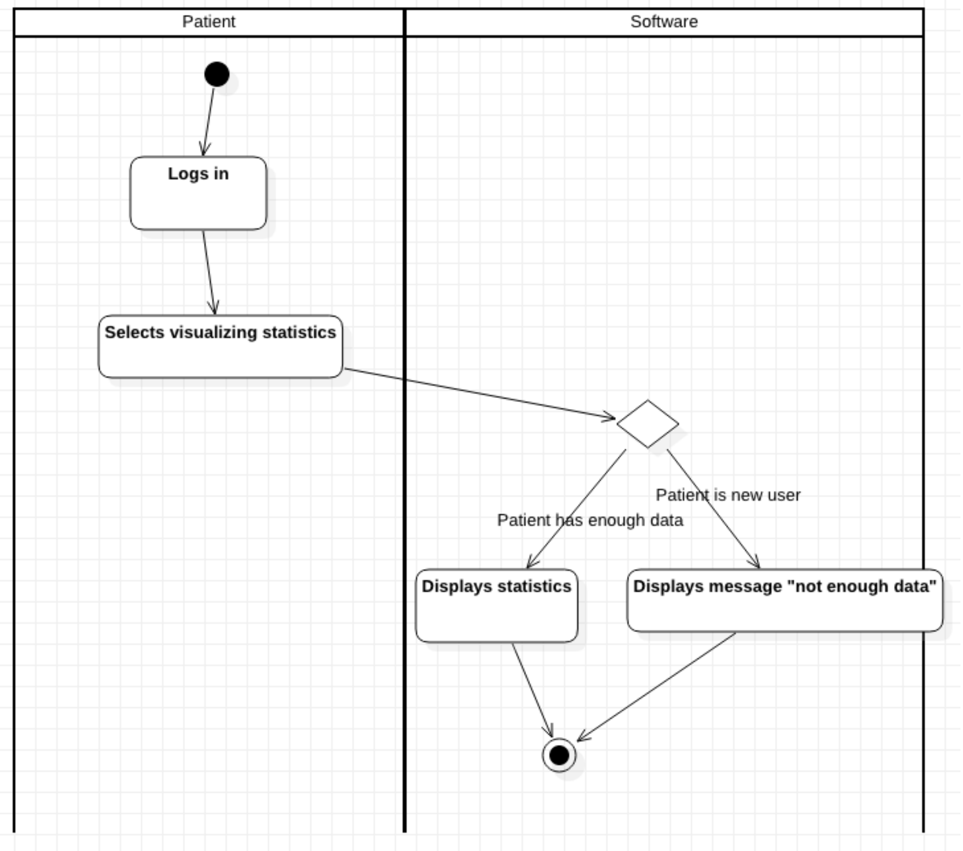
Activity diagram: Specialized practitioner setting a new threshold

Title	Specialized practitioner setting a new threshold
Main actor	Specialized practitioner
precondition	data has been uploaded on the patient (at-home or at-hospital)
postcondition	New threshold is set and saved in the database
Main case scenario	1. Specialized practitioner logs in 2. Specialized practitioner select patient 3. Specialized practitioner visualizes patient's data
Alternate scenarios	3.a. new threshold is needed: Specialized practitioner sets a new threshold


Specialized practitioner
Logs in
Selects patient
Visualizes patient's data
new threshold is needed
new threshold is not needed
Sets new threshold

Activity diagram: Patient visualizing statistics

Title	Patient visualizing statistics
Main actor	Patient
precondition	Patient has inserted and uploaded parameters
postcondition	Patient has visualized diagrams
Main case scenario	1. Patient logs in 2. Patient selects visualizing statistics 3. Patient chooses a temporal window 4. Software displays data
Alternate scenarios	4.a. Patient has no data in the temporal window: Software displays an error message: « Not enough data in the temporal window chosen »


Patient
Software
Logs in
Selects visualizing statistics
Patient is new user
Patient has enough data
Displays statistics
Displays message "not enough data"

- *Class diagram*

The first class is the User one. All users have their ID number and their password, as well as all their personal information. They can log in and manage their profile to modify their information. From that, every user is subdivided into one of the sub-classes: Patient, Specialized practitioner or Technical Administrator.

Patients can cancel visits and exams, upload parameters, and visualize their statistics.

Specialized practitioners can in addition schedule new visits or exams, insert some specific parameters or assign prescriptions.

Lastly, technical administrators can manage users, visualize performance metrics, and create new risk evaluations models.

The relation between the User class and the Patient, Specialized Practitioner or Technical Administrator is a one-to-one relationship, each user can be only part of one unique sub-category.

The patient class has a direct relationship with the Specialized practitioner class, through the doctor ID, as each patient refers to only one doctor, and each doctor can be assigned to several patients. Therefore, this is a one-to-many relationship.

Each patient can cancel exams that are identified through an ID number, a date and time, and the type of exam, and are connected to the patient ID and SP who is conducting it.

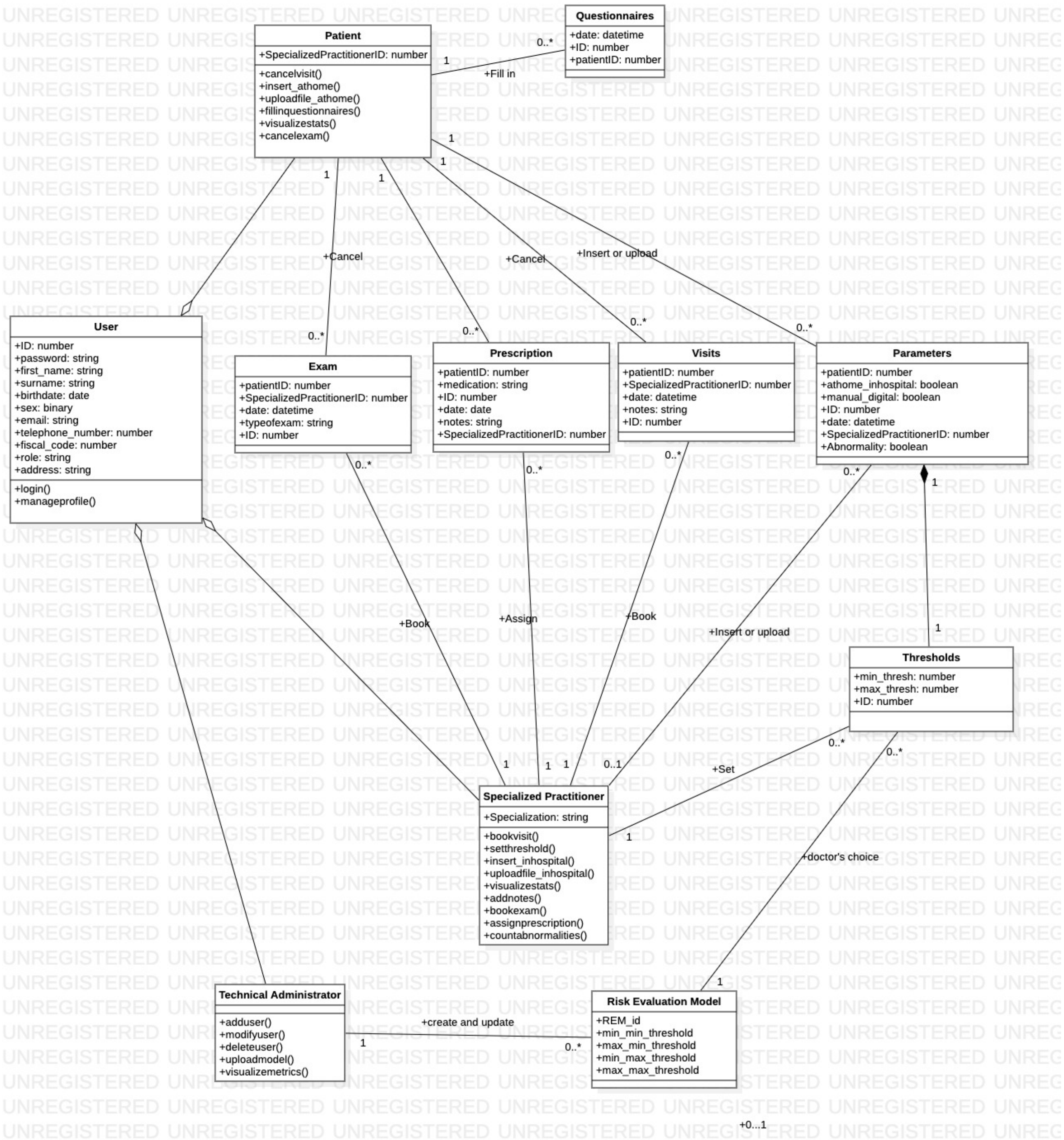
Visits are booked by SPs and can be canceled by the patients. They are also identified with an ID, a date and time, the patient's ID and the Specialized Practitioner's ID. Notes can be added by the SP during or after a visit.

SPs can assign prescriptions to patients. Prescriptions are identified by their ID, the name of the medication, the date when it was assigned, the patient and the SP's IDs. Notes about the process can be added by the SP.

Parameters can be added by the patient and the Specialized Practitioner. When a patient adds parameters, they are called "at home" parameters (identified by the Boolean variable) and they can be either inserted manually or uploaded from files. When an SP records parameters, they're called "in hospital" and can also be either inserted or uploaded. Thresholds for the parameters are set by the SP, who chooses them based on the risk evaluation model (REM) created by the technical administrator. REMs provide ranges for safe minima and maxima values. Parameters are identified by: an ID, whether they are at-home or in-hospital parameters, the patient's ID, the SP's ID, the date and time of their recording, whether they were inserted manually or uploaded from digital files and whether they are outside of the safe threshold and therefore classified as "abnormalities".

All relationships between Prescription, Visits, Exam or Parameters classes and Patient or Specialized practitioner are of the type One-to-Many.

Patients also upload questionnaires, that gather information and are identified by their ID, the patient's ID and date of filling.

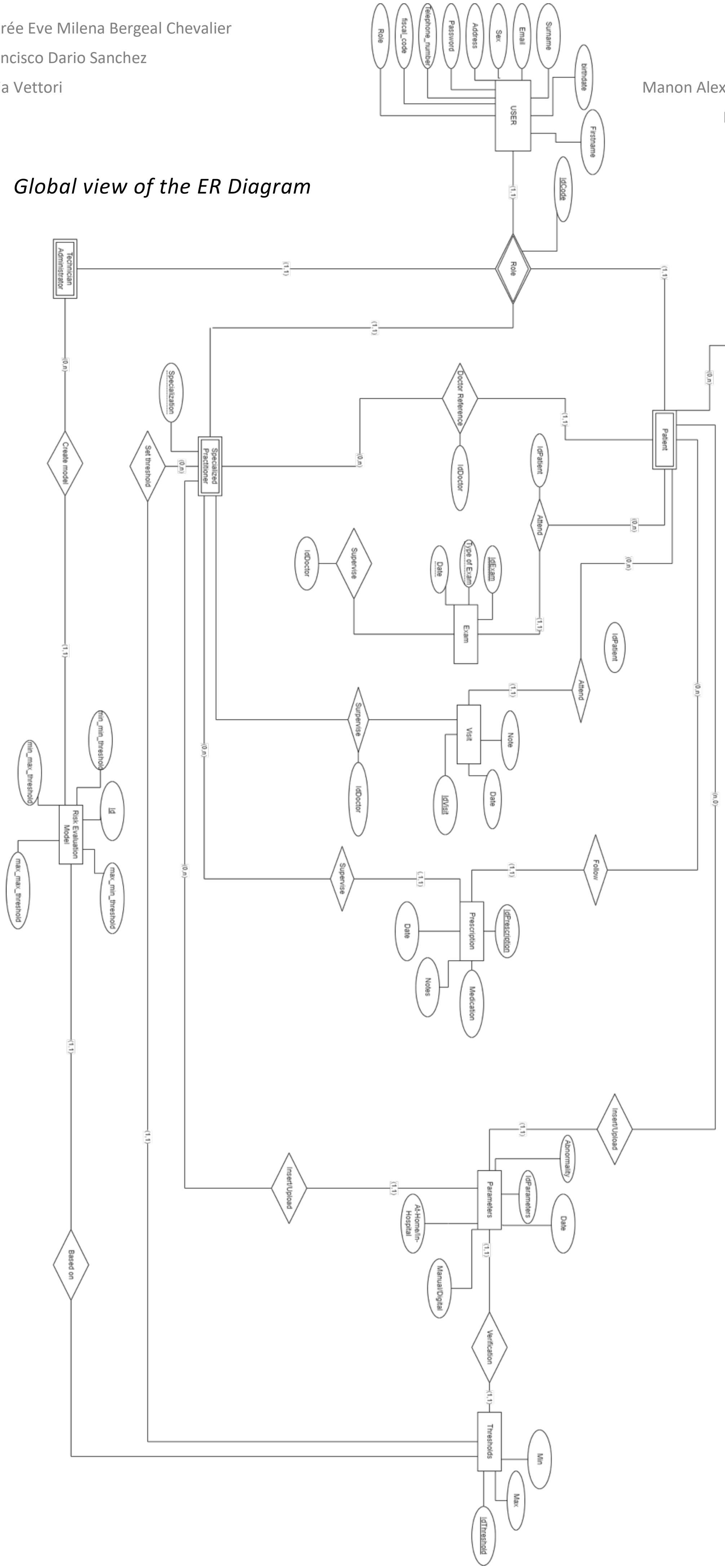

Patient
+SpecializedPractitionerID: number
+cancelvisit()
+insert_athome()
+uploadfile_athome()
+fillinquestionnaires()
+visualizestats()
+cancelexam()
Questionnaires
+date: datetime
+ID: number
+patientID: number
+Fill in
1
0..*
User
+ID: number
+password: string
+first_name: string
+surname: string
+birthdate: date
+sex: binary
+email: string
+telephone_number: number
+fiscal_code: number
+role: string
+address: string
+login()
+manageprofile()
Exam
+patientID: number
+SpecializedPractitionerID: number
+date: datetime
+typeofexam: string
+ID: number
Prescription
+patientID: number
+medication: string
+ID: number
+date: date
+notes: string
+SpecializedPractitionerID: number
Visits
+patientID: number
+SpecializedPractitionerID: number
+date: datetime
+notes: string
+ID: number
Parameters
+patientID: number
+athome_inhospital: boolean
+manual_digital: boolean
+ID: number
+date: datetime
+SpecializedPractitionerID: number
+Abnormality: boolean
+Cancel
+Cancel
+Insert or upload
1
1
1
1
0..*
0..*
0..*
0..*
+Book
+Assign
+Book
+Insert or upload
0..*
0..*
0..*
0..*
1
1
1
1
0..1
1
Thresholds
+min_thresh: number
+max_thresh: number
+ID: number
Specialized Practitioner
+Specialization: string
+bookvisit()
+setthreshold()
+insert_inhospital()
+uploadfile_inhospital()
+visualizestats()
+addnotes()
+bookexam()
+assignprescription()
+countabnormalities()
+Set
0..*
0..*
1
+doctor's choice
1
Technical Administrator
+adduser()
+modifyuser()
+deleteuser()
+uploadmodel()
+visualizemetrics()
Risk Evaluation Model
+REM_id
+min_min_threshold
+max_min_threshold
+min_max_threshold
+max_max_threshold
+create and update
1
0..*
+0...1

III- Database Design

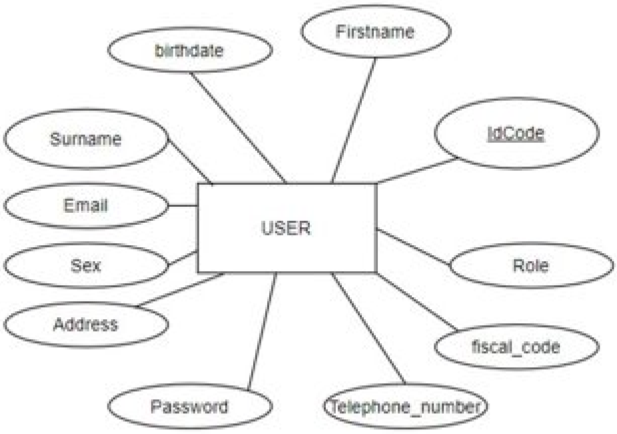
3- ***Modeling and describing the database: ER diagram***

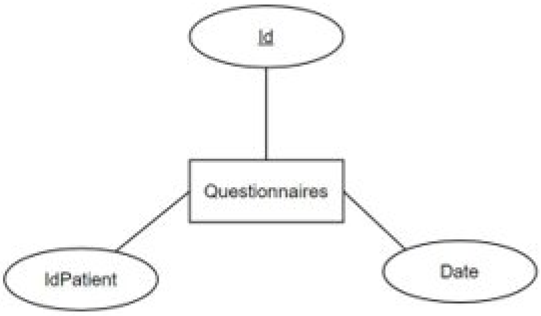
- Technical description of the tables (reporting on attributes domain critical choices), providing examples from the implementation in MS Access or other.

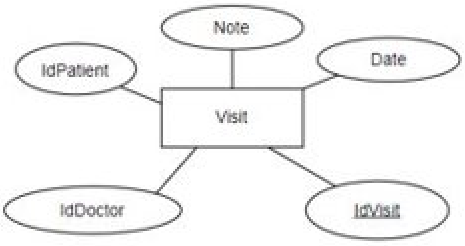
Global view of the ER Diagram

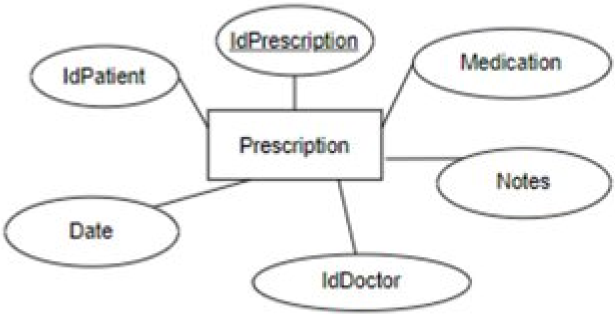

USER
Role
fiscal_code
Telephone_number
Password
Address
Sex
Email
Surname
birthdate
Firstname
IdCode
Role
Technician Administrator
Specialized Practitioner
Patient
Specialization
Doctor Reference
IdDoctor
Fill-in
Questionnaires
Id
Date
IdPatient
Create model
Set threshold
Attend
IdPatient
Supervise
IdDoctor
Exam
Date
Type of Exam
IdExam
Attend
IdPatient
Visit
Supervise
IdDoctor
Note
Date
IdVisit
Risk Evaluation Model
Id
min_min_threshold
min_max_threshold
max_max_threshold
max_min_threshold
Supervise
Follow
Prescription
IdPrescription
Date
Notes
Medication
Insert/Upload
Insert/Upload
Parameters
Abnormality
IdParameters
Date
At-Home/In-Hospital
Manual/Digital
Verification
Based on
Thresholds
Min
Max
IdThreshold
(1,1)
(0,n)
(n,0)

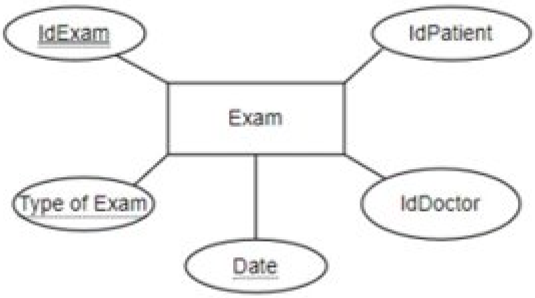
Entities


USER
birthdate
Firstname
IdCode
Surname
Email
Sex
Address
Password
Telephone_number
fiscal_code
Role

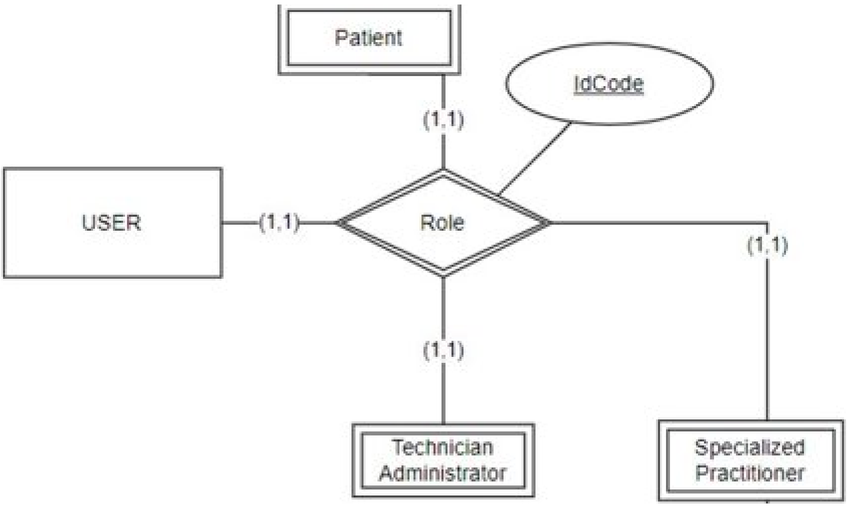

Id
Questionnaires
IdPatient
Date


Note
IdPatient
Date
Visit
IdDoctor
IdVisit

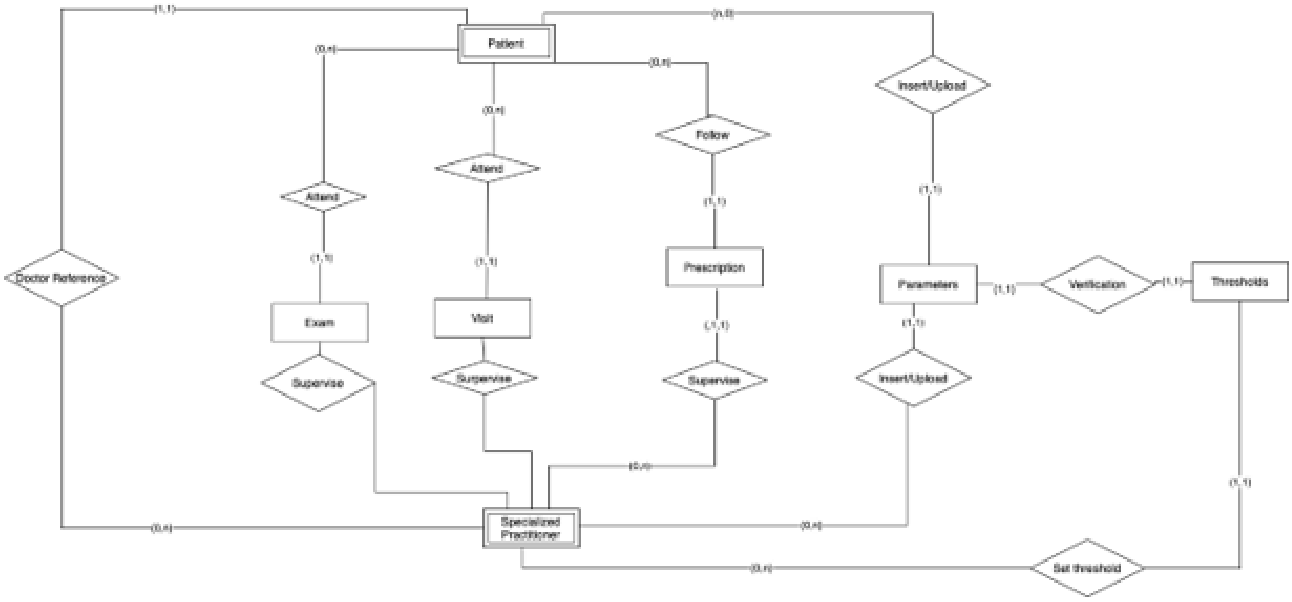

IdPrescription
IdPatient
Medication
Prescription
Notes
Date
IdDoctor


IdExam
IdPatient
Exam
Type of Exam
IdDoctor
Date

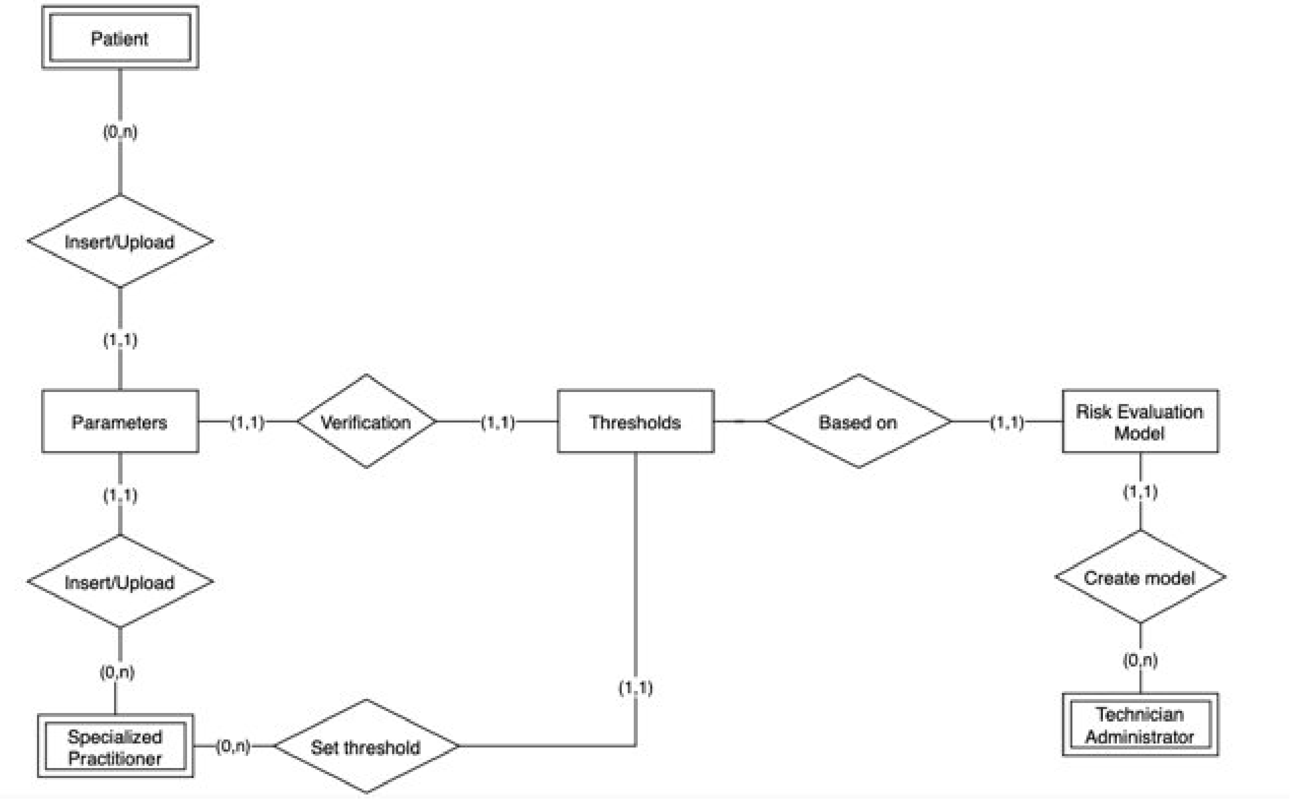
Relationship between the users


Patient
IdCode
(1,1)
USER
(1,1)
Role
(1,1)
(1,1)
Technician Administrator
Specialized Practitioner

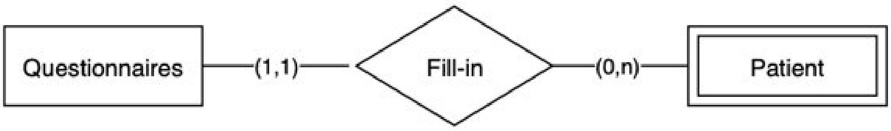
Relationship between SP and Patient


(1,1)
(n,0)
Patient
(0,n)
(0,n)
(0,n)
Insert/Upload
Follow
Attend
Attend
(1,1)
(1,1)
(1,1)
(1,1)
Doctor Reference
Prescription
Parameters
(1,1)
Verification
(1,1)
Thresholds
Exam
Visit
(,1,1)
(1,1)
Supervise
Surpervise
Supervise
Insert/Upload
(0,n)
(1,1)
Specialized Practitioner
(0,n)
(0,n)
(0,n)
Set threshold

Relationship between SP and TA


Patient
(0,n)
Insert/Upload
(1,1)
Parameters
(1,1)
Verification
(1,1)
Thresholds
Based on
(1,1)
Risk Evaluation Model
(1,1)
Insert/Upload
(0,n)
(1,1)
Create model
(0,n)
(1,1)
Specialized Practitioner
(0,n)
Set threshold
Technician Administrator

Relationship between Questionnaires and Patient


Questionnaires
(1,1)
Fill-in
(0,n)
Patient

Technical description of the tables of the final project

Entity	Description	Attribute	Key
User	Person allowed to log in their profile	IDcode password firstname surname birthdate sex email telephone_number fiscal_code role address	IDcode
Patient	Person diagnosed with Depression or Bipolar Disorder	IDcode IDdoctor	IDcode (from User)
Technical Administrator	Person in charge of managing the software	IDcode	IDcode (from User)
Specialized Practitioner	Doctor assigned to patient	IDcode	IDcode (from User)
Questionnaire	Results to usual paper questionnaires	IDquestionnaire IDcode_patient compilation date score	IDquestionnaire
Exam	Exams booked by the SP for the patient	IDexam exam name exam date exam time book date IDcode_SP IDcode_patient	IDexam
Visit	Visit booked by the SP for the patient to assess patient’s state	IDvisit IDcode_patient IDcode_SP bookdate	IDvisit

		visitdate medical report visithour	
Therapy	Medication drug prescribed by the SP to the patient	IDvisit IDdrug start date end date quantity frequency IDcode_patient	IDvisit IDdrug (Foreign keys)
At-home parameter	Parameters uploaded by the patient	IDparameter insertion mode frequency acquisition upper threshold lower threshold measure unit	
In-hospital parameter	Parameters uploaded by the SP	IDparameter acquisition system insertion mode lower threshold upper threshold measure unit	
Risk evaluation model	Model created by the TA to estimate thresholds	code model_equation IDcode_TA Description Model Name	code
Access	Gather the information that will be used for the statistics of the TA	IDaccess userID start time end time dateaccess session_duration	IDaccess

Acquisition	Gathering of the information of at-home parameter	IDcode_patient ID_par_at-home date value	IDcode_patient ID_par_at-home date (Foreign keys)
Sleep efficiency	Questionnaire about the quality of sleep of the patient	IDquestionnaire Q1 Q3 comp1 comp2 comp3 comp4 comp5 comp6 comp7 finalScore	IDquestionnaire (Foreign key)
Drug	List of the drugs that can be used	IDdrug name	IDdrug
Measurement in-hospital	value and notes about the in-hospital exam	IDvisit IDparameter value comments date	IDvisit (primary key) IDparameter (foreign key)
Parameter	List of parameters	IDparameter name	IDparameter
Therapy adherence	Questionnaire on the regularity of medication intake	IDquestionnaire Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8	IDquestionnaire

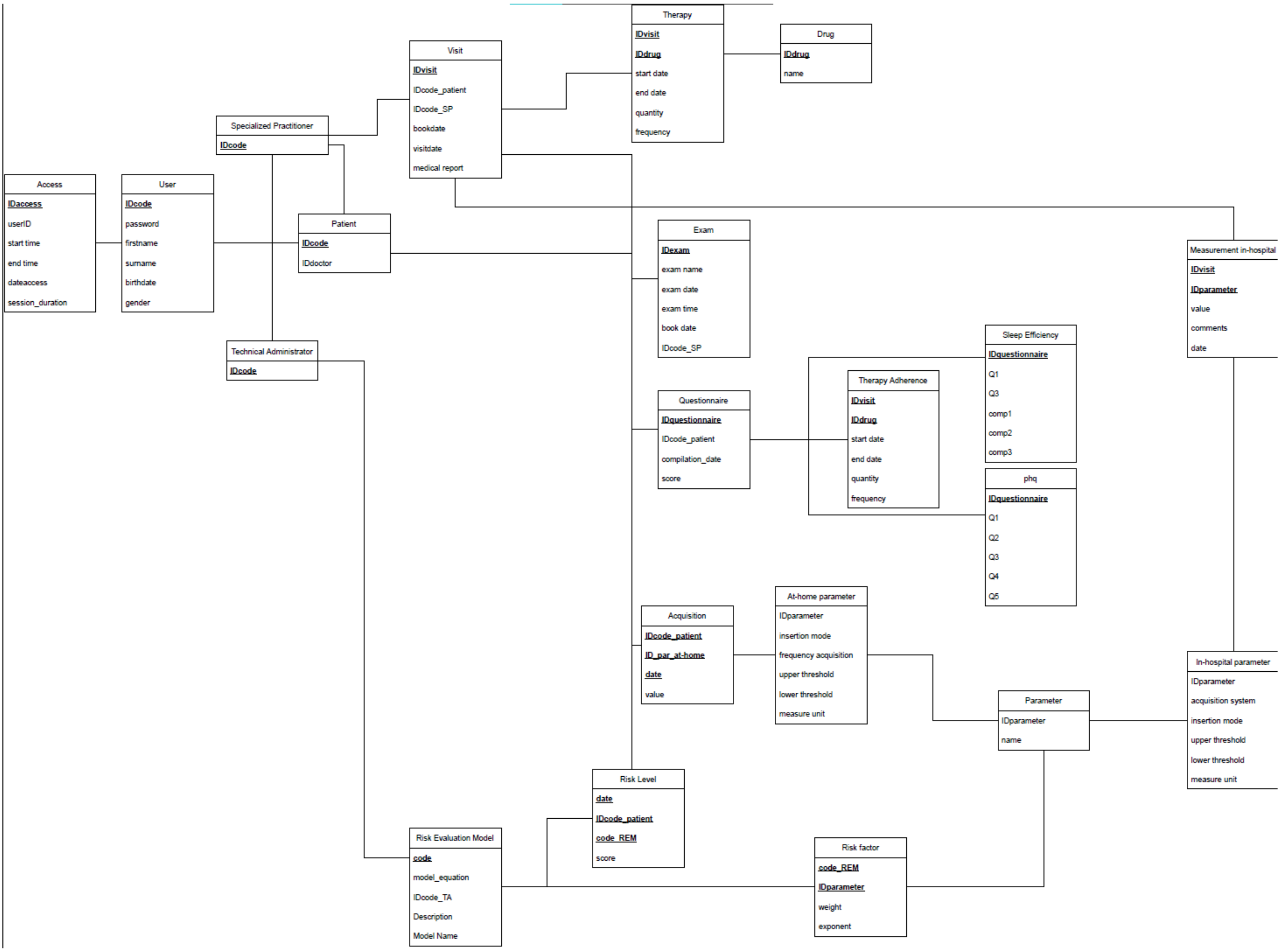
phq	Patient Health Questionnaire	IDquestionnaire Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9	IDquestionnaire
Risk factor	Determines if a patient mood is at risk	code_REM IDparameter exponent weight	code_REM IDparameter
Risk level	Contains the level and the date of the risk for each patient	date IDcode_patient code_REM score	date IDcode_patient code_REM

Relation	Description	Attribute	Type
Role	Each user is associated to one role between patient, SP and TA	IdCode	1-to-1
Fill-in	Each patient can fill each questionnaire everyday	IdPatient	0-to-many
Doctor Reference	Each patient is followed by one doctor	IdDoctor	1-to-many
Set threshold	Doctor can decide parameters thresholds		0-to-many
Create model	The technical administrator can create new risk assessment models		0-to-many

Attend	Each patient can attend visits	IdPatient	0-to-many
Supervise	Each doctor can supervise visits	IdDoctor	0-to-many
Attend	Each patient can attend exams	IdPatient	0-to-many
Supervise	Each doctor can supervise exams	IdDoctor	0-to-many
Follow	Each patient can follow several prescriptions	IdPatient	0-to-many
Supervise	Each doctor can prescribe prescriptions to patient.	IdDoctor	0-to-many
Insert/Upload	Each patient can everyday insert or upload at-home parameters	IdPatient	0-to-many
Insert/Upload	Each doctor can insert or upload in-hospital parameters during visit.	IdPatient	0-to-many
Verification	When a parameter is uploaded, its value is check into the threshold table to see if it is in the normal range.		1-to-1
Based on	Risk evaluation model are based on the values set on the threshold values		1-to-1

4- Modification of the modeling during the implementation

While doing the project we realized that the modeling of the database was not matching what we did so here is the up-to-date model.


Therapy
IDvisit
IDdrug
start date
end date
quantity
frequency
Drug
IDdrug
name
Visit
IDvisit
IDcode_patient
IDcode_SP
bookdate
visitdate
medical report
Specialized Practitioner
IDcode
Access
IDaccess
userID
start time
end time
dateaccess
session_duration
User
IDcode
password
firstname
surname
birthdate
gender
Patient
IDcode
IDdoctor
Exam
IDexam
exam name
exam date
exam time
book date
IDcode_SP
Measurement in-hospital
IDvisit
IDparameter
value
comments
date
Technical Administrator
IDcode
Sleep Efficiency
IDquestionnaire
Q1
Q3
comp1
comp2
comp3
Questionnaire
IDquestionnaire
IDcode_patient
compilation_date
score
Therapy Adherence
IDvisit
IDdrug
start date
end date
quantity
frequency
phq
IDquestionnaire
Q1
Q2
Q3
Q4
Q5
At-home parameter
IDparameter
insertion mode
frequency acquisition
upper threshold
lower threshold
measure unit
Acquisition
IDcode_patient
ID_par_at-home
date
value
In-hospital parameter
IDparameter
acquisition system
insertion mode
upper threshold
lower threshold
measure unit
Parameter
IDparameter
name
Risk Level
date
IDcode_patient
code_REM
score
Risk Evaluation Model
code
model_equation
IDcode_TA
Description
Model Name
Risk factor
code_REM
IDparameter
weight
exponent

IV- System Implementation

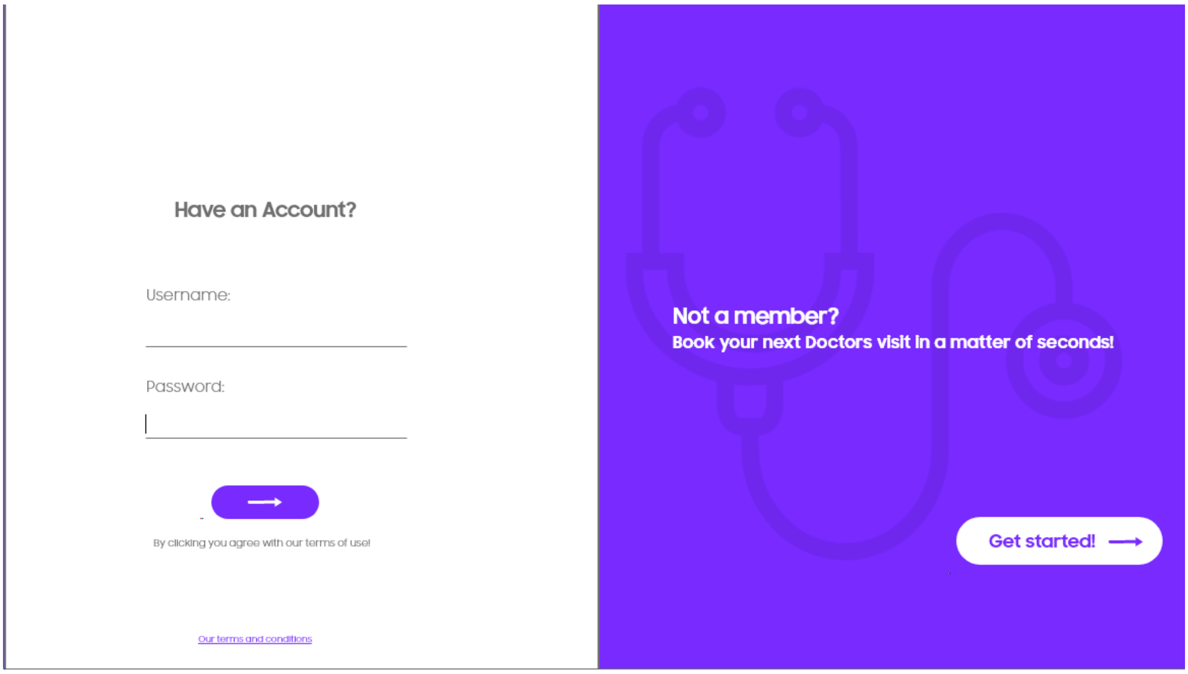
The whole software was developed considering one form for every activity, completely independent from the others, and implemented using mainly VBA. Plus, the software Adobe XD was used to design each page of the GUI, getting us a background image to superimposed on the elements of MS Access and so improves the basic GUI.

All forms have in the upper corner the name of patient, his ID, as well as the logout button.

1- *Log-in and registration*

Description of graphical user interface

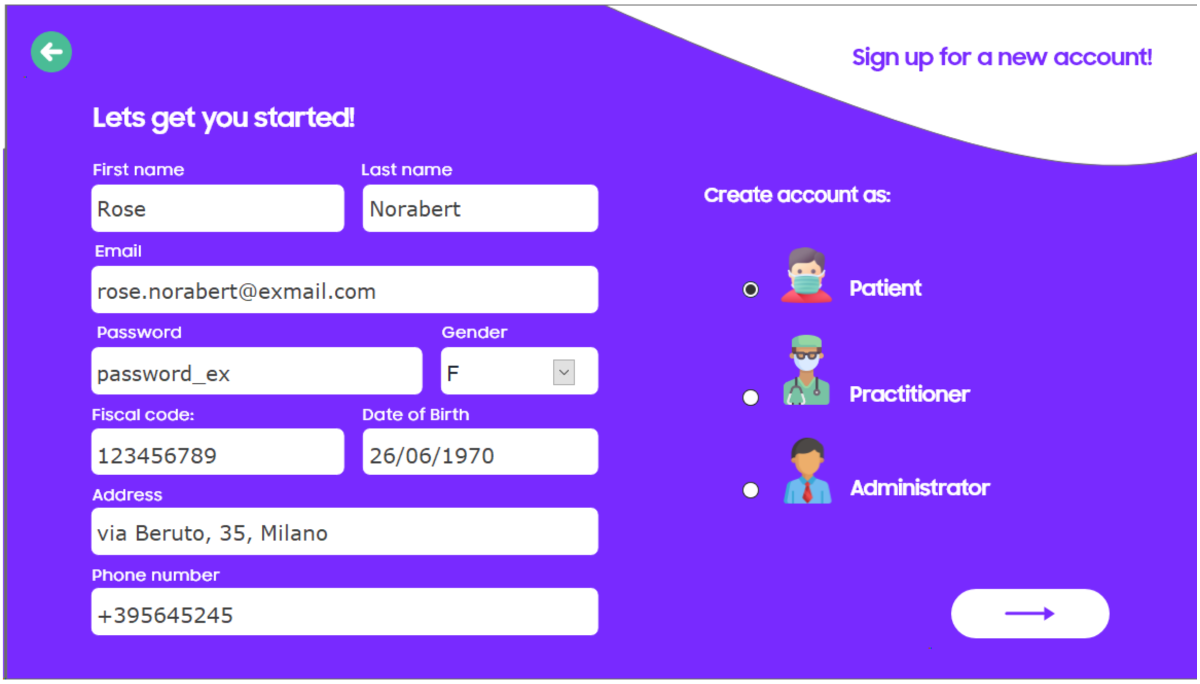
The first functionality accessible from the user is the log-in page:



By clicking you agree with our terms of use!

Book your next Doctors visit in a matter of seconds!

It is composed of two parts: the first one, to log in, with two text fields to fill with the username (the IDCode) and the password of the user. If both are correct, the user that presses the purple button can log in and access the home page of his category: Patient, Specialized Practitioner (SP) and Technical Administrator (TA). The second part, on the right side, is here for users that do not have an account for now. They can choose to create one with the “Get started!” button, leading them to the registration page:



Lets get you started!

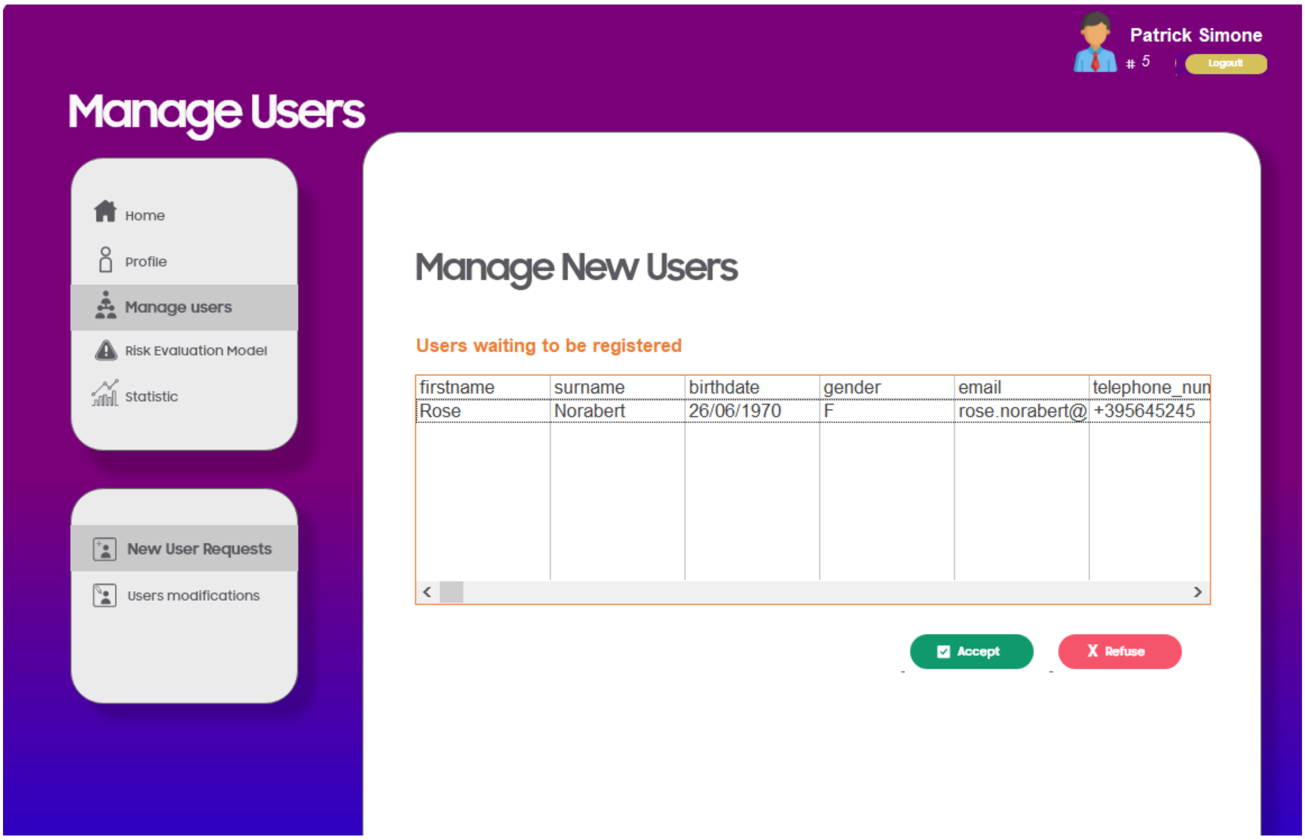
First name: Rose
Last name: Norabert
Email: rose.norabert@exmail.com
Password: password_ex
Gender: F
Fiscal code: 123456789
Date of Birth: 26/06/1970
Address: via Beruto, 35, Milano
Phone number: +395645245

Create account as:

● Patient
○ Practitioner
○ Administrator

The user, from the registration page can then fill all fields with all his useful personal data (name, email, password, gender, fiscal code, date of birth, address, phone number), as well as the role he is supposed to held inside the software to choose between Patient, SP and TA. Some fields are text boxes (to fill with text or dates only), combo box and yes/no buttons.

Once it is done, and the button pressed, the software check if a user with the same fiscal code do not already exists and if not, a pop-up message confirms the registration request has been sent and all information are inserted to the Request table, that will temporarily store data. At this point, the TA is the one that should accept the request for the new user to be added to the User table and have access to his account.


Patrick Simone
# 5
Logout
Manage Users
Home
Profile
Manage users
Risk Evaluation Model
Statistic
New User Requests
Users modifications
Manage New Users
Users waiting to be registered
Accept
X Refuse

firstname	surname	birthdate	gender	email	telephone_nun
Rose	Norabert	26/06/1970	F	rose.norabert@	+395645245

The TA page to manage request consists of a ListBox listing all new user pending requests. The TA only needs then to select one user and to click either the accept button to add the information to the User table or the refuse button to just delete the request.

Description of queries

For those functionalities, several different queries are used.

For the log in, checking the patient username and password, SQL queries are not used, and everything is done inside the code. However, when any user connects, a line is inserted inside the Access table, that will gather the IdCode of the user, the current time and the hour of the connection and later the time at which the user get disconnected and the session duration. This query is then used:

`INSERT INTO [Access]([userID], [dateaccess], [start time]) VALUES ('" & IdUser & "' , '" & CurrentDate & "', '" & CurrentTime & "');`

In the registration page, one query is used to check if the fiscal code is already present in the User database. It is gathering all users having an identical fiscal code as the one entered, and if there is at least one result, the registration is automatically rejected

`SELECT * FROM user WHERE fiscal_code = '" & EnteredFiscalCode & "'`

The sending of the request is made inside the code. It inserts inside the Request table all the fields one after the other.

The last queries are considered when the TA wants to manage requests. When the form is open, the table with the list of all the request is filled with a SELECT query that selects all items from the Request database.

`SELECT [Request].[IDcode_temp], [Request].[password], [Request].[firstname], [Request].[surname], [Request].[birthdate], [Request].[gender], [Request].[email], [Request].[telephone_number], [Request].[fiscal_code], [Request].[role], [Request].[address] FROM Request ORDER BY [IDcode_temp]`

If the TA accepts, the query INSERT is used, in order to fill each field inside the User table with the information from the Request database corresponding to the one selected:

`INSERT INTO User(password, firstname, surname, birthdate, gender, email, address, telephone_number, role, fiscal_code) SELECT password, firstname, surname, birthdate, gender, email, address, telephone_number, role, fiscal_code FROM Request WHERE IDcode_Temp=" & IdUser`

Then, the user is referred as a Patient, SP or TA inside the specific sub-user database, with distinction to his role attribute, using those queries:

`SELECT MAX(IDcode) AS MaxUser FROM User` to get the value of the user ID.

`INSERT INTO Patient(IDcode) VALUES (" & max & ")` to insert the new user inside the patient database

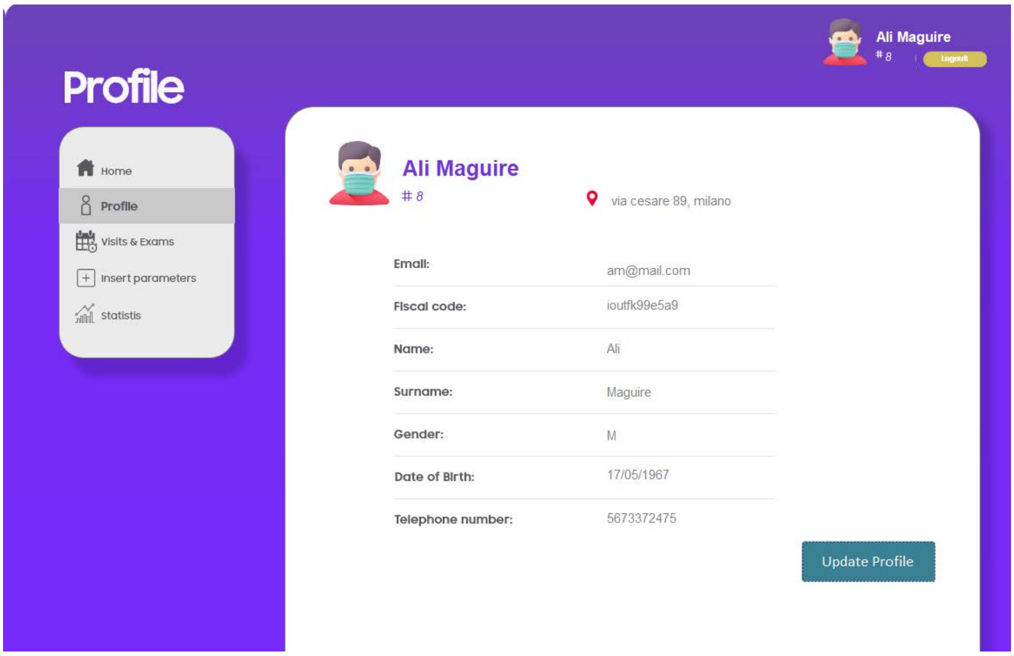
In case of refusal the request is just deleted from the Request database with this query:

`DELETE FROM Request WHERE IDcode_temp=" & IdUser`

2- ***Update of the user profile***

Description of graphical user interface

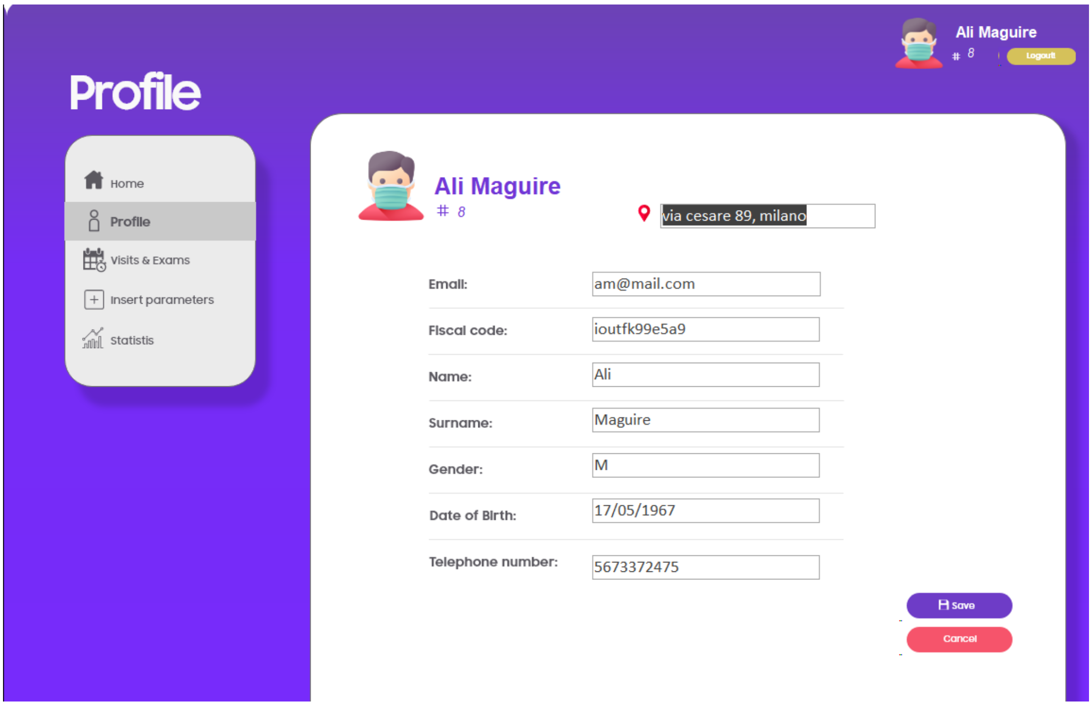
All user profiles have a similar appearance, including text fields with all personal information excepting the password.


Ali Maguire
# 8
Logout
Profile
Home
Profile
Visits & Exams
Insert parameters
Statistis
Update Profile

Ali Maguire
8
via cesare 89, milano

Email: am@mail.com
Fiscal code: ioutfk99e5a9
Name: Ali
Surname: Maguire
Gender: M
Date of Birth: 17/05/1967
Telephone number: 5673372475

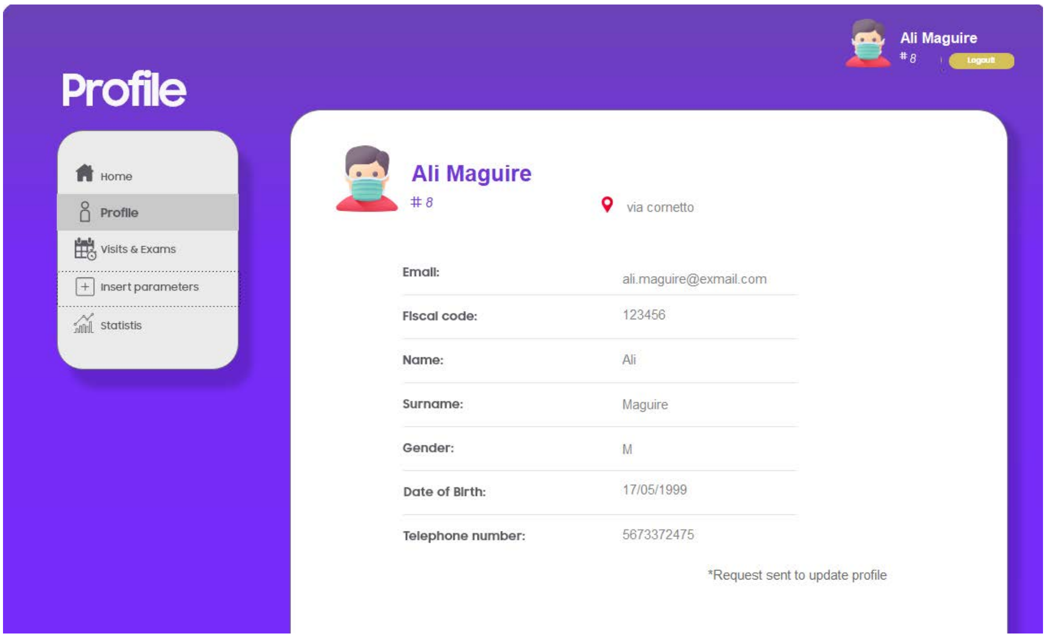
Any user can ask for changing all his data, except the fiscal code by clicking on the ‘Update Profile” button, by changing the fields he wants to modify. All fields are either text box, date box or combo box. Two buttons are available, either to cancel the modification, either to send the request.


Ali Maguire
# 8
Logout
Profile
Home
Profile
Visits & Exams
Insert parameters
Statistis
Save
Cancel

Ali Maguire
8
via cesare 89, milano

Email: am@mail.com
Fiscal code: ioutfk99e5a9
Name: Ali
Surname: Maguire
Gender: M
Date of Birth: 17/05/1967
Telephone number: 5673372475

Once the request is sent, the update button is not available anymore and a message appears indicating the request is pending.

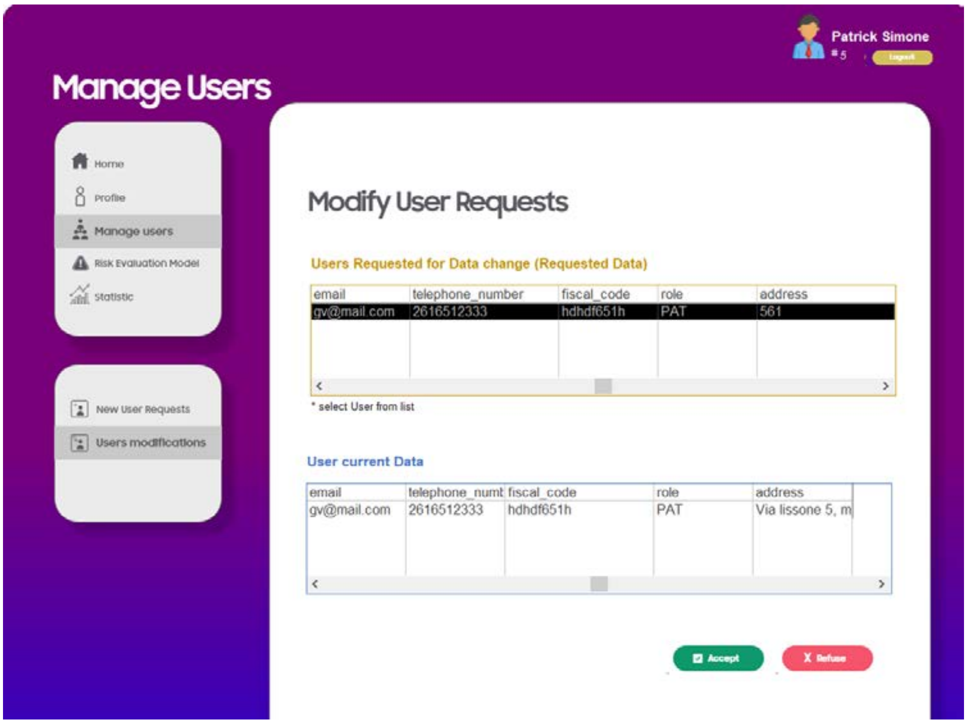

Profile
Ali Maguire
# 8
Logout
Home
Profile
Visits & Exams
Insert parameters
Statistis

Ali Maguire
8
via cornetto

Email:	ali.maguire@exmail.com
Fiscal code:	123456
Name:	Ali
Surname:	Maguire
Gender:	M
Date of Birth:	17/05/1999
Telephone number:	5673372475

*Request sent to update profile

Once again, the TA is the one that should accept request for modifying the profile. The page is really similar to the one for managing new user requests, with a list box item gathering all the pending request for updates and a button to accept and refuse. The only difference is that when selecting the requests, the actual data of the user is plotted under the table, for him to have a look on it.


Manage Users
Patrick Simone
# 5
Logout
Home
Profile
Manage users
Risk Evaluation Model
Statistic
New User Requests
Users modifications
Accept
X Refuse

Modify User Requests

Users Requested for Data change (Requested Data)

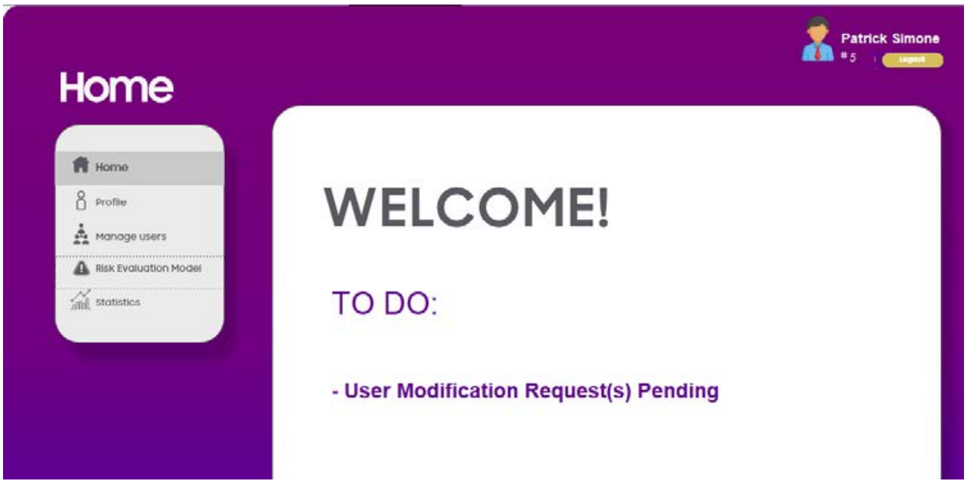
email	telephone_number	fiscal_code	role	address
gv@mail.com	2616512333	hdhdf651h	PAT	561

* select User from list

User current Data

email	telephone_numt	fiscal_code	role	address
gv@mail.com	2616512333	hdhdf651h	PAT	Via lissone 5, m

Anyway, for any requests pending, the TA receives on his home page a notification for him to know he needs to do something, and he only needs to click on the notification to access the managing page.



WELCOME!

TO DO:

- User Modification Request(s) Pending

Description of queries (with example)

Three different queries are used on the TA page. First, the table summarizing the data is filled using a SELECT query, as follow:

```
SELECT * from RequestDataChange
```

Then, when the TA selects one of the requests pending, another SQL request is used in order to plot the information currently available for this user, by selecting in the User database the user corresponding to the IDcode selected.

```
SELECT * FROM [User] WHERE IDcode=IdUserSelected;
```

Finally, when the TA accept or reject the request, a SELECT and/or DELETE query is used.

```
UPDATE user SET address='" & NewAddress & "',email= '" & NewEmail & "',fiscal_code='" & NewFiscalCode & "',firstname='" & NewFirstName & "', surname='" & NewSurname & "',birthdate='" & NewBirthdate & "',gender='" & NewGender & "'  ,telephone_number='" & NewPhone & "' WHERE IdCode=" & IdUserSelected
```

And it then delete the request from the request table:

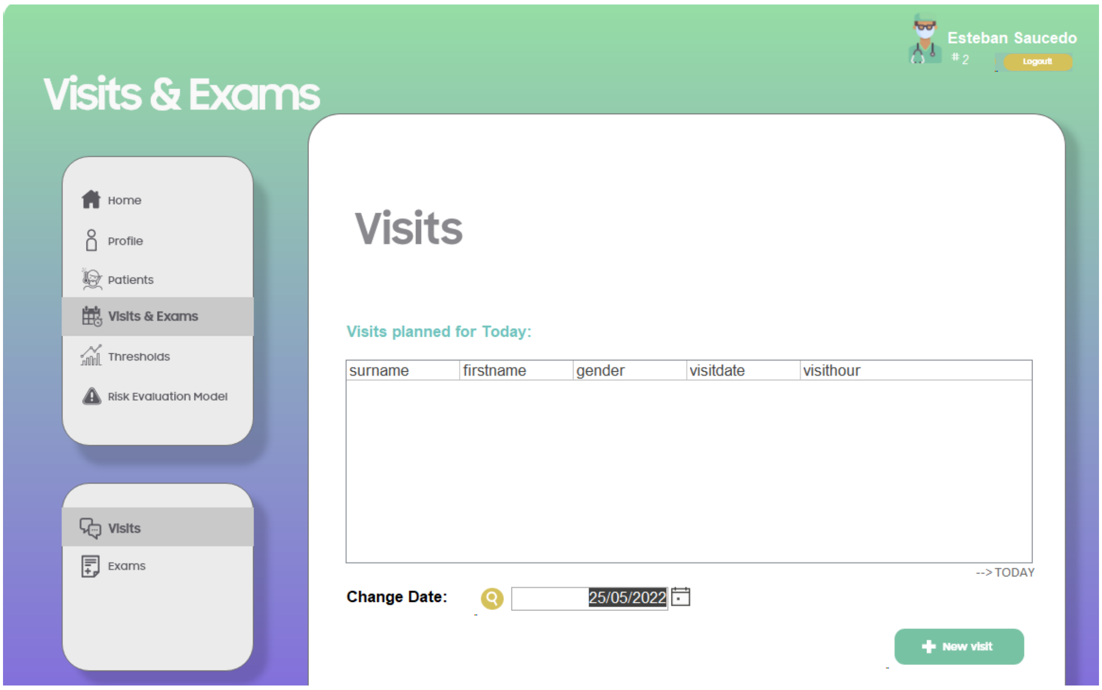
```
Delete from RequestDataChange where idcodeuser =" & IdUserSelected
```

3- ***How to book a visit or an exam?***

Description of graphical user interface

This functionality takes place in the SP page, as he is the one in charge of scheduling new appointments. He has two different pages available for this, one to book visit and the other to book exams even though the two works on the same principle.

The visit page is as follow:


Esteban Saucedo
# 2
Logout
Visits & Exams
Home
Profile
Patients
Visits & Exams
Thresholds
Risk Evaluation Model
Visits
Exams
Visits
--> TODAY
New visit

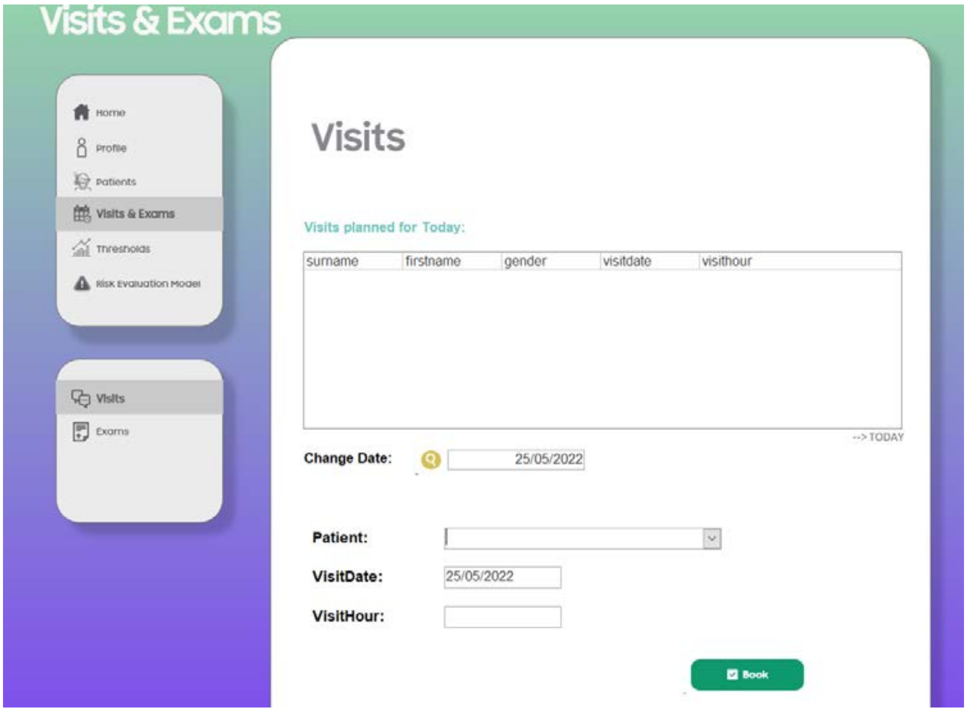
Visits planned for Today:

surname	firstname	gender	visitdate	visithour

Change Date: 25/05/2022

It is composed of one table, that will plot the schedule of visits of the day in a table. It is though possible to select another date in the Change Date field to visualize the agenda of another day by simply clicking on the magnifying glass button. Coming back to the date of the day can then be done by clicking on the 'Today' at the bottom right of the table.

From here, new visits can be booked by clicking on the 'New Visit' button, that will make visible the second part of the form bellow.



Visits planned for Today:

surname	firstname	gender	visitdate	visithour

Change Date: 25/05/2022

Patient:

VisitDate: 25/05/2022

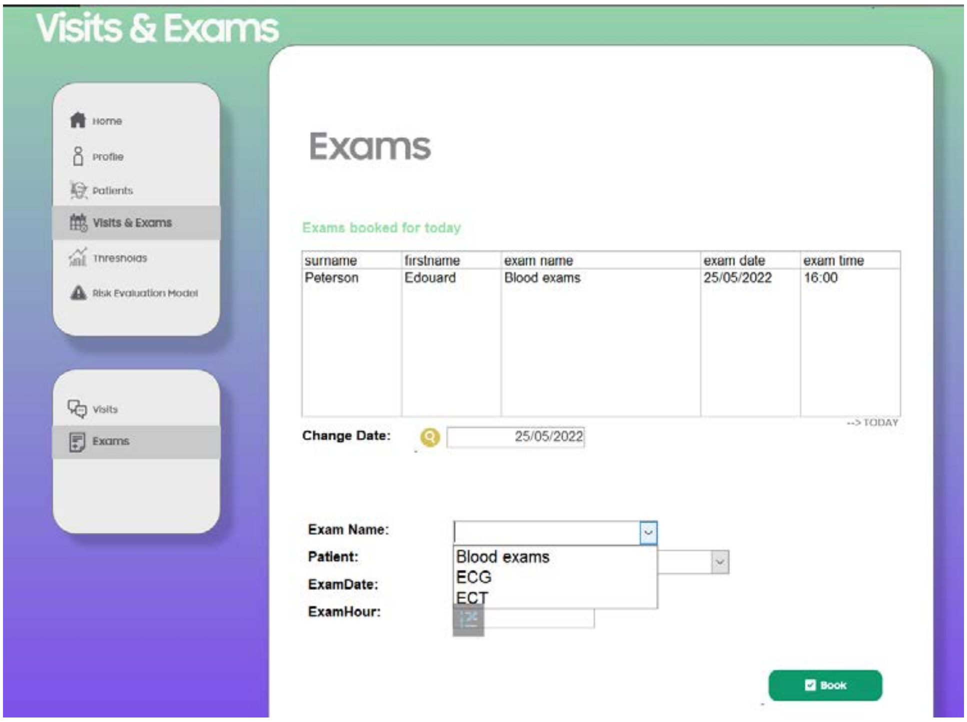
VisitHour:

The user can then select the name of the patient he wants to book a visit with, as well as the data and the visit hour. It is to note that when the date is selected, the timetable on the upper part is automatically updated at the selected date so the practitioner can manage his schedule easily.

The SP can book visits with all patients. And if the patient is currently not followed by any practitioner, the booking of a visit will automatically assign the patient selected to this practitioner.

Once the visit is booked, the table is automatically updated with the new entry.

For the exams, the first part of the exam is the same, with the timetable plotted for the SP to acknowledge it. Things starts to differ when the SP want to book a new exam.


Visits & Exams
Home
Profile
Patients
Visits & Exams
Thresholds
Risk Evaluation Model
Visits
Exams
Book

Exams

Exams booked for today

surname	firstname	exam name	exam date	exam time
Peterson	Edouard	Blood exams	25/05/2022	16:00

--> TODAY

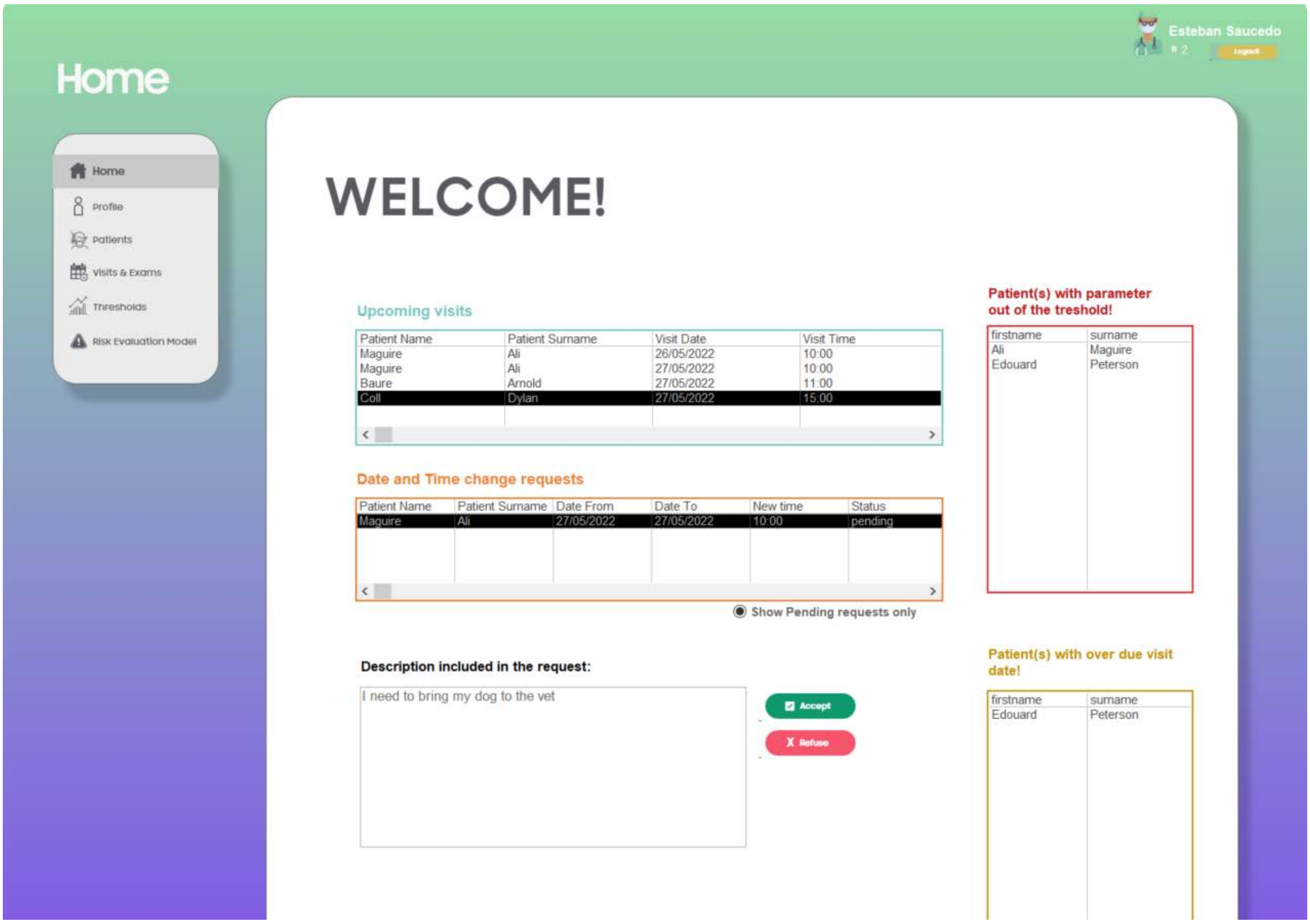
Change Date: 25/05/2022

Exam Name:
Patient:
ExamDate:
ExamHour:

Blood exams
ECG
ECT

Here, in addition to the patient, date and hour, the practitioner should also decide on the type of exam he wants to book through a combo box. Plus, exams can only be booked with patients the SP are following, the patient cannot do an exam with one doctor if he has never seen him during a visit before.

The SP can also find all useful information concerning upcoming exams on this home page. More precisely, it shows a system of notification the SP can see every time he connects to his account.



WELCOME!

Upcoming visits

Patient Name	Patient Surname	Visit Date	Visit Time
Maguire	Ali	26/05/2022	10:00
Maguire	Ali	27/05/2022	10:00
Baure	Arnold	27/05/2022	11:00
Coll	Dylan	27/05/2022	15:00

Date and Time change requests

Patient Name	Patient Surname	Date From	Date To	New time	Status
Maguire	Ali	27/05/2022	27/05/2022	10:00	pending

● Show Pending requests only

Description included in the request:

I need to bring my dog to the vet

Patient(s) with parameter out of the treshold!

firstname	surname
Ali	Maguire
Edouard	Peterson

Patient(s) with over due visit date!

firstname	surname
Edouard	Peterson

In the blue rectangle, he can see all his upcoming visit and so not forget what he must do. Just below, he can see all requests patients send him in order to modify their visits or exams date or hour. If the SP selects a pending request, the reason entered by the patient is made visible and so the practitioner can decide to accept or reject the request. If it is accepted, the schedule of everyone will be updated.

Two other rectangles can also be seen, one is a table in yellow where are listed all patients followed by practitioners that need a visit urgently as all patients should see their doctor at least every six months. This warning appears more or less one month before the deadline.

Finally in the red table, the practitioner can have a look on all patient presenting abnormalities in the uploaded parameters so he can decide to book a new visit or exam for them.

Description of queries (with example)

The main queries used for this functionality are used to fill the tables. For example, to plot all the schedule of the selected day ordered by time, the following type of query is used:

```
SELECT IDvisit, surname, firstname, gender, visitdate, visithour FROM visit, [User] WHERE IDcode = IDcode_patient And IDcode_SP = CurrentUserName  And visitdate=#2022-5-25# ORDER BY visithour
```

In the same way, to plot all the upcoming visits and exams in the SP homepage, the same is done, with an ordering by date instead of the selection of the specific date.

If the request for changing the date of a visit is denied or accepted, the status of the request is changed to “denied” or “accepted” using those type of query which update the status of the request inside the VisitRequestChange database.

```
UPDATE visitrequestCHANGE set status = '" & den & "' where visitid = " & SelectedVisitID & "
```

In addition, if the request is accepted, it is also necessary to change the visit date and time inside the Visit or Exam database.

```
UpDATE visit set visitdate ='" & SelectedVisitDate & "' , visithour = '" & SelectedVisitHour & "' where idvisit = " &
SelectedIdVisit & " "
```

When it comes to the table listing all requests to change appointments time or date, the following query is done in order to place on each column the corresponding information found on different tables, selecting only the one corresponding to the current user and where the IDvisit and IDpatient correspond to actual planned visit (that is to say a pending visit that already occurred will be discarded):

```
SELECT visit.IDvisit, visitrequestCHANGE.description, User.surname AS [Patient Name], User.firstname AS [Patient
Surname], visitrequestCHANGE.visitdatefrom AS [Date From], visitrequestCHANGE.visitdate AS [Date To],
visitrequestCHANGE.visithour AS [New time], visitrequestCHANGE.status AS Status
FROM visit, visitrequestCHANGE, [User]
WHERE (((visitrequestCHANGE.visitid)=[visit].[idvisit]) AND ((User.[IDcode])=[visit].[IDcode_patient]) AND
((visit.IDcode_sp)=[Forms]![Login].[txtUserName]))
ORDER BY visitrequestCHANGE.status DESC , visitrequestCHANGE.visitdate, visitrequestCHANGE.visithour;
```

The table for remaining visits should occur at least every six months functions with the following query, list all user’s name and surname that didn’t realize or plane a visit during the last 6 months but who already had visits.

```
SELECT user.firstname, user.surname
FROM visit, [user]
WHERE (((visit.idcode_sp)=[Forms]![Login].[TxtUserName]) AND ((visit.idcode_patient)=[user].[idcode]) AND
((visit.visitdate)<Date()-180));
```

When it comes to the listing of patients presenting abnormalities, a query using both Acquisition (all uploaded parameters) and Parameters (all threshold) values is used, putting a condition on the values of the parameters, but also on the number of days abnormal values are observed.

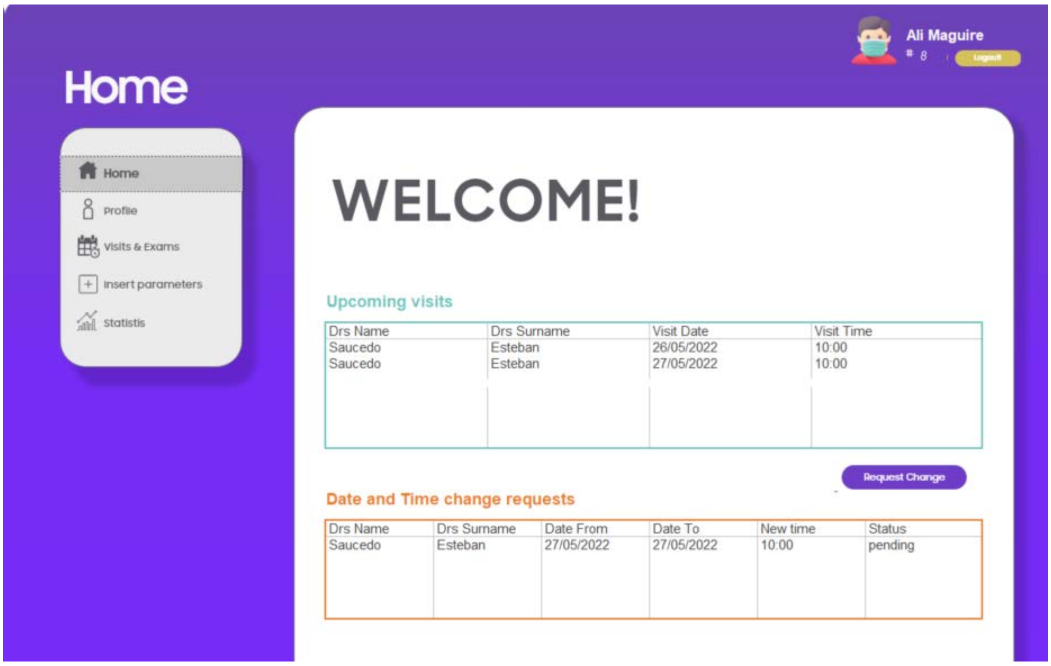
```
SELECT DISTINCT QuerySelectPatient.firstname, QuerySelectPatient.surname
FROM Acquisition, [At-home parameter], QuerySelectPatient
```

```
WHERE (((([At-home parameter].IDparameter)=[Acquisition].[ID_par_at-home]) AND
((Acquisition.IDcode_patient)=[User].[IDcode]) AND ((Acquisition.value)<[lower threshold] Or
(Acquisition.value)>[upper threshold]) AND ((Acquisition.date) Between (Date()-8) And Date()));
```

4- ***How to make manage visits or exams?***

Description of graphical user interface

Patients can manage their visits and exams. When they connect, they have access on their home page to the list of exams and visits they must attend in the next few days. They can also from their request a change with the "Request Change" and see the status of all their past request.



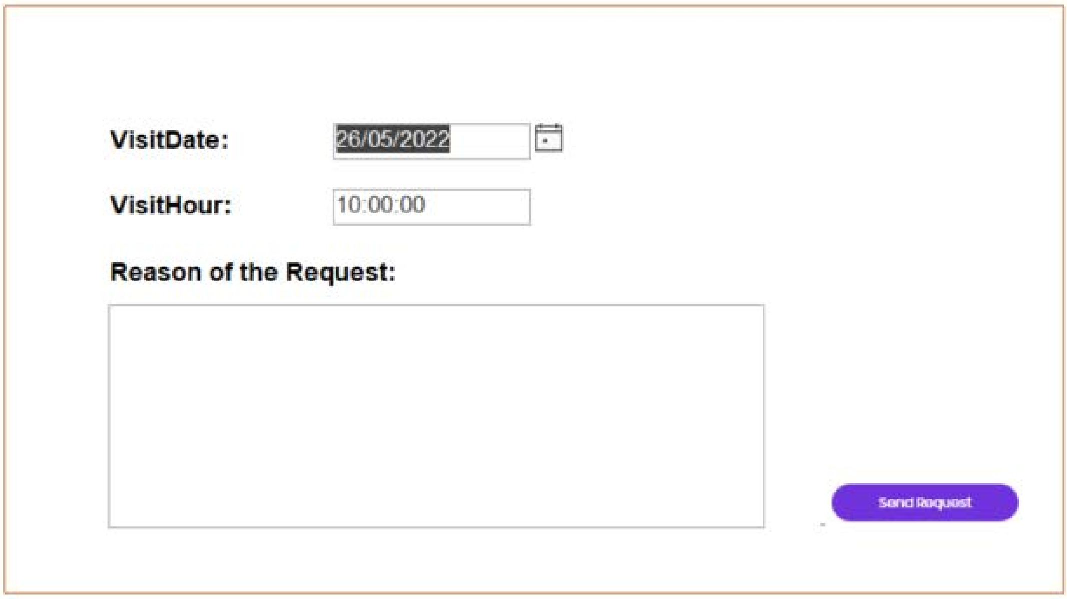
Upcoming visits

Drs Name	Drs Surname	Visit Date	Visit Time
Saucedo	Esteban	26/05/2022	10:00
Saucedo	Esteban	27/05/2022	10:00

Date and Time change requests

Drs Name	Drs Surname	Date From	Date To	New time	Status
Saucedo	Esteban	27/05/2022	27/05/2022	10:00	pending

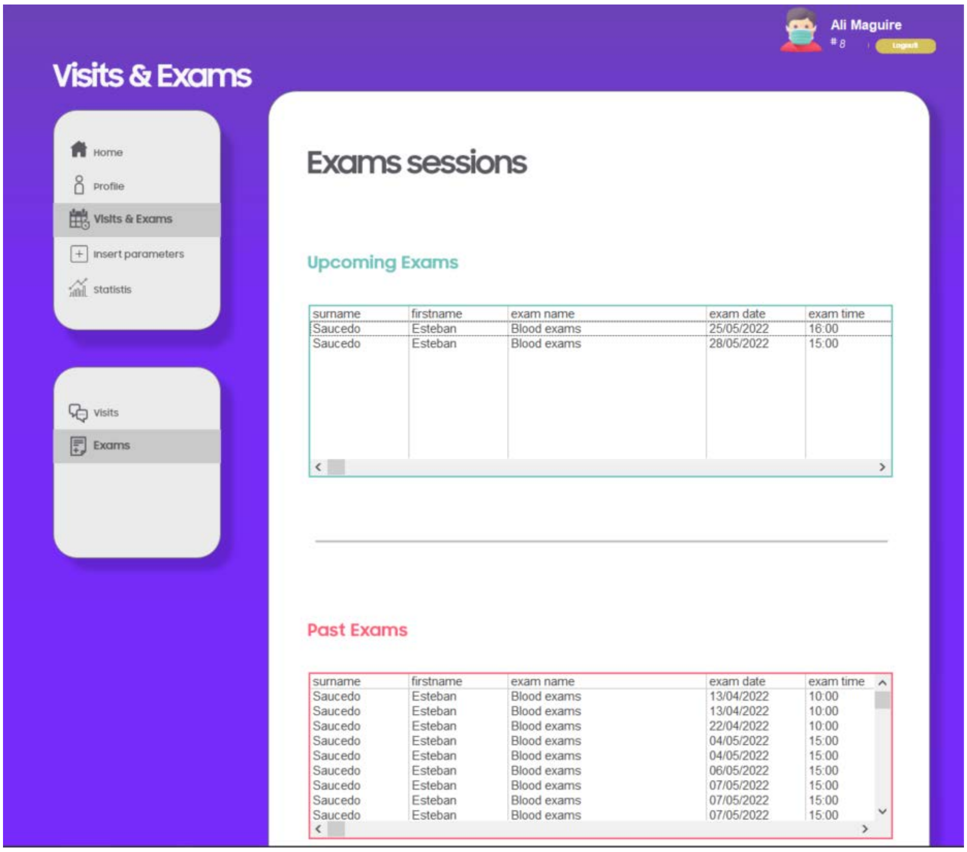
If they click on the button, a hidden part of the form appear bellows, allowing to change the visit currently selected:



VisitDate:	26/05/2022
VisitHour:	10:00:00
Reason of the Request:	

They must select the data and hour they would like to attend the visit, as well as the reason why they want to postpone the appointment.

They have also at their disposal a Visits and Exams page where they can see all the Visit and Exams that are scheduled or already past, to keep a track of their activities, on the form of two tables, just as before.



Exams sessions

Upcoming Exams

surname	firstname	exam name	exam date	exam time
Saucedo	Esteban	Blood exams	25/05/2022	16:00
Saucedo	Esteban	Blood exams	28/05/2022	15:00

Past Exams

surname	firstname	exam name	exam date	exam time
Saucedo	Esteban	Blood exams	13/04/2022	10:00
Saucedo	Esteban	Blood exams	13/04/2022	10:00
Saucedo	Esteban	Blood exams	22/04/2022	10:00
Saucedo	Esteban	Blood exams	04/05/2022	15:00
Saucedo	Esteban	Blood exams	04/05/2022	15:00
Saucedo	Esteban	Blood exams	06/05/2022	15:00
Saucedo	Esteban	Blood exams	07/05/2022	15:00
Saucedo	Esteban	Blood exams	07/05/2022	15:00
Saucedo	Esteban	Blood exams	07/05/2022	15:00

Description of queries (with example)

All tables are filled with queries, selecting all visits concerning the patient, ordering them by date and time and using a condition on the date in the sense as the upcoming visit should occur after the current date included while the past visits are occurring before. It needs then Exam and User databases.

```
SELECT User.surname, User.firstname, Exam.[exam name], Exam.[exam date], Exam.[exam time]
FROM Exam, [User] SELECT IDvisit, IDcode_SP , surname as [Drs Name], firstname as [Drs Surname], visitdate as [Visit Date], visithour as [Visit Time] FROM visit, [User] WHERE IDcode = IDcode_SP And IDcode_patient = CurrentUser And visitdate>=#" & Date & "# ORDER BY visitdate, visithour
WHERE (AND ((User.[IDcode])=[IDcode_sp]))
ORDER BY Exam.[exam date];
```

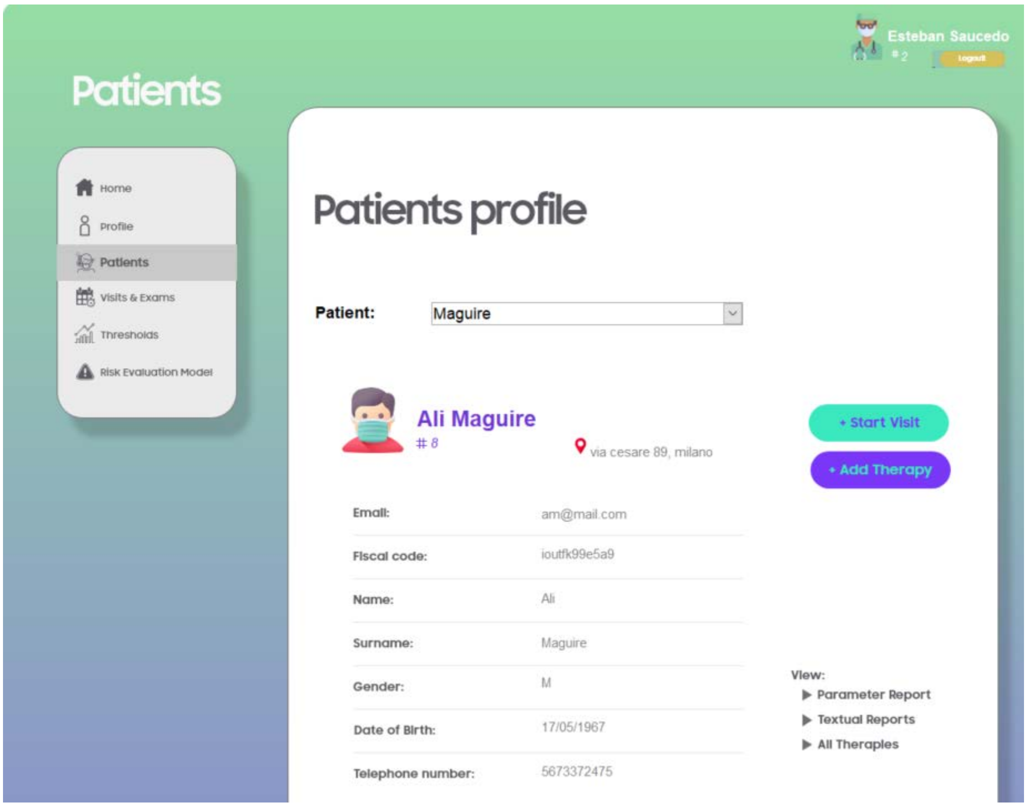
The request table is filled the same way the one present in the SP home. Except that creating a request will add a line on the VisitRequestChange table rather than updating the status as it was the case in the SP case. It uses then an INSERT query on the VisitRequestChange database, as well as the data filled by the patient and the ones already present into the Visit database.

```
INSERT INTO visitrequestCHANGE ( IDcode_patient, IDcode_SP, visitdate, visitdatefrom, visithour,Description,visitID,status ) VALUES ('" & IdUser & "'," & IdDoctor & ", '" & VisitDate & "','" & NewVisitDate & "', '" & NewVisitHour & "','" & Description& "'," & IDvisit) & ",'" & status & "')"
```

5- ***<u>SP’s actions during a visit or exam</u>***

Description of graphical user interface

All SP can see the profile of their patient, with all his data, by selecting the “Patients” page and then the name of the patient.


Patients
Esteban Saucedo
# 2
Logout
Home
Profile
Patients
Visits & Exams
Thresholds
Risk Evaluation Model
+ Start Visit
+ Add Therapy
View:
▶ Parameter Report
▶ Textual Reports
▶ All Therapies

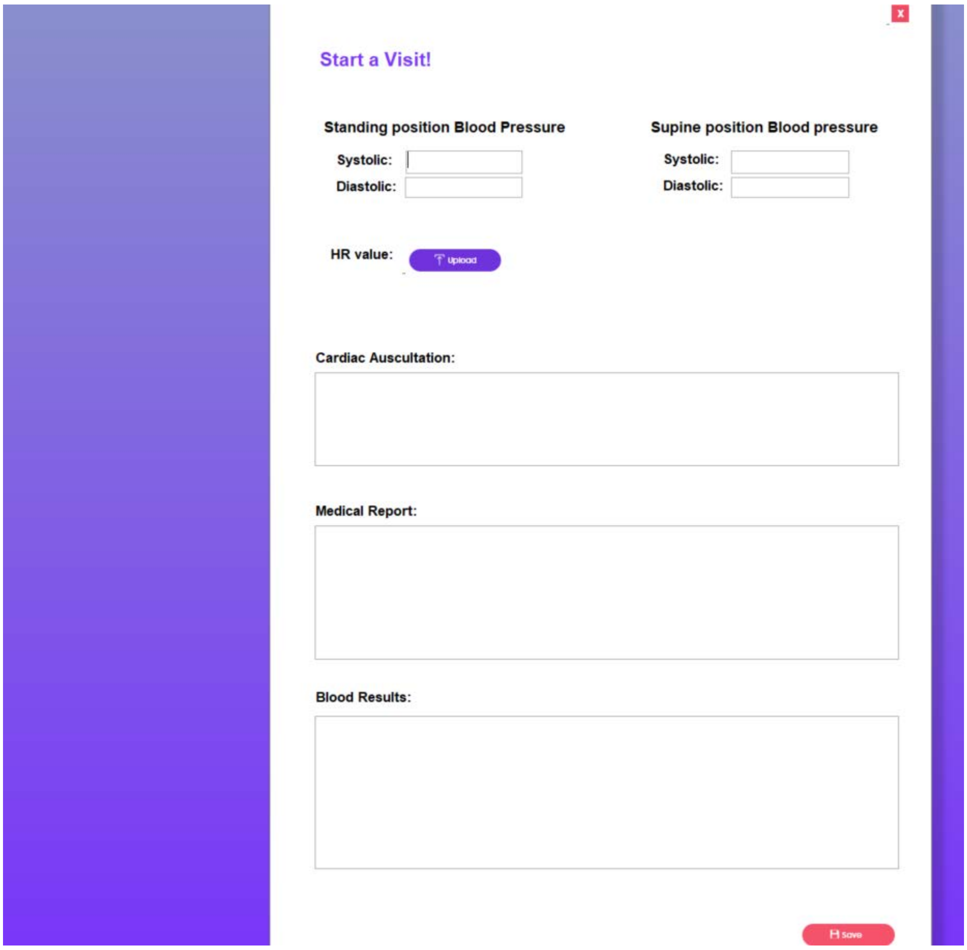
Patients profile

Patient: Maguire

Ali Maguire
# 8
via cesare 89, milano

Email:	am@mail.com
Fiscal code:	ioutfk99e5a9
Name:	Ali
Surname:	Maguire
Gender:	M
Date of Birth:	17/05/1967
Telephone number:	5673372475

From there, he can click on the button 'Start Visit' (to note that this button and the 'Add Therapy' button are only available when a visit is set, if it's not the case, the SP would be informed by a pop-up that there is a problem) and make appear all he can do during a visit or an exam.


x
Start a Visit!
Standing position Blood Pressure
Systolic:
Diastolic:
Supine position Blood pressure
Systolic:
Diastolic:
HR value:
Upload
Cardiac Auscultation:
Medical Report:
Blood Results:
Save

This new section is closable thanks to the red cross on the upper right corner. The SP can here set all parameters he is measuring and all remarks he wants to do about a visit. He does not need to fill every field. Blood Pressure in standing or supine position can be entered as a number, while HR takes a file as an input to upload a list of values that constitute an ECG. Finally, the SP can write notes about Cardiac Auscultation or Blood Results, as well as a Medical Report. Then the “Save” button allow to save all the information inside the database.

Description of queries (with example)

The first one is occurring to gather the list of patients, by selecting from the User table the name, Id and fiscal code of patients with which the SP has already had visits.

```
SELECT DISTINCT User.IDcode, User.surname, User.firstname, User.[fiscal_code]
FROM [User], Visit
WHERE (((User.IDcode)=Visit.IDcode_patient) And ((Visit.IDcode_SP)=CurrentUser))
ORDER BY User.surname;
```

The second one happens when the user is selected, to plot all his information from the User database and print the different components on the graphical interface for the SP to see them (except the password). It will not be recorded as we already explained it before.

Then, when the SP want to insert parameters and so click on the “Start Visit” button, a query is run in order to determine if a visit is occurring this day, checking on the Visit database if at least one element contains the date of day and the ID of the patients and SP.

```
SELECT IDvisit FROM Visit WHERE (visitdate = Date()) AND IDcode_patient =" & patient & " AND IDcode_SP =" & userName
```

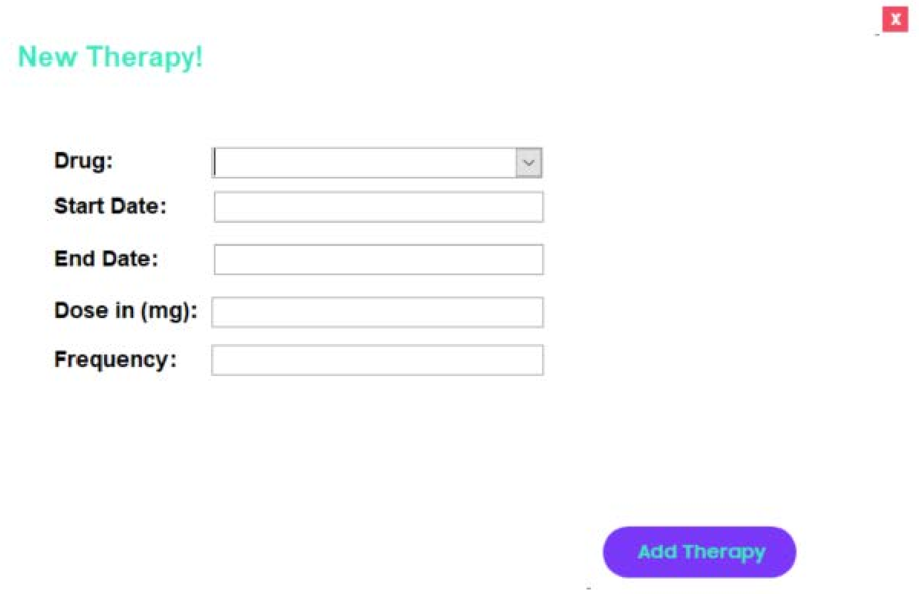
Then, queries only occur when it is wanted to upload new parameters, or reports, by using this query where the parameters are filled into the Measurement in-hospital database, using the ID of the visit, the ID of the parameter and the date of day. For report, the text is added to Visit database.

```
INSERT INTO [Measurement in-hospital](IDvisit, IDparameter, [value], [date]) VALUES(" & visit & ", 11, '" & BPsupine & "','" & Date & "')"
```

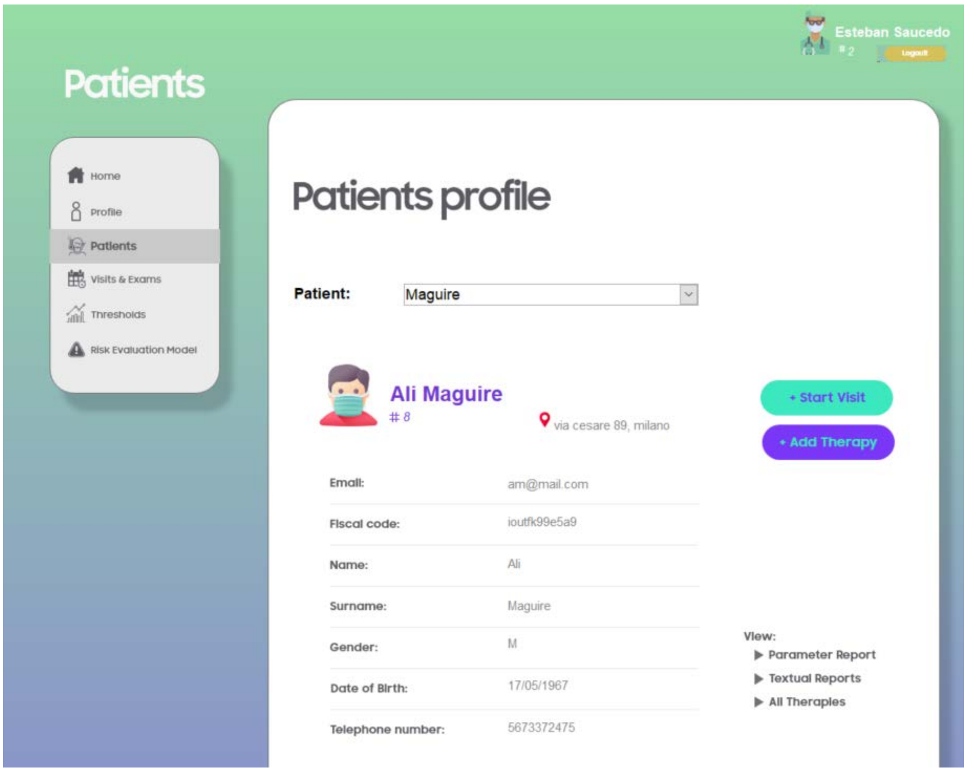
6- ***Prescription***

Description of graphical user interface

From the patient page seen previously, the SP can also decide during a visit to prescribe a therapy to the patient. When the “Add Therapy” button is clicked, the form is expended with the menu to add where the practitioner can select the therapy, the dose, the dates, the frequency.



The SP can also from the profile page of his patient, have access to all the therapy the patient is following by clicking on the “All Therapy” button.

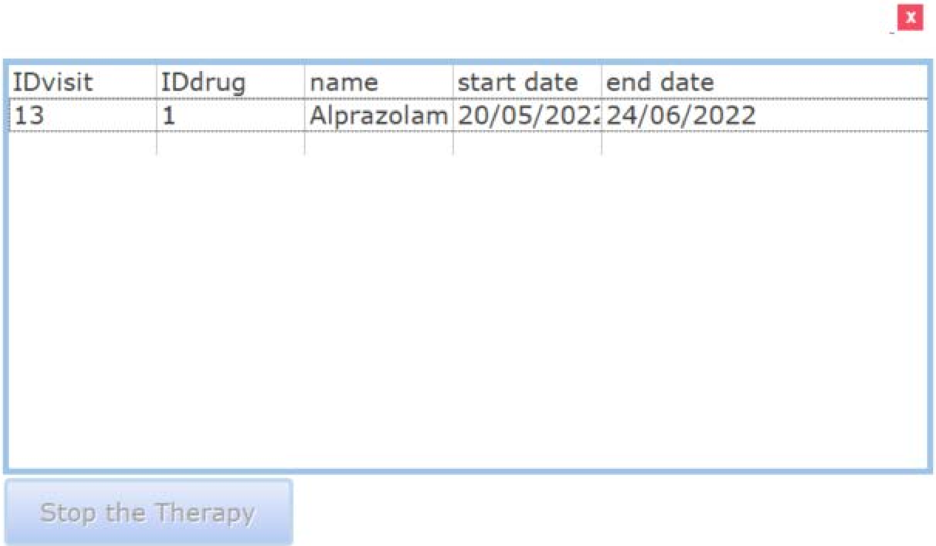

Esteban Saucedo
# 2
Logout
Patients
Home
Profile
Patients
Visits & Exams
Thresholds
Risk Evaluation Model
Patients profile
+ Start Visit
+ Add Therapy
View:
▶ Parameter Report
▶ Textual Reports
▶ All Therapies

Patient: Maguire

Ali Maguire
8
via cesare 89, milano

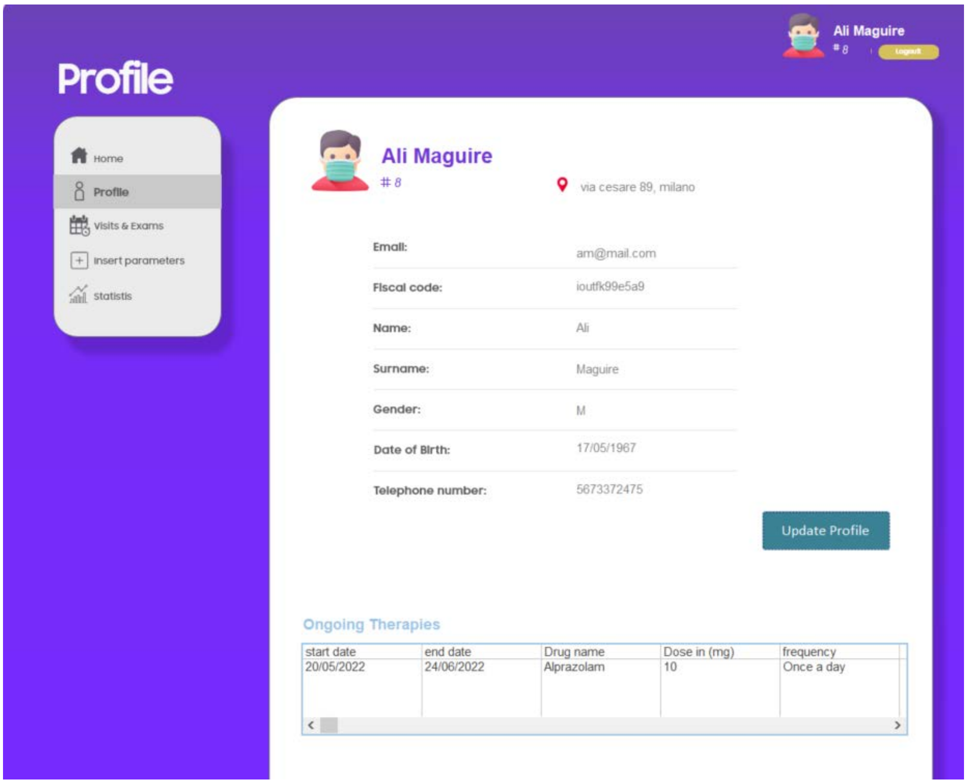
Email:	am@mail.com
Fiscal code:	ioutfk99e5a9
Name:	Ali
Surname:	Maguire
Gender:	M
Date of Birth:	17/05/1967
Telephone number:	5673372475

Once again, it expends the current form and it list all therapies to be found in the database for this patient. It gives also the occasion, when one specific therapy is selected to stop it when the final date is not yet passed.


x
Stop the Therapy

IDvisit	IDdrug	name	start date	end date
13	1	Alprazolam	20/05/202	24/06/2022

The patient can also have a track of all the therapies there are supposed to follow. For that, they just have to go their profile, and it will be listed inside of a table.


Ali Maguire
# 8
Logout
Profile
Home
Profile
Visits & Exams
Insert parameters
Statistis
Update Profile

Ali Maguire
8
via cesare 89, milano

Email:	am@mail.com
Fiscal code:	ioutfk99e5a9
Name:	Ali
Surname:	Maguire
Gender:	M
Date of Birth:	17/05/1967
Telephone number:	5673372475

Ongoing Therapies

start date	end date	Drug name	Dose in (mg)	frequency
20/05/2022	24/06/2022	Alprazolam	10	Once a day

Description of queries (with example)

Once again, by clicking on the “Add Therapy” button, the same query explained previously for the “Start Visit” button is run in order to determine if a visit or an exam is occurring this day.

In addition, for the visualization of all therapy the patient is following, all elements concerning the patient (by using his ID) are simply selected and plotted inside the table.

```
SELECT Therapy.IDvisit, Therapy.IDdrug, Drug.name, Therapy.[start date], Therapy.[end date], quantity, frequency FROM therapy, drug, visit WHERE therapy.IDdrug = drug.IDdrug And therapy.IDvisit = visit.IDvisit And visit.IDcode_patient = " & idpat & " ORDER BY [start date] DESC;
```

From that, the SP can then just decide to stop the therapy by selecting it. The therapy is not deleted, but the end date is updated to the date of the day, so it is possible to keep a track of it, but it will not appear in the list of current medicines of the patient.

```
UPDATE Therapy SET [end date]=Date() WHERE Therapy.IDvisit=" & Me.txtTherapies.Column(0) & " AND IDdrug=" & Me.txtTherapies.Column(1)
```

Finally, for the patient profile, the table is filled with a simple SELECT* query that will select all the elements in the Therapy database using the ID patient where the end date in not already passed.

```
SELECT therapy.[start date] , therapy.[end date] ,drug.name AS[Drug name], therapy.Quantity AS [Dose in (mg)] , therapy.frequency FROM therapy , drug WHERE therapy.IDcode_patient = " & IdUser & " and therapy.[end date] >= date() and therapy.iddrug = drug.iddrug
```

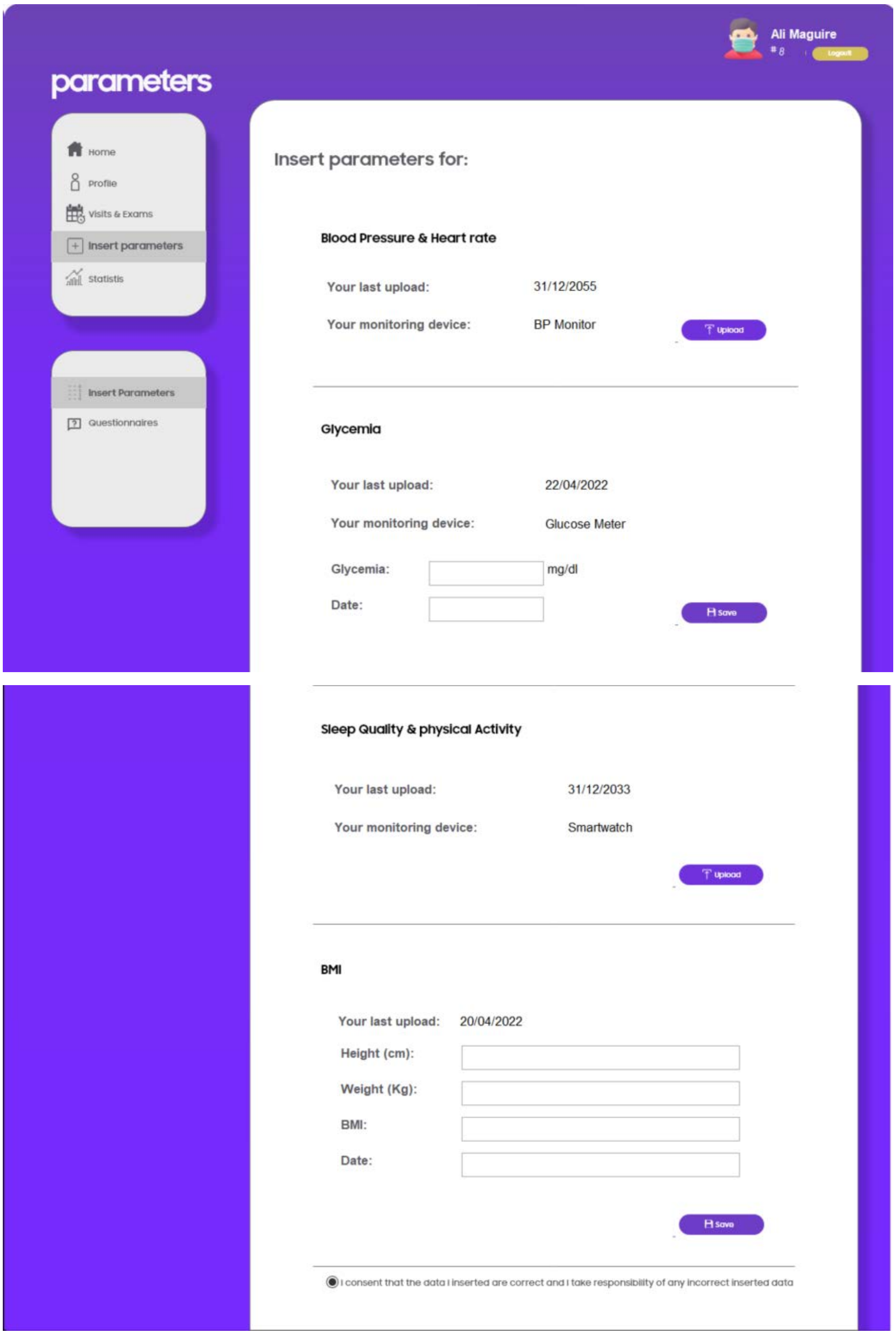
7- ***<u>How to manage at-home parameters?</u>***

Description of graphical user interface

SP is not the only user able to insert parameters, as the patient can uploaded parameters measurable from home, or questionnaires that can be filled from home. All of this is occurring in the “Insert Parameters” page, that is then separated in two different forms: ‘Insert Parameters’ and ‘Questionnaires’.

The parameter page is then as follows, constituting of the list of the different parameters, with the possibility to upload each one of them separately. It gathers Blood Pressure and Heart Rate both to upload through a file as they are from the same device), Sleep Quality and Physical Activity that can both be downloaded from the same device, Glycemia that be entered manually and BMI that is computed by the software after data are filled. When something is uploaded, a field giving the date of the last upload is updated. If nothing has ever been inserted, “Never Uploaded” is plotted. When files are uploaded, the date of the last data present in the file is taken as last uploaded and for manual insertion, date must be selected in case the patient forgot to upload sometimes.

Besides, it is not possible to upload if something as already be entered this day (or this week according to the parameter) and unless the patient consent to the correctness of his data, taking responsibility for any mistake, by ticking the button at the bottom of the page.


Ali Maguire
#8
Logout
parameters
Home
Profile
Visits & Exams
Insert parameters
Statistis
Insert Parameters
Questionnaires
Upload
Save
Upload
Save

Insert parameters for:

Blood Pressure & Heart rate

Your last upload: 31/12/2055
Your monitoring device: BP Monitor

Glycemia

Your last upload: 22/04/2022
Your monitoring device: Glucose Meter
Glycemia: mg/dl
Date:

Sleep Quality & physical Activity

Your last upload: 31/12/2033
Your monitoring device: Smartwatch

BMI

Your last upload: 20/04/2022
Height (cm):
Weight (Kg):
BMI:
Date:

● I consent that the data I inserted are correct and I take responsibility of any incorrect inserted data

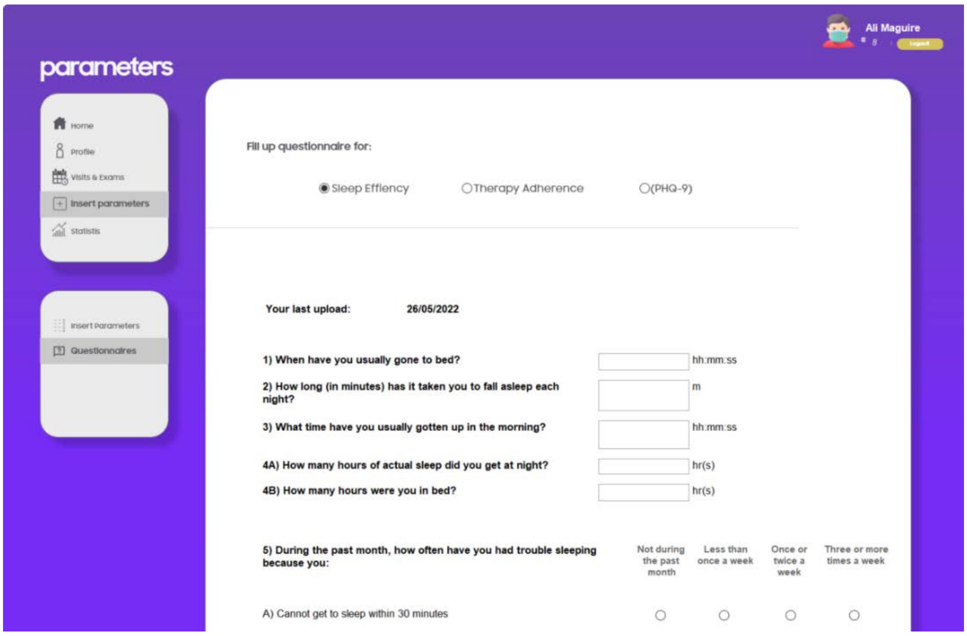
Concerning the questionnaires form, it lists the three different questionnaires, as it has been decided that it would be easier for every user to be able to fill the Sleep Efficiency from home and not during a visit.

The patient should choose the questionnaire he wants to fill between Sleep Efficiency, Therapy Adherence and PHQ-9. When one is selected, he can see when the last update was done, and he is anyway prevented from uploading two times a day or week according to the questionnaires.

All questionnaires are built differently, using writing fields, case to tick and combo box where they need to choose one proposition.

If one question is not filled, a warning is telling the patient he needs to answer all questions, as well as when he is selected two answers (especially with tick buttons).

In the bottom of the form, the date can be selected, and a button pressed to save the result, that are also plotted for the patient to be able to see his score.



Fill up questionnaire for:

● Sleep Effiency ○ Therapy Adherence ○ (PHQ-9)

Your last upload: 26/05/2022

1) When have you usually gone to bed? hh:mm:ss

2) How long (in minutes) has it taken you to fall asleep each night? m

3) What time have you usually gotten up in the morning? hh:mm:ss

4A) How many hours of actual sleep did you get at night? hr(s)

4B) How many hours were you in bed? hr(s)

5) During the past month, how often have you had trouble sleeping because you:	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
A) Cannot get to sleep within 30 minutes	○	○	○	○

Description of queries (with example)

For both parameters and questionnaires, queries are used to get all the uploading dates by simply looking at the acquisition containing the ID of the user. The dates are ordered by decreasing order, which allows to take the first one to plot it.

SELECT A.DATE FROM Acquisition A where A.IDcode_patient=" & IdUser & "AND A.[ID_par_at-home]=" & IDparameter & " ORDER BY DATE DESC"

The insertion of new parameters is done the same way as the insertion of at-home parameters, except that the values are uploaded into the Acquisition database instead of the In-hospital Measurement one.

The questionnaires are them stored into the Questionnaire database

INSERT INTO Questionnaire (IDcode_patient, [compilation date], score) VALUES (" & IdUser & ", #" & SelectedDatet & "#," & FinalScore & ")"

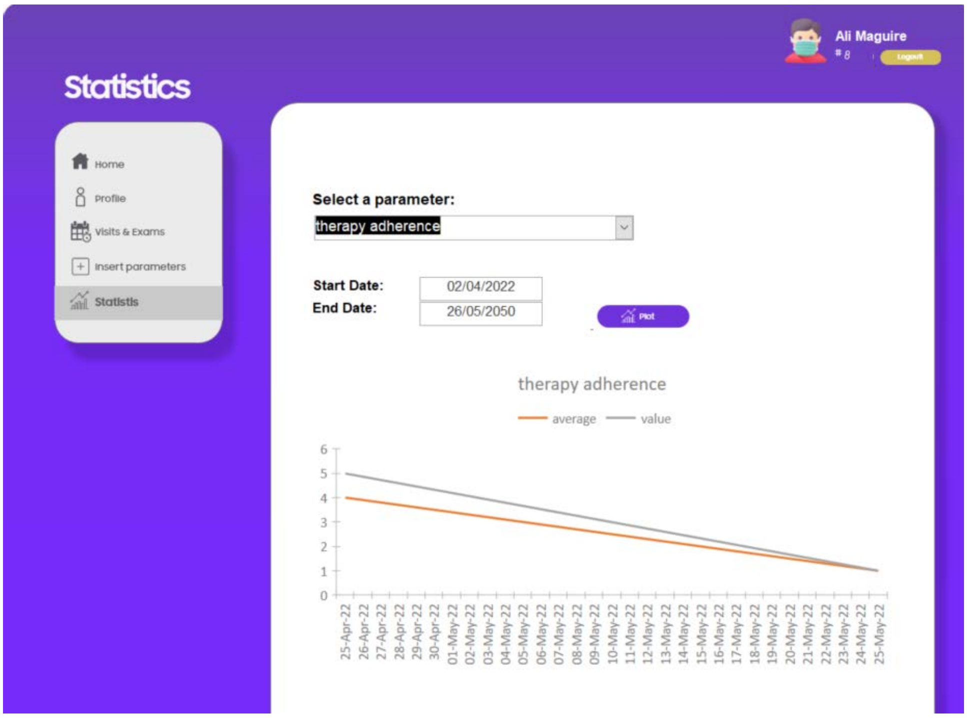
8- ***Patient statistics***

Description of graphical user interface

Patient statistics can be seen by both SP and patient.

Both can see the general trend of each parameter, being in-hospital or at-home parameters or questionnaires.

Patients can see this by looking at his statistic page and selecting the data he wants to visualize, as well as the time period of interest. A graph showing the time evolution of the parameter is then plotted.

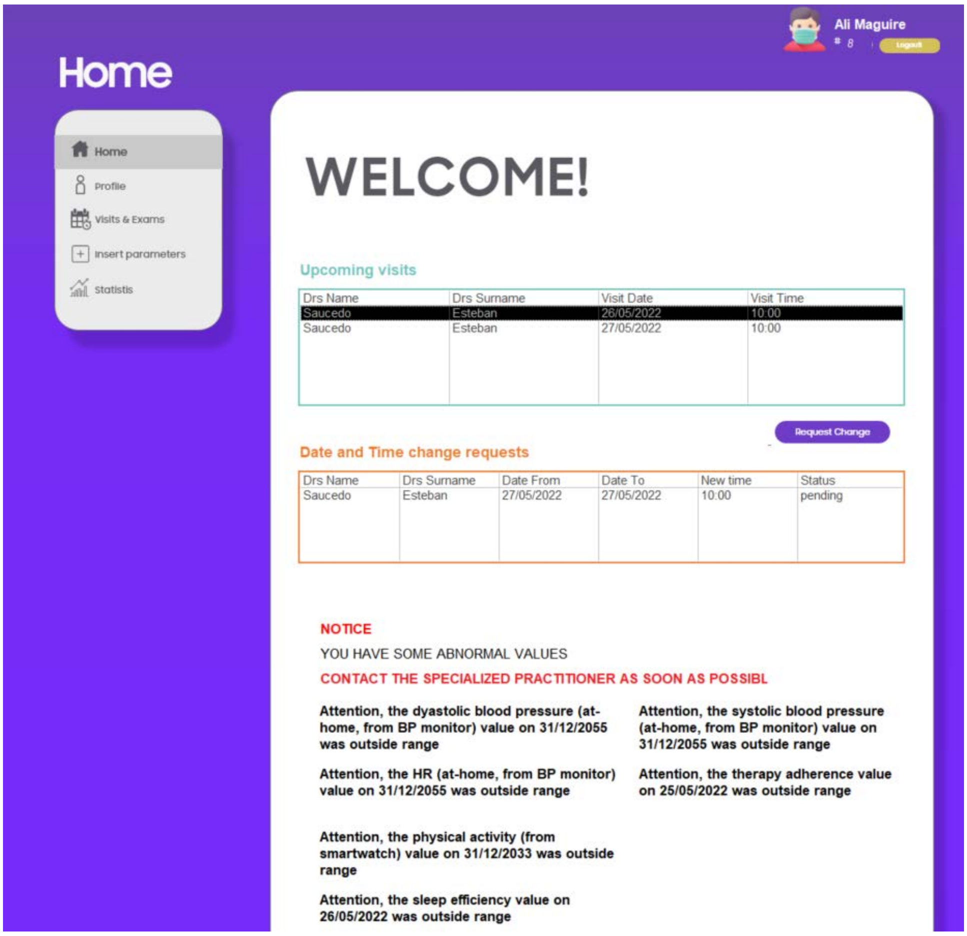


Ali Maguire
# 8
Logout
Statistics
Home
Profile
Visits & Exams
Insert parameters
Statistis
Plot
therapy adherence
average
value
6
5
4
3
2
1
0
25-Apr-22
26-Apr-22
27-Apr-22
28-Apr-22
29-Apr-22
30-Apr-22
01-May-22
02-May-22
03-May-22
04-May-22
05-May-22
06-May-22
07-May-22
08-May-22
09-May-22
10-May-22
11-May-22
12-May-22
13-May-22
14-May-22
15-May-22
16-May-22
17-May-22
18-May-22
19-May-22
20-May-22
21-May-22
22-May-22
23-May-22
24-May-22
25-May-22

Select a parameter: therapy adherence

Start Date: 02/04/2022
End Date: 26/05/2050

He can also have another feedback on his data by going on his home page, where a warning message will appear in case, he inserted some abnormal values (with regards to the thresholds). When there is no problem, nothing is printed.


Ali Maguire
# 8
Logout
Home
Home
Profile
Visits & Exams
Insert parameters
Statistis
Request Change

WELCOME!

Upcoming visits

Drs Name	Drs Surname	Visit Date	Visit Time
Saucedo	Esteban	26/05/2022	10:00
Saucedo	Esteban	27/05/2022	10:00

Date and Time change requests

Drs Name	Drs Surname	Date From	Date To	New time	Status
Saucedo	Esteban	27/05/2022	27/05/2022	10:00	pending

NOTICE

YOU HAVE SOME ABNORMAL VALUES

CONTACT THE SPECIALIZED PRACTITIONER AS SOON AS POSSIBL

Attention, the dyastolic blood pressure (at-home, from BP monitor) value on 31/12/2055 was outside range

Attention, the systolic blood pressure (at-home, from BP monitor) value on 31/12/2055 was outside range

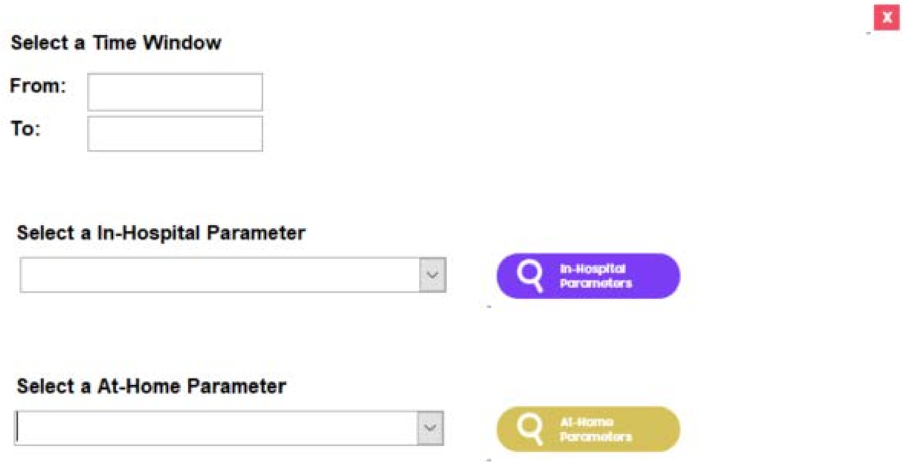
Attention, the HR (at-home, from BP monitor) value on 31/12/2055 was outside range

Attention, the therapy adherence value on 25/05/2022 was outside range

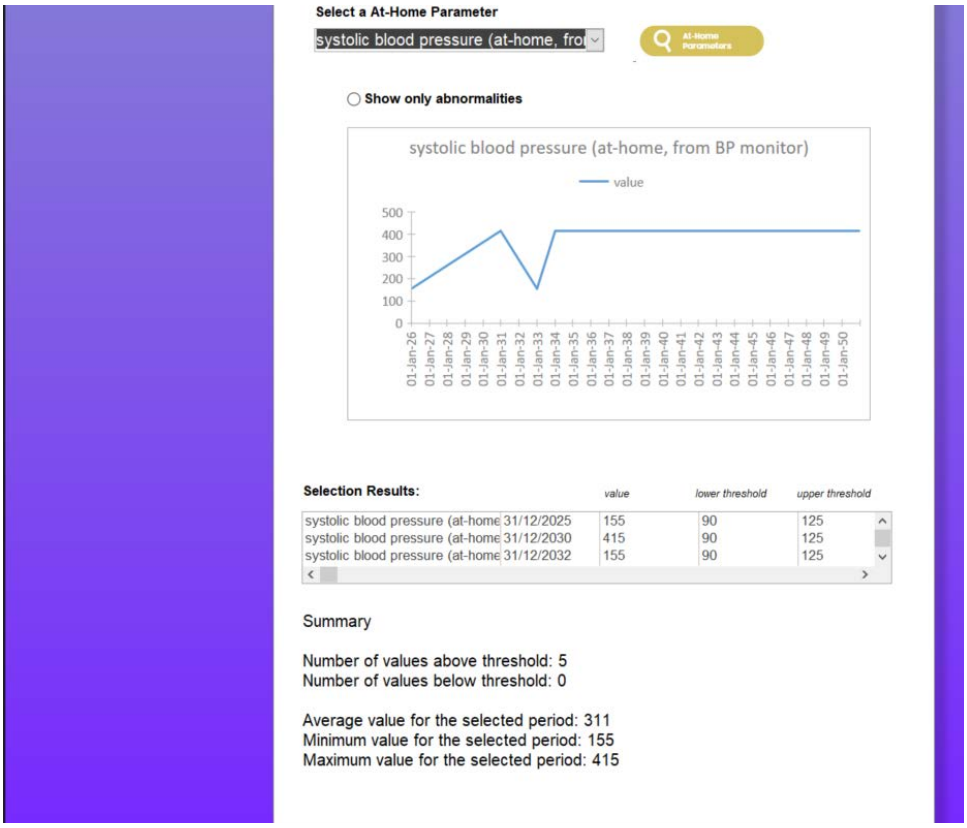
Attention, the physical activity (from smartwatch) value on 31/12/2033 was outside range

Attention, the sleep efficiency value on 26/05/2022 was outside range

The SP can have access to all the information of each of his patient by going to his profile page, and selecting the ‘Parameter report’ button, that will expend the form with fields to select the time window of interest, as well as the parameter, at-home or in-hospital to plot.


X
Select a Time Window
From:
To:
Select a In-Hospital Parameter
In-Hospital Parameters
Select a At-Home Parameter
At-Home Parameters

Once everything has been selected, a graph is shown, with the temporal trend of the parameter. In addition, some statistics containing the average value, the number of normal or abnormal values are also computed, as well as the complete list of values.


Select a At-Home Parameter
systolic blood pressure (at-home, fro
At-Home Parameters
○ Show only abnormalities
systolic blood pressure (at-home, from BP monitor)
value
500
400
300
200
100
0
01-Jan-26
01-Jan-27
01-Jan-28
01-Jan-29
01-Jan-30
01-Jan-31
01-Jan-32
01-Jan-33
01-Jan-34
01-Jan-35
01-Jan-36
01-Jan-37
01-Jan-38
01-Jan-39
01-Jan-40
01-Jan-41
01-Jan-42
01-Jan-43
01-Jan-44
01-Jan-45
01-Jan-46
01-Jan-47
01-Jan-48
01-Jan-49
01-Jan-50

Selection Results:

		value	*lower threshold*	*upper threshold*
systolic blood pressure (at-home	31/12/2025	155	90	125
systolic blood pressure (at-home	31/12/2030	415	90	125
systolic blood pressure (at-home	31/12/2032	155	90	125

Summary

Number of values above threshold: 5
Number of values below threshold: 0

Average value for the selected period: 311
Minimum value for the selected period: 155
Maximum value for the selected period: 415

Description of queries (with example)

For all combo box allowing to see the list of parameters, a query is required to list them all. It takes all parameters, their ID, name and thresholds from the In-hospital parameters (or at-home parameters) databases.

```
SELECT Parameter.IDparameter, name, [lower threshold], [upper threshold]
FROM [In-hospital parameter], Parameter
WHERE [In-hospital parameter].IDparameter = Parameter.IDparameter AND Parameter.IDparameter <> 16
ORDER BY name;
```

Graphs can be realized by using all values contained into the Acquisition or In-hospital Measurement databases comprises between the starting date and the final date, concerning the selected parameter and the selected patients.

```
SELECT date as measure_date, Acquisition.value FROM Acquisition WHERE [ID_par_at-home]=" & IDparameterSelected & " AND IDcode_patient =" & PatientSelected " AND (date BETWEEN #" & StartingDate& "# AND #" & EndingDate & "#)
```

Then, all statistical values are calculated by different use of query. For the sake of simplicity, we will present only the one allowing to compute the average value. It takes all values gathered with the previous query (that is to say all values from the Acquisition database that are common to the parameter and the patient selected between the two selected dates). From that, it is possible to use the AVG function to compute the average value of all the selected items.

```
SELECT AVG(value) AS homeavg FROM [At-home parameter], Acquisition WHERE Acquisition.IDcode_patient=" & PatientSelected & " AND Acquisition.[ID_par_at-home]=" & SelectedParameter & " AND IDparameter=[ID_par_at-home] AND (Acquisition.date >=#" & StartingDate & "#) AND (Acquisition.date <=#" & EndingDate& "#)
```

Statistics on values out of thresholds can be obtained the same way, adding comparison with thresholds present into the Parameter tables.

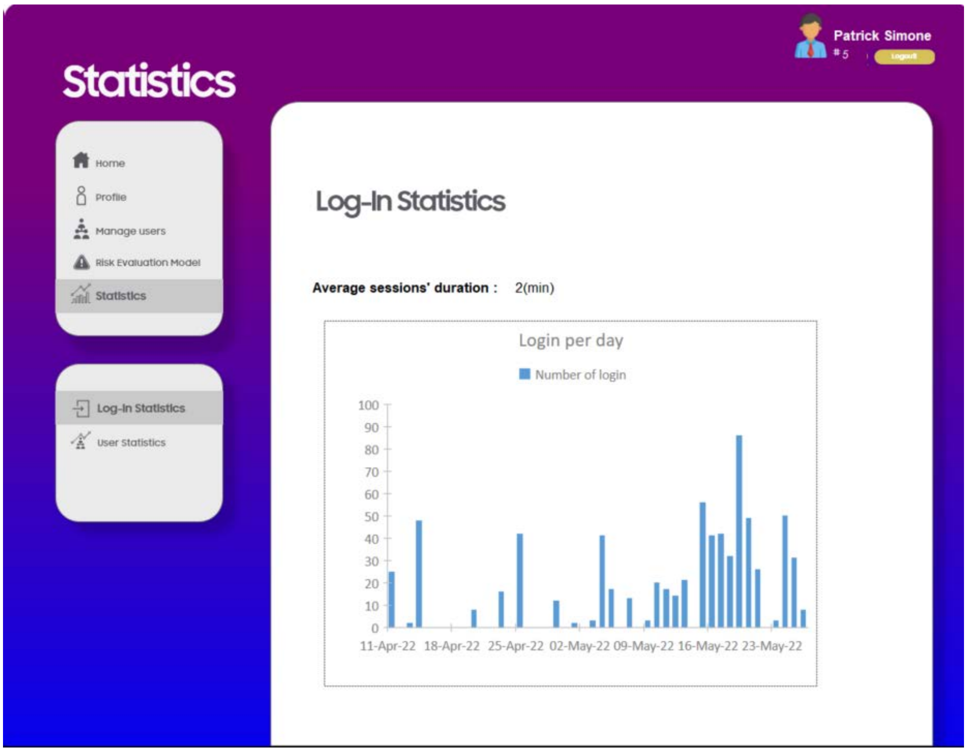
9- ***Software Statistic***

Description of graphical user interface

The TA can also have a look at some parameters, even though it has nothing to do with patient health. It has access to a statistic page, separated into two other pages: the log-in statistics and the user statistics.

The log-in statistics take advantage of the Access table that gathers all information about every single connection and disconnection. It allows the TA to see in average how many users are using the software per day as well as the average session duration. For now, on it is not necessarily useful, but if we were considering a software with online server to host the databases, it would be useful to know how to manage the global infrastructure.

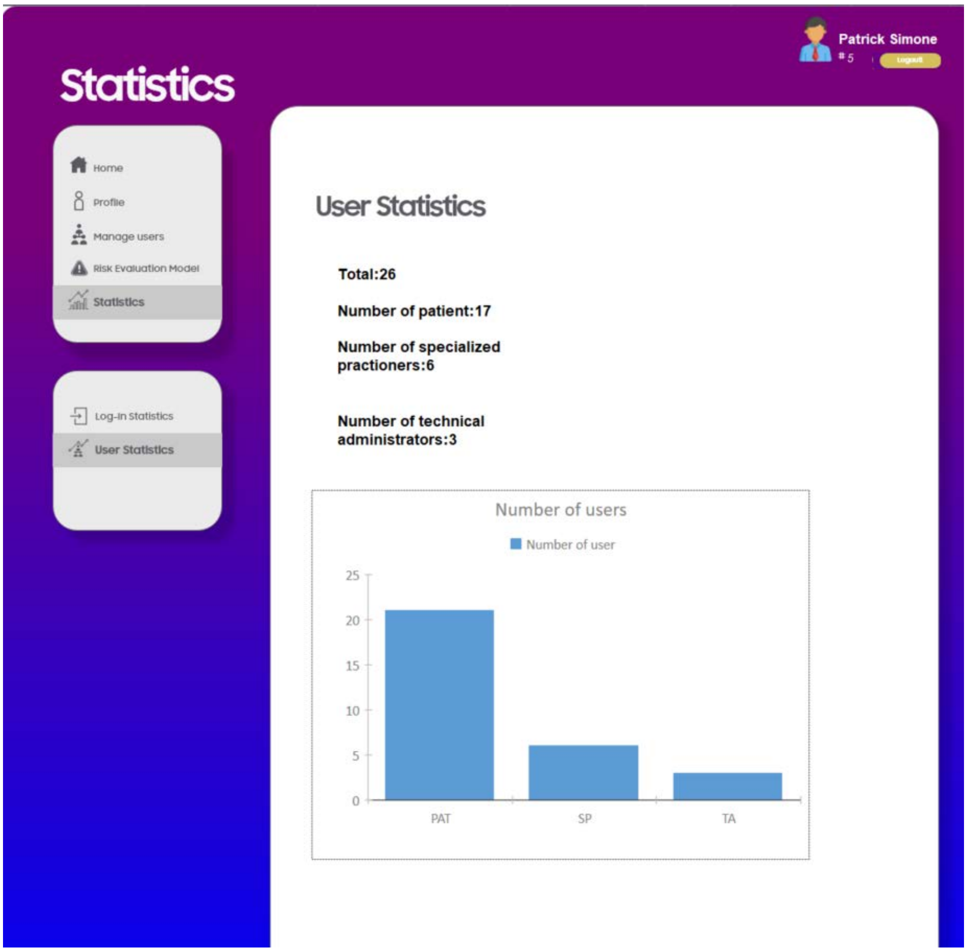
Typically, the TA has nothing to do to visualize the graph once he is on the page. He can observe a histogram, given for each day the number of users that connected, and, on the top, it gives the average sessions' duration.


Patrick Simone
# 5
Logout
Statistics
Home
Profile
Manage users
Risk Evaluation Model
Statistics
Log-In Statistics
User statistics
Login per day
Number of login
100
90
80
70
60
50
40
30
20
10
0
11-Apr-22
18-Apr-22
25-Apr-22
02-May-22
09-May-22
16-May-22
23-May-22

Log-In Statistics

Average sessions' duration : 2(min)

The user statistic, in the other hand, give information about the user themselves, by summarizing the total number of users, as well as their role (patient, TA or SP).


Statistics
Patrick Simone
#5
Logout
Home
Profile
Manage users
Risk Evaluation Model
Statistics
Log-In Statistics
User Statistics
Number of users
Number of user
25
20
15
10
5
0
PAT
SP
TA

User Statistics

Total:26

Number of patient:17

Number of specialized practioners:6

Number of technical administrators:3

Description of queries (with example)

The log-in histogram can be obtained by using a SELECT query, with the COUNT function to count the number of elements corresponding to the condition, as well as the GROUP BY function that will allow to count only the number of elements obtained corresponding for each date. All the information useful are present into the Access database.

```
SELECT Count(Access.userID) AS [Number of login], dateaccess FROM Access GROUP BY Access.dateacces
```

To obtain the average value, a query is done, selecting all duration of session into the Access table and making the average, without forgetting to convert into minute the time that is stored into the database in the format 10:10:10. For that, it is first necessary to get the minutes and the hours from the table. For that we define two different queries, using the MINUTE and HOUR function, after selecting the duration of each line.

QueryGetMinute:

```
SELECT minute(session_duration) AS [minute], IDaccess
FROM Access;
```

QueryGetHour:

```
SELECT hour( session_duration) AS [hour], IDaccess
FROM Access;
```

Final queryl:

```
SELECT Avg(Hour*60+Minute) AS duration_session
FROM Querygethour INNER JOIN Querymin ON Querygethour.IDaccess = Querymin.IDaccess;
```

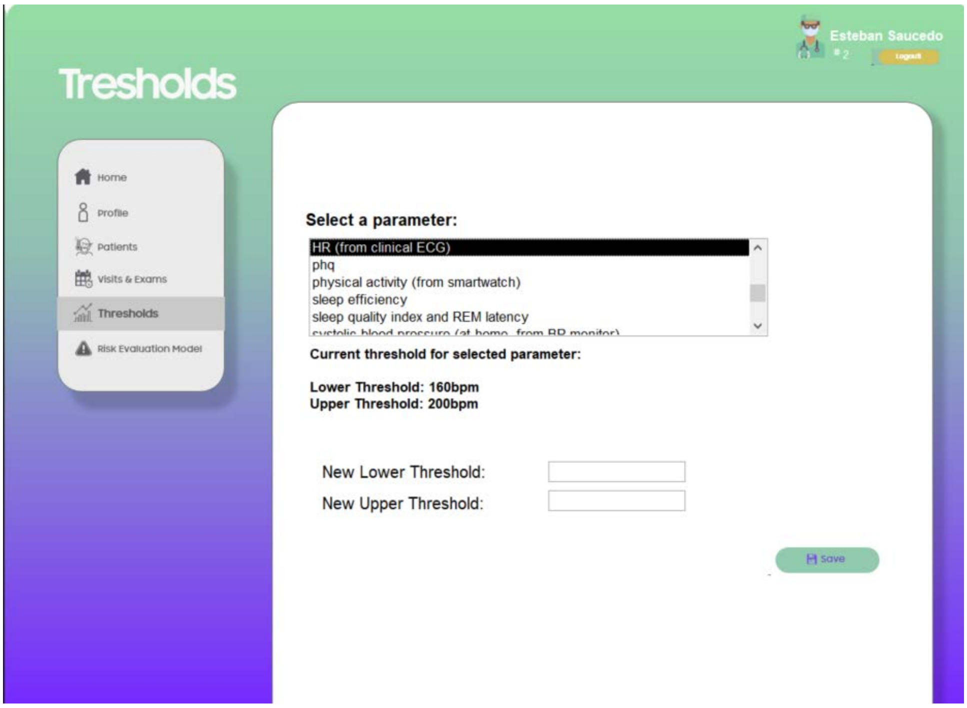
When it comes to the user statistics, everything is working the same way, except that we are working on the User database, with the role instead of the time. A query to determine the histogram can then be the one counting the number of users (number of userID) grouped by their role.

```
SELECT Count(User.IDcode) AS [Number of user], User.role as role FROM [User] GROUP BY User.role
```

10- ***Risk Evalution Model and thresholds***

Description of graphical user interface

SP can insert new thresholds in order to detect automatically parameters that present abnormal values. For that they have a special form “Thresholds”. It consists of selecting the parameters he wants to modify the threshold among the list of parameters present inside a combo box. Once the parameter is selected, the current thresholds are printed, and two text fields allow the SP to enter the new ones. By clicking on the ‘Save’ button, he can save the new values and so the ones that were shown are updated. Those thresholds are then used to tell the SP or the patient in the homepage when something is wrong.



Select a parameter:

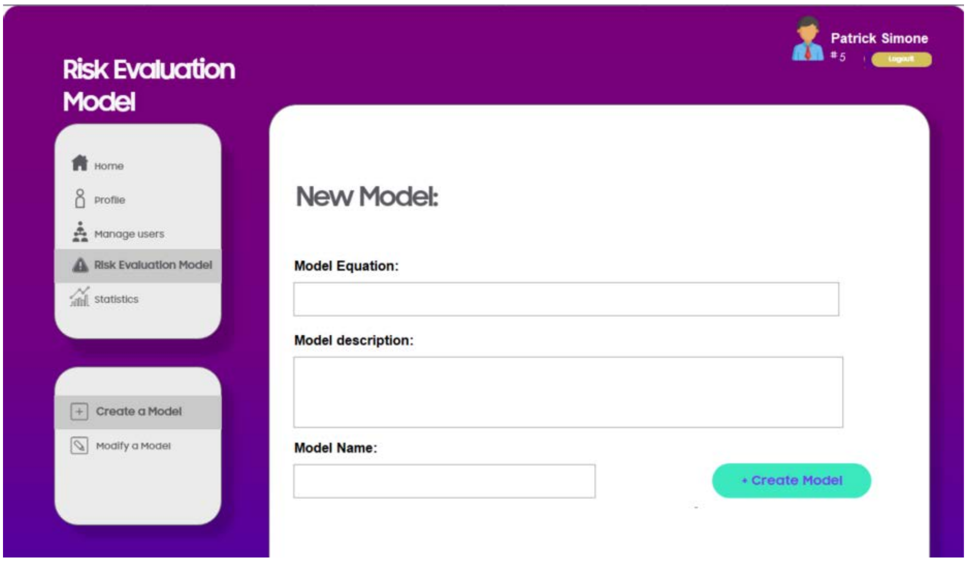
HR (from clinical ECG)
phq
physical activity (from smartwatch)
sleep efficiency
sleep quality index and REM latency
systolic blood pressure (at home, from BP monitor)

Current threshold for selected parameter:

Lower Threshold: 160bpm
Upper Threshold: 200bpm

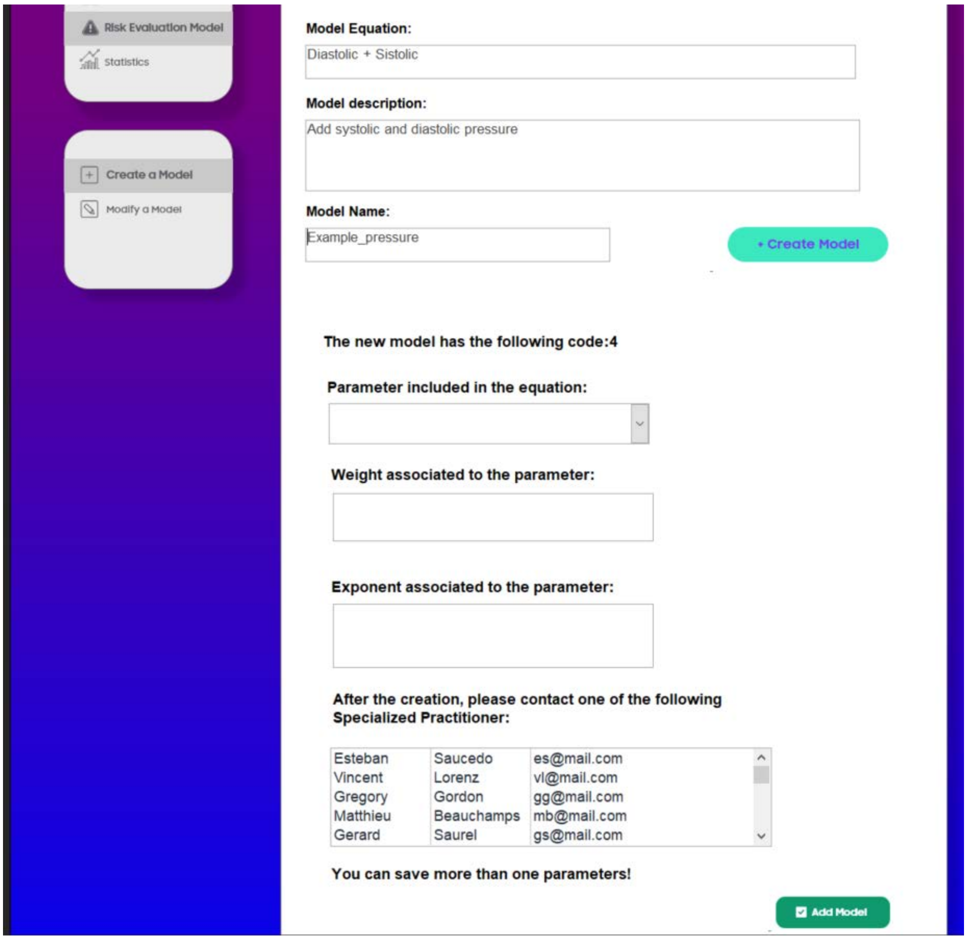
New Lower Threshold:
New Upper Threshold:

A way to enter Risk Evaluation Model has also been implemented. TA are the one able to create one his 'Risk Evalution Model' page. He should enter a model equation (purely descriptive for everyone to recognize it), a description and name. When clicking on the 'Create Model' button, the second part of the form is shown.


Patrick Simone
Logout
Risk Evaluation Model
Home
Profile
Manage users
Risk Evaluation Model
Statistics
Create a Model
Modify a Model
New Model:
Model Equation:
Model description:
Model Name:
+ Create Model

This second part shows the ID of the model to be created and it allows the TA to decide on parameters to consider in the equation as well as its weight and its exponent. All models are some king of weighted sum where each parameter is put at the power of its exponent before being multiplied by its weight and addition the other parameters.

When setting weight and exponent for a parameter, he should click on the 'Add Model' button in order to add the parameter before entering the next one by the same process. If he does not quit the page, the considered model will remain the same.



Model Equation: Diastolic + Sistolic

Model description: Add systolic and diastolic pressure

Model Name: Example_pressure

The new model has the following code:4

Parameter included in the equation:

Weight associated to the parameter:

Exponent associated to the parameter:

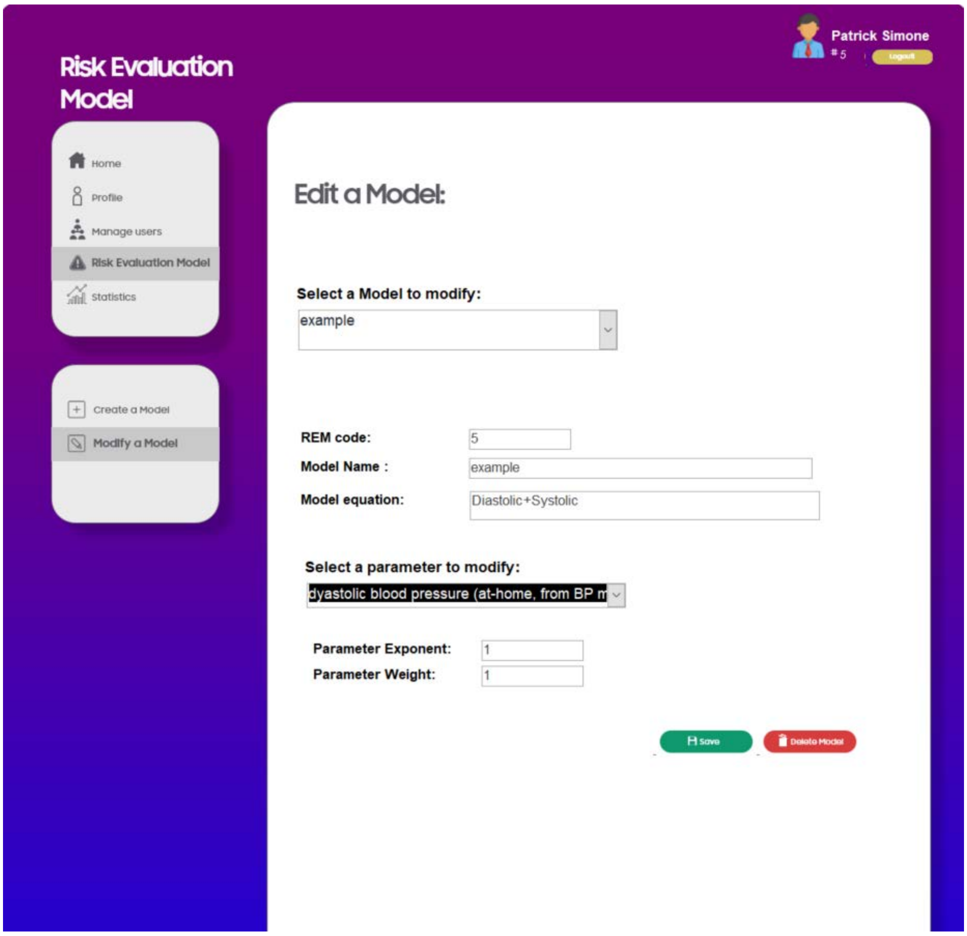
After the creation, please contact one of the following Specialized Practitioner:

Esteban	Saucedo	es@mail.com
Vincent	Lorenz	vl@mail.com
Gregory	Gordon	gg@mail.com
Matthieu	Beauchamps	mb@mail.com
Gerard	Saurel	gs@mail.com

You can save more than one parameters!

The TA can also need to modify a model rather than creating one, he can then go to the ‘Modify a Model’ page. There, he can select a model in the combo box listing all existing models. He can also change the ID of the model for a new one non existing, as well as he can modify the name and the equation.

The interesting part comes when he can select all parameters involved in the model and change the exponent and the weight. He can also decide to delete the model.


Risk Evaluation Model
Patrick Simone
# 5
Logout
Home
Profile
Manage users
Risk Evaluation Model
Statistics
Create a Model
Modify a Model
Save
Delete Model

Edit a Model:

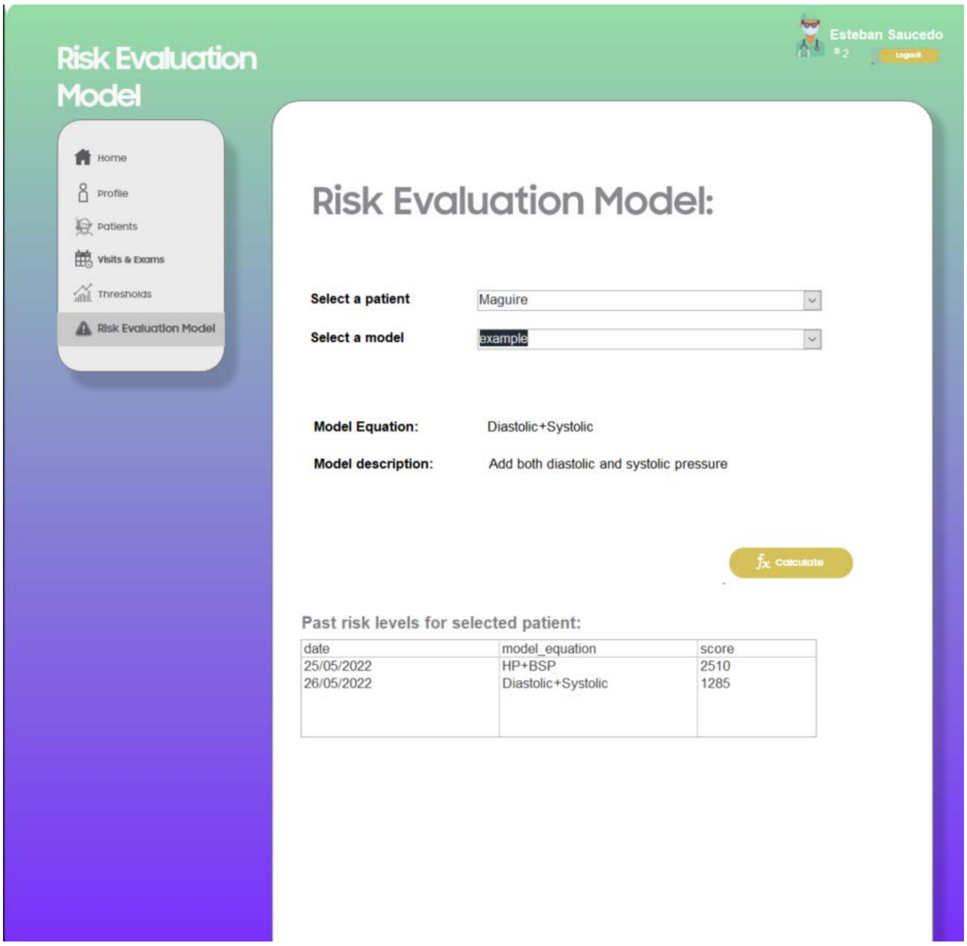
Select a Model to modify: example

REM code: 5
Model Name : example
Model equation: Diastolic+Systolic

Select a parameter to modify: dyastolic blood pressure (at-home, from BP m

Parameter Exponent: 1
Parameter Weight: 1

Risk Evaluation Model are used by the SP, when for example the patient presents some abnormal values, so he can compute the risk factor of one patient according to his parameter's values and one selected model. The SP should select a patient and a model from combo box, he will then see the information of the model and if everything is correct for him, he can click on the “Calculate” button and so the patient risk level will be computed, and he comes to his own conclusions. In addition, all past risk levels are plotted on a table on this page for the SP to be able to consult them.



Risk Evaluation Model:

Select a patient Maguire

Select a model example

Model Equation: Diastolic+Systolic

Model description: Add both diastolic and systolic pressure

Past risk levels for selected patient:

date	model_equation	score
25/05/2022	HP+BSP	2510
26/05/2022	Diastolic+Systolic	1285

We didn’t implement any real meaningful models, because all our assumptions where full of doubts. Though, the risk evaluation model functionality is here and working in order for the SP and TA to come up with a model one day if they feel the need to use one.

Description of queries (with example)

As we already seen it a lot in the report, all list of parameters and patients inside tables and combo box were done in the same way.

On the ‘Thresholds’ page, current thresholds as well as measure units are plotted by selecting them from the at-home parameter or in-hospital parameter (in function of the parameter selected).

```
SELECT [lower threshold], [upper threshold], [measure unit] FROM [In-hospital parameter], Parameter WHERE [In-hospital parameter].IDparameter = Parameter.IDparameter AND Parameter.IDparameter = " & SelectedParameter
```

Then, when new values are entered, it is necessary to insert them in the corresponding database by using an UPDATE query to set the threshold into the in-hospital parameter or at-home parameter databases

```
UPDATE [In-hospital parameter] SET [lower threshold]=" & NewLowerThreshold& ", [upper threshold]=" & NewUpperThreshold & " WHERE [In-hospital parameter].IDparameter=" & SelectedParameter
```

When it comes to the risk evaluation models, things are more complicated. The risk evaluation model will store all the models, including its ID, name, equation and description. The risk factor database will gather for each model (identified through its ID) the parameters involved as well as their weight and exponent. And finally the risk level database keeps a track of all risk levels computed for all patients with any model.

Consequently, when a new model is created, by clicking on the “Create Model” button, Name, ID, Description and Equation are inserted into the risk evaluation model database.

```
INSERT INTO [Risk evaluation model]([model_equation], IDcode_TA, Description, [Model Name])VALUES('" & Equation & "'," & IdTA & ",'" & Description & "','" & Name & "'
```

Once a new model is created and the TA wants to include new parameters inside of it, each time a new parameter is added, it is necessary to insert the ID of the parameter as well as its weight and exponent inside the risk factor database.

```
INSERT INTO [Risk factor](IDparameter, weight, code_REM, exponent)VALUES (" & SelectedParameter & ",'" & Weight & "'," & REMcode & "," & Exponent & ")"
```

When the TA wants to modify the models, SELECT queries are made to get and print the current information and UPDATE queries are used to update the values into the database when there are saved. The principle is the same as everything that was done previously.

Finally, when the SP wants to compute the risk factor for a specific patient, all weight, exponent and IDparameter for the selected model are selected from the risk factor database, as well as all last entered parameters are selected from the Acquisition or In-hospital Measurement databases, using SELECT queries. Those values are used to compute the risk level that is then inserted into the risk level database.

V- Conclusions

To conclude, the time allocated to the realization of the system was short and it was necessary to show flexibility and perseverance, sometimes to respect the deadline and sometimes to respect the constraints imposed by the project. The organization of the database has been also modified to best adapt to the project.

This project has taught us how to work as a team, we got familiar with Access and we also learned how to work on a good-looking interface.

To improve this project and make it smoother to use, there are several improvements that can be made:

- Improving the Graphical User Interface, to make it simpler and user friendly (for example: make the management of exams and visits from the same page)
- Adding a forget password functionality, a rather important feature in the practice.
- Adding a notification option
- Adding a notification possibility from the TA to the SP to influence them to book new visits for new patients registered.
- Allowing the SP to cancel booked appointments for visits or exams
- Adding the possibility of entering even more parameters and different models
- Adding the feature of password security checking for a better security in the system
- Adding the feature of request visit
- Adding the feature for the TA to delete users when necessary (also to lighten the database)

VI- References

Bibliography:

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