Software Engineering Project

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2 Introduction

2.1 Motivation

In the module BTX8081 Software Engineering and Design we realize a case study in a group of four. The project consists of typical tasks like analysis, design and implementation. The complete study counts 25% of overall grade and is based on documents, software and/or presentation.

2.2 Goal

The following description is adopted by the official assignment.

A regional health authority wishes to procure a patient management system (PMS) to manage the care of patients suffering from mental health problems. The overall goals of the system are

1. *To provide medical staff (doctors and health visitors) with timely information to facilitate the treatment of patients.*
2. *To support patients and their relatives in coping with the disease.*

Most mental health patients do not require dedicated hospital treatment but need to attend specialist clinics regularly where they can meet a doctor who has detailed knowledge of their problems. The health authority has several clinics that patients may attend. To make it easier for patients to attend, these clinics are not just run in hospitals. They may also be held in local medical practices or community centers. Patients need not always attend the same clinic and some clinics may support 'drop in' as well as pre-arranged appointments.

The nature of mental health problems may be that patients are often disorganized so may miss appointments, deliberately or accidentally lose prescriptions and medication, forget instructions or make unreasonable demands on medical staff. In a minority of cases, they may be a danger to themselves or to other people. They may regularly change address and may be homeless on a long-term or short-term basis. Where patients are dangerous, they may need to be 'sectioned' – confined to a secure hospital for treatment and observation.

Users of the system include clinical staff (doctors, nurses, health visitors), receptionists who make appointments and medical records staff. Reports are generated for hospital management by medical records staff. Management have no direct access to the system.

The system is affected by two pieces of legislation

1. *Data Protection Act that governs the confidentiality of personal information*
2. *Mental Health Act that governs the compulsory detention of patients deemed to be a danger to themselves or others.*

The system is NOT a complete medical records system where all information about a patients' medical treatment is maintained. It is solely intended to support mental health care so if a patient is suffering from some other unrelated condition (such as high blood pressure) this would not be formally recorded in the system.

In our group, we focus on the role **doctor** and the mental health problem **obsessive-compulsive disorder**.

3 Planning

3.1 Project management

We use Microsoft Teams for communication and regularly meetings. Additionally, we created a WhatsApp group to organize spontaneously.

The data transfer and thus the prevention of data loss is achieved by Git. This project documentation, however, is the only document saved in the Microsoft Teams group “GREEN”, because in this way we can edit the file at the same time without merge conflicts.

3.2 Literature research

3.2.1 What is OCD?

Obsessive–compulsive disorder (OCD) is a mental disorder in which a person feels the need to perform certain routines repeatedly (called "compulsions") or has certain thoughts repeatedly (called "obsessions"), to an extent which generates distress or impairs general functioning. The person is unable to control either the thoughts or activities for more than a short period of time.
Source: https://en.wikipedia.org/wiki/Obsessive%E2%80%93compulsive_disorder#:~:text=Obsessive%E2%80%93compulsive%20disorder%20(OCD),distress%20or%20impairs%20general%20functioning.

3.2.2 How to treat OCD?

The most effective treatments for OCD are Cognitive Behavior Therapy (CBT) and/or medication. More specifically, the most effective treatments are a type of CBT called Exposure and Response Prevention (ERP), which has the strongest evidence supporting its use in the treatment of OCD, and/or a class of medications called serotonin reuptake inhibitors, or SRIs.

Exposure and Response Prevention is typically done by a licensed mental health professional (such as a psychologist, social worker, or mental health counselor) in an outpatient setting. This means you visit your therapist’s office at a set appointment time once or a few times a week.

Medications can only be prescribed by a licensed medical professional (such as your physician or a psychiatrist), who would ideally work together with your therapist to develop a treatment plan.
Link zum Dokument, plus eine kurze Beschreibung. Was ist die Quintessenz?
Source: https://iocdf.org/about-ocd/ocd-treatment/

3.2.3 International classification of diseases 10

According to ICD 10, OCD can be divided as follows:

ICD10 Code	Code Description
F42	Obsessive-compulsive disorder
F42.0	Predominantly obsessional thoughts or ruminations
F42.1	Predominantly compulsive acts [obsessional rituals]
F42.2	Mixed obsessional thoughts and acts
F42.8	Other obsessive-compulsive disorders
F42.9	Obsessive-compulsive disorder, unspecified

Source: http://www0.sun.ac.za/aotc/icd10/mf_icd10_codelist.php?showmaster=mf_icd10_node3&icd10_block=F00-F99&icd10_subblock=F40-F48&icd10_n3=F42

3.3 Interview

After the diligent Literature research, the interview was created as part of the first section of the Project, the *Design Thinking*. Since the Project has its roots in the study of human psyche, our first instinct was to contact the only Medical Staff that, according to our prior information, worked at a psych ward, Prof. Dr. Holm. We considered the fact, that Prof. Holm might be fully booked and therefore we decided to have other contacts: Prof. Dr. Lehmann and Prof. Dr. Nüssli.

For the Interview, we created five open-ended questions, that would have allowed for spontaneous following questions. The interview would have been performed in German (or Swiss German, depending on the personal preference of the interviewee). Below are the intended interview questions that were created for this task.

1. Was sind die Herausforderungen, wenn Daten zu psychischen Erkrankungen erfragt werden?
2. Gibt es Unterschiede bei der Anamnese von physischen und psychischen Erkrankungen?
    a. Wenn ja, welche sind das?
3. Was sind besondere Daten, also krankheitspezifische Angaben, die beim Patienten / bei der Patientin erfragt werden müssen?
4. Bezüglich Zwangsstörungen: Wann gilt ein Patient / eine Patientin als gefährlich?
5. Um die Diagnose stellen zu können, müssen diverse Bedingungen erfüllt sein. Diese lassen sich überprüfen, in dem man eine Rating-Skala hinzuzieht, z.B. die Yale-Brown Obsessive Scale (Y-BOCS). Macht es Sinn, ein User Interface auf Basis einer solchen Skala aufzubauen?

On the 20th October 2020 Prof. Dr. Holm was contacted to establish the Interview Date. Shortly after, Dr. Lehmann and Dr. Nüssli were also contacted. Sadly, to this date, no answer has been given.

Although the interview was not conducted, the questions that arose can still be answered with the help of the Literature research.

1. Was sind die Herausforderungen, wenn Daten zu psychischen Erkrankungen erfragt werden?

Diagnosing a Person with a mental disorder is very challenging because there are no reliable biomarkers for the Doctor to examine at a first glance. Giving such a diagnostic to a Patient is only done after many structured clinical interviews, but also these interviews can be biased, as they are based on the patient's affective state and recall ability. (source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5483244/)

2. Gibt es Unterschiede bei der Anamnese von physischen und psychischen Erkrankungen?
    a. Wenn ja, welche sind das?

According to the literature found on the internet, there is a clear difference between physical medical history and mental medical history. A physical exam focuses mainly on the patient's body, but also includes the family medical history and the social situation of the patient. Whereas a psychiatric exam focuses mainly on the patient's mind, family history and his surrounding environment.

3. Was sind besondere Daten, also Krankheit spezifische Angaben, die beim Patienten / bei der Patientin erfragt werden müssen?

Since OCD does not show any visible biomarkers, the Patient's mind needs to be analysed. It has proven very hard to find a reliable source, a scientific Paper or a standardised test for OCD, nevertheless our team found a website that provided some examples. The Interview is structured in three parts. The first part consists of open questions, where the Patient's perspective on the Disorder is analysed. The second part of the interview focuses on the intrusive thoughts that the Patient has experienced, and the third part consists of the compulsions that the Patient exhibits. Below are the highlights of the interview questions. (source: https://psychscenehub.com/psychpedia/obsessive-compulsive-disorder-diagnostic-interview/)

- Are you constantly checking things, feeling dirty or having annoying thoughts pop into your mind over and over?
- Do you ever have thoughts or impulses that come into your mind even though you try not to have them? How hard is it to resist the thoughts or actions?

- What would happen if you didn't perform the action? Do you have any other ways of neutralising the distressing thoughts?

Searching the internet has provided us also with the Obsessive-Compulsive Test from Yale Brown University. This test is designed to pinpoint the severity of the OCD. The Patient fills out a questioner of 10 questions which can be given 0 to 4 points (0 referring to *None* and 4 referring to *More than 8 hr/day*. The sum of the points reflects the severity of the OCD in the Patient. Scores between 8-15 represent a Mild OCD, 24-31 indicate a Severe OCD and a score of over 32 Points indicate Extreme OCD. Source (https://www.iwanttochangemylife.org/tools/obsessive-compulsive-disorder-test-yale-brown-ocd-scale-ybocs.htm)

4. Bezüglich Zwangsstörungen: Wann gilt ein Patient / eine Patientin als gefährlich?

Patients with OCD do not pose a threat to others, but more to themselves. In a medical paper that was found on the internet, 36% of patients with OCD report suicidal thoughts and 11% have attempted suicide (source: https://www.psychiatrist.com/JCP/article/Pages/suicidality-obsessive-compulsive-disorder-prevalence.aspx).

Another study, entailing of 50 patients diagnosed with OCD, was made at the Dayannand Medical College and Hospital, Ludhiana, Punjab, India. The aim of the study was to assess depression and risk of suicide in patients diagnosed with OCD as per ICD-10 Classification. This study has showed that 70% of the females had suicidal Ideations whereas 40% of males showed such ideations. Over the study period, 52% of the patients have shown suicide ideations and 18% of them actually attempted suicide. (source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5479089/#:~:text=As%20per%20data%20Thirty%2Dsix,plans%20or%20actually%20attempt%20suicide.) .

Although patients with OCD have a higher propensity to commit suicide, they are no less likely than general population to commit violent crimes that result in murder.

5. Um die Diagnose stellen zu können, müssen diverse Bedingungen erfüllt sein. Diese lassen sich überprüfen, in dem man eine Rating-Skala hinzuzieht, z.B. die Yale-Brown Obsessive Scale (Y-BOCS). Macht es Sinn, ein User Interface auf Basis einer solchen Skala aufzubauen?

The Yale Brown Obsessive Compulsive Scale Calculator is an online tool that helps the patients get a better understanding on how a medical exam will look like. After completing the test, a disclaimer is given to the user. Further implementation of such a Scale, where the data is submitted to the referring Doctor to be further analysed, is the logical step in the eHealth.

4 Results

4.1 Personas

Our team, team Green, has chosen the target user group *Doctor in a clinic* therefore, the personas that were created, refer specifically to the medical staff. Although the patient represents an important actor in our Project, he is excluded from our Persona definition.

4.1.1 Persona Dr. Peterman

Dr. Petersman has been working in the psychiatry Department since he was 30-year-old. Over the last years, he has noticed that his colleagues have developed a very illegible handwriting, and this leaves room for interpretation when he needs to treat one of his colleague's patients.
He has helped patients with numerous mild conditions, of different ages. In his 20 years of experience, he has found that the best method of dealing with OCD Patients was by traying to solve the cause and not the symptoms of the Obsessions. He has noticed that some patients are very bias when it comes to describing the most recent OCD episodes.

Name	**Dr. Peterman**	
Age	50 years old	

Role	Chief Doctor, Psychiatry, University of Psychiatric Services Bern	
Skills	Empathy and compassion; emotional resilience and initiative to work, capacity to monitor developing situations and anticipate issues	
Goals	View and edit new patient data. Ability to search and find Patient data	
Pain points	Reading the handwriting from other doctors that is illegible	

Table 1: Persona 1

4.1.2 Persona Dr. Noob

Dr. Noob just finished his studies and is not trained in the proper ways of the MHS-PSM system. Regardless of this, he has a notion on how things should work in a clinic. When an OCD Patient gets into his office, he goes out of his way to help in every possible way. He is open to new treatment options and mostly, he wants to use digital solutions to support his decisions. Should such an application arise, this would mean an easier workflow and could re-imagine the process for OCD patients that would work in this environment.
He sometimes has patients that are *walk-in patients* and finds it very difficult to properly treat them, since he doesn't know on what type of medication they are currently on. He wishes there was an easy way to find out the current patient medication without a big hassle and implicitly, to share this information with his fellow colleagues.

Name	**Dr. Noob**	
Age	30 years old	
Role	Doctor, Psychiatry, University of Psychiatric Services Bern	
Skills	Digitally inclined, change oriented, empathic, highly initiative to work and self-growth	
Goals	Help as many patients as possible, by treating the cause of the OCD and not the symptoms	
Pain points	Not having access to the most recent patient medication plan	

Table 2: Persona 2

4.1.3 Persona Dr. Fix-It

Dr. Fix-It is the commanding doctor at a well renowned psychiatric hospital. Besides her work with patients she oversees other non-patient related tasks.
During her shift she wants to serve as good as possible patients that arrive at the main Headquarters of the chain clinic. For this reason, she asked around to find developers who could find a reliable way to summarize information. Once this information was acquired, she included the Digital solution in her workflow, further helping her patients.
Although Dr. Fix-It is a workaholic, who likes to work many hours a day, she wants to have quality time to spend with her husband and children over the weekend. Being with her family should not hinder her work, that is why, she can see the patients collected information at any time. With the help of this information, she can act accordingly and, in any case, restructure the workflow of the upcoming week.

Name	**Dr. Fix-It**	
Age	45 years old	
Role	Doctor, Psychiatry, University of Psychiatric Services Bern	

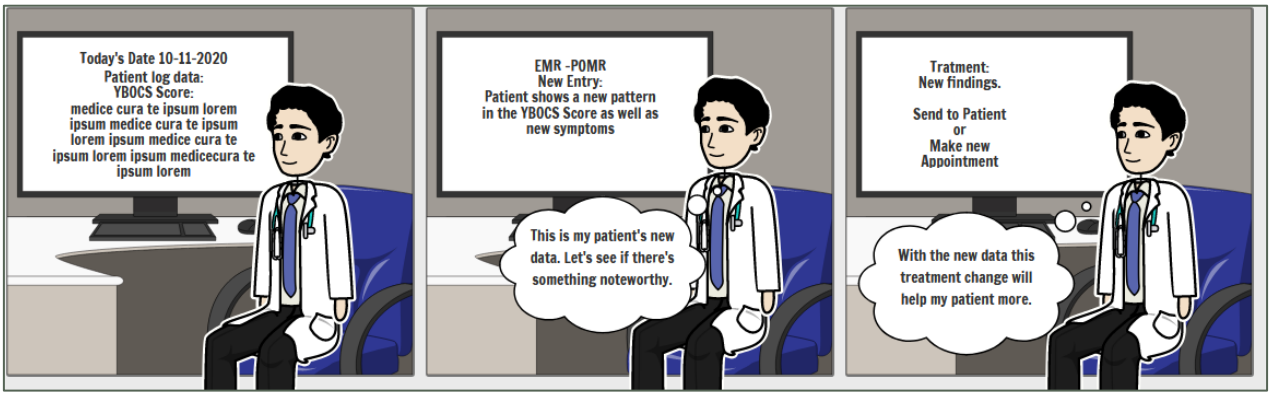
Skills	Digitally inclined, change oriented, empathic	
Goals	Better herself and help change the world one Patient at a time	
Pain points	Not having enough time to analyze the Patient data	

Table 3: Persona 3

4.2 Storyboards

The storyboards were designed from the perspective of the doctor. The project focus will be on the following storyboards. The stories behind them were promising and offer a variety of use cases.

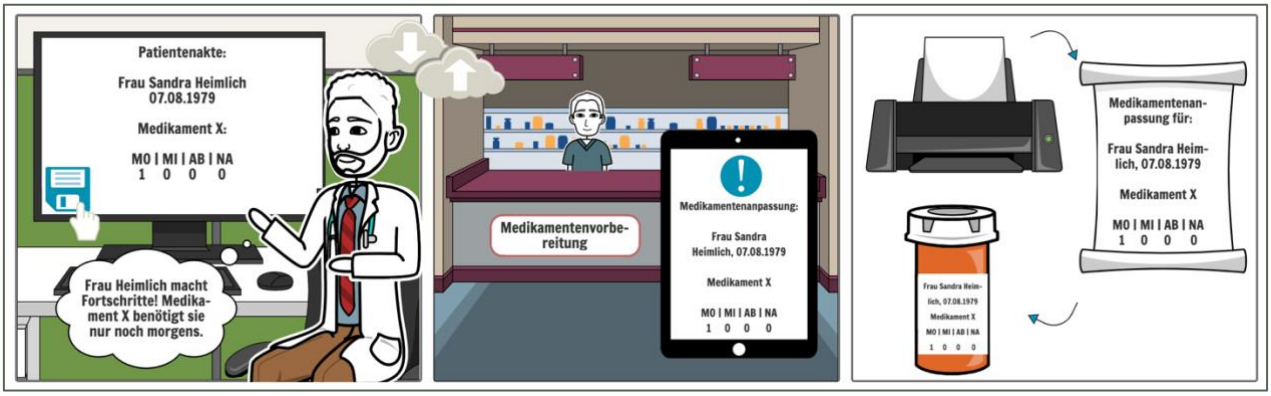
4.2.1 Doctor: Patient Documentation at the office



Ill. 1: Storyboard Patient – Doctor Anamnesis

This storyboard shows a doctor after receiving the patient's data from a remote application. This data is based on daily entries. It has a The YBOCS Score and free text. After examining the information, the physician can write into the electronic medical record his finding and use it in a problem oriented medical record within the EMR. Finishing the analysis, the doctors is either able to send a change in the therapy or eventually organize a date for further discussion.

4.2.2 Doctor – nurse: medication process



Ill. 2: Storyboard doctor - nurse (medication)

In this case, the doctor changes the prescription of a stationary patient. He commits the update to a web application. Employees of care have access to this platform as well but with different roles. They

either get a notification about the change or read the latest updates. The caregiver prints out the latest prescription in form of a sticker. Afterwards, he puts it on the patients' specific medicine box. The nurse will have the updated and correct medicine before their next patient visit. By this, the two of them do not require to exchange a verbal report, since the communication is done digitally.

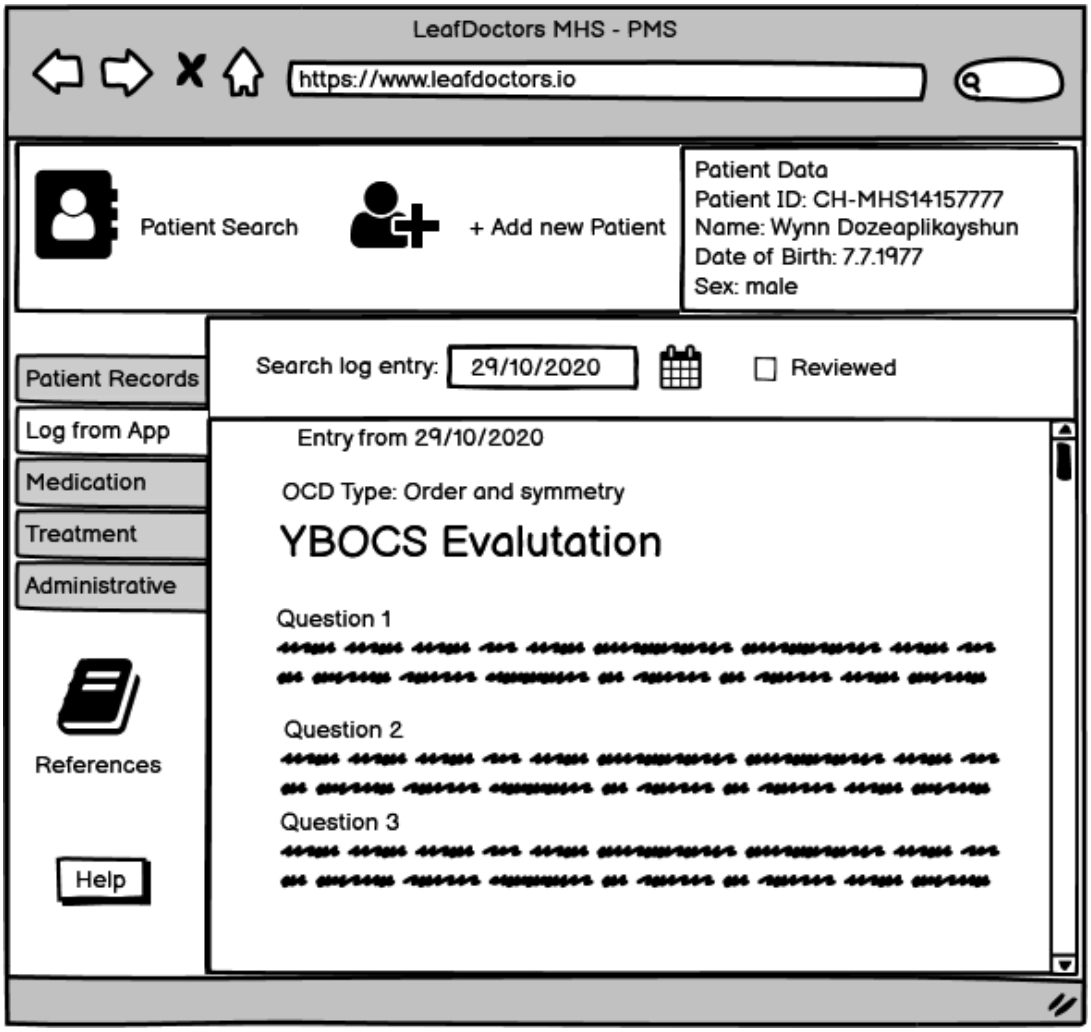
4.3 Main features

The main features were discussed out of the point of view of a doctor.

4.3.1 Functional features

4.3.1.1 Anamnesis based on patient's documentation

For a psychiatric disorder like OCD, it is very important that a thorough documentation is properly created for the first 14 days. This is the usual case when an OCD patient visits a doctor. Most documentation happens during the meeting with the physician and may be very inaccurate. This App will log, with cooperation from the patient, the crucial time the characteristics and discomfort patients suffer. After each patient Log, the doctor receives the information that the Patient has written in the App, this leading to the first assessment of the doctor.



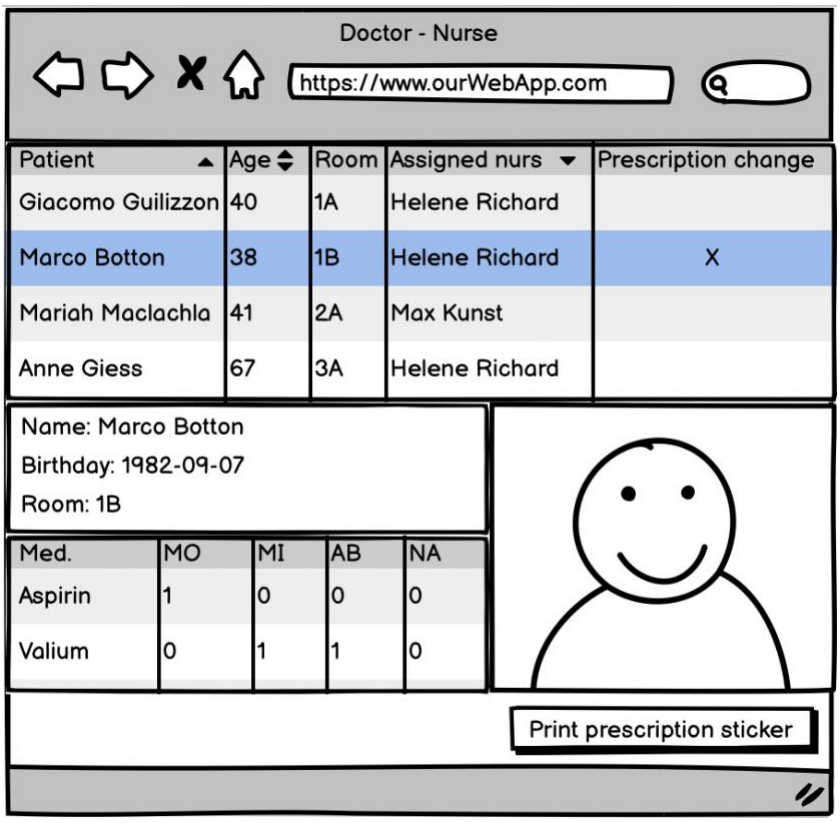
Ill. 3: Screen prototype of recorded data from patient in the doctor's app.

After receiving the data from the patient, the doctor will be able to review all the information gathered up to that time. Will be able to isolate the factors that define OCD characteristics and will be able to do a first diagnose. Further use of the app and the log features will also work to fine tune the therapy chosen by the doctor.

4.3.1.2 Electronic health recording (EHR)

While patients stay in a clinic, their medication plan can change over time. The adjustments can happen at any time of the day by different persons. Furthermore, it happens that the physical patient record can't be found because it was handed out too many places.

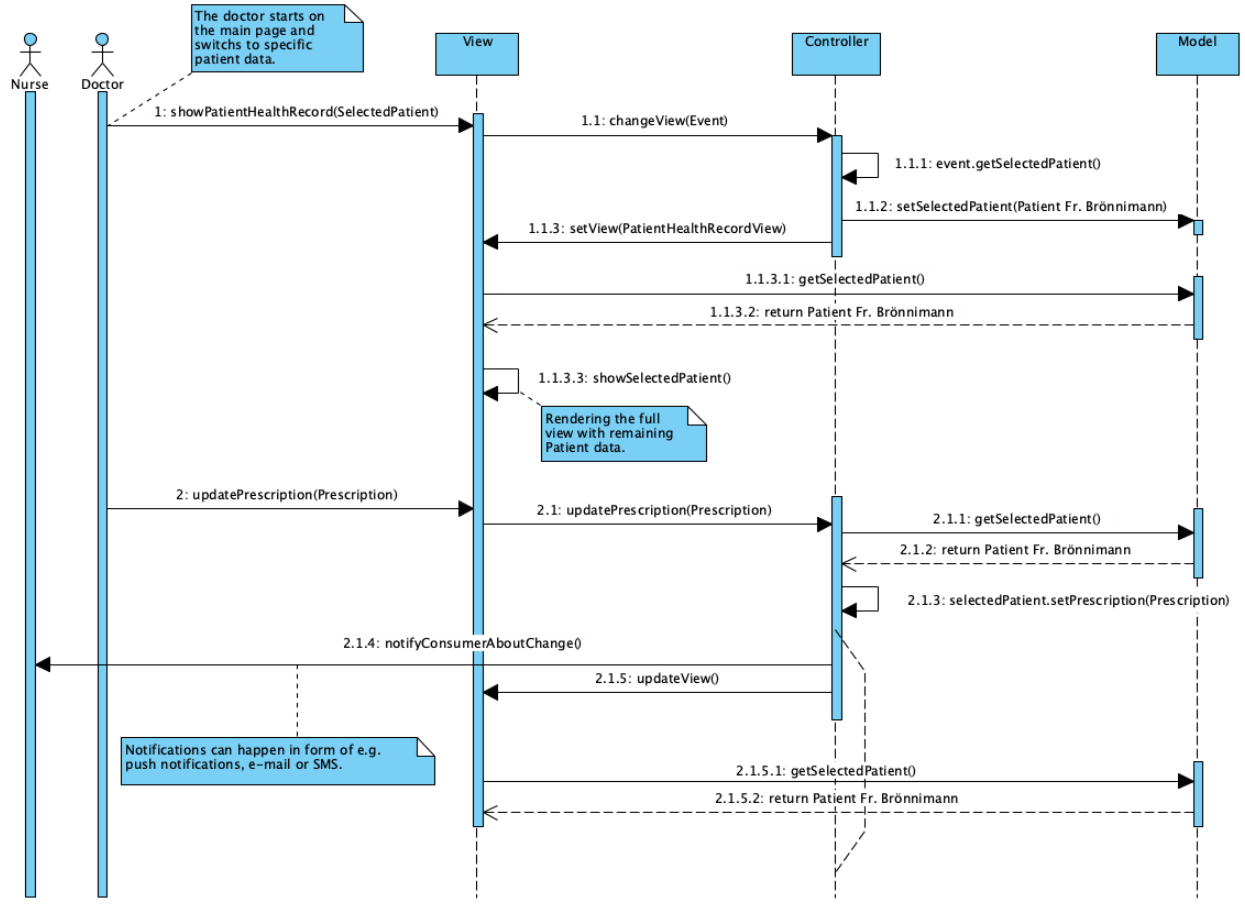
Basically, this prototype is about to make changes within a medical process visible to others. In this case, it is about the change of a prescription. The caregivers need to know when their patients received a new doctor's order as fast as possible.



Ill. 4: Screen prototype of prescription changes in medical health recording

After the doctor has made changes in the medication, the application checks the prescription change column. Date and time of this action will be saved in the background for documentation purposes. The thickened visual aid of the column will disappear after the responsible staff has notified and reacted to the change.

The following sequence diagram shows the process of updating data and notifying actors in detail:



Ill. 5: Sequence diagram shows the process of updating data in a patient health record and notify the actors.

The event shown in 1.1 refers to a row-click-event. It is assumed that Vaadin offers a possibility to observe user actions. An event like this holds the information about the clicked data record.

A web application like this supports the nurse because he / she is involved in the medication process. Even if doctor and caregivers do not meet, the modifications are visible to every authenticated party. In a next level and to extend the feature, the change could also refer to any kind of therapy adjustment.

4.4 Project Scope

The focus lies in the anamnesis of obsessive-compulsive disorders. We want to know what a practicable way is of determining the disease with support of a web application. This includes a logical structure of the user interface components and specific user input fields. In particular, it is about adapting medical data and notifying other actors of this adaptation. An interface for self-documentation of the patient is also to be established. Health professionals should be able to access this documentation.

4.5 Out of Scope

The web-application is not a medical device. Further this system will not replace the interactions between medical staff and patients, and it is not a complete electronic health record.

5 Discussion

5.1 Storyboards

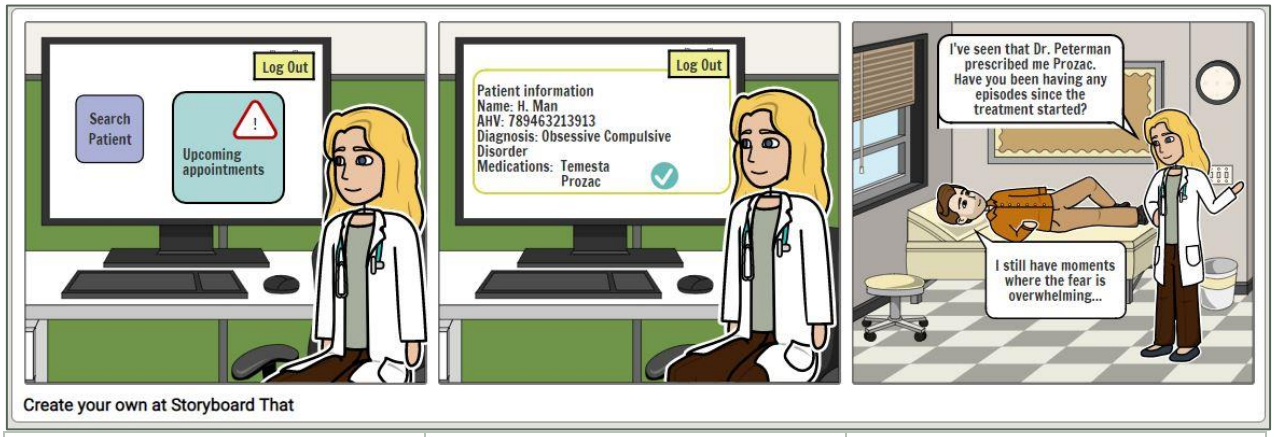
In the *Design Thinking* task, nine storyboards were created, of which two were selected as the base of the prototype that would be designed. Each storyboard has the story description written under each storyboard block. The main perspective stays the role of the doctor. However, to get different ideas, each of us took a different role.

5.1.1 Doctor storyboard

Patient is on his way to the Psych clinic. On the way there, he cannot seem to stop thinking about his latest fixation, the stove. He has been having this constant fear that his apartment will catch fire, because he felt the stove On.	The Patient explains his fears to the Doctor, describing exactly how his latest episode started and how long it lasted. The Doctor listens patiently to the Patient, in order to give the best diagnostic.	The Doctor announces his diagnostic and prescribes *Prozac* for the Patient. The Patient zooms out, letting his fear overwhelm him.

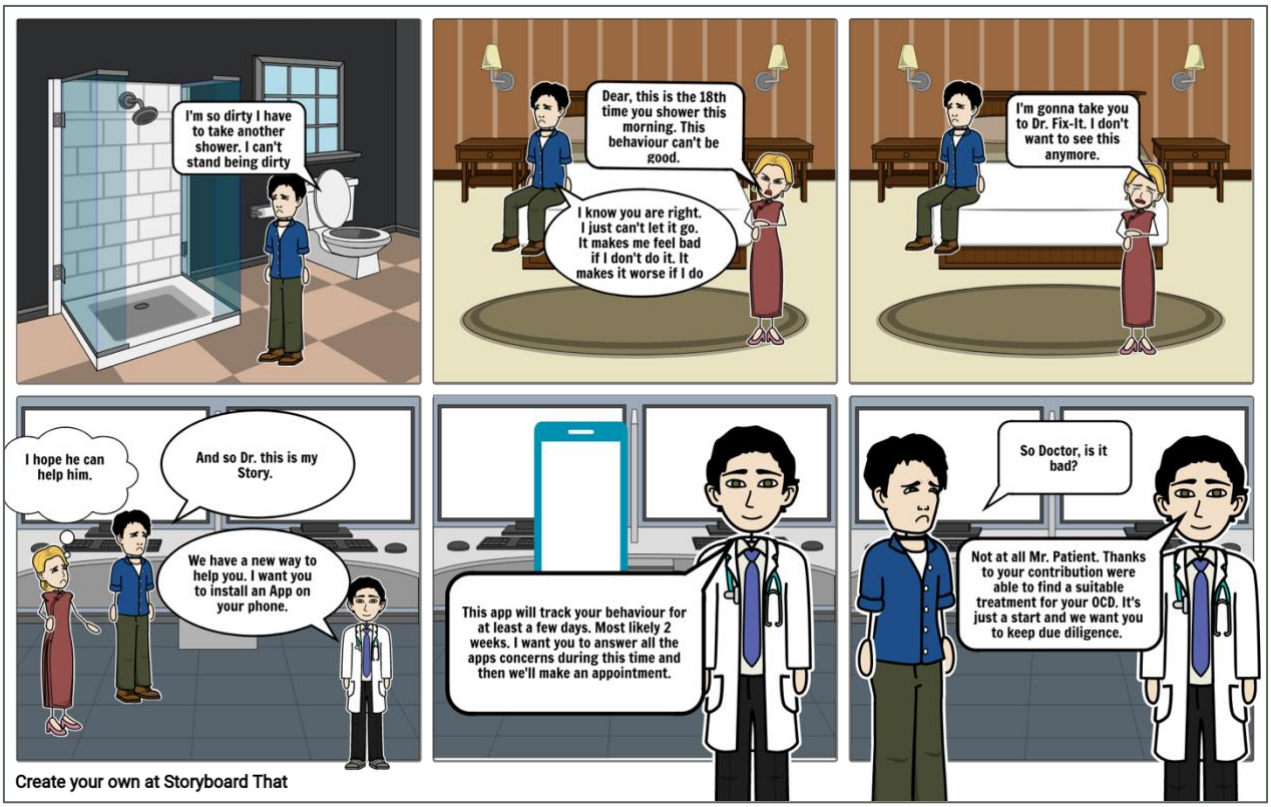
The Doctor uses the MHC-PMS System to log into his account. He uses his MedReg Number to Authentify his acknowledged Status as Chief Dr.	When selecting a Patient from the Database, he can review, but also edit the Information available.	The Doctor presses on the *Green* button and now he can edit the Patient information. Once he is satisfied with the results, he will press the *Blue*

In the System he can see the Upcoming Appoints that the Medical Assistant created.	If he wishes to just read the Information, he will press on the *Blue* button.	button to send the information to the Database.



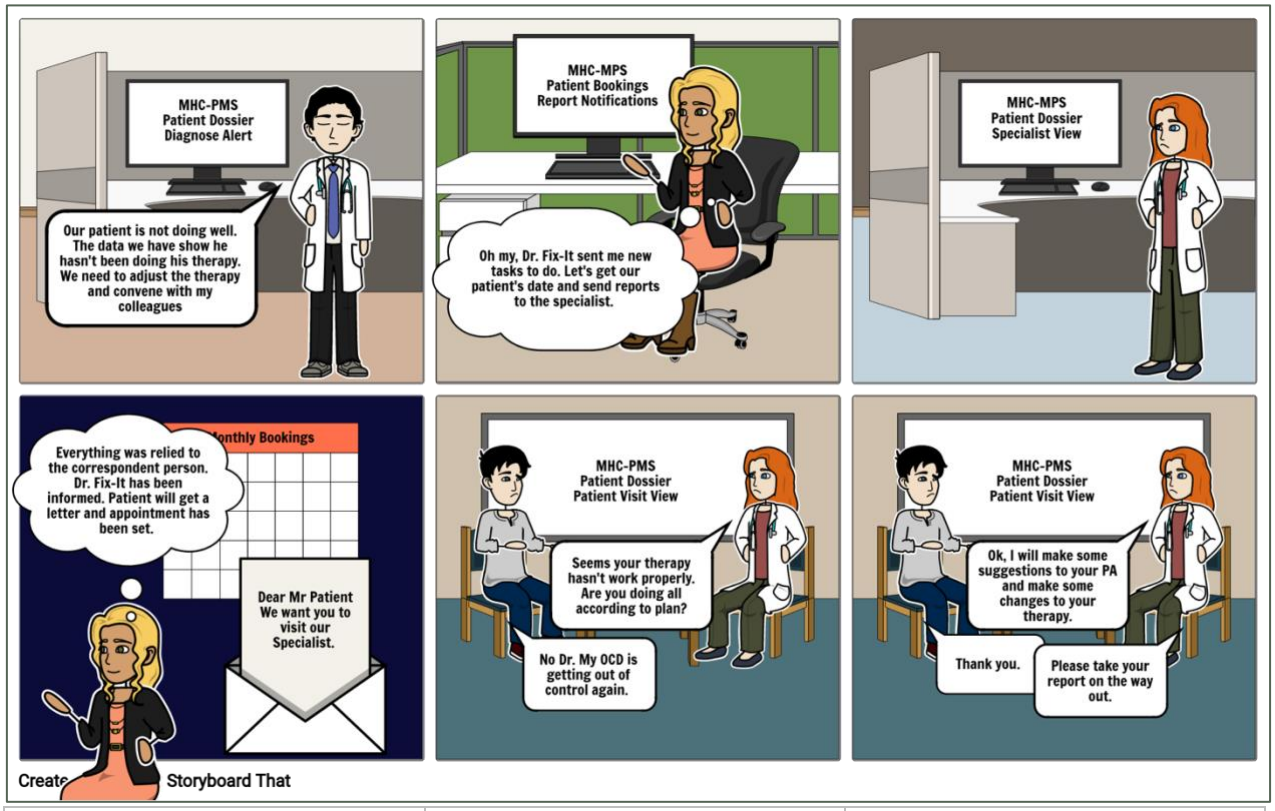
Another Doctor logs in the MHC-PMS system. She gets a notification, that a Patient will arrive soon for a check-up. She can use the *Search Patient* button to search for Patients.	She carefully reads the Patient Information and plans on how the Appointment will be structured.	The Appointment goes as planned and the Patient seems to have improved.

5.1.2 Patient storyboard



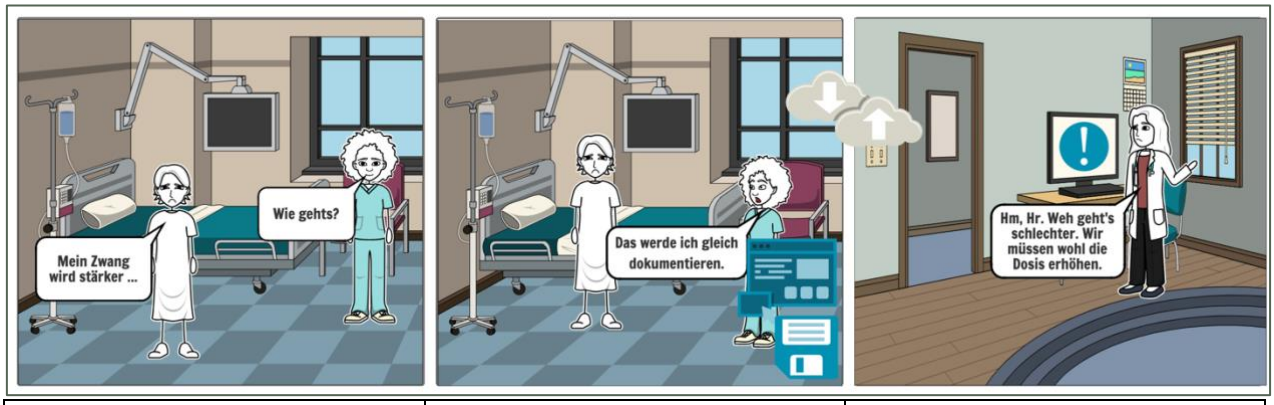
The patient is having another acute episode of OCD.	This leads to a discussion with a family member.	It is decided that a personal physician has to be involved.

The patient and his wife made an appoint with the specialist and told what has happened so far.	In order to have an accurate diagnosis, the patient is asked to track all his OCD characteristics with an app.	After all data is gathered, the personal physician is able to do a first diagnose and start treatment and therapy.

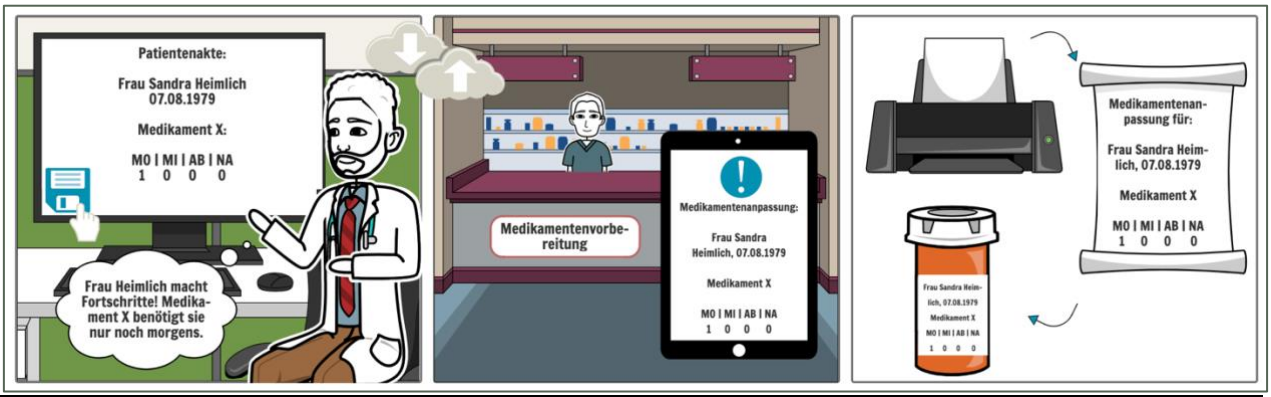


The doctor treating the patient is still tracking data provided by the subject. He notices things are starting to go wrong and needs to do something about it.	The MPA receives the task from the doctor to contact a specialist.	The specialist receives the data and starts working on the case as soon as possible. Returning all findings to her MPA.
The MPA from the specialist organizes everything that must be done. An invitation to an appointment is sent and the personal physician is also notified about the outcome.	A first appointment with the specialist is happening and both patient and doctor are discussing, with the help of the monitor in the background, what the best course of action is.	At the end of the session, the specialist makes the required changes. Communicates her findings with the patient and will eventually send a report.

5.1.3 Nurse storyboard

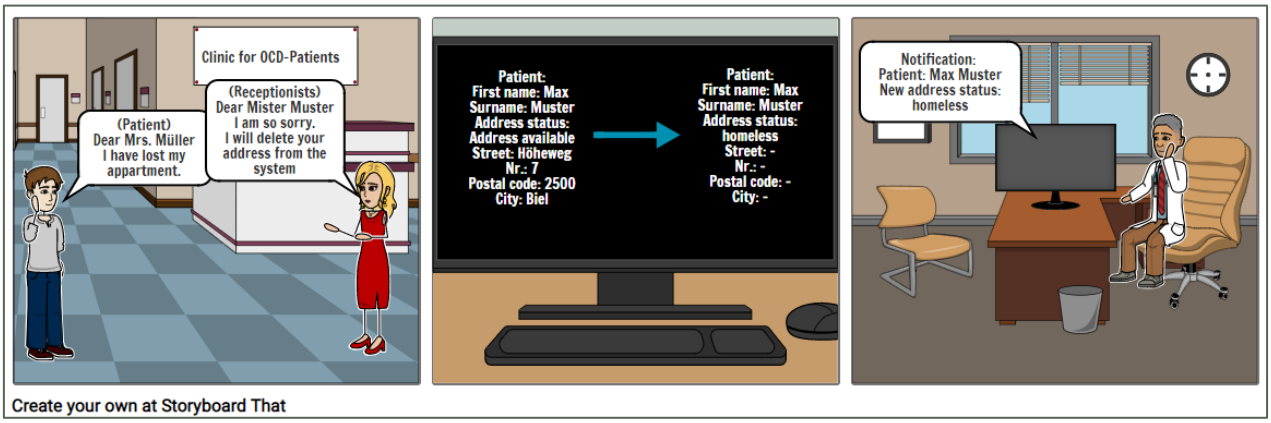


This scene takes place in the regularly patient visit. Besides measuring the vital signs, the nurse asks about the well-being. The patient answers in this case that he is feeling worse than the last time.	The nurse must document everything during the visit. This includes the vital signs, the state of mind and other useful parameters. This happens with help of a smart device. The changes will be saved immediately on the platform.	At the same time, other authorized persons are able to monitor the patient visits. Any signs of improvement and weakening can be seen remotely.

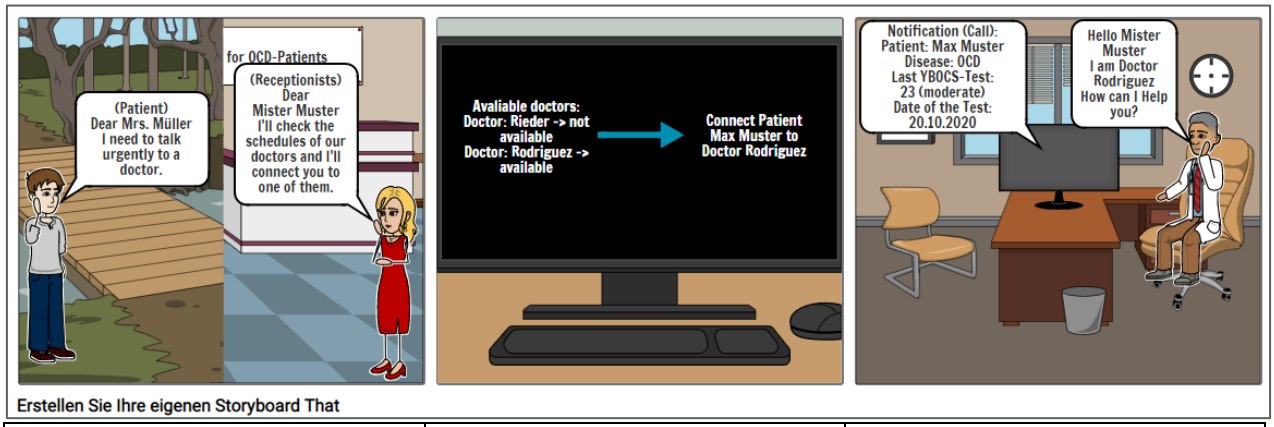


In this case the doctor changes the prescription for a patient. He changes the patient-specific data in the web application.	The employee prepares the drug boxes for the patients. On the web application he can check the latest prescriptions. Sudden changes become visible.	The updated prescriptions can be printed out as a sticker and put on the corresponding drug box.

5.1.4 Secretary storyboard



The patient informs the clinic that he has lost his apartment.	The receptionist changes the address status in the system.	The doctor gets the information of the patient by a notification.



The patient calls the clinic because he doesn't get his disease under control and needs to talk urgently to a doctor	The receptionist checks the schedule of the doctors and connects the patient to one of the doctors.	The doctor gets a first all the necessary information of the patient and then gets connected to the patient.

6 Glossary

OCD → Obsessive-compulsive disorder
EHR → Electronic health record
CBT → Cognitive Behavior Therapy
SRI → Serotonin reuptake inhibitors
ERP → Exposure and response prevention
Vaadin → Full stack framework for building wep applications in Java.