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Design de uma Plataforma para Avaliação da Doença de Parkinson Fora da Clínica

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Resumo

A doença de *Parkinson* é a segunda doença neurodegenerativa mais comum do sistema nervoso central, afetando cerca de 1% da população mundial e chegando a afetar 1 em cada 10 pessoas com 80 anos ou mais. A doença de *Parkinson* é caracterizada por tremores, rigidez do tronco e membros assim como a bradicinésia, que faz com que os movimentos do doente sejam cada vez mais lentos. Adicionalmente, a doença de *Parkinson* também reduz a velocidade do pensamento, causa a perda de memória a curto prazo e, em estados avançados da doença, causa demência. Os sintomas da doença ocorrem quando 70% ou mais das células responsáveis pela libertação de dopamina no cérebro morrem, cansando uma redução no nível de dopamina.

Os sintomas da doença de *Parkinson* variam de paciente para paciente, no entanto, os primeiros sintomas são o tremor nas mãos, braços ou pernas. Com a progressão da doença, surge uma maior dificuldade em andar e instabilidade postural, dificultado o dia-a-dia do paciente. Uma das particularidades da doença de *Parkinson* é a flutuação dos sintomas, que não só variam completamente de paciente para paciente, como também variam ao longo do dia, em fases *on* e *off*.

Apesar de não existir uma cura, é possível melhorar a qualidade de vida do paciente através de fármacos que aumentam os níveis de dopamina no cérebro, mitigando os sintomas.

Um dos maiores desafios para a intervenção clínica é entender a progressão da doença no paciente, assim como a sua resposta aos medicamentos administrados. Devido à natureza imprevisível dos sintomas, o método clínico tradicional à base de consultas é insuficiente para os clínicos entenderem o estado da doença no paciente, visto que certos sintomas podem não se manifestar durante a consulta. Uma forma dos clínicos obterem informação sobre o estado real da doença é através da monitorização do paciente via sensores durante 2 ou mais dias. Dados como a atividade física, energia gasta, marcha ou a condição do sono conseguem ser obtidas de forma objetiva e servem de complemento para os diários dos pacientes.

A utilização de plataformas para melhorar a qualidade do tratamento de doenças têm vindo a aumentar ao longo dos anos. A maioria das plataformas identificadas neste projeto pretendem recolher dados objetivos dos pacientes fora da clinica, procurando mitigar o efeito da imprevisibilidade dos sintomas. As soluções atuais focam-se na medição de

pontos-chave de sintomas motores, como a marcha ou o tremor dos membros superiores, no entanto, outros aspetos relevantes para o tratamento como a avaliação dos sintomas psicológicos, o cumprimento das instruções do clínico ou a comunicação paciente-clínico fora da clínica foram pouco exploradas.

O principal objetivo deste projeto é otimizar o processo de comunicação entre os profissionais de saúde e o paciente ao adaptar a interface da plataforma utilizada pelo Campus Neurológico Sénior (CNS) às necessidades diárias dos mesmos. A plataforma chama-se *Datapark* e foi desenvolvida para facilitar a análise clínica do paciente ao simplificar o processo de recolha de dados sobre o mesmo. A plataforma também fornece ferramentas adicionais que proporcionam um aprofundamento maior da condição do paciente, através da recolha de dados a partir de sensores inerciais utilizados pelo paciente durante as avaliações clínicas. Estas avaliações tanto podem ser realizadas num ambiente controlado, como podem ser num ambiente fora da clínica durante vários dias, onde o paciente utiliza os sensores durante as suas atividades diárias.

Para otimizar o processo de comunicação, foi desenvolvida uma interface nova para a aplicação web da plataforma. Esta interface nova prevê corrigir as falhas da versão anterior, assim como adaptá-la tendo em conta a experiência de utilização dos clínicos e as suas sugestões. Estas alterações foram obtidas através de uma análise heurística realizada à plataforma, assim como em conversas informais com os clinicos e em duas sessões onde esta nova interface foi testada e reiterada.

Outro objetivo deste projeto é melhorar tanto a aplicação web como a aplicação móvel. Estas melhorias foram obtidas através das conversas informais e durante as sessões mencionadas anteriormente. Exemplos das sugestões que foram desenvolvidas no âmbito deste projeto incluem a opção de gravar as avaliações feitas através da aplicação móvel num ficheiro caso a dispositivo não tenha acesso à internet, assim como a inclusão de uma nova API capaz de obter métricas adicionais sobre as avaliações.

Com o aprofundamento do conhecimento do autor deste projeto sobre as capacidades desta plataforma, surgiu também o conhecimento das limitações da mesma. O conjunto destas limitações, assim como algumas das melhorias mencionadas pelos profissionais de saúde e o surgimento de novas arquiteturas que permitem um melhor escalonamento desta plataforma, levaram a que uma nova iteração do *Datapark* fosse desenvolvida neste projeto. Esta nova iteração foca-se apenas no que foi desenvolvido no âmbito da comunicação entre os profissionais de saúde e o paciente, assim como nas componentes *back-end* que a compõem. Neste projeto, foram desenvolvidas seis componentes: Uma aplicação web e cinco APIs. Estas APIs podem efetuar operações *RESTful* às estruturas de dados, traduzir as estruturas de dados da base de dados da versão atual da aplicação (como é o caso da *Legacy API*), efetuar operações lógicas sobre as estruturas de dados (por exemplo, fazer o *login* ou o *logout* na aplicação web), ou uma combinação destes três.

Esta nova iteração do *Datapark* é uma aplicação web que possui a versão final do

protótipo como a sua interface e utiliza uma metodologia à base de APIs onde todas as operações que involvem estruturas de dados são efetuadas nas APIs em vez da aplicação web, algo que não só melhora a *performance* da aplicação web, como evita a dependência de outras aplicações na mesma (como era o caso da aplicação móvel, que depende da aplicação web para efetuar todas as interações com a base de dados). A interface web serve apenas para recolher a informação obtida pelas APIs e gerar a interface sobre a mesma através de *templates*, evitando criar o conteúdo no *front-end* da aplicação via *javascripts*, algo que pode afetar a performance da mesma em dispositivos com especificações reduzidas. Esta iteração não deve ser vista como um projeto final pronto para ser utilizado pelos clínicos, mas sim como um alicerce onde futuros trabalhos irão expandir sobre o mesmo e substituir gradualmente a versão antiga.

Palavras-chave: Doença de Parkinson; Design de interface; Engenharia de Software; Desenvolvimento Web; Avaliação de Protótipo com Utilizadores

Abstract

This report describes the development of a new iteration of an already existant platform called Datapark, which is used by CNS, which is a clinical institution specialized in the treatment of Parkinson's Disease. The main goal is to identify any flaws present in the web platform and implement any fixes or changes to it. This platform allows users to analyze their patient's condition by keeping all of their assessments, as well as any notes written by clinicians in a single, centralized spot. Furthermore, Datapark takes into account sensory data that was gathered during the assessments via accelerometers wored by the patients. This sensory data is then used as a complement to the assessment in order to display further metrics about patient's performance.

In order to create this new version of Datapark, an analysis to the platform's interface, as well as two separate sessions withe the clinicians were conducted. During these sessions, both subjective and objective analysis were conducted in order to get as much feedback regarding both the current web application, as well as the prototype. The result was a new interface that matches with the clinician's daily needs. This interface was then taken into account when creating the new, API-driven iteration.

Keywords: Parkinson's Disease; Interface Design; Software Engineering; Web Development; Prototype Evaluation with Users

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Chapter 1

Introduction

1.1 Motivation

Applications that aim to improve the patient's treatment often aim to take advantage of the digital format by gathering, analyzing and/or storing information that can be easily accessed by clinicians. This helps the clinician and patient in diagnosing and deciding on the treatment to use by providing useful insight that might have not been possible to have otherwise. However, if the clinicians are not taken into account in the application's interface design process, it is possible that the application provides the opposite effect and ends up overwhelming users with too much information and, as a result, hinder the clinician-patient process [36] [25].

One way to adjust the application's interface to the clinician's perspective is to include them in the design process and let them design their own interface [25], as well as to understand what they need from a platform and how it affects their daily routine. Furthermore, such necessities may change over time either due to new tools being available, new methods being invented, or other factors altogether. This creates new opportunities to improve the applications by including new features.

1.2 Goals

The main goal of this project is to improve the clinician workflow by changing the interface of a clinician-centered application and introducing new features according to the clinician's feedback. To accomplish both goals, this project can be divided into three separate components:

The first component consisted of finding flaws in the web platform's interface and providing a high-fidelity prototype that would fix any of the issues found. A heuristic analysis was performed on the web platform to find flaws in the interface. It consisted of analyzing each page of the web platform to see if it broke any of Nielsen's heuristics [34]. From this heuristic analysis, a low-fidelity prototype was created. It proposed a

new design to be more usable than the previous version. This low-fidelity was further refined by me and my coordinator until we felt that it was ready to be made into a high-fidelity prototype. This high-fidelity prototype suffered the same process as the previous prototype, but now it was refined by the clinicians during the sessions we had with them.

The second component consisted of finding flaws in the system's back-end, as well as gathering the clinician's issues and general feedback about the platform, either via informal conversations or via focus group sessions that were conducted during the sessions we had with the clinicians, as well as my code analysis of the web platform's code. The new platform's requirements and documentation were created based on the feedback extracted on this component and represent the deliverables for this component.

The third and last component lasted throughout the entire master project and consisted on the implementation of new functionalities and bug fixes that were requested by either the clinicians during informal conversations with my guide. Examples of new functionalities included the ability to offline save any appointments that were created using the mobile platform, as well as an algorithm that could provide a conversion between mobile and web report formats. This component also consists on the development of the new platform, following the conclusion of both previous components.

1.3 Methodology

Since the main concern of this project is to improve the interface of a clinician-centered application, it is important first to understand what exactly is the clinician's interaction with the platform. To accomplish this, the main scope of the background is centered around this goal. Due to the abstract nature of the goal, however, a set of more materialistic goals need to be extrapolated from it.

The most basic goal of the research is to understand what is the full background behind this platform. This means understanding what is the process where the clinician requires such assistance from the platform. Furthermore, it will also require to evaluate what are the consequences of altering this process.

The second goal of the research is to understand what other similar platforms are doing and why they are doing it. This means understanding what features are being implemented, as well as the full context behind them. This is done by not only researching for platforms that are designed towards improving the symptom diagnosis or treatment of Parkinson's Disease, but also by researching other platforms that share similar symptoms, such as urinary incontinence and depression. Any features that can be useful for the current platform can then be suggested to the clinicians to be implemented, should they find them useful for their case.

Our third and final goal of the research is to understand the platform being improved, called DataPark. This means understanding what features it has (just like the previous

goal), and how it came to be. This is useful in order to steer the sessions with the clinicians toward the most useful functionalities of the platform.

It is possible to summarize the research goals as follows:

1. **Understanding how the patient-clinician communication flow works**, in order to display as much information as possible without disturbing this flow;
2. **Learning about other platforms that are related with the treatment of Parkinson's disease**, in order to bring up features that can be relevant to the platform;
3. **Understanding how DataPark came to be, what features it has and how it became what it is today**, in order to steer the conversations with the clinicians towards less explored features in the platform.

1.4 Contributions

1. **A collection of user feedback regarding the previous platform**. This feedback consisted of a set of observations, opinions and suggestions that were gathered from clinicians via informal conversations and interviews. Such information allows developers to modify and add features that improve the clinician's performance.
2. **An application that extracts more metrics from raw sensory data** that was gathered during clinical assessments.
3. **An interpreter that converts two distinct data structure formats to a single unified data structure**.
4. **Added the ability to save appointments without requiring internet access in the mobile application**.
5. **A new platform** that features the same functionalities showcased in the final high-fidelity prototype and contains the groundwork from which to create a more scalable and faster version of the current project.

1.5 Document Structure

This document is organized in the following format:

In **chapter 2 - Background**, I will talk about some of the projects I came across while researching for this project, as well as some studies that were taken into consideration when creating the prototype.

In **chapter 3 - Context and Requirements**, I will explain how the current platform works and how the current platform came to be, along with a description on how each component works.

In **chapter 4 - Implementation**, I will identify the types of actors whose processes inside the clinic are affected by this platform. I will also lay out this project's scope in the form of functional and non-functional requirements. Furthermore, I will talk about the new platform's system architecture, as well as provide a description of each component and data structure present in the platform.

In **Chapter 5 - User Studies**, I will talk about the two sessions we have had with the clinicians in detail, as well as their results.

Chapter 2

Background

The research conducted for this project was focused as it follows:

1. Understanding how DataPark[11] came to be, what features it has and how it became what it is today. This is done to steer the conversations with the clinicians towards less explored features in the platform. This will be fully explained in section 3.1.

2. Learning about other platforms that are related to the treatment of Parkinson's disease to bring up features that are relevant in DataPark's context.

3. Understanding how the patient-clinician communication flow works to display as much information as it is possible without disturbing this flow.

2.1 Parkinson Disease-related IT Systems

The development and widespread usage of applications that aim to increase the quality of life of the users in the healthcare sector have existed at least since the 1990s, with the adoption of EMRs by physicians. Before this period, the main focus of healthcare-centered applications was to lower costs by sharing clinical, financial, and administrative information amongst them [4].

Based on the platforms that focus on PD and were identified during this thesis, most of them are focused on gaining further objective data during physiotherapy by using either using smartphones or sensors on patients. Metrics such as posture and gait [6], bouts [8], steps, rhythm, postural control, and asymmetries [15] can be extracted, which are then analyzed by the physiotherapists to determine the patient's condition. It is unsurprising then, that most of the projects that I came upon whilst researching for this project are centered around these features. Some exceptions exist, however, with some other platforms implementing patient-oriented features, such as nutritional plans, medical schedules [37], or electronic diaries. The objective data is then complemented with the subjective data[7][28] to create a more complete profile of the patient. Some alternatives to

gather objective data about the patient's condition exist, such as via games [28], in an attempt to gamify this procedure to the participants, however, these games only tested the patient's hand motor skills and, therefore, is limited in terms of how much data they can gather.

2.2 Patient-clinician Communication

Communication between the patient and the clinician is one of the key points when it comes to providing medical treatment. It holds three main purposes: Create a good interpersonal relationship (1), exchange information (2) and make treatment-related decisions (3) [36]. The first purpose can be ignored, as it is out of the scope of this project. The second purpose can be described as two symbiotic components, where the patient provides information about their symptoms, and doctors need to perform the diagnosis, as well as create the treatment plan. The third and final purpose consists of the clinician laying out one or more treatments, it is possible risks, and outcomes, for the patient to choose their desired treatment.

One of the main changes that DataPark does to the patient-clinician communication process is the replacement of the paper format with electronic devices. To explore the effects of the use of devices in patient-clinician communication, Alsos et al [3] conducted two different experimental simulation studies where the main objective is to access the impact of three different means to extract patient-related information during patient-clinician communication. To accomplish this, 22 doctors accessed patient-related information in over 80 rounds using either a paper chart, a PDA, or a laptop mounted on a trolley. The main result categories were face-to-face communication, non-verbal communication, and action visibility. Table 2.1 contains the summary of the results highlighted by the research team.

The paper chart outperformed the other means in all result categories, with clinicians citing the information overview, tangibility, and how fast and simple it was to add information as qualities. The PDA offered poor information and awkward navigation, often drawing away the clinician's attention from their conversation with the patient to use the device. The laptop was the worst offender of both verbal communication, as well as action visibility, with clinicians often facing away from the patient in order to access it.

From this study, it is important to conclude that not only is the physical means from which to extract patient information important, but also that the user interface holds significant importance, as a comprehensive interface that provides all the required information about the patient as fast and attention-free as possible improves clinician-patient communication. Kim et al [25] explored this question by designing a clinician interface through a design process where clinicians would design their own interfaces on paper. The final implementation, named *DataMD*, is a single-page design that was organized in three

Information device	Face-to-face communication	Nonverbal communication	Action Visibility
Paper chart	**High:** Easy to reestablish eye contact	**High:** e.g. closing chart signals end of ward round	**High:** Actions are highly visible for the patient.
PDA	**Medium:** Requires more attention, but easy to re-establish eye contact.	**Low:** Very little nonverbal communication observed	**Low:** All actions appear similar.
Laptop on wheels	**Low:** Physician turn away from the patient during usage	**Medium:** e.g. moving trolley signals end of ward round	**Low:** All actions appear similar.

Table 2.1: Summary of results provided by Alsos et al [3].

levels:

- The **holistic summary**, where the main values were on the top of the page, along with a multi-line chart displaying the changes throughout time.
- The **individual data summary**, where a decomposition of each single factor value that leads to the holistic summary value is shown, along with a graphic that better displays the value variation on a daily basis.
- The **individual information summary** that, when a day is selected on the individual data analysis, a graphic shows the value variation throughout the day. In the interface's case, the daily variations are divided into three sections: Morning, afternoon, and evening.

Figure 2.1: An exemplary use-case scenario of the *DataMD* clinician interface (kim et al. [25])

Chapter 3

Context and Requirements

The goal of this section is to explain what needs to be developed over DataPark 1.0, as well as its reasons. To accomplish this explanation, a full explanation of the main goals of DataPark 1.0, as well as a brief overview of how the platform works will be presented, as well as the limitations that the platform has that were identified over the course of this thesis.

After the limitations are explained, the focus is then shifted toward detailing what actors are part of this system and their roles. Their roles are then detailed via the system requirements that will be followed during the development of DataPark 2.0.

3.1 DataPark 1.0

The main goal of DataPark is to provide clinicians with better tools for understanding patients' fluctuations and health state. This is done by extracting objective data from either manual or computer-assisted means (for example: Inertial sensors or IVR systems[1]) as well as subjective data. This use of automated means of data extraction allows clinicians to extract data about their patients both inside and outside of the clinic, which is another of this platform's goals.

It is initial phase started as a web and mobile platform that clinicians could access by signing in by a web browser (in the case of the web platform) or by a mobile application. The mobile application's purpose is to create new assessments associated with a patient, while the web application's purpose is to upload the sensory data that was gathered from the patient, as well as to view both the assessment results and the sensory data that was gathered from outside the clinic, called free-living reports. The assessment view can have sensory data to complement it. Metrics such as the type of physical activity that the patient is conducting, the different sleeping positions that the patient is currently on, or the patient's energy are all extracted from sensory data and are then shown to the clinicians

[1]IVR, or Interactive voice response, is a technology that allows humans to interact with a computer-operated phone system through the use of voice

in a report format that was achieved through a series of sessions with both the developers, as well as the clinicians[11].

The web platform is shown in diagram **??** and is composed of four separate components:

- The controller, which handles all requests from either the user or from front-end and contacts all other components if necessary;
- The front-end, which is responsible for displaying content provided by the controller, as well as receiving any user input and redirecting it accordingly;
- The pre-processing module, which handles the transformation of the CWA sensor files to a CSV format comprised of the epoch[2], as well as the X, Y and Z axis of the accelerometer;
- The analyzing module, which uses the CSV file that was created by the pre-processing module to categorize each entry according to either the type of physical activity the patient was involved in at the time, the position it was sleeping in, or any energy it has.

The entire web platform was entirely built using the Django[3] framework and follows a monolithic approach, with few components in the platform using APIs. It functions as both the platform's back-end, as well as the template render engine. Furthermore, the platform uses Google Firebase[4] as it is database due to the flexibility offered by it is no-SQL approach, it is authentication API, and due to the fact that it can double as the data storage server of the accelerometer data. Finally, the entire platform is deployed using Google AppEngine[5], using Nginx and Gunicorn as web servers in order to support the Django framework.

The mobile application was built using Android Studio[6]. It indirectly communicates with the project's database via web platform endpoints in order to perform simple actions such as logging in, getting a list of all patient or creating new appointments.

3.2 Formative Analysis

In order to improve upon an already existent platform, we must first understand what are the flaws that this platform has. To accomplish this, we conducted a heuristic analysis

[2] An epoch is a date and time from which a computer measures system time [40]. In the CWA to CSV API's case, the epoch is a Unix timestamp that can be in seconds or milliseconds, depending on the endpoint being used by the platform.

[3] https://www.djangoproject.com/

[4] https://firebase.google.com/

[5] https://cloud.google.com/appengine/docs/

[6] https://developer.android.com/studio

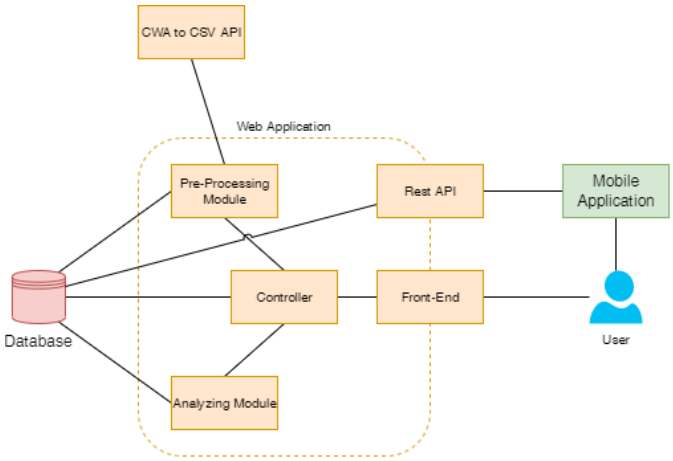

Figure 3.1: Architecture diagram of the old platform before work on this project began.

of the web platform. We also included a section in the first session with the participants that aimed to extract their feedback regarding the platform, with the latter of which being detailed in chapter 5. We have also analyzed the web platform's code in order to find existing flaws in the platform's software design.

3.2.1 Heuristical Analysis

The heuristical analysis was conducted on all web pages of the web platform where each web page was searched in order to find any components that broke any of Nielsen's heuristics [34] were used. This heuristic analysis was the baseline for the initial low-fidelity prototype.

Each issue found was organized in the following manner:

1. A title containing a very brief description of the issue;
2. The heuristics it broke;
3. A full description of the issue;
4. The suggested correction;
5. A number from 1 to 4 describing the issue severity, where 1 is the lowest priority and 4 is the highest.

All issues were classified according to their severity. The following list contains a description of what each severity means:

1. Only impacts the platform's design and, therefore, has no impact on the clinician's task performance. Examples of such tasks include text alignments and the confirmation and cancellation buttons being in the opposite order that usually are.

Heuristic	Quantity
H2-1	6
H2-2	5
H2-3	13
H2-4	20
H2-5	23
H2-6	4
H2-7	6
H2-8	12
H2-9	0
H2-10	3

Table 3.1: Heuristical analysis results by broken heuristics.

Severity	Quantity
1	12
2	41
3	29
4	2
Total	**84**

Table 3.2: Heuristical analysis results by severity.

2. Have little impact on the clinician's task performance. Examples include small font size in crucial information, textual incoherence or lack of a back button.

3. Impact clinician performance. Examples include a confusing page design, text box that allows incorrect format or blocked options without context.

4. Can potentially block the patient from performing a task or can block it altogether. Examples include the web page showing up an error message that is not user friendly or allowing users to change the patient code, which might confuse clinicians.

The results show that a total of 84 issues were found on all web pages, with 53 issues with a severity of 2 or lower and almost half of the issues being of severity 2. Table 3.1 shows the results of this heuristic analysis by the amount of heuristics that were broken, while table 3.2 shows all issues categorized by severity. The full report can be found in appendix A.

3.2.2 Code Analysis

A code analysis was conducted in order to find and fix bugs in the platform, as well as to add new features to the platform. The following list details the flaws that I've found while working with the platform:

- **Both the web and mobile platforms follow a monolithic approach.** This approach hinders maintenance, as fixing bugs or problems implies working on the entire application, instead of the affected component only. Furthermore, this approach does not allow us to replace the application on a component basis, instead, we are forced to replace the entire application.

- **All interactions between both platforms and the database are conducted via the web platform which, besides functioning as an API of sorts to the mobile platform, also provides interactions with the users of the database.** This approach makes the mobile application dependent on the web application to communicate with the database. Furthermore, this ”API” basically redirects any information between the mobile application and the database, so any changes to the data structure need to be done to both the web application and mobile application.

- **The web platform was built using Python 2.7.10, a software version that is deprecated since January 1st 2020. Furthermore, all libraries that are used by the platform will also not be supported.** This makes the web platform vulnerable to any security issues that may be discovered, as well as hindering any further developments by constraining the developers into using libraries that are compatible with the python version being used and whose dependencies also have versions compatible. This effect's the web platform's maintenance, as well as any new features that we wish to add to the platform.

- **A lack of documentation regarding the project, besides the free-living aspect of the web application.** This delays any further developments made to the mobile and web platforms due to developers having to spend time understanding how the applications work.

- **The data structure used in the database does not allow good scalability for higher data volumes.** This is something that came up during an informal conversation with the previous developer of the project and can be seen when performing any operation that the web platform to get all patients, for example. In order to fix this issue, some major changes need to be done to the database, either by changing to a SQL database, or by changing the data structure, something that will require replacing the entire web and mobile platforms.

All aforementioned flaws heavily impacted the programmers' ability to modify the already existent project and, as a result, a solution should be reached in order to fix all of these issues. The solution reached was that a new version of DataPark should be developed, one that took into account all of the aforementioned flaws, as well as the previous version's features. This new version should take into account the most recent software architecture practices, such as a new API-centric approach.

3.3 Use Case Scenarios

In order to conceive the system's requirements, we must first understand how the platform fits into the current workflow. This was achieved by asking clinicians about their daily routines with the patients and how they use the platform. From their feedback, we elaborated a user story that follows a hypothetical patient throughout their treatment in the clinic. This user story will be used to group the characters involved into different actors and to define their actions in the system.

3.3.1 Patient Story

The following story was created by piecing together several accounts of the clinicians' daily routines with the patients:

Paulo is a 64-year-old that lives on the outskirts of Lisbon. He was diagnosed with Parkinson's Disease roughly 5 years ago. He is been performing daily walks ever since he's been diagnosed in order to slow down the disease's progression, however, his condition worsened. His doctor advised him to go to the clinic as an inpatient in order to obtain more specialized treatment. When the clinician arrived at the clinic, a psychologist created a new patient in the platform based on the information that Paulo provided. The psychologist will also give Paulo a tablet and some writing material in order to fill out a set of assessments that aims to evaluate the psychological impact of the disease on his psyche.

During dinner, Paulo was approached by a nutritionist, that asked him if they could observe his meal in order to gather information, as well as to ask him about his food habits. Paulo agreed and they had a small conversation about Paulo's food habits. The conversation ended when Paulo finished his meal, where the nutritionist thanked him and went to the office in order to fill out a set of nutrition assessments on the web platform using the information it gathered. This set of assessments aims to check Paulo's dietary habits, as well as his overall health.

The following morning, Paulo was approached by a physiotherapist that asked him if he could perform an admission assessment. Paulo agreed and they went to a clear space in the clinic in order to perform the exercises. Paulo wore a sensor that was previously calibrated by the physiotherapist and performed a set of assessments that aimed to assess the effect that Parkinson's Disease had on his motor skills. After performing the set of assessments, the physiotherapists prescribe to Paulo a set of physical activities, as well as a schedule of physiotherapeutic activities to partake in, that will help mitigate his symptoms.

Some time passes, and Paulo's condition has improved. All previously mentioned clinicians performed the same set of assessments in order to determine how much Paulo's condition improved. This difference between admission and discharge assessments, as

well as some notes that were taken that provide further insight into his condition, will be shown to Paulo.

3.3.2 Actors

From the story defined in the previous section, we can define the following actors:

Clinicians They represent the psychologist, nutritionist, and physiotherapist in the story and represent a medical professional in the clinic. They are responsible for assessing the patient's condition, which can be done either by simply observing the patient's behavior or writing down their observations. Clinicians can also conduct a set of scored assessments, which they named "batteries", in order to quantify the patient's condition. This procedure is done at least two times: During their admission, and during their discharge; Although it is possible that one or more batteries can be performed during the patient's stay at the clinic.

When it comes to their interactions with the platform, clinicians are responsible for writing all information about the patient on the platform. This can be basic information, information regarding the condition reports containing the assessment results, prescriptions, risks, etc. This information is used as a historical record of the patient, often being used when clinicians need to evaluate the patient's condition and prescribe treatments and/or drugs.

Patients They represent Paulo in the story and, despite not interacting directly with the platforms, patients are the focal point of the entire platform. They sign in to the clinic, where their condition is then monitored by clinicians in multiple areas. After some analysis conducted by the clinicians, they can give them some instructions in order to improve their health, and the patient can choose to follow through or not.

System Administrator The system administrator is an individual whose purpose is to create new users and give them their respective permissions. It does not represent any character in the story, however, it is crucial for the system users as they regulate the platform usage.

3.3.3 Use Cases

Use cases describe the software from the point of view of the user. It helps in setting up the system's scope, as well as to decompose each element of the scope.

Clinician Assessment

- **Actor(s):** Clinician, Patient

- **Overview:** When the clinician needs to perform one or more assessments of their field to a patient, he will ask him if he wants to perform them. When they finish, the clinician will add the results to the appointment and save them.

- **Alternative flow 1:** If the patient is unwilling to perform the assessments, no appointment will be performed and the use case will end.

- **Alternative flow 2:** If the patient was not registered, the clinician will register him and the flow will return to the overview.

- **Alternative flow 3:** If the patient can not perform the assessment anymore, the clinician will add whatever progress they had and save the assessment.

- **Alternative flow 4:** If the assessment requires any objects that the platform can not provide (such as drawing materials, for example), the clinician will provide them to the patient and the assessment will continue.

Updating Patient Information

- **Actor(s):** Clinician, Patient

- **Overview:** If the patient is not registered in DataPark, the clinician will create a new patient by entering their personal information. The clinician will also add to the patient profile any information that is relevant to the treatment (for example: Any physical or psychological impairments that restrain the patient from performing certain treatments or in which room is the patient housed, if it is an inpatient).

- **Alternative flow 1:** If the patient already exists in the platform, use the already created patient instead.

- **Alternative flow 2:** If the clinician found any incorrect information, he can delete it.

3.3.4 System Requirements

Defining the system requirements is a crucial step toward describing which features are included in this project's scope. These requirements are divided into two components: Functional and non-functional requirements. It is worth noting that the functional requirements are further divided according to the actors that have access to this feature.

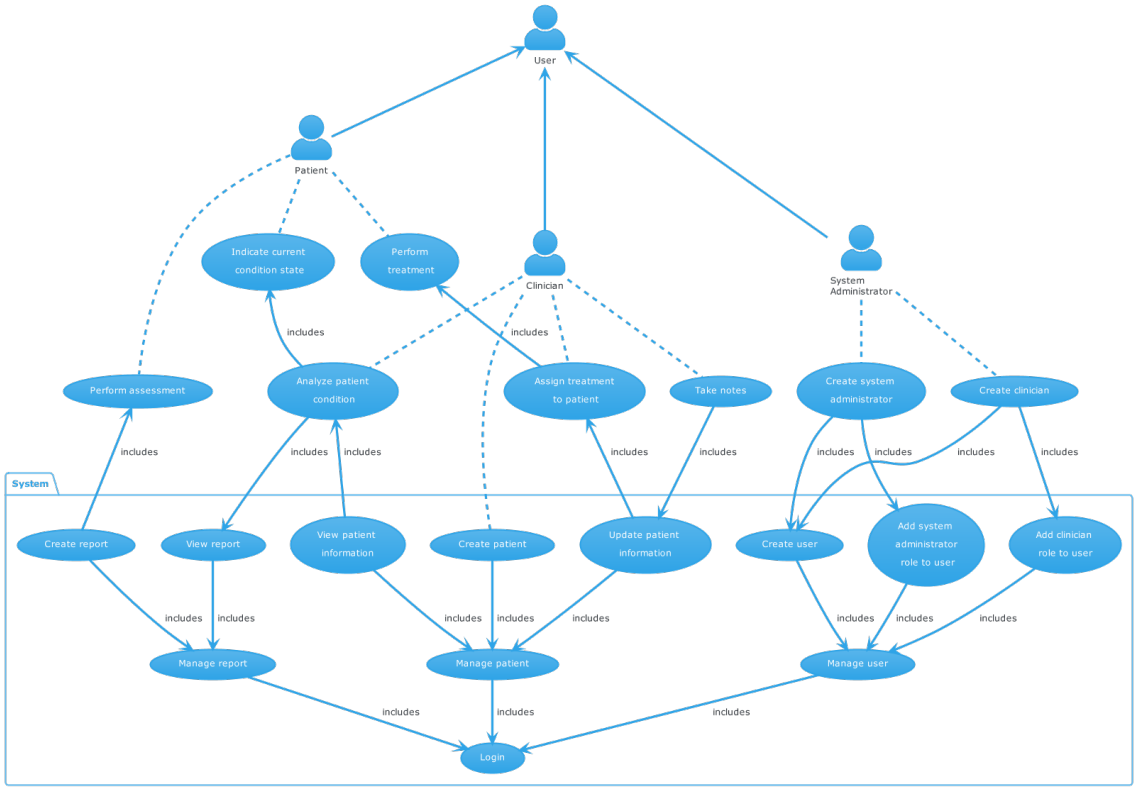

Figure 3.2: Use case diagram of DataPark.

Functional Requirements

Functional requirements are responsible for describing what services the web platform must provide. the following items detail what actions can be performed by which actor.

1. Users shall have access to this platform by entering their username and password.
2. Clinicians must have access to a list of all patients registered in the platform.
3. Clinicians must be able to see what types of reports were already performed by the patient.
4. Clinicians must be able to search for the patient by typing the patient's name or code.
5. Clinicians must be able to filter what patients appear in the list by selecting the categories of reports that the patient already performed, as well as their current hospitalization context, if any.
6. Clinicians must be able to create new patients by only entering their full name, birthday, gender, and clinic that they are being admitted to. Additionally, they can also include height, education, and informed consent as additional information when registering.
7. Clinicians must be able to see the patient profiles by selecting the desired patient from the patient list.
8. Clinicians must be able to see a list of all risks associated with the desired patient, describing the type of risk, the priority it has, when it started, and if it ended.
9. Clinicians must be able to create new risks associated with the desired patient by entering the type of risk, the priority it has and it is start date and, additionally, the risk end date.
10. Clinicians must be able to edit risks by changing the type of risk, the priority it has and the start and/or end date.
11. Clinicians must be able to delete risks.
12. Clinicians must be able to see a list of all diagnoses associated with the desired patient, describing the condition, status, start date and, if existent, end date.
13. Clinicians must be able to create new diagnoses associated with the desired patient by entering the condition, status, start date and, optionally, end date.

14. Clinicians must be able to edit diagnosis by changing the condition, status, start and/or end date.

15. Clinicians must be able to delete diagnoses.

16. Clinicians must be able to see a list of all hospitalizations associated with the desired patient, describing the room, context, start date and, if existent, end date.

17. Clinicians must be able to create new hospitalizations associated with the desired patient by entering the room, context, start date and, optionally, end date.

18. Clinicians must be able to delete hospitalizations.

19. Clinicians must be able to see a list of all weight registries associated with the desired patient.

20. Clinicians must be able to create new weight registries associated with the desired patient by entering the weight, as well as the date of registry.

21. Clinicians must be able to edit weight registries by changing the weight and/or date of the registry.

22. Clinicians must be able to see a list of all reports associated with the desired patient, describing the date when the report was made, area, category, context, type, assessor, whether it was completed or not, and the hospitalization period it belongs to.

23. Clinicians must be able to filter reports from the list of all reports associated with the desired patient by the date when the report was made, area, category, context, type, assessor, whether it was completed or not, and/or the hospitalization period it belongs to.

24. Clinicians must be able to view all of the answers to the desired report, as well as their individual scores.

25. Clinicians must be able to see the score of all assessments of the desired report.

26. Clinicians must be able to see the total score of the desired report.

27. Clinicians must be able to compare the assessment scores between admission and discharge reports of the same type.

28. Clinicians must be able to create new reports by selecting the desired patient and battery.

Non-Functional Requirements

Non-functional requirements are responsible for defining system attributes and serve as restrictions during the system's design phase.

1. **Data Integrity:** The project must be able to fetch content from the previous project database if it is not found in the current project;
2. **Privacy:** All communications between all components must be encrypted;
3. **Portability:** The web platform must work on different devices and browsers;
4. **Security:** All account passwords are to be stored using SHA256 encryption;
5. **Security:** All password validations must occur inside the Account API;
6. **Portability:** The new web platform must be compatible with most mobile devices, as well as most tablet screen resolutions;
7. **Usability:** It must be easy for users to interact with the system;
8. **Reliability:** The majority of the functionalities must work most of the time;
9. **Data integrity:** The system must validate all the data being shown;
10. **Data integrity:** Communications between all new components should be made using the JSON format;
11. **Extensibility:** The system must follow a RESTful API design methodology;
12. **Extensibility:** All APIs must be independent of one another;
13. **Extensibility:** The addition of new functionalities must be easy;
14. **Availability:** The system must be available to all devices that can and have internet access.
15. **Maintainability:** The system's software must be easy to understand.
16. **Maintability:** The system must be easy to perform maintenance.

Chapter 4

Datapark 2.0: Components and Main Functionalities

4.1 Information Architecture

In order to provide a more concise web platform, it is important to define what content is to be displayed in the final project via information architecture. To accomplish this definition, we must highlight what are the main components that the platform has, as well as any sub-components that come from these components via a diagram. Diagram 4.1 is the information architecture diagram that came from the final product.

Despite the lengthy nature of the information diagram 4.1, in reality, there are effectively three web pages: Login, patient list, and the patient profile.

Login When the user first accesses the web platform, it is greeted by a login screen. The login form asks the user to type in the email and password. The user will only progress past the login screen if both the email and password typed coincide with an already existent user.

Patient List If the user's account is either of one of the clinician types or is a system administrator, they will be redirected to the patient list web page after a successful login. Furthermore, they can also access this web page via the navigation bar on the top of all pages. As the name suggests, the patient list web page contains a list of all patients that are present in the new platform, as well as a single text input form where the user can search either the patient code or the patient name. Furthermore, the user can apply one or more filters to their search criteria, all focused on the reports that they already performed. These filters are divided into the report type, battery category, and the area where they already performed the batteries.

Besides being able to view all patients present, user's can also create new patients by clicking on the "New Patient" button. A modal will appear asking for the user to type in the patient information in order to create a new patient.

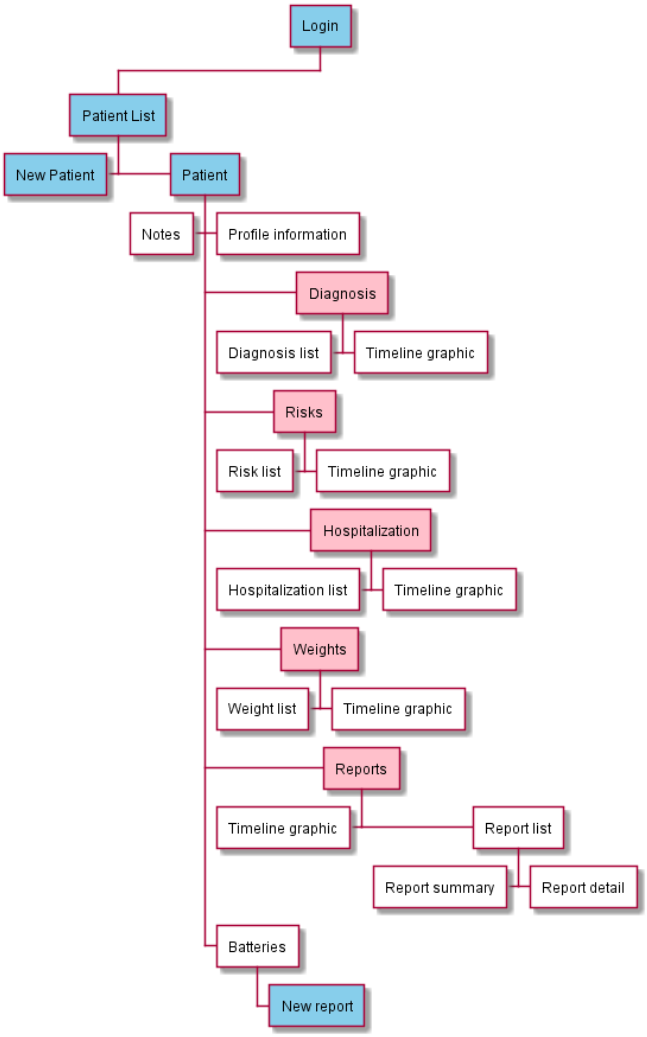

Figure 4.1: Information architecture diagram

Patient Profile When the user selects a patient from the patient list, they will be redirected to a web page showing all the information that is associated with the patient. This web page is divided into three sections:

1. **Profile**, where the user can find information regarding the user's personal information, as well as their risks, diagnosis, hospitalizations, weight registries, and a bar chart depicting the total scores of all reports that the patient performed. Furthermore, it is possible to edit patient information in this section, as well as perform CRUD operations on all of the aforementioned data structures.

2. **Reports**, where a list of all reports is shown, as well as filters of all report's columns. For each report, the patient can either see the patient's summary, where the scores of all assessments performed are shown, as well as the total report score, or they can see the entire report, where all of the patient's answers are shown, along with the scores for each question, assessment and the total scores. Furthermore, on the

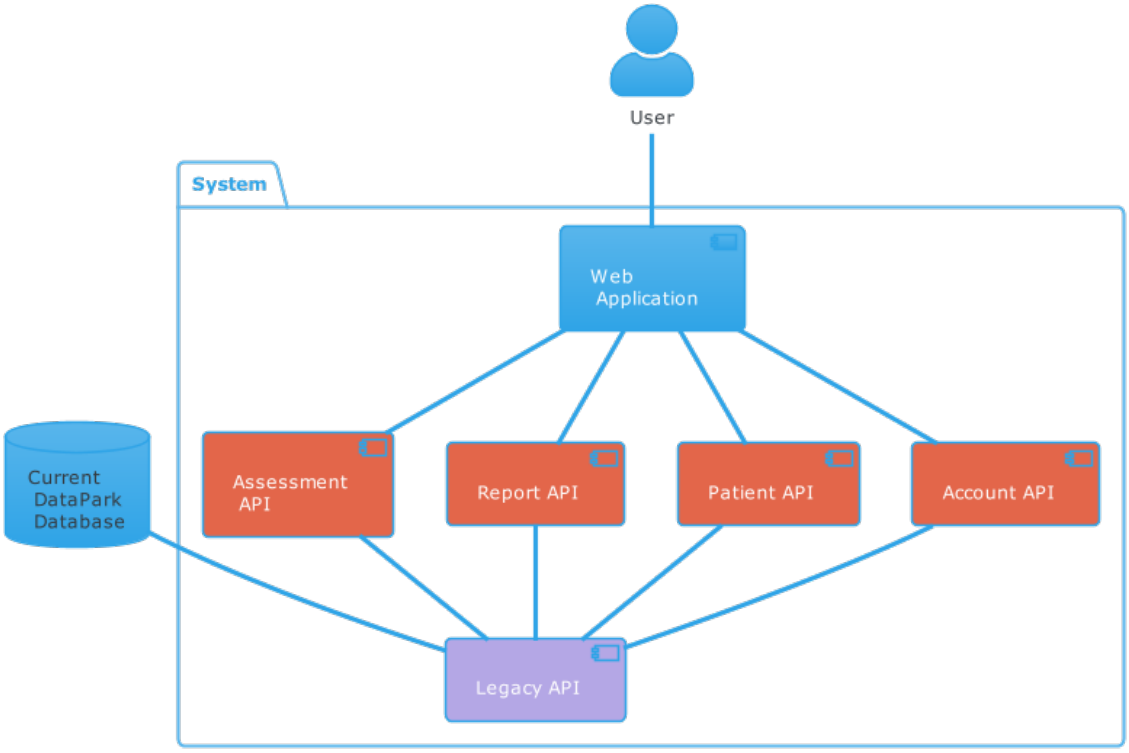

Figure 4.2: Architecture diagram displaying the new DataPark platform.

option where they can see the entire report, the user can also compare between admission and discharge reports of the same type, where a table and a stacked bar chart will show the assessment scores of both the assessment and discharge reports, as well as the variation.

3. **Batteries**, where the user will create a new report based on the set of assessments associated to the selected battery. Furthermore, the user can also upload new data that was gathered by the sensors.

4.2 System Architecture

DataPark 2.0 is comprised of a web application and 5 independent APIs where the web application fetches the data it uses from. Diagram 4.2 shows every component of DataPark 2.0 and which components interact with each other, where the system can be categorized into three separate layers:

- Platform translators, which is colored in purple, and whose purpose is solely to import content from the previous platform to the new one by fetching information from the previous platform and converting it to one or more POST requests to the specific APIs.

- RESTful APIs, which are colored in red, and whose purpose is to provide services according to the content types, as well as to store said information in an independent database.

- User interfaces, which are colored in blue, and whose purpose is to provide a graphical interface that the users can rely on to view and interact with their content. It does not interact directly with the data structures, instead, it relies on the REST APIs to perform these interactions on the data.

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All components were developed using the latest versions of all dependencies.ç It uses python[1] as the programming language and the Django web framework, as using the same technological stack as the previous version for all components reduce maintenance costs due to developers having to learn new technologies. Furthermore, all components have their own database independent of all other components and whose SQL structure is generated by the framework used in order to take full advantage of any features that help during development.

Web Application

The web application provides the user with a web interface that allows them to interact with all components. It was developed using the Model-View-Controller (MVC) pattern and it takes advantage of every tool that the framework provides.

The views are created using the framework's template language and are organized into three different types:

- **Generic**, where they are meant to perform common actions (such as displaying a form, or displaying a confirmation modal, for example). These actions can be customized by passing the required arguments (for example, a custom form, or a confirmation message).

- **Section**, where they will assemble one or more or more generic views in order to create a custom view (for example, a diagnosis table).

- **Web page**, where they will assemble one or more sections and generic views in order to create a cohesive web page (the patient profile page, for example).

All scripting done in the front end follows the same principles as the views, with some libraries performing generic actions (such as assembling graphic information and creating the chart) that are then called by more specific libraries that gather all the required arguments in order for the generic library to deploy the customized result (for example,

[1] https://www.python.org/

a diagnosis-specific timeline chart). The main function of these specific libraries would then be called inside the web page.

The controllers are responsible for handling the flow of web pages, as well as creating any forms or calling any necessary models and assembling them in the context in order to pass them to the views as variables.

The models are responsible for calling the APIs and assembling their responses into data structures that the web platform can process. Since usually information is scattered throughout the project, multiple API calls across various APIs might be necessary in order to create the entire necessary structure.

Patient API

The Patient API harbors all information that identifies the patients, as well as the profile information, location in the clinic, and any registries that allow the user to quickly assess the patient's current state and where it is staying, should it be an inpatient. Current registries include a generic Entry object that is only used to register the weight, as well as some specific entries such as the Risk, Diagnosis, and Hospitalization objects.

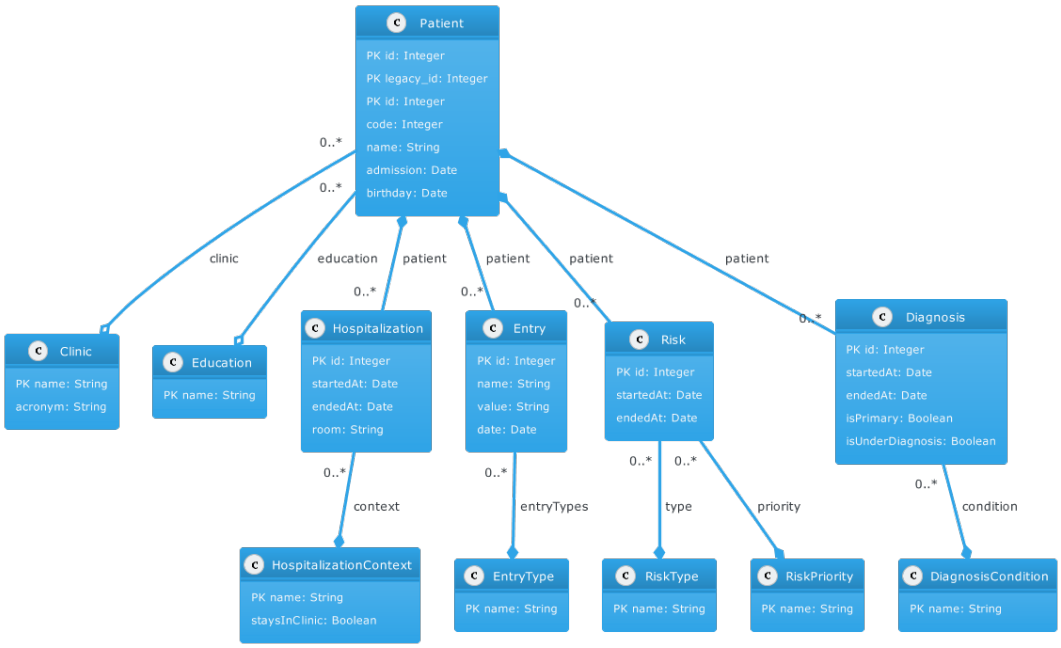

Figure 4.3: Class diagram of the Patient API.

Account API

The Account API harbors all accounts and roles of the platform. It consists of two endpoints (`account` and `role`) which provide CRUD interactions with the Account and Role objects, as well as the `login` and `logout` endpoints, which aim to centralize the

entire login and logout process inside this API. Sensitive information, such as passwords, is further encrypted in the API during the account creation process and can not be retrieved by other components. Figure 4.4 details how the API models are organized.

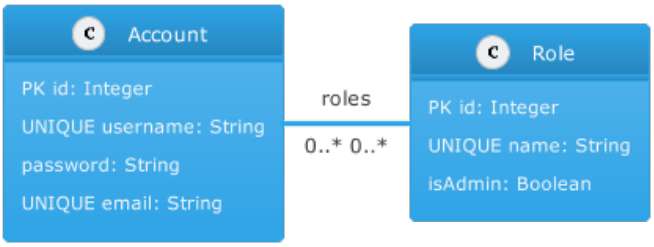

Figure 4.4: Class diagram of the Account API.

Report API

The Report API contains all the information regarding the battery results. These results are stored in a hierarchical order, where one report is stored in many small instances.

The component consists of a single endpoint (`report`) that provides CRUD interactions with the Report object, as well as to all Assessment, Question, Option, and Note objects that are associated with it. Figure 4.5 details how the API models are organized.

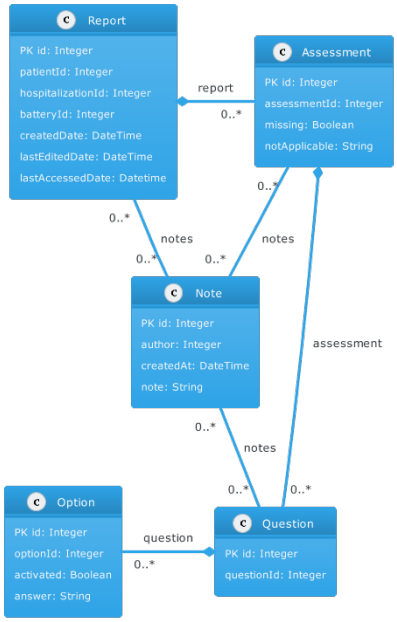

Figure 4.5: Class diagram of the Report API.

Assessment API

The Assessment API contains all battery and assessment information, which is then combined in the web platform in order to create and interpret the created reports. Like the

Report API, the Assessment API also stores the information in a hierarchical order, which results in a single battery being stored in many small instances. It consists of three endpoints (`area`, `assessment` and `battery`) that provide CRUD interactions with the Area, Assessment and Battery objects respectively, as well as all other cascading objects. Figure 4.6 details how the API models are organized.

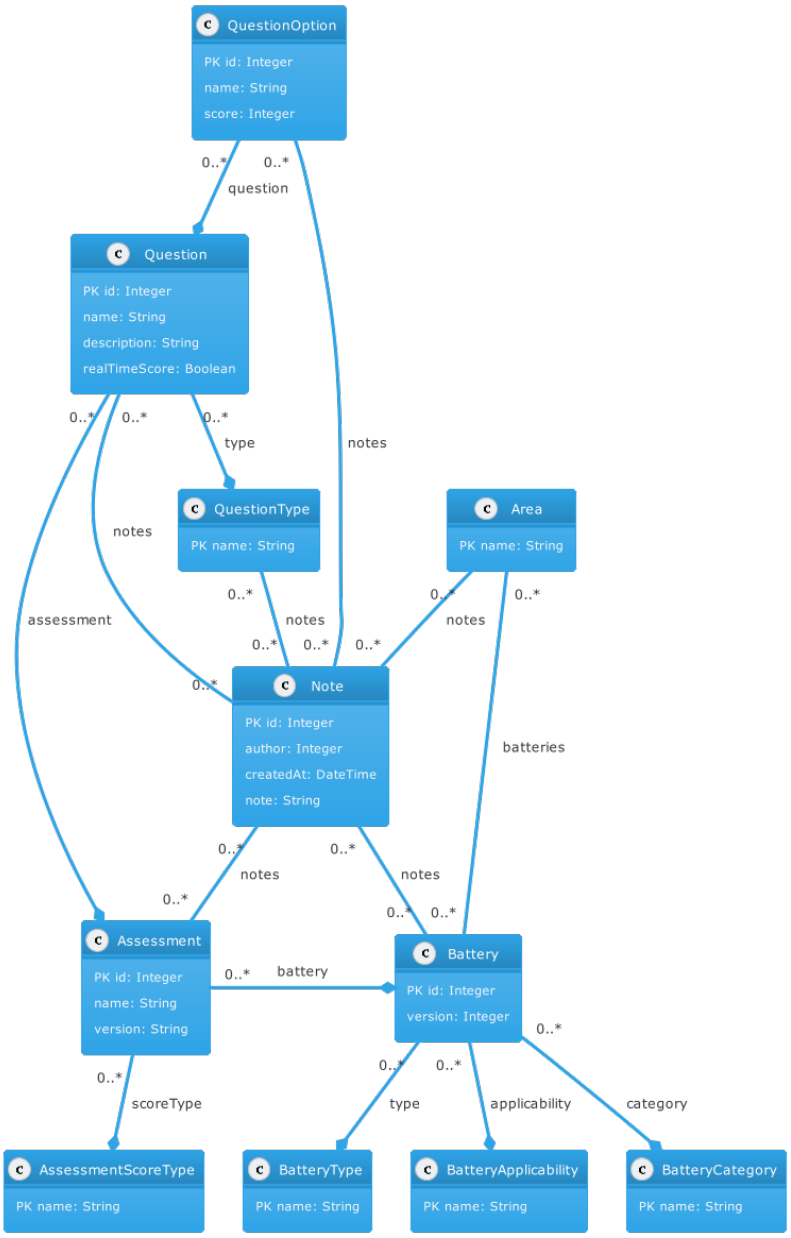

Figure 4.6: Class diagram of the Assessment API.

Legacy API

The Legacy API is responsible for providing all interactions with the old platform via the database and converting the contents to the new format currently used by the APIs. It is

capable of not only directly translating and importing data structures but also converting and unifying several data structures (such as the Report object, for example).

4.3 Other Challenges

4.3.1 Mobile Application Offline Save

The idea of implementing an offline save feature came during an informal conversation with a clinician and was brought up again during the first session with the clinicians. Clinicians often stated that they would lose the entire assessment results when they saved them without an internet connection, which often resulted in the clinicians repeating the assessments. This naturally hurt the clinicians' trust in the mobile application, making them frustrated with the app.

The developed solution consisted on storing the assessment solutions locally in a file inside the mobile device. This file contains whatever contents would be sent to the web application endpoint and the filename would be the timestamp that the clinician first saved it. In order to send this information to the web application, a thread would start every 5 seconds that tried to send all files present to the web application. If such connections with the web application exist, it would make a POST request to the endpoint responsible for creating the report, with the POST body being the file contents. If the report was created successfully, the file would then be deleted. Diagram 4.7 illustrates the solution's flow.

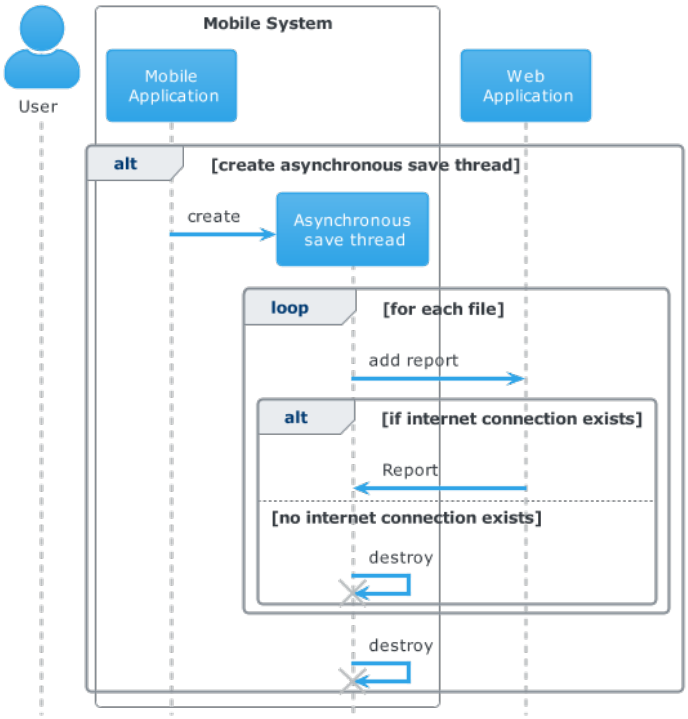

Figure 4.7: Sequence diagram of the asynchronous save feature.

4.3.2 Gait Extractor API

The Gait Extractor API is a single API whose purpose is to extract further metrics from the sensory data using a python library developed by LASIGE and send them to the web platform. This python library was not compatible with the current web platform's version, hence the API. The API works according to the following logic:

1. The API fetches the filename, start timestamp, end timestamp, patient height, and threshold from the request's POST request body.
2. Fetch and interpret CSV files from the application's google Firebase storage component.
3. Extract metrics using the gait_extractor[2] library, which was developed by LASIGE. This API will extract the metrics mentioned in the table 4.1 and store them in a dictionary.
4. Return the dictionary to the original requester.

The output sent to the web platform follows the JSON protocol and is comprised of a dictionary, where the key is the metric and the value consists of either a double or an integer value. Table 4.1 shows all keys that can be found in the results, where the key follows the format *Category Metric* (ex: "Gait velocity", "Cadence", "Stride length", etc.).

Category	Metric
Gait	Velocity
Cadence	—
Stride	Length, velocity, time variability and time asymmetry
Step	Length, velocity, time, length variability, velocity variability, time variability, length asymmetry, velocity asymmetry and time asymmetry.
Stance	Phase, time, time variability, time asymmetry
Swing	Phase, time, time variability, time asymmetry
Double support	Phase, time, variability
Distance predicted to walk	—

Table 4.1: Metrics that are sent to the web platform by the Gait Extractor API.

[2]https://github.com/Gustavo-SF/gait_extractor.git

Chapter 5

User Studies

We were given the opportunity to conduct two meetings with the clinicians that use DataPark on a daily basis. The first session was conducted in the clinic and our main goal was to gather as much insight about their experience with the previous version as possible in order to define our scope for the next iteration, as well as to test the high-fidelity prototype that was developed with the end users and gather their feedback.

The second and last session was conducted remotely due to the pandemic situation at the time. Our main goal was to get the clinician's feedback about the changes that were made to the prototype according to their previous session feedback. To accomplish this, they tested the new features that were implemented first, followed by a series of questions aimed to gather their feedback.

5.1 First Session With the Clinicians

5.1.1 Procedure

We started by asking all participants a series of questions to be answered in a focus group format that aimed to gather their opinion about the platform without any influences from the prototype, as well as any feature suggestions that they would like to have. We have also asked some questions in order to get context regarding the clinician's workplace (questions such as "How long have you been using DataPark?", or "Do you think DataPark helped in increasing your work performance?").

After the first part, all participants were asked if they could complete a series of tasks in order to both introduce them to the prototype, as well as to record objective data regarding their performance at completing the tasks, such as the duration of each task, as well as the amount of click and mistakes they made. After the participants completed all tasks, they were asked to complete a SUS questionnaire regarding their individual opinions based on what they saw.

The third and last part of the session was similar to the first part, however, since the clinicians already knew how the prototype looked like, they were instead asked a series

of questions regarding their opinion about the prototype itself, as well as any suggestions about each specific component of the prototype.

The full protocol can be found in appendix B.

5.1.2 Participants

ID	Area	Experience with platform
P1	Psychologist	18 months
N1	Nutritionist	6 months
PH1	Physiotherapist	18 months
PH2	Physiotherapist	18 months
S1	Speech Therapist	18 months
S2	Speech Therapist	18 months

Table 5.1: Participants in the first session.

5.1.3 Analysis

The focus group questionnaires were recorded and a transcript containing what was said during the session was elaborated. From this transcript, we highlighted the different discussion points that were relevant to the scope of this project.

In order to perform the metric analysis, the following objective metrics were gathered from the patients performing each task:

- Time the participant took to finish the task;
- Amount of clicks that the participant performed on their mouse;
- Amount of mistakes that the participant made.

Additionally, all participants performed the SUS questionnaire and the results were taken into consideration when evaluating the prototype's quality.

5.1.4 Results

Clinician's Perspective about DataPark

Every clinician interacts with DataPark in some way or another with DataPark, with all of the participants interacting with the web platform. The physiotherapists pose an exception to this interaction, where they use the mobile platform to perform the majority of their assessments in the mobile platform due to the necessity of performing their assessments away from a laptop, usually preferring a tablet.

When it comes to patient-clinician interaction, there seems to be a clear divide by their area on how they perform their assessments. The following list describes how each clinician type present in the first session performs their assessments:

- **Physiotherapists:** They perform the assessments via tablet in an open space (either in a gymnasium or in a garden) with internet access. This open space needs to be nearby the clinic in case the physiotherapist requires any assistance and in when the physiotherapist needs to configure the sensors, as well as upload them to the web platform.

- **Psychologists:** They will take notes on the mobile platform while the patient's performing the assessments using either the tablet or some drawing or writing material. This is usually performed inside the psychologist's office.

- **Speech Therapists:** They will fill out a set of assessments on the web platform via tablet. They will also record what the patient is saying via the tablet's microphone, in order to be processed by a voice program.

- **Nutritionists:** They'll observe one of the meals and gather information via food amnesis. Such information is later filled out on the web platform in their offices.

The clinician's perception of DataPark is that of a very useful, albeit sometimes buggy tool. It is responsible for shifting the patient analysis process from the paper format to the digital realm by providing a cleaner, faster, and more centralized alternative to the aforementioned format. Furthermore, DataPark helped clinicians by automating some processes such as calculating assessment scores. It is an easily accessible interface that also allows them to continue upon the previous clinician's work without providing many contexts, something that the clinicians had difficulty with when they were using the paper format.

Despite DataPark's virtues, it also comes with some flaws. The biggest flaw was the fact that, in order to perform any assessments (either by the web platform or by mobile application), the device that is being used requires an internet connection. This constrains the clinicians from performing assessments where there's no internet connection, such as in some of the patient's households. Furthermore, the fact that the clinician needs to type values that were already registered in the platform, such as the patient's birthday or height, is seen as an annoyance that can easily be fixed. One final flaw that was mentioned by the clinicians was the complete lack of contextualization when a patient writes a note down. If the patient does not include the note's context in the note, this leads the clinicians to lose the context of the note and, therefore, renders it useless.

Improvements to the Platform

Besides the flaws mentioned in the first sub-section, clinicians also mentioned a possible expansion to the free-living component. Clinicians proposed an application where the patient could see information about themselves. In a more elaborate description, this includes the patient's weight, as well as any results from the free-living evaluation. Furthermore, this application could also send hydration and medication reminders to the patients, should they need them.

Another addition to DataPark would be the automatic recognition of which sensor file belongs to which sensor type, as well as the body position where the recording took place.

Metric Analysis

Figure 5.1: New patient form from the high fidelity prototype with the date picker widget selected.

In order to understand participant performance during these tasks, one must first have in mind what's the ideal metrics for each task, which are shown by table 5.2. Furthermore, the average and standard deviation of each task can be found in table 5.3. An additional column dedicated to the number of participants that took part in the task was also created due to the fact that some participants either didn't perform the task or didn't start or end the task being performed.

Participants often took four times the duration to complete their task at hand. This seems to be due to the fact that their first time coming into contact with the platform and not due to a matter of design complexity, as showcased by the almost consensual low score when they were asked about the system complexity.

When it comes to the number of clicks, the participants came close to the ideal clicks on tasks 2 and 3 but performed poorly on tasks 1 and 4. In task four, this is explained due

Task	Clicks	Duration
T1	12	0:00:34
T2	1	0:00:04
T3	3	0:00:06
T4	7	0:00:12

Table 5.2: Ideal amount of clicks and duration of each task in session 1.

Task	Participants	Duration	Clicks	Mistakes
T1	4	0:01:36 (20.5)	17.8 (2.3)	0 (0)
T2	3	0:00:16 (7)	1.3 (0.6)	0 (0)
T3	2	0:00:23 (9.2)	3 (0)	0 (0)
T4	3	0:00:56 (14.2)	13.3 (5.5)	0 (0)

Table 5.3: Average and standard deviation of each metric by task.

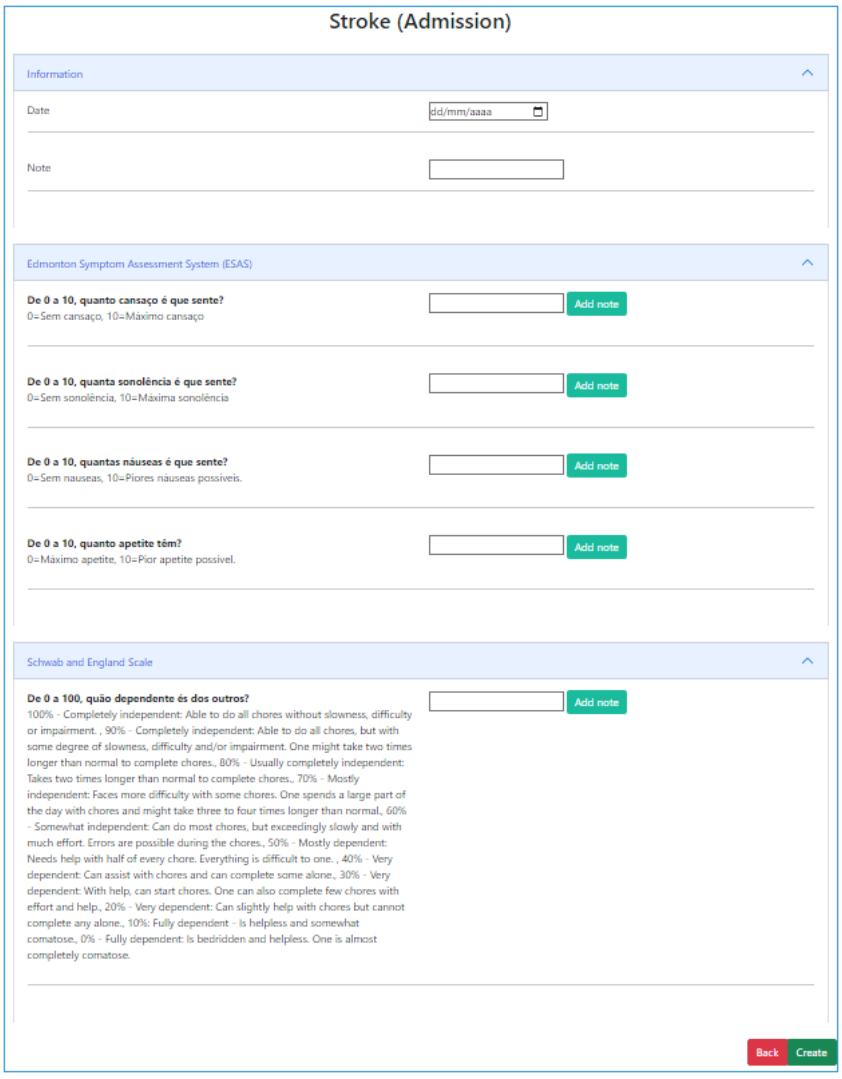

Figure 5.2: Example of an assessment in the high fidelity prototype

to the fact that the participants often preferred entering the patient birth date using the date picker widget instead of typing it in the text form, as figure 5.1 illustrates. In the case of task 4, the task's syntax was rather abstract and, as a result, some participants filled up a mock-up assessment that was present. Figure 5.2 showcases an example of this oversight.

SUS Questionnaire

The System Usability Scale (SUS)[12] is a reliable tool for measuring usability. It consists of a 10-item questionnaire with five response options for respondents; from Strongly agree (5) to Strongly disagree (1).

This section aims to denote the results from the questionnaire by question. Please note that participants S1 and S2 answered the same questionnaire.

Given from the information we could gather from the SUS questionnaires, the overall reception of the new prototype was positive and, with the exception of questions 2 and 4, fairly consensual. All the participants' SUS scores are above average, with the exception of N1, which is below average. This is likely due to N1 having a tendency to give a more neutral answer than the other participants.

Question	Average	Standard Deviation
1. I think that I would like to use this system frequently	4.6	0.55
2. I found the system unnecessarily complex	1.8	1.3
3. I thought the system was easy to use	4.4	0.55
4. I think that I would need the support of a technical person to be able to use this system	2.4	1.52
5. I found the various functions in this system were well integrated	4.2	0.45
6. I thought there was too much inconsistency in this system	1.2	0.45
7. I would imagine that most people would learn to use this system very quickly	4.4	0.55
8. I found the system very cumbersome to use	1	0
9. I felt very confident using the system	4.2	0.84
10. I needed to learn a lot of things before I could get going with this system	1.4	0.55

Table 5.4: Average and standard deviation of the SUS questionnaire of the first session.

Participant	Scores
P1	77.5
N1	65
PH1	72.5
PH2	72.5
S1 and S2	82.5
Average	74

Table 5.5: Participant SUS Score of the first session by participant.

5.1.5 Post Application Evaluation

Participant reaction to the platform

All participants agreed that the platform itself was faster and that the new design was better than the previous version. Physiotherapist PH2 notes that the weight and height input boxes weren't relevant during the patient's creation. Nutritionist N1 also mentioned that having a way to check the patient's weight change would be beneficial.

5.2 Second Session with the Clinicians

After the first session, our focus shifted towards implementing the suggestions provided by the clinicians in the first session. All points of action (including the suggestions) can be found in appendix C. After implementing the clinician's suggestions, we started creating a new protocol focused on the implemented suggestions, rather than the entire high-fidelity prototype. This was done in order to avoid repeating the same results and to validate that our implementations enhanced the overall project.

5.2.1 Procedure

Unlike the first session, the second session was conducted remotely via voice call and every participant could connect to the voice call using any device they could use. After the interview was conducted, the prototype was left accessible for 5 days after the meeting, in case any participant could not test the prototype during the voice call.

The overall structure of the session was very similar to the previous session, with the exception that, after a brief introduction, participants were testing the prototype right away, rather than asking questions before. These tasks were created with the goal of showing all the changes that were done to the prototype. After the participants tested the prototype, they would perform a SUS questionnaire, followed by some brief questions aimed towards providing more constructive feedback regarding the changes.

The full protocol can be found in appendix D.

5.2.2 Participants

In total, five clinicians participated in this study, with all of them testing the high-fidelity prototype and answering the SUS Questionnaire after performing the tasks. Furthermore, of these five participants, two answered the Post Application Evaluation.

5.2.3 Analysis

The focus group questionnaire was recorded and notes were taken during the meeting. From this transcript, we highlighted the different discussion points that were relevant to the scope of this project.

In order to perform the metric analysis, the same objective metrics were gathered from the patients performing each task. Furthermore, all participants performed the SUS questionnaire and the results were taken into consideration when evaluating the prototype's quality.

5.2.4 Results

There was an overall positive perception of both the prototype and all changes made to it, however, the participants also identified some flaws in this new iteration. All highlights that were mentioned by the clinicians will be mentioned below, as well as some context.

Battery Layout Organization

One example of such positive feedback was mentioned by a participant in the new battery layout organization, which organizes each battery by a row and the admission and discharge variants of the battery by column. It considers this layout superior to the current version of the platform, which displayed the battery and required the user to add whether it was an admission or discharge in the ”General Information” section of the report creation.

End Dates on Risks

There was a mixed reception regarding whether risks should have an end date or not. One physiotherapist stated that a falling risk should not have an end date, arguing that it is difficult to identify when the risk ends and, therefore, it cannot tell accurately when a patient is prone to falling or not. Shortly after this argument was stated, a speech therapist claimed that an end date makes sense in the choking risk, arguing that it could function as a history of the patient's condition.

In the end, both parties agreed that the end date should be kept for the risks, as they see that it can be used to evaluate the patient's progress.

Notes Associated to Context

There was a negative perception regarding how notes are displayed. They argue that, instead of all notes associated with the patient being displayed in the patient profile in chronological order, they should be displayed according to the context assigned to them. If a note was created for a certain section of a report, it should appear on the report results only. This leaves the more general notes in the patient profile and would prevent situations where the user needs to search through all notes associated with a patient in order to find a specific note.

Data Graphical Representation

One physiotherapist stated that the timeline graphics of all data structures do not add any value to the information being presented in the tables and, therefore, should be either excluded or accessible to the user should they wish to see it.

End Date on Hospitalization

One participant reported having difficulty discharging a patient, which is done by clicking on the *End* button in the current hospitalization. This operation should be made more explicit by renaming the button from *End* to *Discharge* and changing all mentions of the end date to *discharge date*, as the steps required to complete this task are entirely new are not obvious to the user.

Treatment Recommendation

When asked to further elaborate on the loosely mentioned treatment recommendation feature of the previous session, the participants stated that they wanted to be able to have certain treatment recommendations according to certain triggers. They further elaborated by providing two distinct examples:

- If a patient has sedentary behavior during the free-living evaluation, they should be recommended to take a walk.

- If the patient has a choking risk, treatment should be suggested.

These examples suggest that the participants want an algorithm that checks for a series of triggers in a patient and, should one or more triggers be true, it should recommend one or more treatments accordingly. Such triggers and treatments need to be defined by the clinicians in order to proceed with this feature.

SUS Questionnaire

After performing the tasks, all participants were invited to fill out the SUS questionnaire. This questionnaire would be available for 7 days in order to give enough time to all participants who could not participate in the session to do so. Table 5.6 shows the average and standard deviation for each question in the second question, while table 5.7 shows the individual SUS score of each participant, followed by the average. Both tables also contain the variation of the averages of both sessions.

Question	Average	Standard Deviation
1. I think that I would like to use this system frequently	4.6 (+0)	0.55
2. I found the system unnecessarily complex	1.8 (+0)	0.75
3. I thought the system was easy to use	4.4 (+0)	0.52
4. I think that I would need the support of a technical person to be able to use this system	2 (-0.4)	1.69
5. I found the various functions in this system were well integrated	4 (-0.2)	0.75
6. I thought there was too much inconsistency in this system	2 (+0.8)	0.75
7. I would imagine that most people would learn to use this system very quickly	3.6 (-0.8)	0.52
8. I found the system very cumbersome to use	1.8 (+0.8)	0.75
9. I felt very confident using the system	4 (-0.2)	0
10. I needed to learn a lot of things before I could get going with this system	1 (-0.4)	0

Table 5.6: Average and standard deviation of the SUS questionnaire of the second session.

In total, 5 participants answered the SUS questionnaire with an average score of 80 (a 6-point increase compared to the previous session) with a standard deviation of 6.06. When comparing the averages of both sessions, we can see that the participants think, on average, that the system is more inconsistent and cumbersome and that the various functions of the system were slightly worse when compared to the previous iteration. Furthermore, on average, the confidence they have in this iteration fell slightly compared to the previous iteration. Despite this feedback, participants also think, on average, that they do not need as much support as the previous iteration and that they would not need to learn as much in order to use this system. They also think that the system is just as easy and simple to use as the previous iteration.

ID	SUS Score
1	85
2	77.5
14	85
18	70
19	82.5
Average	80 (+6)

Table 5.7: SUS scores for each participant in the second session.

Chapter 6

Conclusion

This project focused on expanding and improving the DataPark web platform. Initially, the main focus was on including both patients and caretakers in the platform through a new component, however, the scope soon changed in order to improve upon the existing web platform.

In order to improve the system's user interface, a high-fidelity prototype was developed that aimed to replace the current interface. This prototype was developed by conducting a heuristic analysis and underwent various iterations. It was then tested by clinicians in order to adjust it according to their feedback.

Initially, both the new user interface and its features mentioned were to be added to the already existent platform, however, a new platform was developed due to a combination of multiple factors.

While the new user interface was being developed, some new features were also developed that aimed to improve the already existing web and mobile platforms. The ability to save appointments without requiring online access in the mobile application, as well as the creation of an API that extracts further metrics from sensory data are two features that were completed during this project. The ability to translate web and mobile reports was initially intended to be included in the existent version, however, it was instead added to the new platform in order to create a new simple report format.

6.1 Benefits

The creation of the new platform eliminated many of the mentioned flaws that were present in the current version. In other words, it brought the following benefits:

- The use of an API approach helps any further developments due to its modularity.
- Improves system scalability by adding the option to scale more than a single component.

- By using an up-to-date version of Python, it allows further updates to both the Django framework, as well as all libraries that the project uses, something that not only improves the project's stability and reliability, but also further protects them from any security issues.
- It improves database search speeds by using an SQL approach instead of a No-SQL approach.

The new user interface brought the following benefits to DataPark:

- Reduced amount of interactions that the clinician needs to perform in order to complete their tasks.
- Reduced amount of front-end libraries that each web page uses, thereby improving page load speed and standardizing the page's design.
- Reduced the amount of Javascript usage of each web page by taking advantage of Django's template engine.

Beyond the developments of the new platform, developments made to the current web and mobile projects allow clinicians to:

- Avoid losing any new appointments due to not having an internet connection on their mobile device;
- Observe more metrics when viewing an appointment.

6.2 Limitations

This project provided a new platform that implemented the features showcased in the high-fidelity prototype. These features don't cover the full scope that the current DataPark offers. As such, this new version is merely the groundwork for future developments and, as such, isn't ready for any real usage.

During the objective performance evaluation phase of both sessions with clinicians, the objective metrics of some participants were lost due to user error (such as two or more participants logging in to the same account, for example) or due to a bug in the high-fidelity prototype. Furthermore, the pandemic situation at the time of the second session meant that we had to perform the session remotely.

6.3 Future Work

This new iteration of DataPark lays the groundwork for a more effective platform, however, it still has a long way to go in order to be used by clinicians:

- Implement the sensor data upload feature by creating a file storage component where sensor data would be stored and information about them kept.
- Incorporate the metric analysis that is performed in the reports.
- Expand upon the admission and discharge report comparison.
- Finalize the legacy API, thereby allowing every data structure to be translated into the new iteration.
- Adapt the mobile application back-end in order to support this new API approach.
- Allow the clinician to create their own assessments and batteries in the new iteration.
- Allow the system administrators to create new roles and create new accounts inside the platform.

Appendix A

Heuristic Analysis Report

Ciências ULisboa

Análise Heurística

DataPark

Maria Silva
Martim Viana

Ciências ULisboa

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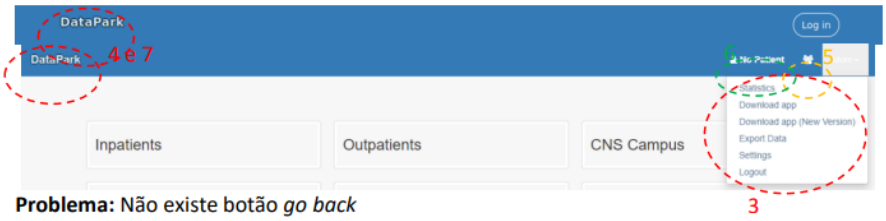
Ciências ULisboa

Geral

1. **Problema:** Falta documentação/ajudas/tutoriais para novos utilizadores da plataforma.
   Heurística: H2-1 (Tornar estado do sistema visível)
   Descrição: Não existe nenhum ícone ou nenhuma documentação disponível ao cliente que lhe ajude a começar a utilizar a plataforma ou que forneça conselhos para melhorar o uso da mesma.
   Correção: Criar um mecanismo para ajudar os novos clientes a utilizar a plataforma.
   Gravidade: 3

Barra de Navegação



2. **Problema:** Não existe botão *go back*
   Heurística: H2-3 (Utilizador controla a navegação e tem livre arbítrio)
   Descrição: É possível voltar para o menu principal ao clicar no link *DataPark* e é possível voltar para a página anterior clicando na seta a apontar para a esquerda no *browser*, no entanto, os utilizadores evitam clicar nas setas porque pode também cancelar a operação atual do cliente.
   Correção: Adicionar pelo menos uma seta a apontar para a esquerda, no lado esquerdo da barra de navegação, que leve o utilizador para a página anterior.
   Gravidade: 2

3. **Problema:** Demasiadas opções no submenu *More*
   Heurística: H2-7 (Flexibilidade e eficiência)
   Descrição: A barra de navegação contém espaço que pode ser aproveitado para "aliviar" a quantidade de opções que estão dentro do menu *More*.
   Correção: Adicionar algumas das opções mais usadas ou que devam ser mais destacadas do submenu *More*, como *Logout* ou *Statistics*, e incluí-los na barra de navegação
   Gravidade: 1

4. **Problema:** Título da plataforma demasiado pequeno
   Heurística: H2-4 (Consistência e aderência a normas)
   Descrição: O título da plataforma na página inicial é demasiado pequeno e demasiado discreto. Quando abrimos a página, a primeira coisa que vemos é a foto da FCUL e depois o texto descritivo. Só depois é que vemos o título. E, normalmente, o título é o principal identificador da página onde nos encontramos e está destacado.
   Correção: Aumentar o tamanho da letra e/ou dar uma posição de maior destaque.

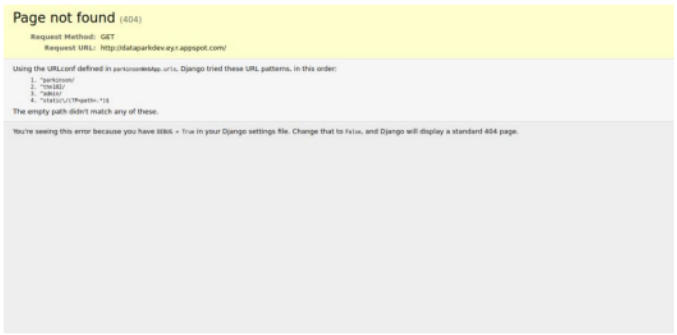
Gravidade: 2

5. **Problema:** Ícone das pessoas
   Heurística: H2-4 (Consistência e aderência a normas), H2-5 (Evitar erros) e H2-6 (Reconhecimento em vez de lembrança)
   Descrição: O botão leva-nos de volta ao menu /parkinson/notifications/, sendo que o ícone não indica ao utilizador a sua função.
   Correção: Remover o botão ou dar-lhe outro uso.
   Gravidade: 2

6. **Problema:** Ícone da pessoa
   Heurística: H2-4 (Consistência e aderência a normas) e H2-6 (Reconhecimento em vez de lembrança)
   Descrição: O símbolo da pessoa e a sua localização está normalmente associado ao utilizador logado, no entanto, nesta plataforma refere-se ao paciente que estamos a visitar, o que é confuso.
   Correção: Colocar o nome do utilizador nessa parte e encontrar outra opção para identificar o paciente visitado pela última vez.
   Gravidade: 2

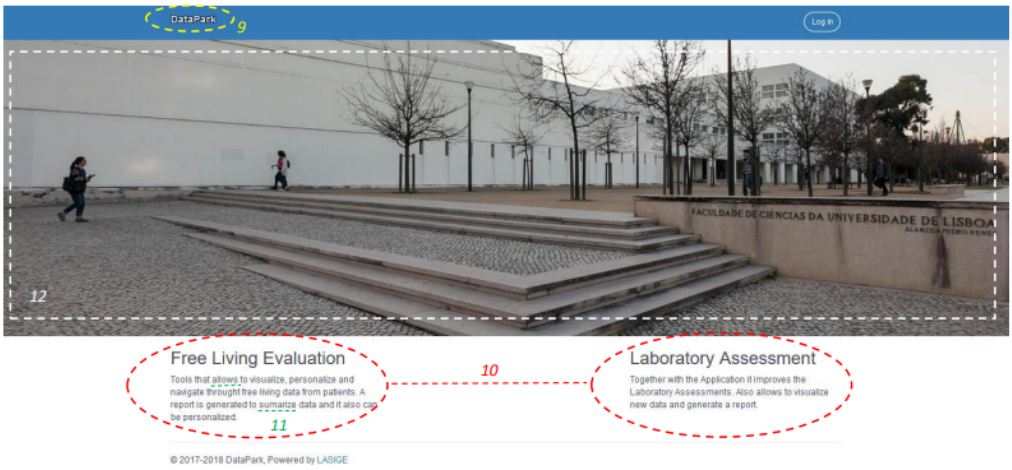
7. **Problema:** Nome da aplicação não está alinhado com Log in
   Heurística: H2.8 – Desenho estético e minimalista
   Descrição: Um utilizador mais perfecionista depara-se com um nome da aplicação descentrado na página, perdendo ali uns segundos de pensamento que o poderão distrair do objetivo de ter aberto a aplicação.
   Correção: Centrar o nome da aplicação.
   Severidade: 1

Página de Erro



8. **Problema:** Mensagem de erro para *developers* acessível ao utilizador.
   Heurística: H2-2 (Falar a linguagem do utilizador) e H2-3 (Utilizador controla a navegação e tem livre arbítrio)
   Descrição: Sempre que não é possível aceder a uma página web pedida pelo utilizador, surge uma mensagem de erro padrão do *django*, onde contém informação para os *developers* e não para os clientes.
   Correção: Desligar a flag que indica que o *website* está em modo *debug* e associar erros a novas páginas de erro que explicam o que aconteceu na linguagem do utilizador.
   Gravidade: 2

Página Inicial



9. **Problema:** Título da plataforma demasiado pequeno
   Heurística: H2.4 – Coerência e adesão a Normas
   Descrição: O título da plataforma na página inicial é demasiado pequeno e demasiado discreto. Quando abrimos a página, a primeira coisa que vemos é a foto da FCUL e depois o texto descritivo.

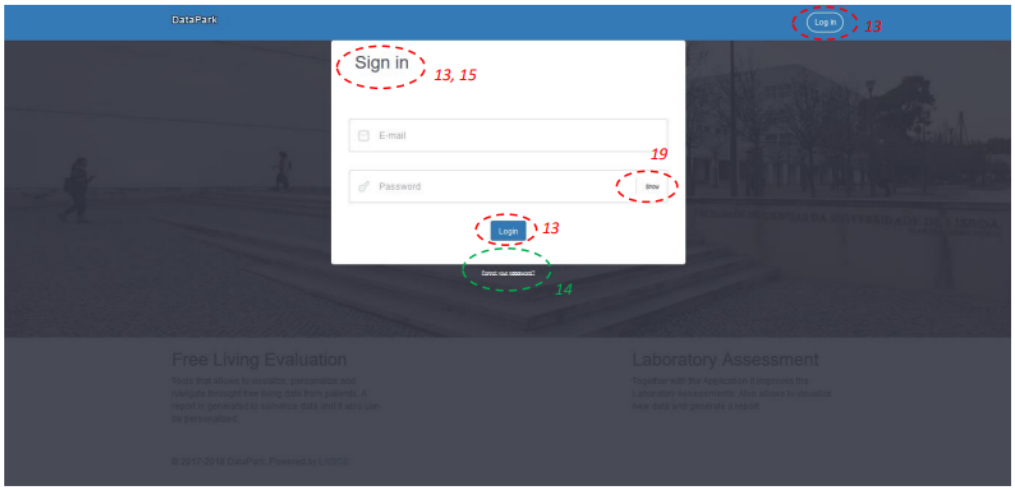
Só depois é que vemos o título. E, normalmente, o título é o principal identificador da página onde nos encontramos e está destacado.
Correção: Aumentar o tamanho da letra e/ou dar uma posição de maior destaque.
Severidade: 2

10. **Problema:** Descrição da plataforma
Heurística: H2.2 – Correspondência entre o sistema e o mundo real
Descrição: O texto não resume bem o que a plataforma faz para quem não tem conhecimento sobre ela. Não é possível perceber que a plataforma é dedicada a doentes com Parkinson.
Correção: Adicionar frases como: "DataPark is a platform that enables subjective and objective data collection for Parkinson's disease" e/ou "The main goal of this platform is to provide clinicians with better tools for understanding Parkinson patients' fluctuations and health state" (Diogo Branco *et al*, 2019).
Severidade: 2

11. **Problema:** Erros ortográficos e gramáticos
Heurística: H2.2 – Correspondência entre o sistema e o mundo real
Descrição: O texto tem erros em "allows" e "sumarize".
Correção: Trocar "allows" por "allow" e "sumarize" por "summarize".
Severidade: 2

12. **Problema:** Foto da FCUL não é representativa da plataforma
Heurística: H2.4 – Coerência e adesão a Normas
Descrição: Normalmente as plataformas usam imagens descritivas do que fazem/para que servem e a foto da FCUL não nos dá informação sobre isso.
Correção: Trocar para uma foto representativa da plataforma juntamente com o logótipo da FCUL.
Severidade: 2

Modal de Login



13. **Problema**: Inconsistências no login do utilizador na plataforma

Heurística: H2.4 – Coerência e adesão a normas
Descrição: Existem três termos diferentes para a entrada do utilizador na plataforma: "Log in", "Sign in" e "Login".
Correção: Escolher só um dos termos e usá-lo sempre
Severidade: 2

14. **Problema**: Texto demasiado pequeno
Heurística: H2.4 – Coerência e adesão a normas
Descrição: O "Forgot your password?" está demasiado pequeno e é difícil de ler.
Correção: Aumentar o tamanho da letra.
Severidade: 2

15. **Problema**: Elementos não alinhados
Heurística: H2.4 – Coerência e adesão a normas
Descrição: O "Sign in" deveria estar centrado para acompanhar o Login e o "Forgot your password?".
Correção: Centrar o "Sign in"
Severidade: 2

16. **Problema:** Campo "email" permite formato inválido
Heurística: H2-5 (Evitar erros)
Descrição: O campo "email" permite que o utilizador insira qualquer *string*, independentemente se contém o formato único do email ou não, sendo que apenas adiciona um contorno vermelho ao campo "email".
Correção: Permitir que o utilizador apenas insira uma *string* que esteja no seguinte formato: name@servicename.domain.
Gravidade: 2

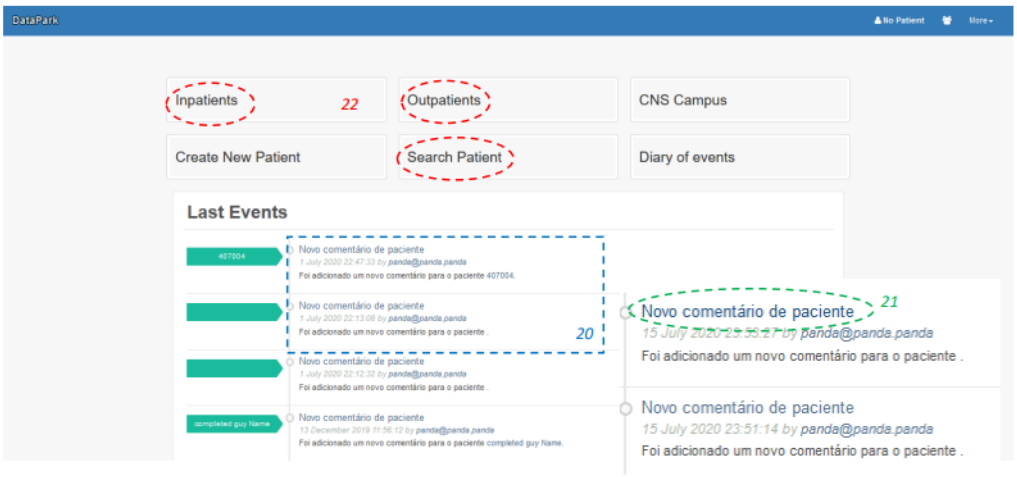
17. **Problema:** Não é indicada a fonte do problema quando o utilizador não consegue fazer login.
Heurística: H2-9 (Ajudar a reconhecer, diagnosticar e recuperar de erros)
Descrição: Quando um ou mais campos contém informação errada, apenas é adicionado um contorno a vermelho a indicar ao utilizador quais campos é que contém o erro.
Correção: Criar mensagens únicas para cada tipo de erro, fornecendo a razão do erro, assim como sugestões para o corrigir.
Gravidade: 3

18. **Problema:** Log in poderia ter as barras de e-mail e password menos afastadas do "Sign in"
Heurística: H2.8 – Desenho estético e minimalista
Descrição: A distância entre "Sign in" e a primeira barra e entre barras acabam por não ser proporcionais na ótica do utilizador.
Correção: Reduzir espaço entre "Sign in" e "E-mail".
Gravidade: 1

19. **Problema**: No Log in ao se carregar em "Show" ocorre uma sobreposição da palavra com um ícone de password.
Heurística: H2.8 – Desenho estético e minimalista

Descrição: Um utilizador mais perfecionista depara-se com uma sobreposição duma imagem de chave com a palavra “Show” e “Hide”
Correção: Retirar imagem de chave que aparece ao se selecionar “Show” e “Hide”.
Gravidade: 1

Menu/Parkinson/notifications



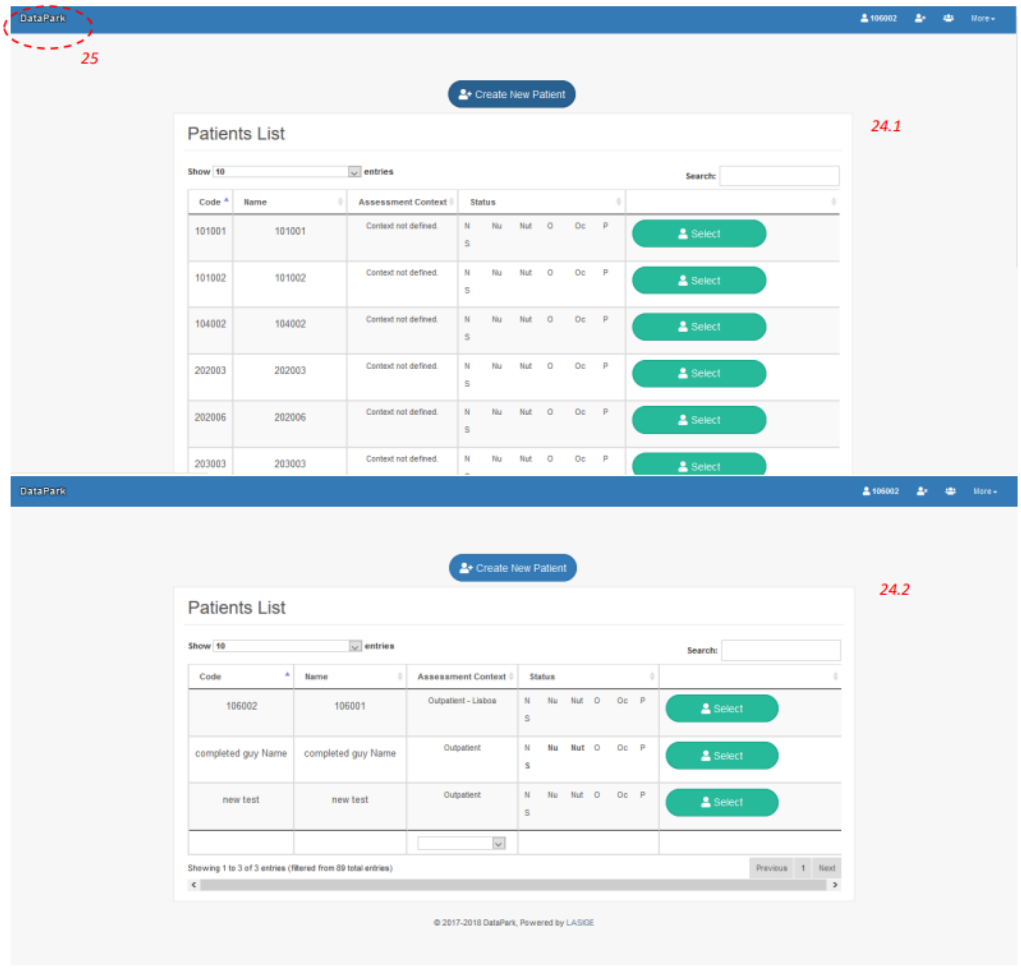
20. **Problema:** Comentários de pacientes sem número
    Heurística: H2.5 – Evitar erros
    Descrição: Na lista de eventos, há comentários associados a pacientes sem identificação.
    Correção: Não deixar haver pacientes sem identificação.
    Severidade: 3

21. **Problema:** Texto *highlighted* sem hiperligação
    Heurística: H2.4 - Coerência e adesão a normas
    Descrição: Quanto colocamos o rato em cima de “Novo comentário de paciente” e no *user*, o texto fica *highlighted* mas não é clicável e normalmente isto está associado a uma hiperligação.
    Correção: Retirar o *highlight* ou colocar a hiperligação correspondente.
    Severidade: 2

22. **Problema:** Acesso a lista de pacientes
    Heurística: H2.7 - Flexibilidade e eficiência
    Descrição: É confuso se a opção “Search Patient” abre a lista de pacientes completa e se o “Inpatients” e o “Outpatients” só os respetivos? Mas cada uma destas duas ligações tem uma opção de *search*. Redundante.
    Correção: Colocar uma opção de “Patients” onde estará uma lista de todos os pacientes e haverá a opção de filtrar por “Outpatients” e “Inpatients” diretamente, bem como de fazer *search* a um paciente em específico.
    Severidade: 2

23. **Problema:** Acesso a lista de pacientes
Problema: Criação de pacientes pode ocorrer em diversos sítios
Heurística: H2.7 – Flexibilidade e eficiência
Descrição: De facto, queremos que os utilizadores tenham flexibilidade para criar pacientes, mas não queremos deixá-los confusos se há diferenças donde os criar.
Correção: Deixar apenas essa função no "Create New Patient".
Gravidade: 1

Search Patient

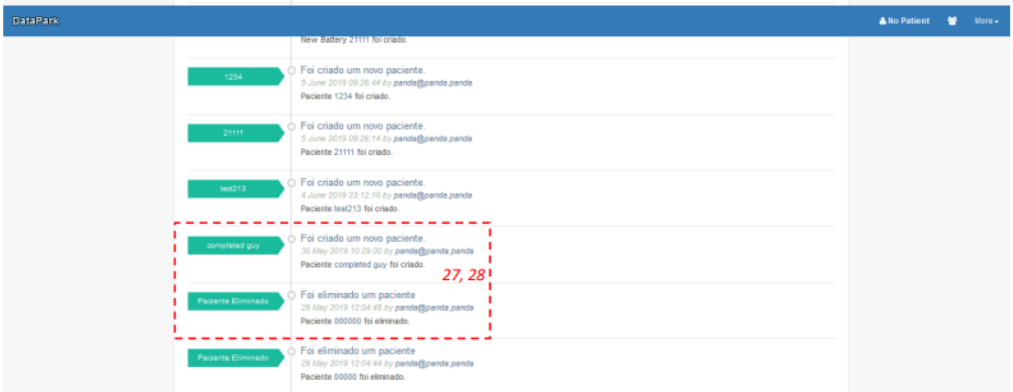


24. **Problema:** Lista de paciente incorreta
Heurística: H2.5 – Evitar erros
Descrição: Quando se carrega em "Outpatients", aparece uma lista de pacientes grande (20.1) que passado alguns segundos ou um *scroll* para cima e outro para baixo é reduzida a 3 (20.2).
Correção: Melhorar a rapidez do código de pesquisa/filtragem.
Severidade: 3

25. **Problema**: Para voltar à página inicial só dá apenas ao clicar para voltar atrás na página do browser ou por clicar no símbolo "DataPark"
Heurística: H2.3 – Utilizador controla e exerce livre-arbítrio e H2.6 – Reconhecimento em vez de lembrança
Descrição: O utilizador não tem livre-arbítrio ou não ter um símbolo facilmente reconhecível para voltar atrás nas suas ações, como no caso de sair da ágina dos "Outpatients". "DataPark" oferece essa capacidade, mas quem não conhece a aplicação demora a perceber essa funcionalidade.
Correção: Adicionar botão facilmente reconhecível para voltar atrás
Gravidade: 3

26. **Problema**: Página não identifica se está por exemplo no "Search Patient"
Heurística: H2.6 – Reconhecimento em vez de lembrança e H2.1 – Tornar o estado do sistema visível
Descrição: O utilizador após clicar numa página, esta nada o informa sobre o seu título.
Correção: Criar um caminho com hiperligação de maneira a que o utilizador perceba onde está e facilmente consiga voltar atrás.
Gravidade: 2

Last Events

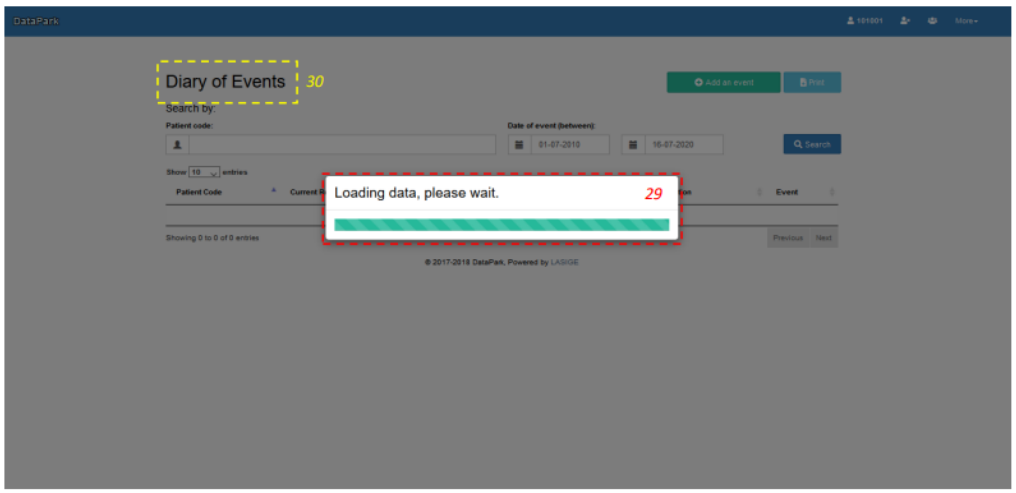


27. **Problema:** A mesma cor é usada para criação e eliminação de pacientes

Heurística: H2.4 – Coerência e adesão a normas
Descrição: A cor verde está associada à eliminação do paciente e à sua criação.
Correção: Se calhar seria melhor meter a cor verde na criação de qualquer coisa e a vermelha na eliminação e depois adicionar ícones representativos do paciente, dos relatórios e das baterias?
Severidade: 2

28. **Problema:** Uso de duas línguas diferentes na homepage
Heurística: H2.4 – Coerência e adesão a normas
Descrição: Informação em português e data em inglês. Mas depois o cabeçalho também está em inglês. Não é coerente. Assume que quem usa a plataforma sabe falar as duas línguas.
Correção: Escolher uma das línguas ou então adicionar a opção de trocar entre as duas.
Severidade: 2

Diary of Events

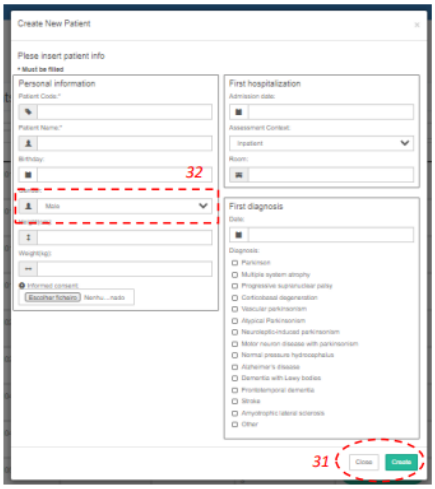


29. **Problema:** "Loading data" sem indicação de estado
Heurística: H2.1 - Tornar estado do sistema visível
Descrição: Quando se carrega em procurar evento, o "Loading data" não mostra nem dá indicação a que percentagem vai ou se falta muito tempo para abrir. Quando se procura eventos desde 2010, parece ficar bloqueado, como no exemplo.
Correção: Colocar uma indicação de percentagem de *loading* e/ou o tempo que falta para acabar.
Severidade: 3

30. **Problema:** "Diary of Events" sem utilização
Heurística: H2.10 - Dar ajuda e documentação
Descrição: O que é o "Diary of Events"? Não aparece nada. É equivalente à lista de eventos? Dá para adicionar um evento ou um evento é criado sempre que se faz uma modificação nos pacientes?

Correção: Não sei, não percebo bem.
Severidade: 3

Modal Create New Patient

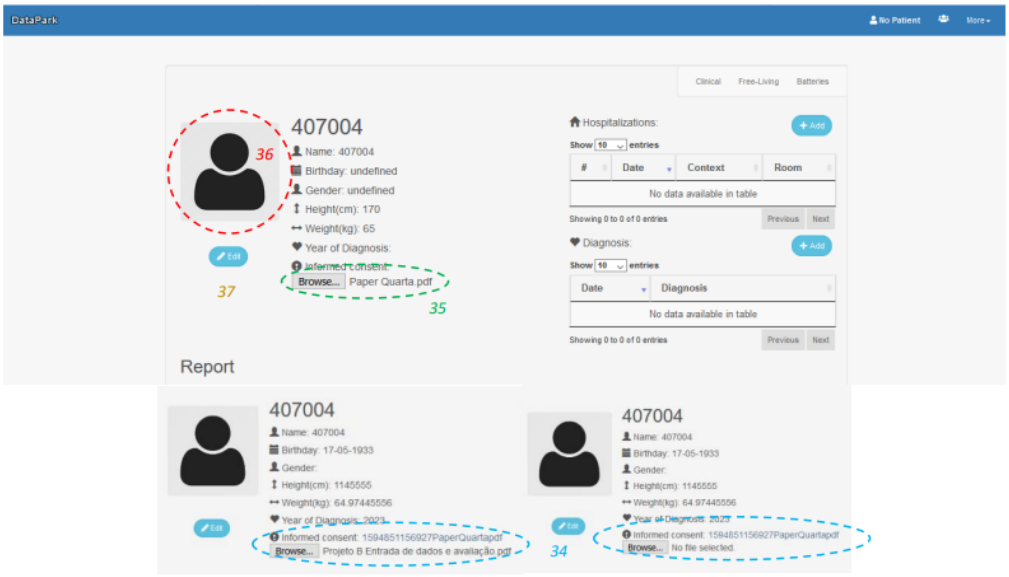


31. **Problema:** Botão *Close* errado
Heurística: H2-5 (Evitar erros), H2-4 (Consistência e aderência a normas), H2-7 (Flexibilidade e eficiência) e H2-6 (Reconhecimento em vez de lembrança)
Descrição: O botão 'Close' cancela todos os campos preenchidos pelo utilizador e sai da página Create New Patient. Como trata-se de um botão que cancela todos os registos feitos pelo cliente, o cliente deve ter a perfeita noção do que o botão indica ao olhar de relance para o mesmo. Deve aderir às normas de design de interface tradicionais (exemplo indicado abaixo), assim como deve destacar-se de todos os outros botões da região.
Correção: Adicionar cor vermelha, ao botão *Close*, posicioná-lo à direita do botão *Create* e renomea-lo para *Cancel*
Gravidade: 2

32. **Problema**: O formulário de "Create New Patient" assume já um género
Heurística: H2.3 – Utilizador controla e exerce livre-arbítrio
Descrição: Formulário assume já o género, só dando 2 hipóteses destes mesmos
Correção: Sendo o campo do género algo suscetível de mágoa por parte dos pacientes e poderá não ser um campo obrigatório, não assumir já um género aparecendo este em branco e dar outras opções que não aquelas 2, isto se o género não for de facto obrigatório.
Gravidade: 2

33. **Problema**: Após ser criado um novo paciente, não se recebe feedback sobre a ação completada com sucesso.
Heurística: H2.1 – Tornar o estado do sistema visível
Descrição: Após o utilizador criar um novo paciente, este não recebe feedback sobre a sua ação.
Correção: Adicionar uma mensagem de sucesso.
Gravidade: 2

Patient Profile



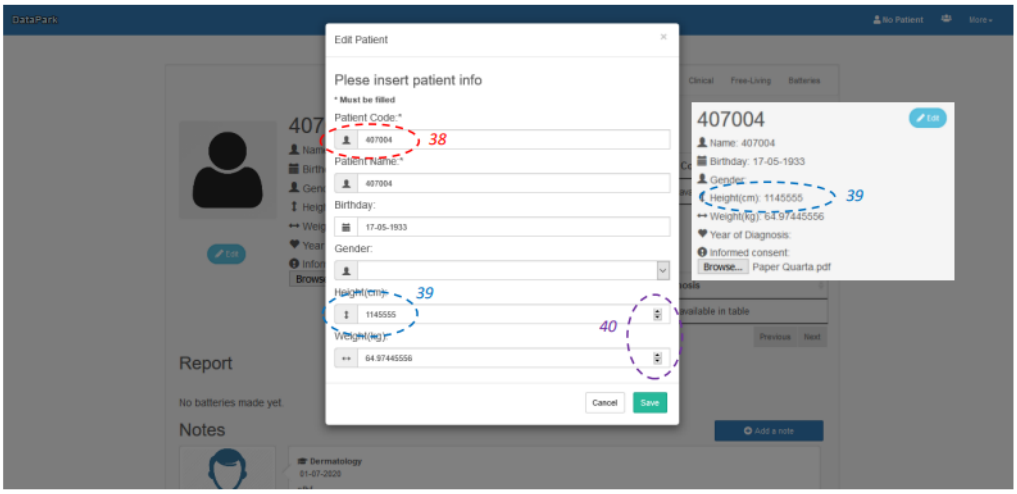
34. **Problema:** Edição de ficheiro de consentimento.
Heurística: H2.5 – Evitar erros
Descrição: Quando se adiciona um ficheiro de consentimento, ele fica automaticamente guardado e quando se tenta colocar um diferente carregando em *browse* (única opção disponível), o novo ficheiro aparece, mas acaba por não ficar guardado. Quando se faz *refresh* à página, o ficheiro de consentimento continua a ser o primeiro colocado e não é possível eliminá-lo. É problemático, porque pode ser adicionado o papel de consentimento do paciente errado e depois não é possível mudá-lo.
Correção: Colocar uma cruz ao lado do nome do ficheiro para o eliminar ou colocar a opção de sobrepor outro ficheiro.
Severidade: 3

35. **Problema:** Botão de adicionar ficheiro de consentimento informado
Heurística: H2.5 – Evitar erros
Descrição: Carregar ao lado do botão do "Browse…" também abre o envio de arquivos, quando deveria ser só no "Browse…".
Correção: Abrir o envio de arquivos apenas quando se carrega no botão "Browse…"

Severidade: 2

36. **Problema:** Adicionar foto de paciente
Heurística: H2-3 (Utilizador controla a navegação e tem livre arbítrio)
Descrição: Existe a opção de disponibilizar a foto de perfil do paciente, mas não existe a opção de adicionar uma foto de perfil.
Correção: Adicionar uma opção para colocar uma foto de perfil ou retirar o espaço dedicado à foto de perfil.
Gravidade: 2

37. **Problema**: Botão de "Edit" induz em erro
Heurística: H2.4 – Coerência e adesão a normas e H2.5 – Evitar erros
Descrição: Botão de "Edit" no perfil dos pacientes serve para alterar os dados à direita e não para adicionar uma foto do paciente. Este botão induz em erro a cerca da sua função.
Correção: Colocar o botão no lado direito da informação a ser editada e acrescentar outro para editar de facto a foto de perfil.
Gravidade: 2

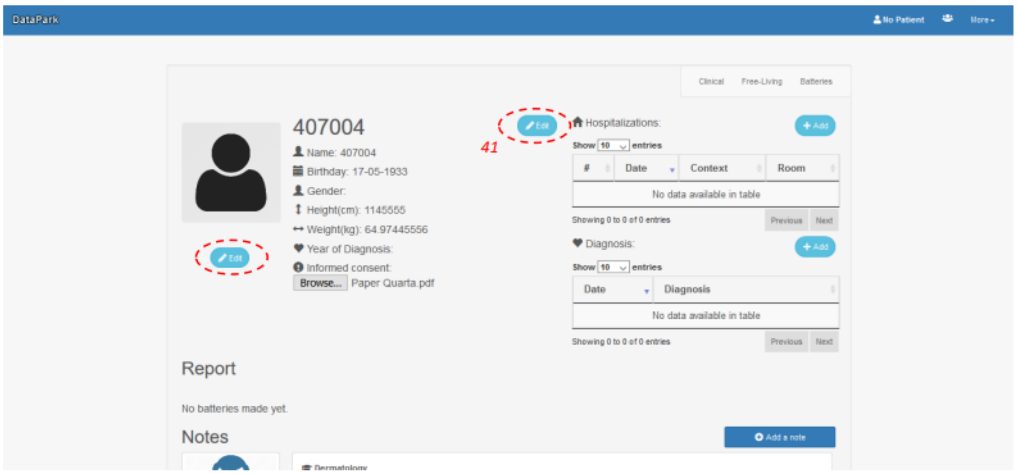


38. **Problema:** Código dos pacientes
Heurística: H2.5 – Evitar erros
Descrição: O código do paciente não é único e pode ser alterável para um código já existente, o que poderá levar a confusão e troca de dados entre pacientes.
Correção: Tornar o código de cada paciente único e gerá-lo automaticamente quando se adiciona um novo paciente.
Severidade: 4

39. **Problema:** Valores sem sentido real de altura e peso
Heurística: H2.5 – Evitar erros
Descrição: Os valores da altura e peso do paciente têm limites muito elevados e o número de casas decimais no peso é desnecessária

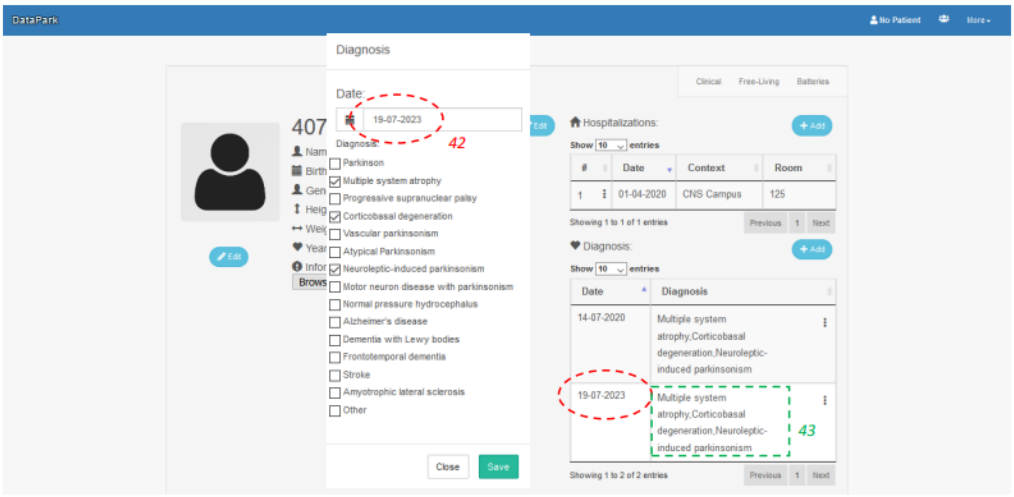
Correção: Colocar limites na altura e peso do paciente e alterar o número de casas decimais para o padrão.
Severidade: 2

40. **Problema:** Botões de altura e peso
Heurística: H2.5 – Evitar erros
Descrição: Os botões de altura e peso são demasiado pequenos e demoram muito tempo para passar entre valores.
Correção: Aumentar um pouco o tamanho ou substituir por um tipo *scroll*.
Severidade: 2



41. **Problema:** Botão de edição duplicado
Heurística: H2.4 – Coerência e adesão a normas
Descrição: Há um *bug* em que aparecem 2 botões "Edit" que fazem exatamente a mesma coisa. Aparecem depois de uma primeira edição de valores do perfil.
Correção: Procurar onde está o bug no código e eliminá-lo.
Severidade: 2

Modal Diagnosis



42. **Problema:** Uso de datas futuras no adicionar diagnóstico
Heurística: H2.5 – Evitar erros
Descrição: Ao adicionar um diagnóstico ao paciente, é permitido adicionar uma data futura, na qual um diagnóstico não poderia ter sido feito ainda.
Correção: Limitar o calendário até à data em que é feito o diagnóstico.
Severidade: 3

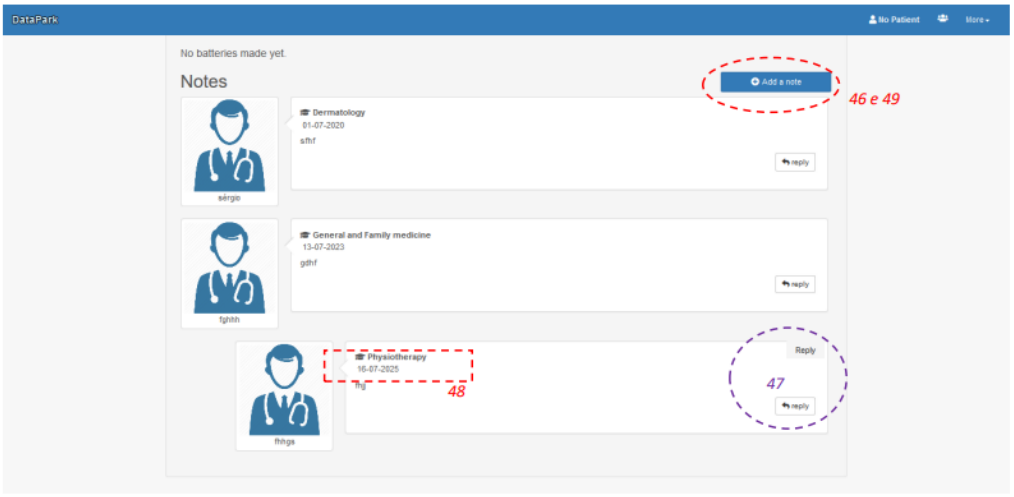
43. **Problema:** Diagnósticos não alinhados
Heurística: H2.4 – Coerência e adesão a normas
Descrição: Os diagnósticos estão alinhados à esquerda e seguidos por vírgula. Torna a leitura mais difícil e não é coerente com o uso geral de alinhamento à esquerda e palavra/frase por linha.
Correção: Colocar um diagnóstico por linha, mantendo o alinhamento à esquerda
Severidade: 2

44. **Problema**: Diagnóstico é permitido sem selecionar data
Heurística: H2.5 – Evitar erros
Descrição: É permitido adicionar um diagnóstico sem data, podendo levar a que um doutor que não o usual não perceba quando foi feito o diagnóstico ou se de facto é só um erro da plataforma.
Correção: Colocar restrição de maneira a que seja obrigatório colocar data, sendo esta conforme o atual e não datas irreais.
Gravidade: 2

45. **Problema**: Diagnóstico completamente repetidos são aceites
Heurística: H2.5 – Evitar erros
Descrição: É permitido adicionar o mesmo diagnóstico o número de vezes que se quiser.

Correção: Restringir núemero de diagnósticos completamente iguais (ou seja, mesma doença e data) para 1
Gravidade: 2

Add Note



46. **Problema:** Uso de notas na página do paciente
    Heurística: H2-3 - Utilizador controla e exerce livre arbítrio
    Descrição: Dá para adicionar uma nota à página do paciente, mas não há maneira de a editar ou remover.
    Correção: Acrescentar opções de edição e remoção da nota.
    Severidade: 2

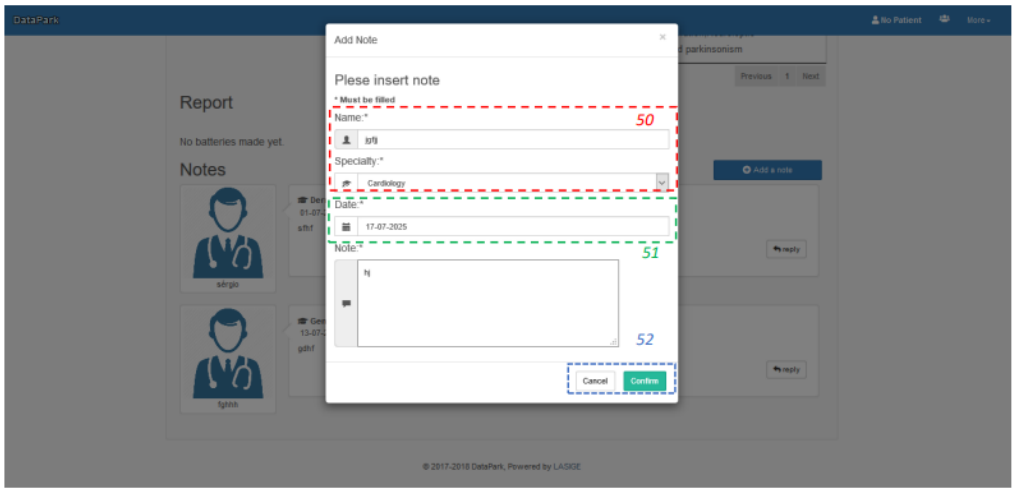
47. **Problema:** Edição de respostas a notas de paciente
    Heurística: H2-3 - Utilizador controla e exerce livre arbítrio
    Descrição: Ao adicionar uma resposta à nota na página do paciente, não é possível eliminá-la nem a editar depois.
    Correção: Deveria ser dada a opção de pelo menos editar a resposta, em caso de erro.
    Severidade: 2

48. **Problema:** Uso de datas futuras na resposta às notas do paciente
    Heurística: H2-5 – Evitar erros
    Descrição: Ao adicionar uma resposta à nota na página do paciente, é permitido colocar uma data futura.
    Correção: A resposta deveria ser colocada com a data do dia em que foi feita de forma automática.
    Severidade: 3

49. **Problema**: Caixa de "Add a Note" poderia encontrar-se alinhada com as restantes caixas de cima
    Heurística: H2.8 – Desenho estético e minimalista

Descrição: A Caixa de "Add Note" poderia encontrar-se alinhada com as restantes caixas de cima de maneira a que cumpra a norma de alinhamento e sem espaço branco desnecessário.
Correção: Estender largura da caixa de "Note".
Gravidade: 1

Modal Add Note

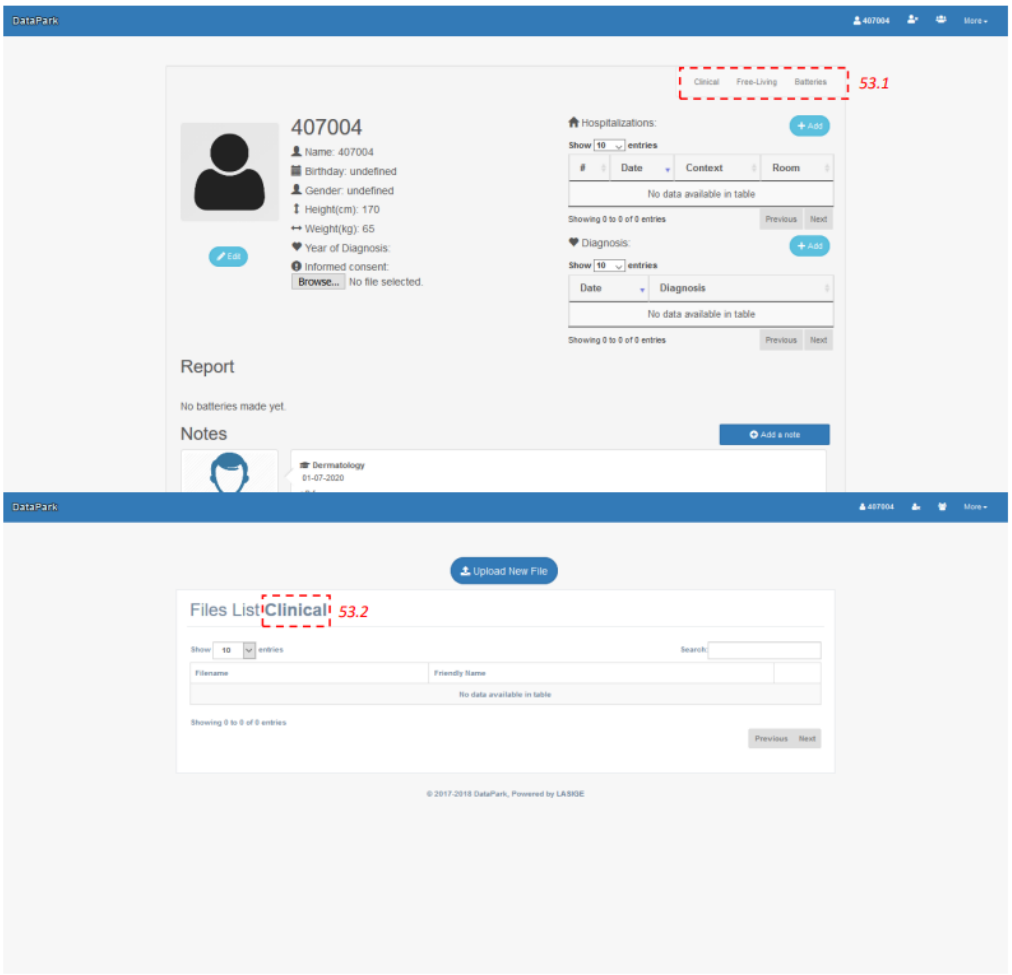


50. **Problema:** Confusão no nome/especialidade de quem insere a nota
Heurística: H2-10 - Dar ajuda e documentação
Descrição: As notas são inseridas por quem? Só pelo médico que tem acesso à plataforma e ele insere os comentários dos outros especialistas? Ou cada um dos especialistas pode inserir notas? Não entendi.
Correção: Se a nota for inserida pelo próprio utilizador, então ter o nome dele automaticamente preenchido. Caso contrário, preciso de mais informação. Acrescentar informação de ajuda.
Severidade: 3

51. **Problema:** Uso de datas futuras na adição de notas
Heurística: H2-5 – Evitar erros
Descrição: Ao adicionar uma nota na página do paciente, é permitido adicionar uma data futura.
Correção: A nota deveria ser colocada com a data do dia em que foi feita de forma automática.
Severidade: 3

52. **Problema**: Botões de "Cancel" e "Confirm" encontram-se por norma ao contrário
Heurística: H2.4 – Coerência e adesão a normas
Descrição: Em diversos locais do perfil dos pacientes, os botões "Cancel" e "Confirm" encontram-se numa ordem que suscita erros, fazendo com que um utilizador habituado a um certo tipo de desenho carregue em "Cancel" em vez de "Confirm"
Correção: Trocar ordem dos botões
Gravidade: 1

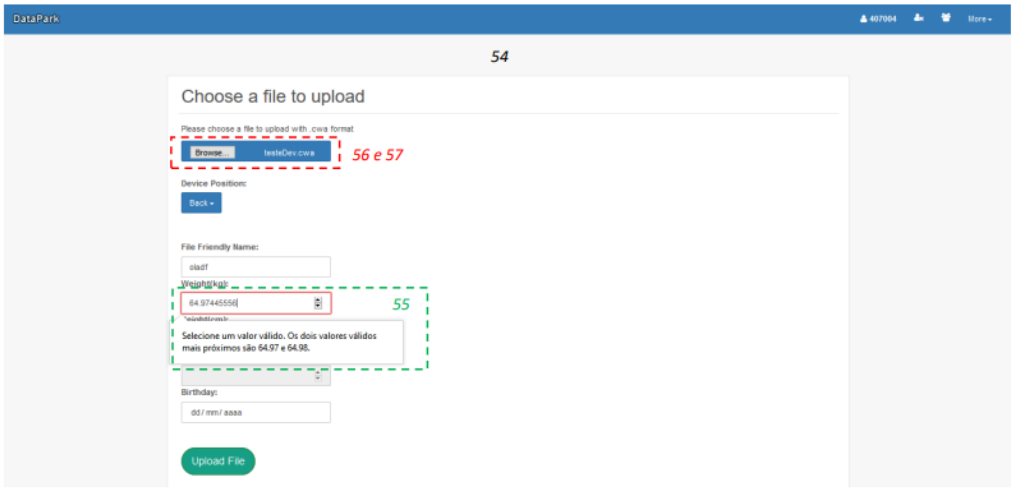
Files List Clinical



53. **Problema:** Estado do sistema não claro
Heurística: H2-1 - Tornar estado do sistema visível
Descrição: Quando se carrega em "Clinical", "Free-Living" ou "Batteries" (40.1), entramos em páginas que não estão devidamente identificadas. Temos de associar o número do paciente em cima à direita com o nome a negrito ("Clinical" no exemplo 40.2) o que não é muito intuitivo para um utilizador novo.
Correção: Manter a barra assinalada em 40.1, e em cada uma das páginas a que vamos, o título respetivo fica em destaque, sendo a negrito, cor diferente, *highlighted*, etc.
Severidade: 3

Ciências ULisboa

Upload File



54. **Problema:** Estado do sistema não claro
Heurística: H2-1 - Tornar estado do sistema visível
Descrição: Ao carregar em "Upload New File" (imagem do erro 40), abre uma página que nos faz perder mais um elemento no estado do sistema. Ficamos sem perceber que estamos na secção "Clinical", apenas sabemos que tem a ver com o paciente 407004.
Correção: Manter a barra do exemplo 40.1, e em cada uma das páginas a que vamos, o título respetivo fica em destaque, sendo a negrito, cor diferente, *highlighted*, etc.
Severidade: 3

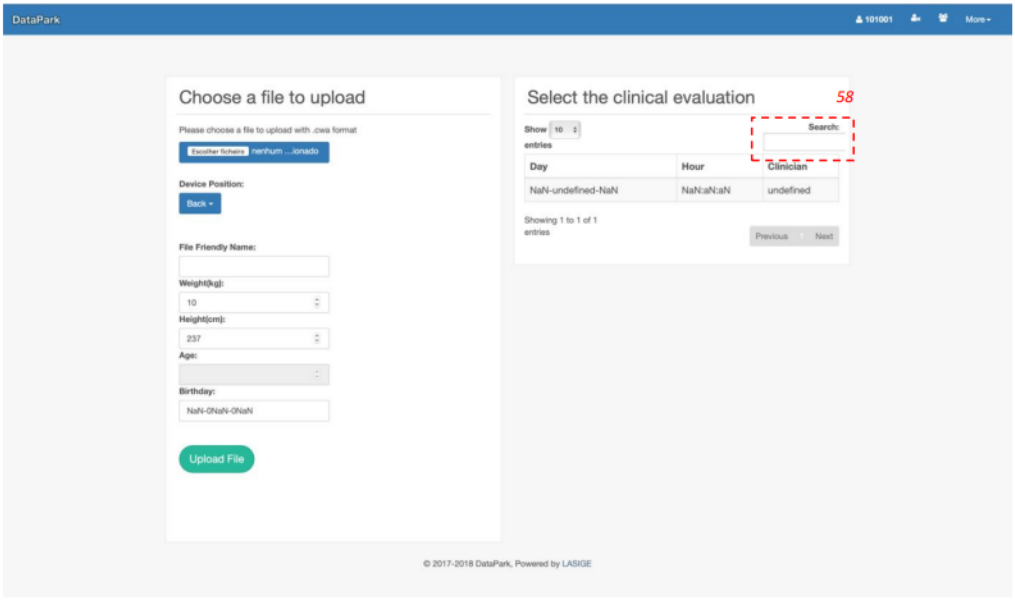
55. **Problema:** O ficheiro não faz upload
Heurística: H2-5 - Evitar erros
Descrição: O ficheiro não faz *upload* se o peso do paciente for inserido com mais do que duas casas decimais. No entanto, se alterarmos o peso aqui para 65, por exemplo, o ficheiro é enviado, mas na página do paciente o valor do peso continua o antigo.
Correção: Não deixar inserir valores de peso errados na página do paciente.
Severidade: 3

56. **Problema:** Botão de adicionar ficheiro
Heurística: H2-5 – Evitar erros
Descrição: Carregar ao lado do botão "Browse..." também abre a janela de carregamento de ficheiros
Correção: Abrir o envio de arquivos apenas quando se carrega no botão "Browse..."
Severidade: 2

57. **Problema**: O ficheiro escolhido para "Upload File" não é guardado
Heurística: H2.5 – Evitar erros

Descrição: O ficheiro escolhido para "Upload File" não é guardado e o utilizador não recebe feedback sobre o erro.
Correção: Corrigir o Upload File".
Gravidade: 3

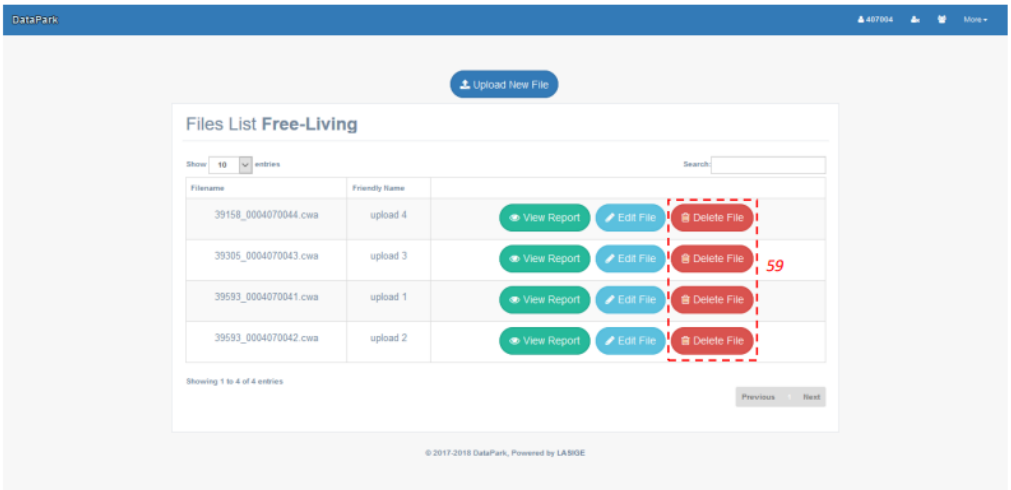
Upload File - Clinical



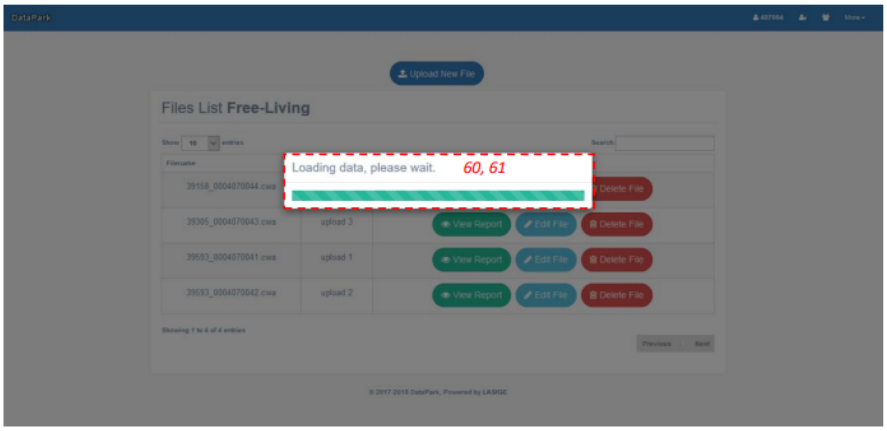
58. **Problema**: Caixa de "Search" no "Upload New File" do "Clinical" está mal posicionada e alinhada
Heurística: H2.8 – Desenho estético e minimalista
Descrição: A caixa de "Search" está mal posicionada e alinhada.
Correção: Alinhar a caixa conforme as outras da página.
Gravidade: 1

Ciências ULisboa

Files List Free-Living



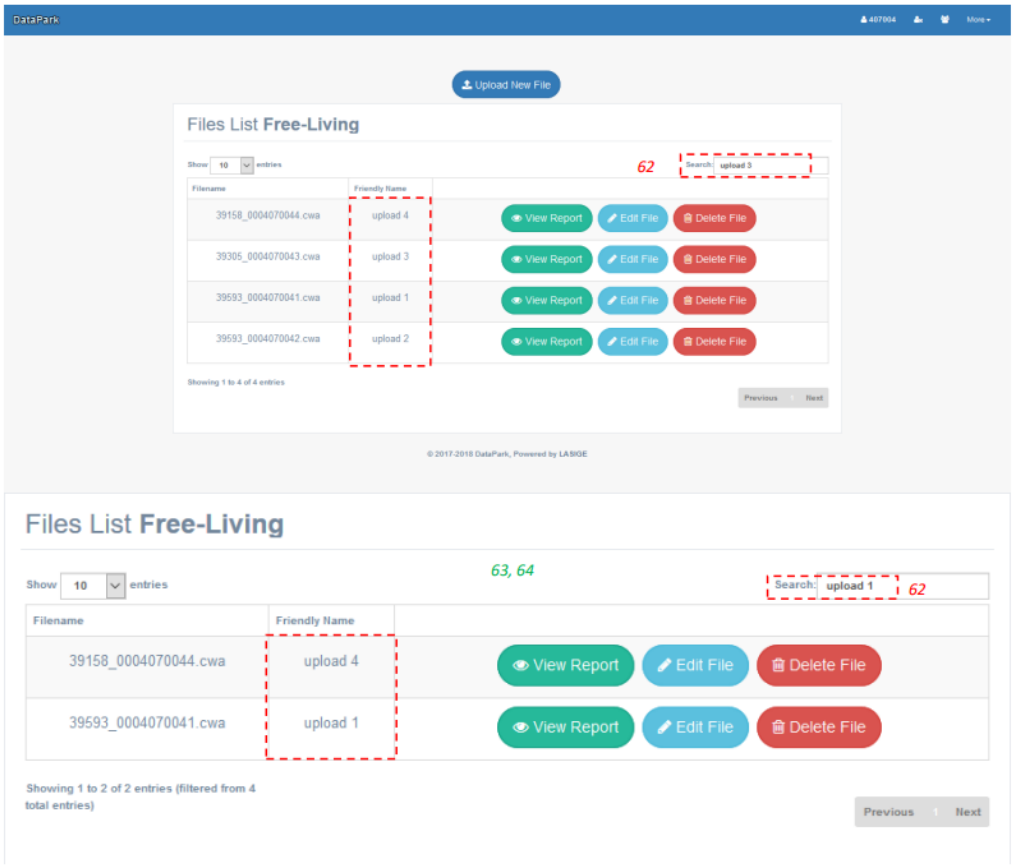
59. **Problema:** Eliminação de ficheiros
Heurística: H2-3 - Utilizador controla e exerce livre arbítrio
Descrição: Os ficheiros contêm uma opção de eliminação, no entanto, esta não funciona.
Correção: Eliminar a opção de eliminação ou então resolver o problema de forma a que seja possível fazê-lo.
Severidade: 3



60. **Problema:** *Loading* de data sem indicação de estado
Heurística: H2-1 (Tornar o estado do sistema visível)
Descrição: Quando se carrega em "View Report", o "Loading data..." não mostra nem dá indicação a que percentagem vai ou se falta muito tempo para abrir. Várias vezes demora tanto tempo que não se percebe se está bloqueado ou se a quantidade de dados é demasiado grande, lentidão do servidor, etc.
Correção: Colocar uma indicação de percentagem de *loading* e/ou o tempo que falta para acabar.

Severidade: 3

61. **Problema:** Ausência de opção de cancelamento do *loading* data
Heurística: H2.3 - Utilizador controla e exerce livre arbítrio
Descrição: Não há opção de cancelamento do *loading*. A única opção dada é retroceder pelo browser.
Correção: Adicionar um botão de cancelamento.
Severidade: 3



62. **Problema:** Pesquisa confusa/errada
Heurística: H2-5 (Evitar erros)
Descrição: O "Search" não funciona corretamente ou se funciona, não percebo qual é o critério de pesquisa, se é o "Filename" se é o "Friendly Name", etc. No exemplo dado, esperava que só aparecesse o ficheiro upload 1. Mas também aparece o upload 4. Pode ser problemático se o número de ficheiros se tornar demasiado grande.
Correção: Corrigir possíveis falhas no filtro da pesquisa.
Severidade: 3

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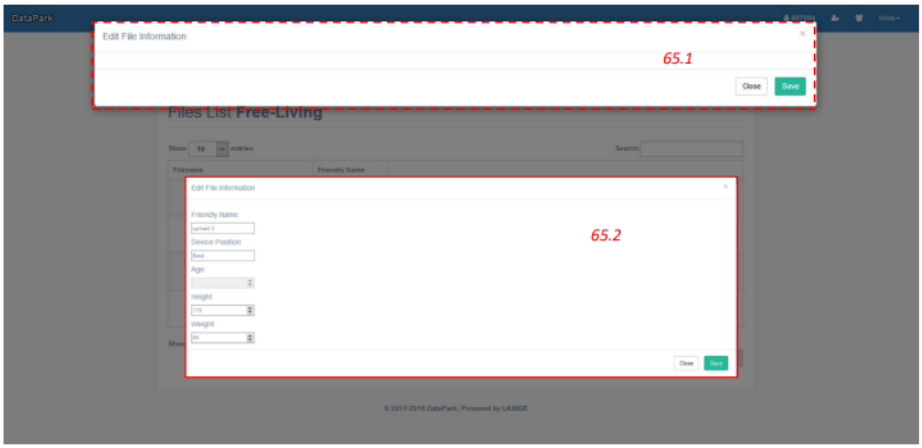
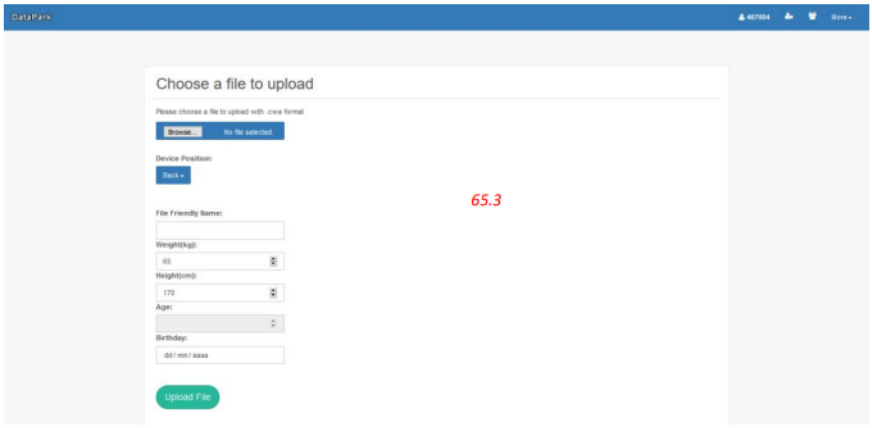
63. **Problema:** Ausência de opções de pesquisa/filtros
Heurística: H2-3 - Utilizador controla e exerce livre arbítrio
Descrição: Não existem opções para filtrar os ficheiros que não seja pela pesquisa direta do nome.
Correção: Acrescentar opção de filtrar por data, por exemplo.
Severidade: 1

64. **Problema:** Ausência de opção de ordenação dos ficheiros
Heurística: H2-3 - Utilizador controla e exerce livre arbítrio
Descrição: Não existem opções para ordenar os ficheiros, penso que por *default* estão por ordem crescente de *filename*, mas poderia fazer mais sentido ser pelo *friendly*.
Correção: Acrescentar opção de ordenar por filename, por friendly e/ou por data.
Severidade: 1

Edit File Information



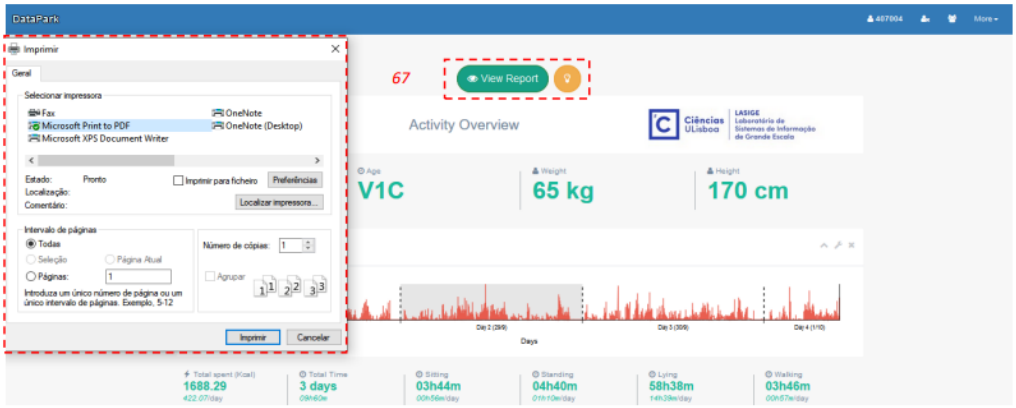


65. **Problema:** Edição de ficheiros no "Free-Living"
Heurística: H2-5 – Evitar erros
Descrição: O "Edit" às vezes não funciona (50.1) ou demora demasiado tempo, não é claro. E quando isto acontece e carregamos em "Save", passa para uma página (50.3) que não sei o que faz e o que significa, visto que o que era suposto acontecer está representado em 50.2.
Correção: Corrigir o bug de não aparecer em nada quando se carrega em "Edit" e não permitir a entrada na outra página quando se carrega em "Save". Se as duas páginas fizerem a mesma coisa, decidir entre as duas qual é a melhor para edição.
Severidade: 3

66. **Problema**: Na página do "Free-living", ao se editar ou não os ficheiros para valores sem sentido, a aplicação apresenta uma página de erro que não é compreendida por um qualquer utilizador.
Heurística: H2.2 – Correspondência entre o sistema e o mundo real e H2.9 – Ajudar o utilizador a reconhecer, diagnosticar e recuperar erros

Descrição: A Aplicação apresenta uma página de erro que não é compreendida por um qualquer utilizador ao se inserir valores descabidos como por exemplo na altura.
Correção: Dar feedback sobre o erro cometido que seja percetível a qualquer utilizador e acrescentar restrições nos valores.
Gravidade: 4

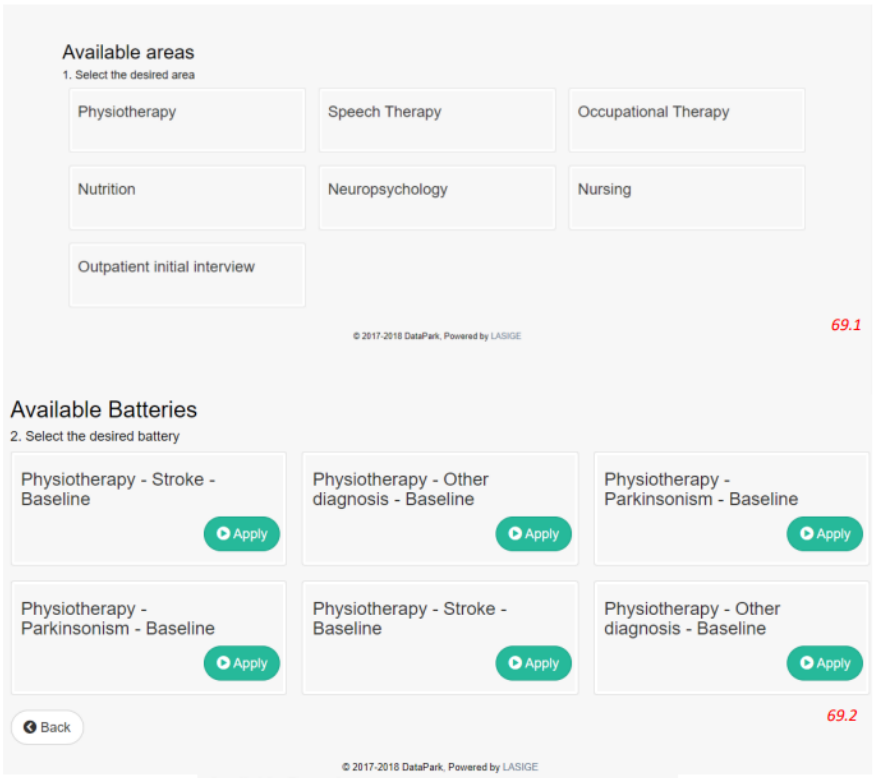
View Report

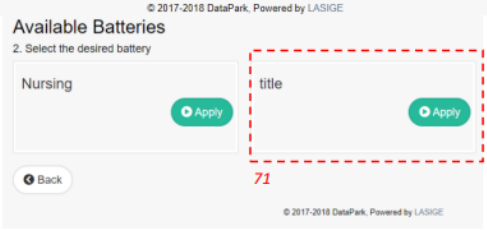


67. **Problema:** A visualização do relatório abre janela de impressão
Heurística: H2-4 – Coerência e adesão a Normas; H2.5 – Evitar erros
Descrição: Ao clicar em "View Report" abre a janela de imprimir do Windows e não abre o relatório para ser visto, como seria de esperar pela descrição e pelo olho no botão. Isto pode levar o utilizador a imprimir o relatório sem o desejar e não é coerente com a utilização da palavra "view" e do símbolo do olho.
Correção: Seria preferível aparecer "Download Report" ou "Print Report", consoante o objetivo.
Severidade: 3

68. **Problema:** Design confuso
Heurística: H2-8 (Desenho e ecrã estético e minimalista)
Descrição: Ao aceder a um relatório clínico de um paciente, toda a informação encontra-se espalhada na página de uma forma aparentemente desorganizada. Inicialmente, é também difícil distinguir os vários tipos de título, assim como a sua hierarquia.
Correção: Minimizar a quantidade de informação disponibilizada no ecrã, incorporando acordeões que disponibilizam a informação adicional, caso o cliente pretenda vê-la. Definir 2 ou 3 tons de cores para todo o texto e botões.
Gravidade: 3

Batteries





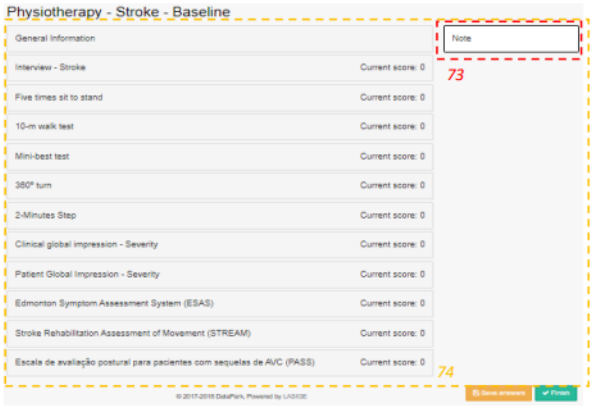
69. **Problema:** Repetição redundante da categoria
Heurística: H2-8 (Desenho e ecrã estético e minimalista)
Descrição: Ao selecionar a área de *battery*, as sub-opções disponíveis contêm a área selecionada.
Correção: Remover a área da sub-opção e adicionar um título indicando a área selecionada
Gravidade: 2

70. **Problema:** Botões desalinhados
Heurística: H2-7 (Flexibilidade e eficiência)
Descrição: Tanto as áreas como as *batteries* são botões, e como botão o texto indicativo deve estar centrado horizontalmente e verticalmente.
Correção: Centrar o texto verticalmente e horizontalmente.
Gravidade: 2

71. **Problema:** Subopção genérica acessível ao utilizador
Heurística: H2-5 (Evitar erros)
Descrição: Na opção *Nursing*, existe a sub-opção *Title*, que é uma sub-opção genérica para desenvolvimento apenas.
Correção: Tornar a opção inacessível ao cliente.
Gravidade: 3

72. **Problema:** Sessões duplicadas
Heurística: H2-8 (Desenho e ecrã estético e minimalista)
Descrição: No campo *Physiotherapy*, os tipos de sessões encontram-se duplicados.
Correção: Remover sessões duplicadas.
Gravidade: 2

Apply Battery



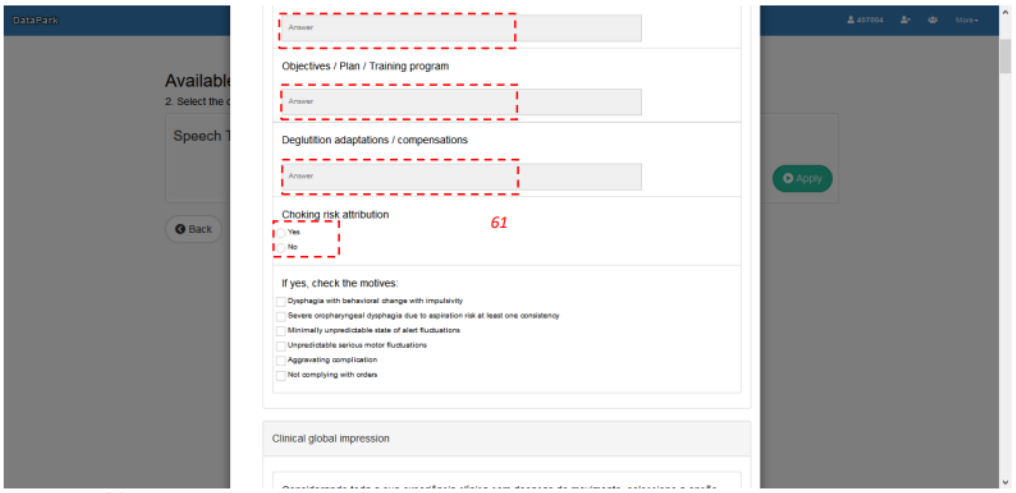
73. **Problema:** Acordeão *Note* não indica implicitamente o que é
Heurística: H2-6 (Reconhecimento em vez de lembrança) e H2-8 (Desenho e ecrã estético e minimalista)
Descrição: O acordeão *Note* têm um formato que leva o cliente a deduzir que é uma caixa de texto.
Correção: Alterar o design do acordeão de forma a representar corretamente o que é.
Gravidade: 2

74. **Problema:** Acordeão mal formatado.
Heurística: H2-5 (Evitar erros)
Descrição: Para expandir o acordeão, deve-se clicar apenas no texto do acordeão, sendo que clicar em qualquer outra região não faz nada.
Correção: Permitir que o estado do acordeão seja alterado ao clicar na parte superior do acordeão.
Gravidade: 3

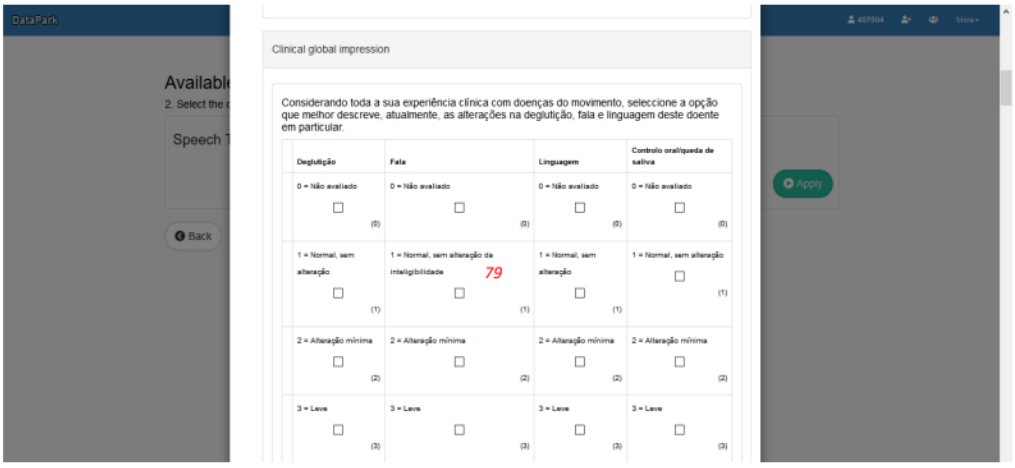
75. **Problema:** Caixa de texto que permite formato errado
Heurística: H2-5 (Evitar erros)
Descrição: No acordeão *Nine Hole Peg Test*, os campos *Right hand (seconds)* e *Left hand (seconds)*, por exemplo, devem apenas aceitar números, no entanto, pelo tipo de *input* utilizado, é possível inserir caracteres também.
Correção: Modificar o tipo de *input* de forma a poder apenas receber números.
Gravidade: 3

76. **Problema:** Textos em línguas diferentes
Heurística: H2-2 (Falar a linguagem do utilizador)
Descrição: Os campos *10-m walk test, Five times sit to stand, Time up and Go (TUG), 360º Turn, Clinical global impression - Severity, Patient Global Impression - Severity, Edmonton Symptom Assessment System ESAS, MDS UPDRS, 2 Minutes Step, New Freezing of Gait Questionnaire NFOG, Schwab and England Scale*, etc. que contêm texto em português, enquanto que o resto da plataforma encontra-se em inglês.
Correção: Traduzir o texto escrito de português para inglês. Caso seja necessário, adicionar uma opção para selecionar a linguagem que a plataforma utiliza.
Gravidade: 3

77. **Problema**: Utilizador não consegue voltar para trás se não fizer alterações na bateria
Heurística: H2.3 – Utilizador controla e exerce livre-arbítrio
Descrição: Caso o utilizador não queira fazer alterações numa bateria específica, este não consegue voltar atrás sem carregar na seta do browser, visto que mesmo o botão "Finish" não aceita a finalização do "processo" sem alteração do "**Assessment Context**".
Correção: Corrigir erro ao adicionar botão de "Close"
Gravidade: 2

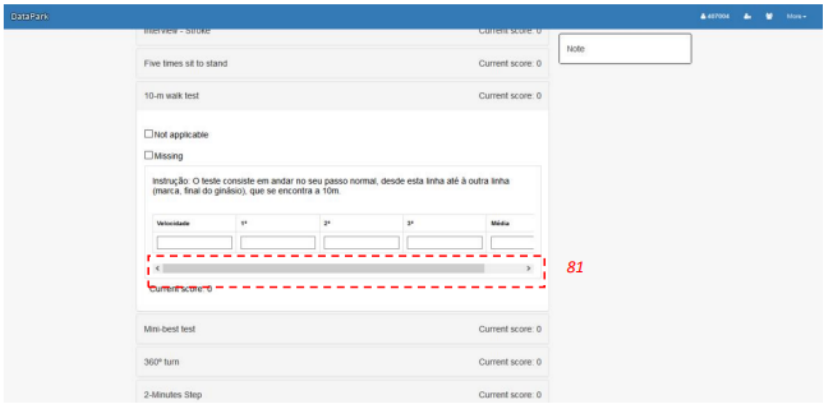


78. **Problema:** Respostas bloqueadas
Heurística: H2-3 -Utilizador controla e exerce livre arbítrio
Descrição: Não dá para responder à secção "Interview". Não é possível colocar o rato em "Answer" e aparece um botão de proibição nas *checkboxes*.
Correção: Se não for possível responder, explicar porquê ou então resolver o problema.
Severidade: 3

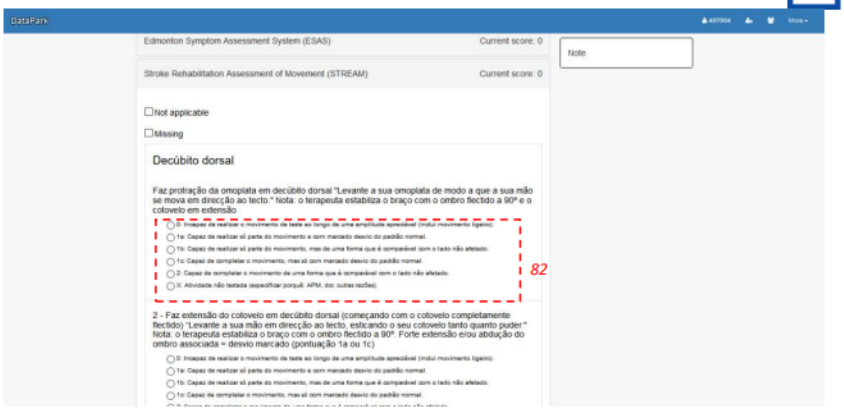


79. **Problema:** Alinhamento de “Speech Therapy – Stroke” em “Batteries”
Heurística: H2-4 –Coerência e adesão a Normas
Descrição: O alinhamento das várias opções desta secção não é esteticamente agradável.
Correção: Alterar este formato.
Severidade: 1

80. **Problema:** Incoerência entre o texto e as opções de escrita
Heurística: H2-10 -Dar ajuda e documentação
Descrição: O texto fala em velocidade normal, mas há opção de normal e rápido
Correção: Acrescentar a informação relevante ao campo “fast” no texto.
Severidade: 2

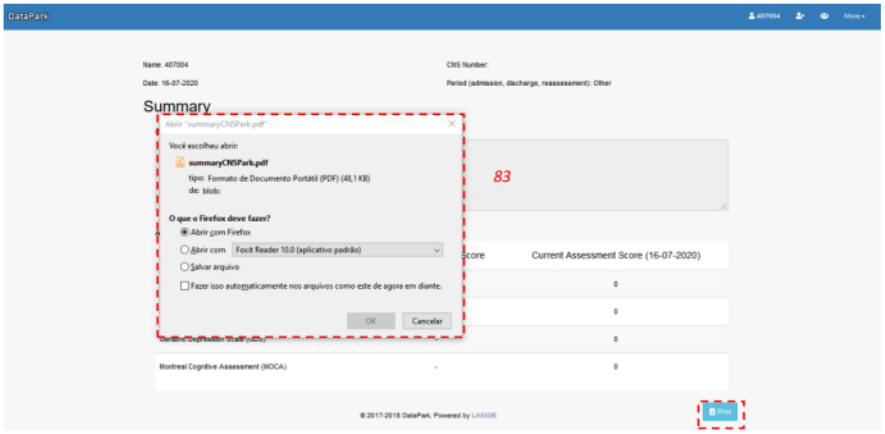


81. **Problema:** *Scroll* lateral não necessário
Heurística: H2-8 -Desenho estético e minimalista
Descrição: No “10-m walk test” as opções horizontais são mais largas do que o espaço oferecido e surge um scroll lateral.
Correção: Colocar opções em baixo de outras.
Severidade: 1

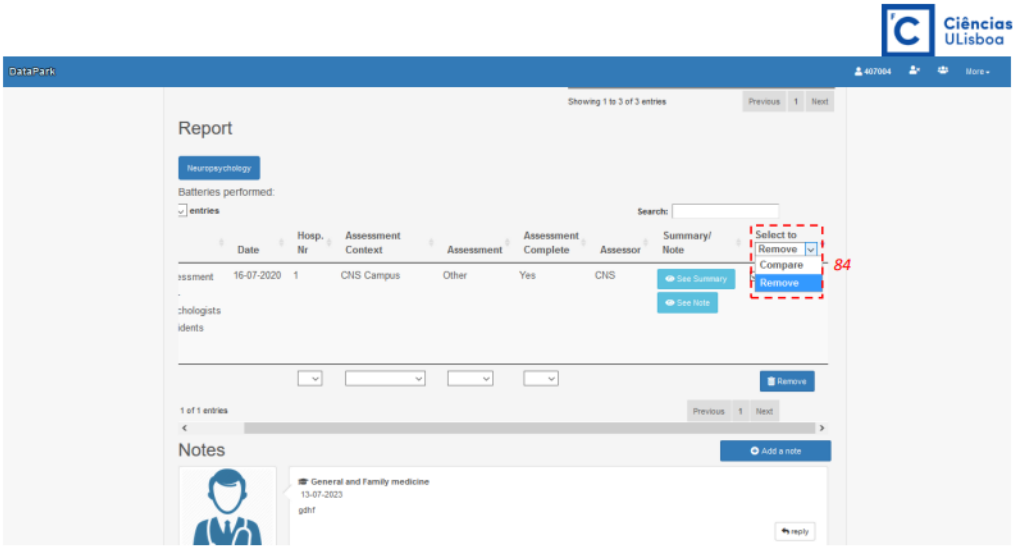


82. **Problema:** Letra demasiado pequena nas opções das entrevistas
Heurística: H2-4 –Coerência e adesão a Normas
Descrição: A letra é demasiado pequena nas opções de resposta das entrevistas o que torna a sua leitura saturante e difícil.
Correção: Aumentar o tipo de letra.
Severidade: 2

Report



83. **Problema:** Print abre janela de abrir ou fazer download do ficheiro
Heurística: H2-4 – Coerência e adesão a Normas
Descrição: O botão de "Print" abre a janela de abertura ou download do ficheiro, enquanto que no problema 43, o botão de "View Report" é que abria a janela de impressão.
Correção: Deveriam ser trocados os botões.
Severidade: 3



84. **Problema:** Opções de remoção e comparação de relatório
Heurística: H2-7 - Flexibilidade e eficiência, H2-8 - Desenho estético e minimalista
Descrição: Há duas opções de remoção dos relatórios. E juntamente com as opções de seleção há uma opção de comparação. Para aceder a estas opções é preciso fazer *scroll* lateral, que não é esteticamente agradável, não está logo visível e demora mais tempo.
Correção: Remover as opções de seleção e acrescentar um botão de comparação junto ao de remover em baixo.
Severidade: 2

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Resultados

Heurística	Quantidade
H2-1	6
H2-2	5
H2-3	13
H2-4	20
H2-5	23
H2-6	4
H2-7	6
H2-8	12
H2-9	0
H2-10	3

Gravidade	Quantidade
1	12
2	41
3	29
4	2
Total	67

Appendix B

First Session Protocol

First Session Protocol

This document aims to standardize the whole evaluation process for the new Datapark re-iteration.

How to Evaluate Datapark?

Currently, Datapark is a platform that enables subjective and objective data collection for Parkinson's disease [1]. It's composed in two components:

- A **mobile app**, where clinicians can create new appointments to assess on their patient's current condition;
- A **web application**, where clinicians can create and manage patients, as well as to create more customized appointments (called batteries) as well as to create new assessments.

Since this thesis is about a new iteration of the web application of Datapark, this document will focus on standardizing the evaluation process of the web application only.

General Application Evaluation

This phase aims to extract from the focus group their general opinion about the platform, as well as the focus group's feedback on what they would like to keep from the old version and what they would prefer to be reworked. This phase is to be conducted as a focus group spanning multiple occupations[1] that use the platform. Participants are free to openly deviate from the question as long as they provide any insightful feedback. Each question should have a debate period of 5 minutes maximum.

The following table contains all the questions that should be asked to each focus group:

	English	**Português**
Q1	How long have you been using Datapark?	Há quanto tempo é que utiliza o Datapark?
Q2	Do you think Datapark helped in increasing your work performance? If yes, how? If not, why?	De que forma o Datapark mudou a sua rotina clinica?
Q3	Do you prefer any alternative to Datapark? If yes, which one and why?	Utiliza alguma alternativa ou complemento ao Datapark? Se sim, quais e porquê?
Q4	Name at least three qualities that you find positive about the platform.	Nomeie, no mínimo, três qualidades que a plataforma tem.

[1] The following occupations interact with the Datapark project: Physiotherapist, nurse, nutritionist, psychologist, speech therapy and occupational therapy.

Q5	Name at least three flaws that you find about the platform.	Nomeie, no mínimo, três defeitos que a plataforma tem.
Q6	Please describe what tasks you perform on this platform on your daily basis.	Descreva as principais tarefas que realiza no Datapark
Q7	What would you like Datapark to have, if there were no limitations.	O que gostaria que o Datapark tivesse, imaginado que não existem limitações.
Q8	Do you have any more feedback you wish to give?	Há mais algum feedback que queira dar?

Specific Application Evaluation

In this phase, the participant will perform a set of tasks prepared by the interviewer and the interviewer will be recording the following metrics:

- Time the participant took to finish the task;
- Amount of clicks that the participant performed on their mouse;
- Amount of mistakes that the participant made.

The following table describes the tasks to be performed by the participants. Please note that there are tasks to be performed by specific user types:

	Task in English	**Tarefa em Português**
T1	Create a new patient with the same name as your account's and with the patient code also of your choosing. The patient was diagnosed with Parkinson. The patient was as it's birthday is on the day of this evaluation, it's gender is "other" and was diagnosed with Parkinson's disease on the day of this evaluation.	Crie um novo paciente com o mesmo nome que a tua conta e o código à sua escolha. O paciente têm como data de nascimento o dia da avaliação, têm o sexo "other" e foi diagnosticado com a doença de Parkinson no dia da realização desta avaliação.
T2	Access the profile of your recently created patient.	Aceda ao perfil do paciente que acabou de criar.
T3: Depending on the field	See the report summary of the recently created patient and of your field. The report dates back to 24th of August 2020.	Veja o resumo do relatório da sua área para o paciente que criou. O relatório é de 24 de Agosto de 2020.
T4: Depending on the field	Create a new battery of your field on the recently created patient.	Preencha uma bateria nova da sua área e no paciente que criou.

Post Application Evaluation

This phase occurs after all participants from the focus group conclude their specific application evaluation. This is very similar to the General Application Evaluation, where the questions will be performed to a focus group after all participants finished their tasks.

The following table contains the questions to be asked to the focus after all participants completed all tasks:

	English	**Português**
Q1	After having performed this use cases, have your opinion changed about the platform?	Após realizar estas tarefas, a sua opinião geral sobre a plataforma mudou?
Q2	Do you have any comments regarding the patient creation task?	Tem algum comentário que deseja fazer acerca da tarefa de criação de paciente?
Q3	Do you have any comments regarding accessing the patient profile?	Tem algum comentário que deseja fazer acerca da tarefa de aceder ao perfil do paciente?
Q4	Do you have any comments regarding seeing the report?	Tem algum comentário que deseja fazer acerca de ver o resumo do relatório?
Q5	Do you have any comments regarding the creation of the new report?	Tem algum comentário que deseja fazer acerca da tarefa de criação do novo relatório?

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Appendix: Script in Portuguese

Introduction (3 min)

Bom dia a todos. O meu nome é Martim Viana e atualmente estou a desenvolver a minha tese com o professor Tiago Guerreiro que envolve melhorar a plataforma Datapark.Comigo tenho o Diogo Branco, aluno de doutoramento e investigador do LASIGE, um centro de investigação que faz parte da Faculdade de Ciências da Universidade de Lisboa.

A minha tese consiste em identificar problemas e potenciais melhorias para o datapark, tanto a aplicação web como a móvel. Estas melhorias variam, desde permitir gravar os appointments na aplicação móvel de forma offline, até melhorias na interface da aplicação web, como é o caso do motivo desta sessão de avaliação.

A sessão de hoje está dividida em 3 partes: Primeiro vamos-vos pedir em grupo para falarem sobre como a experiência de uso do Datapark. De seguida iremos pedir para realizar um conjunto de tarefas no novo protótipo. No final em grupo iremos abordar como foi a experiência de uso no protótipo :

Antes de começarmos queríamos pedir a vossa autorização para gravar esta sessão para posterior análise por parte da equipa de investigação.

General Application Evaluation (40 min)

Vou realizar algumas questões sobre a plataforma. Fiquem à vontade para elaborar mais sobre as questões em si, aqui o objetivo é extrair o máximo de feedback pessoal sobre a plataforma.

Questões:

1. Há quanto tempo é que utiliza o Datapark?
2. De que forma o Datapark mudou a sua rotina clínica?
3. Utiliza alguma alternativa ou complemento ao Datapark? Se sim, quais e porquê?
4. Nomeie, no mínimo, três qualidades que a plataforma tem.
5. Nomeie, no mínimo, três defeitos que a plataforma tem.
6. Descreva as principais tarefas que realiza no Datapark.
7. O que gostaria que o Datapark tivesse, imaginado que não existem limitações.
8. Há mais algum feedback que queira dar?

Specific Application Evaluation (30 min)

Concluímos a primeira fase da entrevista, agora passamos à segunda fase da sessão, onde o objetivo é recolher informação mais específica sobre algumas tarefas específicas que preparei previamente e vou estar a tirar notas sobre a sua performance nestas tarefas. Esta fase não é uma competição, portanto realize estas tarefas ao passo que costuma realizá-las. Quando acabarem as tarefas, podem preencher o formulário de feedback individual que se encontra por cima do texto Test cases.

Tarefas:

1. Crie um novo paciente com o mesmo nome que a tua conta e o código à sua escolha. O paciente têm como data de nascimento o dia da avaliação, têm o sexo "other" e foi diagnosticado com a doença de Parkinson no dia da realização desta avaliação.
2. Aceda ao perfil do paciente que acabou de criar.
3. Veja o resumo do relatório da sua área para o paciente que criou. O relatório é de 24 de Agosto de 2020.
4. Preencha uma bateria nova da sua área e no paciente que criou.

Post Application Evaluation (25 min)

Tendo terminado as tarefas, passamos agora à fase final desta sessão. Vou realizar algumas questões sobre a plataforma (como nós fizemos na primeira parte desta avaliação) e queria que elaborassem entre todos o feedback tendo em conta o que viram da vossa experiência com o protótipo.

Questões:

1. Após realizar estas tarefas, a sua opinião geral sobre a plataforma mudou?
2. Tem algum comentário que deseja fazer acerca da tarefa de criação de paciente?
3. Tem algum comentário que deseja fazer acerca da tarefa de aceder ao perfil do paciente?
4. Tem algum comentário que deseja fazer acerca de ver o resumo do relatório?
5. Tem algum comentário que deseja fazer acerca da tarefa de criação do novo relatório?
6. Para além do que abordamos que outras componentes da plataforma gostaria de ver reformuladas?

Conclusão (2 min)

Chegamos ao fim da sessão. Gostaríamos de agradecer pela vossa colaboração e tempo dispensado.

Appendix C

First Session Report

Session 1 Results

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Next Session Points of Action 15

Background

Currently, Datapark is a platform that enables subjective and objective data collection for Parkinson's disease. It's composed in two components:

- A **mobile app**, where clinicians can create new appointments to assess on their patient's current condition;
- A **web application**, where clinicians can create and manage patients, as well as to create more customized appointments (called batteries) as well as to create new assessments.

This first session took place on 22th of July and lasted from 16:00 until 20:00. It's purpose was to find potential flaws and features that the clinicians think should be included in the new Datapark platform, as well as to further evolve the new prototype's design around the clinician interaction and to observe how the clinicians use this new prototype.

The prototype itself was the result of an heuristic analysis to the Datapark platform which was performed. The document itself consisted of a number of user experience flaws that needed to be corrected in order to fix usability problems and improve user experience.

Methodology

The first session was comprised of 6 participants and two interviewers. The participants were chosen in order to have as many occupations as possible and consist of:

- 1 psychologist (P1)
- 1 nutritionist (N1)
- 2 Physiotherapists (PH1 and PH2)
- 2 Speech therapists (S1 and S2)

The participants tested an iteration of the new Datapark prototype, as well as answered a series of questions in a focus group format before and after testing this prototype. During this focus group, participants were free to openly deviate from the question as long as they kept within the general boundary of the Datapark platform.

For this first session, we've decided to split it into three parts:
General Application Evaluation, for understanding the positive and negative aspects of using the application we asked participants the following questions:.

1. How long have you been using Datapark?
2. Do you think Datapark helped in increasing your work performance? If yes, how? If not, why?
3. Do you prefer any alternative to Datapark? If yes, which one and why?
4. Name at least three qualities that you find positive about the platform.
5. Name at least three flaws that you find about the platform.
6. Please describe what tasks you perform on this platform on your daily basis.
7. What would you like Datapark to have, if there were no limitations.
8. Do you have any more feedback you wish to give?

Specific Application Evaluation, where each participant would perform a set of tasks (some of which depending on their occupation) and they would come into contact with the prototype version for the first time. During this phase, the interviewer would record the time the paciente took to finish the task, as well as the amount of clicks and mistakes the participants made. The tasks were performed by the participants:

1. Create a new patient with the same name as your account's and with the patient code also of your choosing. The patient was diagnosed with Parkinson. The patient was as it's birthday is on the day of this evaluation, it's gender is "other" and was diagnosed with Parkinson's disease on the day of this evaluation.
2. Access the profile of your recently created patient.
3. [Depending on the field] See the report summary of the recently created patient and of your field. The report dates back to 24th of August 2020.
4. [Depending on the field] Create a new battery of your field on the recently created patient.

Post Application Evaluation, for discussing the new prototype changes we asked the participants the following questions:

1. After having performed these use cases, has your opinion changed about the platform?
2. Do you have any comments regarding the patient creation task?
3. Do you have any comments regarding accessing the patient profile?
4. Do you have any comments regarding seeing the report?
5. Do you have any comments regarding the creation of the new report?

We've also aimed to recruit participants from as many occupations as possible. In the end, our participant pool consisted of one psychologist (P1), one nutritionist (N1), two physiotherapists (PH1 and PH2) and two speech therapists (S1 and S2).

Clinician Feedback Analysis

This section aims to answer all the questions present in the previous question, as well as to detail further insight we've managed to gather throughout this part.

General Application Evaluation

How long have you been using Datapark?

Datapark has been in use for at least three years. Almost all participants have used the platform for about one to one and a half years, with the exception being N1, which started seven months ago.

Do you think Datapark helped in increasing your work performance? If yes, how? If not, why?

With the exception of some exercises, Datapark ended the paper format in the clinic by automating some tasks such as counting and registering the durations in which the patient performed the tasks, as well as standardizing duration results.

PH1: "Porque eu acho que antigamente usávamos o cronómetro, antes usávamos o telemóvel então os dispositivos que tínhamos para fazer o start e no stop variam de utilizador para utilizador e depois começamos a usar apenas o tablet. eu acho que isso melhora em termos de resposta do start e do stop."

Regarding the clinician-patient interaction, PH1 mentioned that patients feel motivated by having sensors on them, therefore increasing their performance.

PH1: "Eu acho que eles ficam motivados de terem sensores com eles. eu acho que os motiva no desempenho do teste. eu acho que é isso"

However, the jump to the digital realm also led to the loss of patient autonomy.

S1: "...enquanto antes eram 100% autônomos com uma caneta e um papel, agora nem sempre são tão autônomos."

Another downside to the digital platform, as mentioned by the clinics, is that they lose more data in the platform than in paper. One example mentioned is data loss ranges from not being able to view information in the website that they added in mobile.

PH1: "Porque nós perdemos muitos dados e porque as notas que colocamos naquele símbolo do olho... Nós depois não temos acesso a plataformas online, ou seja, na app nós fazemos notas, depois pomos na plataforma e não temos acesso a elas ou, pelo menos, se não temos acesso a elas, não sei onde estão…"

Do you prefer any alternative to Datapark? If yes, which one and why?

PH2 mentioned that the only alternative to Datapark is writing everything on paper, something that Datapark ended.

Name at least three qualities that you find positive about the platform.

The participants stated that the patient-oriented design that Datapark is a positive aspect due to having all information about the patient focused in one single spot...

PH1: "Eu acho que isso [síntese de dados] é interessante. Apesar de não haver correlação entre as coisas de umas áreas com as outras, eu acho que é bom. Temos tudo daquele doente naquele sítio."

...find information about a patient that left the clinic a long time ago or that it came from a different clinic...

PH2: "facilita o acesso ao registo. Um paciente que venha cá, vamos imaginar, venha hoje e venha daqui a três anos daqui a três anos conseguimos facilmente encontrar o seu registo que ele fez hoje"

As well as being able to pass to other colleagues the assessment you were performing without losing any context.

S2: "Eu acho que também a facilidade na quantidade de… de pegar, ou seja, se eu estiver a pegar num doente, não dou oportunidade na avaliação facilmente outra colega que irá estar a seguir com a pessoa conseguirá dar continuidade, ter acesso fácil."

Name at least three flaws that you find about the platform.

The fact that you can't perform any evaluations offline in the web platform was mentioned as a potential flaw of the platform due to the fact that clinicians wish to perform tests in the clinician's household and, since the patient may not have an internet connection, this becomes a hassle.

PH2: "O facto das baterias, ou seja a página web, não dá para fazer a avaliação offline por causa dessa história de não perder dados. E isso também, não é só perder dados, quando isso for possível, ainda vai ser possível ir a casa de um doente e utilizar o datapark porque a avaliação vai ser offline e por isso vai ser mais fácil."

Another flaw that was raised was the lack of an overall synchronization of some values that need to be specified only once, such as the patient's birthdate, their weight and their height. Such values should be fetched from the patient profile or another place where they are inserted, whenever they need to be gathered, instead of asking the clinician to type them again.

One final flaw that was raised in the platform is the lack of contextualization when the clinician writes a note down. All notes are written in the patient profile, which doesn't allow for any other contextualization besides a text description of where it comes from. S1 proposed a feature where the clinician would be able to write a note down and associate it to a specific assessment.

Please describe what tasks you perform on this platform on your daily basis.

The following list describes how each occupation interacts with the Datapark platform on a daily basis:

Psychology, they'll verify if the patient was already created on the platform. If not, they'll create the patient. They'll also bring the tablet and some writing materials for the patient to draw and write, whilst the psychologist is taking notes on the web platform.

Physiotherapy, they first verify if the patient was created. If so, they'll program the sensors and will call for the patient to perform the assessments on the mobile platform. After performing the assessments, they'll leave the patient performing an exercise whilst being supervised by another colleague in order to download sensory data.

Speech Therapy, they'll bring the tablet with the web platform and, as the patient is eating, they'll record with a microphone what the patient is saying whilst filling out the Datapark form. The voice file is later analyzed with a speech program.

Nutrition, they'll observe one of the meals and gather information via food amnesis. Such information is later filled out on the web platform in their offices.

What would you like Datapark to have, if there were no limitations.

One of the features PH1 mentioned was the ability for the platform to recognize which sensor file belonged to which part of the body automatically without any manual intervention.

Another feature mentioned by S1 was having an app where the patients could see their free-living results. Such app should also display such information as the patient's weight, information about their sleep and physical activity. The app could also send to the patients medication or hydration reminders.

Do you have any more feedback you wish to give?

No further feedback was given in this question

Specific Application Evaluation

Tasks Performance

T1. Create a new patient with the same name as your account's and with the patient code also of your choosing. The patient was diagnosed with Parkinson. The patient was as it's birthday is on the day of this evaluation, it's gender is "other" and was diagnosed with Parkinson's disease on the day of this evaluation

Minimum amount of clicks	12
Minimum duration	0:00:34

Participant	Duration	Clicks
P1	0:01:36	12
N1	0:01:23	17
PH1	0:01:22	21
PH2	?	?
S1 and S2	0:02:06	21

T2. Access the profile of your recently created patient.

Minimum amount of clicks	1
Minimum duration	0:00:04

Participant	Duration	Clicks
P1	?	?
N1	0:00:11	1
PH1	0:00:13	1
PH2	?	?
S1 and S2	0:00:24	2

T3. See the report summary of the recently created patient and of your field. The report dates back to 24th of August 2020

Minimum amount of clicks	3
Minimum duration	0:00:06

Participant	Duration	Clicks
P1	?	?
N1	0:00:16	3
PH1	0:00:29	3
PH2	?	?
S1 and S2	?	?

T4. Create a new battery of your field on the recently created patient

Minimum amount of clicks	7
Minimum duration (in seconds)	0:00:12.281383

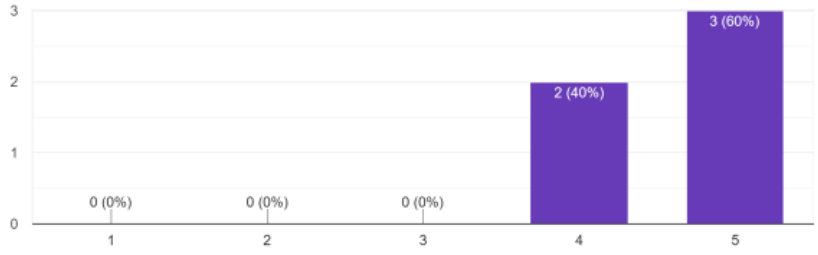
Participant	Duration	Clicks
P1	?	?
N1	0:01:03	17
PH1	0:00:40	7
PH2	?	?
S1 and S2	0:01:06	16

SUS Questionnaire

The System Usability Scale (SUS) is a reliable tool for measuring the usability. It consists of a 10 item questionnaire with five response options for respondents; from Strongly agree (5) to Strongly disagree (1).

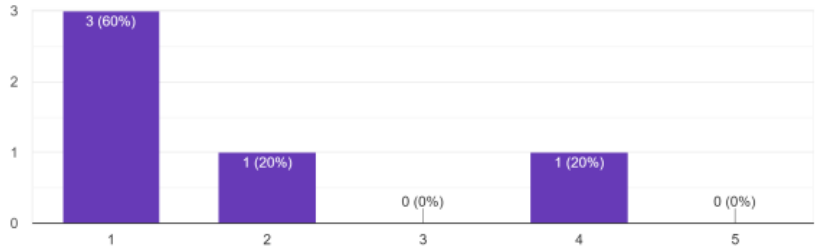
This section aims to denote the results from the questionnaire by question. Please note that participants S1 and S2 answered in the same questionnaire.

1. I think that I would like to use this system frequently



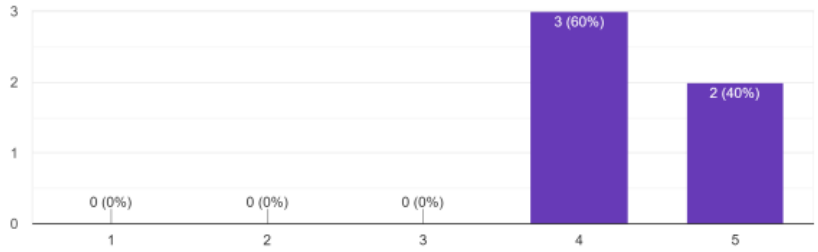
Average	4.6
Standard Deviation	0.55

2. I found the system unnecessarily complex



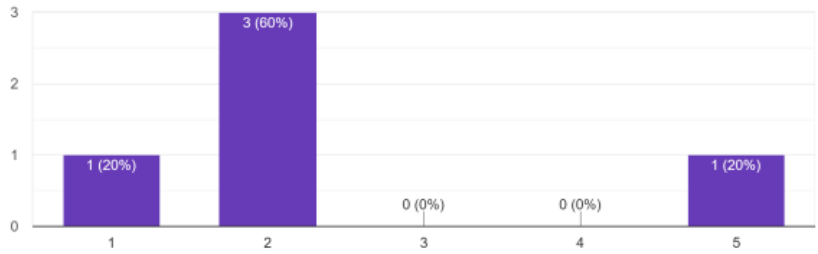
Average	1.8
Standard Deviation	1.3

3. I thought the system was easy to use



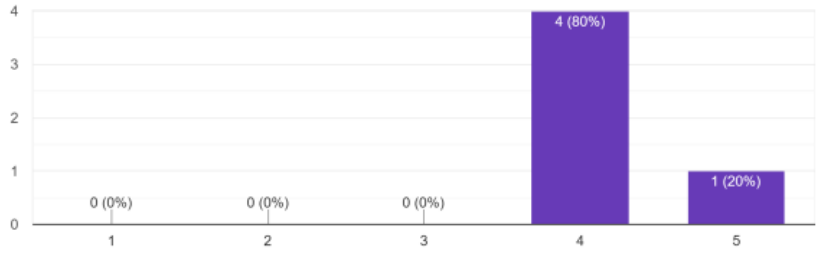
Average	4.4
Standard Deviation	0.55

4. I think that I would need the support of a technical person to be able to use this system



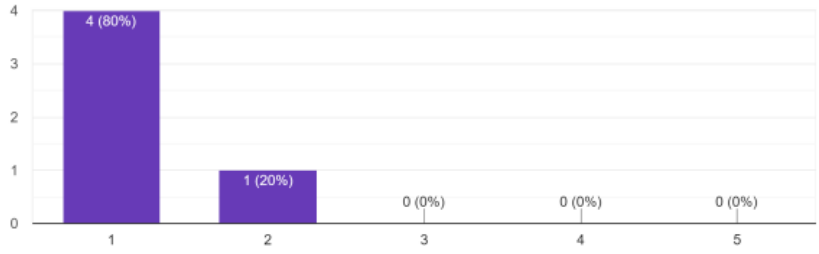
Average	2.4
Standard Deviation	1.52

5. I found the various functions in this system were well integrated



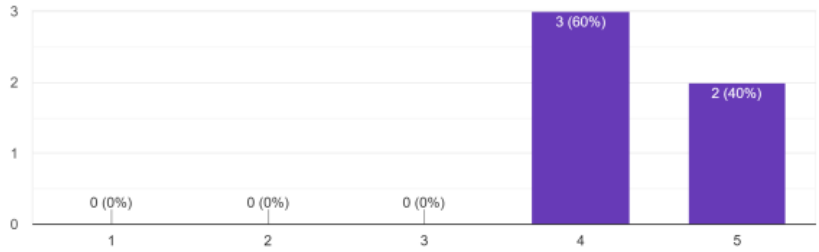
Average	4.2
Standard Deviation	0.45

6. I thought there was too much inconsistency in this system



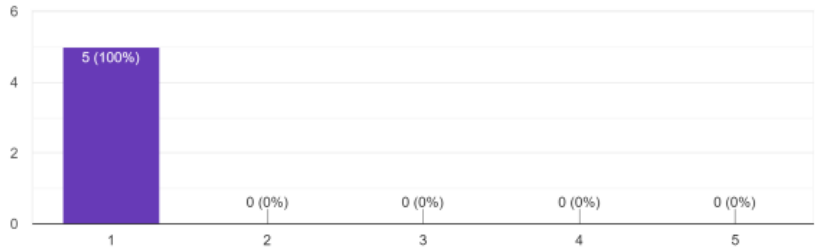
Average	1.2
Standard Deviation	0.45

7. I would imagine that most people would learn to use this system very quickly



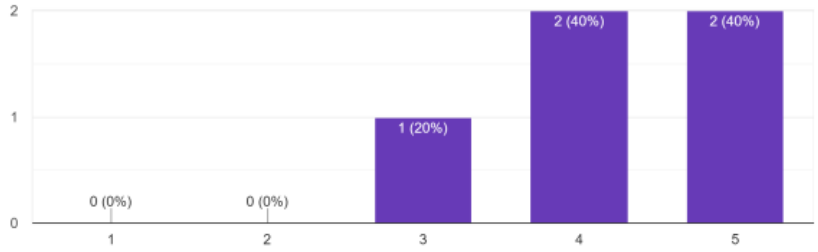
Average	4.4
Standard Deviation	0.55

8. I found the system very cumbersome to use



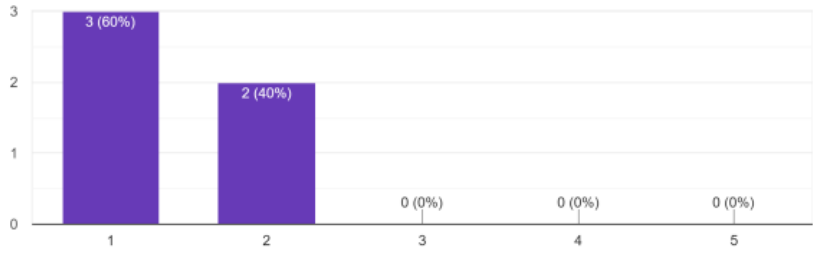
Average	1
Standard Deviation	0

9. I felt very confident using the system



Average	4.2
Standard Deviation	0.84

10. I needed to learn a lot of things before I could get going with this system



Average	1.4
Standard Deviation	0.55

Scores

The following table displays the SUS scores for each participant. It's important to keep in mind that a score above 68 is considered above average and anything below 68 is below average.

Participant	**Score**
P1	77.5
N1	65
PH1	72.5
PH2	72.5
S1 and S2	82.5
Average	**74**

Results

The specific application evaluation had mixed views: Participants were expecting to test new features to be added to Datapark, when instead they were greeted with a new prototype with the main core features (or representations of the core features). In this particular session and component, we were seeing if the overall changes to the UI were positive, as well as to test and improve our measuring system and the metrics we're using. PH2 used the same account as PH1, resulting in all metrics being lost for PH2. For future sessions, the interviewers will specifically assign an account to each participant instead of letting them choose their own accounts.

The metrics we've used were very useful for reconstructing the user's reaction to the prototype and to assemble a greater narrative when it came to the user's behaviour. They

helped us detect both task description failures, as well as user interface failures. They will be continued in the following sessions to further improve the prototype.

However, this automation has some flaws: Any data that was gathered by the platform can be easily ruined if two or more participants use the same account. As a result, the interviewers need to strictly enforce a one account per participant policy and prevent any further logins to an account that is already logged in.

T1

All participants finished Task T1 in more than double the time that the interviewers took. This is due to the fact that the patient creation form doesn't imply that all fields must be filled in order to complete the patient creation, as well as the fact that the task description doesn't explicitly state all fields to be filled in the patient creation form. PH1 and S1/2 have more clicks when compared to the other patients due to the fact that they used the number wheel feature that was presented in the right margin of the height input box. P1 typed both the birthday and diagnosis dates itself, whilst every other participant used the calendar featured to setup the dates themselves.

T2

All participants understood where to fetch their created patients straightaway, however, they took much more time than the minimum duration.

T3

In this particular task, both PH1 and N1 completed the tasks with the minimum amount of clicks, with PH1 taking one more click due to having double clicked the Reports button.

T4

All participants went to the battery creation form in the minimal amount of clicks, however, they were confused when they saw four empty accordions that represented mockup assessments and tried to open. Furthermore, N1 went twice to the battery creation form to double check if the task was completed successfully.

SUS Questionnaire

Given from the information we could gather from the SUS questionnaires, the overall reception of the new prototype was positive and, with the exception of question 2 and 4, fairly consensual. All the participants' SUS scores are above average, with the exception of N1, which is below average. This is likely due to N1 having a tendency to give a more neutral answer than the other participants.

Post Application Evaluation

After having performed these use cases, has your opinion changed about the platform?

The participants agreed that the platform itself was faster and that the design itself was better than the previous version, however, the participants also noted that they didn't see enough of the prototype to give more insight.

PH2 noted that the weight and height might not be relevant during the patient's creation, with N1 stating that they have to always type the weight in both admission and discharge. N1 also noted that having a history of the patient's weight change would be beneficial.

Do you have any comments regarding the patient creation task?

No feedback was gathered.

Do you have any comments regarding accessing the patient profile?

No feedback was gathered.

Do you have any comments regarding seeing the report?

No feedback was gathered.

Do you have any comments regarding the creation of the new report?

No feedback was gathered.

Next Session Points of Action

Based on the topics mentioned during the session, the following topics will be discussed in the second session:

Adding further comparisons between admission and discharge results, if a patient has at least one admission and one discharge report of the same type, there should be an option to compare each result via tables and/or graphics where all assessment scores should be displayed, as well as it's variation and the time when the report evaluation took place. For this case, a solution will be presented in the prototype and the participants will be able to discuss this feature.

Reorganize batteries in two columns: Admission and discharge, the participants mentioned that all batteries should be organized in two columns: Admission and discharge, where the line would denote the report type.

Reformulate the note feature, the participants expressed their opinion about the potential of the note feature, stating that they should be able to associate the note feature to a specific question or assessment. Instead of only being associated with the patient, clinicians wanted

to be able to associate specific results. A solution will be presented in the prototype and the participants will be able to discuss this feature.

Recommend certain treatments given certain assessment scores, during the session, S1 commented that it would like to recommend certain treatments, given certain assessment results. Since this comment raises the possibility of an interesting feature, it will be further explored in the next session.

Prevent question scores from counting to the whole assessment score when they shouldn't, S1 stated that some question scores were counting for the final assessment score, when they shouldn't. This will be further explored in the session, since it wasn't stated which assessment questions.

Remove day and month from diagnosis, leaving only the year, participants stated that they don't know the patient's diagnosis date, so they usually put the 1st of January of that year. This feature is to be added to both Datapark and to the prototype.

Avoid moving the entire screen when opening an accordion, when the clinician opens an assessment that's big enough to occupy more than the entire screen and they decide to open another assessment, the previous one closes, which can be confusing to the clinicians. As such, a solution to avoid this will be implemented to both Datapark and to the prototype.

Avoid typing in the patient's birthday, weight and month every time the clinician uploads a new sensor file, the patient's birthday, weight and month should be added in the patient profile only. All other instances where these values are needed should fetch the patient's current value at the time. This feature is to be added to both Datapark and to the prototype.

Fix duplicate patient codes, clinicians mentioned that there are some patients with the same code, but from different clinics, and that this causes some issues due to the patient code being unique in Datapark. A solution to this problem is to be implemented to both Datapark and to the prototype.

Fix clinician being able to access the index page without being logged in, sometimes, when the user isn't logged in, it can access the index web page, only being logged out when it tries to access another web page. A solution to this problem is to be implemented to both Datapark and to the prototype.

Add a go-back button to the patient selection in mobile, the clinicians want to have a button that sends them back to the patient selection screen instead of using the back button that the smartphone has, which can result in clinicians clicking more than once on the smartphone button and going to a screen that they don't want. This is to be implemented to the mobile version of datapark.

In the mobile platform, add a button to be sure that the appointment is saved, clinicians expressed their concern that, when they were creating a new appointment in the mobile platform, their appointments would be lost due to not having network access. An offline appointment creation solution was already created, so a new button that makes sure

that the appointment is saved is to be added to the appointment creation screen. This feature is to be added to Datapark.

In the mobile platform, fix minibest description, the mobile description of the minibest test is incorrect. This fix is to be added to Datapark.

Add diagnosis prioritization feature, clinicians expressed that they would like to prioritize some diagnosis over others

Rework patient profile webpage, all participants mentioned that they would like the patient profile to feature the patient's evolution in all existent metrics, as well as each value per assessment. Such evolution graphs would be in bar charts. This feature is to be implemented in the prototype.

Prevent clinicians from losing data when merging, PH2 mentioned that they lose data when performing an operation that wasn't mentioned during the meeting, as a result, this should be brought up again in the next session to gather further insight about this bug.

Add weight history, N1 mentioned during the meeting that having a weight history graph in the patient profile webpage would help them, therefore, it will be implemented in the prototype version.

Appendix D

Second Session Protocol

Session 2 Protocol

This document aims to standardize the whole evaluation process for the new Datapark re-iteration.

In this session, we will:

1. Measure participant performance during tasks by recording both the amount of clicks they did, as well as where they clicked and whether it contributed to the task resolution or was a mistake;
2. Receive participant feedback regarding what they tried in the prototype;
3. Bring up "loose points" that were mentioned in the previous version in order to have a better explanation;
4. Gather more features that they would like to have in the new Datapark iteration.

How to Evaluate Datapark?

Currently, Datapark is a platform that enables subjective and objective data collection for Parkinson's disease [1]. It's composed in two components:

- A **mobile app**, where clinicians can create new appointments to assess on their patient's current condition;
- A **web application**, where clinicians can create and manage patients, as well as to create more customized appointments (called batteries) as well as to create new assessments.

Since this thesis is about a new iteration of the web application of Datapark, this document will focus on standardizing the evaluation process of the web application only.

Specific Application Evaluation

In this phase, the participant will perform a set of tasks prepared by the interviewer and the interviewer will be recording the following metrics:

- Time the participant took to finish the task;
- Amount of clicks that the participant performed on their mouse;
- Amount of mistakes that the participant made.

The following table describes the tasks to be performed by the participants. Please note that there are tasks to be performed by specific user types:

	Tarefa em Português
T1	Crie um paciente novo chamado de Mário P<número do participante>, e o código é o número do participante. Pode atribuir o género que quiser ao paciente. O paciente deu entrada na clínica onde trabalha.

T2	Adicione dois registos de peso novos: 1. 84 kg, datado de 10/01/2022 2. 86 kg, datado de 14/01/2022
T3	Adicione dois registos de diagnóstico novos: 1. Parkinson's Disease diagnosticado em 2019 2. Stroke diagnosticado em 2021
T3.1	Assinale o diagnóstico *Parkinson's Disease como* primário.
T3.2	Adicione um diagnóstico novo. Esse diagnóstico tem a condição *dementia, datado de 2021* e encontra-se sobre investigação.
T4	Adicione dois registos de hospitalização novos: 1. Outpatient datado de 06/12/2021 2. Inpatient no quarto 123, onde entrou no dia 07/01/2022
T4.1	Marque a alta do paciente.
T5	Preencha uma nova bateria de admission pertencente à sua área e assinale a data da bateria como de há 2 dias atrás. Nessa nova bateria, adicione uma nota à primeira questão do segundo assessment.
T5.1	Preencha uma nova bateria de discharge pertencente à sua área. Nessa nova bateria, adicione uma nota à primeira questão do segundo assessment.
T5.2	Compare as duas baterias preenchidas.
T5.3	Observe o gráfico da pontuação dos relatórios, presente n<o perfil do paciente.

After completing the tasks, all participants should fill the SUS questionnaire present in the web page.

Post Application Evaluation

This phase occurs after all participants from the focus group conclude their specific application evaluation. This is very similar to the General Application Evaluation, where the questions will be performed to a focus group after all participants finished their tasks.

The following table contains the questions to be asked to the focus after all participants completed all tasks

	English	**Português**

Q1		Acham que os dados que são pedidos para preencher os vários tipos de dados (Patient, Diagnosis, Risks, Hospitalizations, Weight etc.) são adequados? Acham que a plataforma devia pedir mais dados?
Q2		Acham que a representação dos vários tipos de dados é adequada? Acham que os dados que são mostrados, assim como a sua representação gráfica, são adequados para desempenharem as vossas funções?
Q3		Acham que componente de comparação dos relatórios poderá fornecer feedback útil da forma como está atualmente? Se não, seria possível sugerir alguma adição ou alteração?
Q4		Tem alguns comentários a fazer sobre a solução de notas atualmente implementada? Se possível, seria possível sugerir melhorias?
Q5		Tem alguns comentários a fazer sobre a forma como pode definir diagnósticos primários e sobre investigação?
Q5.1		Durante a sessão anterior, tinham mencionado que estavam interessados em implementar um sistema onde recomendava certos tratamentos ao identificar pontuações fracas em certos tipos de assessments. Conseguiam dar algum exemplo real que pudéssemos implementar na plataforma?
Q6		Tem mais alguma sugestão que pudéssemos melhorar neste protótipo?
Q7 opcional		Tem alguns comentários a fazer sobre a reestruturação do código do paciente por clínica e número?

Appendix A: Script

Introduction (3 min)

Bom dia a todos. O meu nome é Martim Viana e atualmente estou a desenvolver a minha tese com o professor Tiago Guerreiro que envolve melhorar a plataforma Datapark. Comigo tenho o Diogo Branco, aluno de doutoramento e investigador do LASIGE, um centro de investigação que faz parte da Faculdade de Ciências da Universidade de Lisboa.

A minha tese consiste em identificar problemas e potenciais melhorias para o datapark, tanto a aplicação web como a móvel.

Esta é a 2ª sessão que faço com a clínica, onde o objetivo é testar as alterações que foram feitas ao protótipo tendo em conta o vosso feedback da sessão anterior, assim como tocar em tópicos interessantes que foram mencionados na sessão anterior, mas que não foram elaborados.

Esta sessão estará dividida em duas partes: A avaliação do protótipo, onde vos irei pedir para completar um conjunto de tarefas com o objetivo de familiarizar-se com esta nova iteração do protótipo, assim como preencher um questionário de usabilidade para recolher o vosso feedback da interação com a plataforma, e uma discussão em grupo, onde irei fazer-vos algumas questões.

Antes de começarmos queríamos pedir a vossa autorização para gravar esta sessão para posterior análise por parte da equipa de investigação.

Specific Application Evaluation (30 min)

Vamos então dar início à primeira fase desta sessão. Esta fase não é uma competição, portanto realize estas tarefas ao passo que costuma realizá-las. Quando acabarem as tarefas, podem preencher o formulário de feedback individual que se encontra por cima do texto Test cases.

Tarefas

T1	Crie um paciente novo chamado de Mário P<número do participante>, e o código é o número do participante. Pode atribuir o género que quiser ao paciente. O paciente deu entrada na clínica onde trabalha.
T2	Adicione dois registos de peso novos: 3. 84 kg, datado de 10/01/2022 4. 86 kg, datado de 14/01/2022
T3	Adicione dois registos de diagnóstico novos: 3. Parkinson's Disease diagnosticado em 2019 4. Stroke diagnosticado em 2021

T3.1	Assinale o diagnóstico *Parkinson's Disease como* primário.
T3.2	Adicione um diagnóstico novo. Esse diagnóstico tem a condição *dementia, datado de 2021* e encontra-se sobre investigação.
T4	Adicione dois registos de hospitalização novos: 3. Outpatient datado de 06/12/2021 4. Inpatient no quarto 123, onde entrou no dia 07/01/2022
T4.1	Marque a alta do paciente.
T5	Preencha uma nova bateria de admission pertencente à sua área e assinale a data da bateria como de há 2 dias atrás. Nessa nova bateria, adicione uma nota à primeira questão do segundo assessment.
T5.1	Preencha uma nova bateria de discharge pertencente à sua área e que seja equivalente à bateria de admission. Nessa nova bateria, adicione uma nota à primeira questão do segundo assessment.
T5.2	Compare as duas baterias preenchidas.
T5.3	Observe o gráfico da pontuação dos relatórios, presente no perfil do paciente.

Post Application Evaluation (25 min)

Tendo terminado as tarefas, passamos agora à fase final desta sessão. Vou realizar algumas questões sobre a plataforma e queria que elaborassem entre todos o feedback tendo em conta o que viram da vossa experiência com o protótipo.

Questões:

1. Acham que os dados que são pedidos para preencher os vários tipos de dados (Patient, Diagnosis, Risks, Hospitalizations, Weight etc.) são adequados? Acham que a plataforma devia pedir mais dados?
2. Acham que a representação dos vários tipos de dados é adequada? Acham que os dados que são mostrados, assim como a sua representação gráfica, são adequados para desempenharem as vossas funções?
3. Acham que componente de comparação dos relatórios poderá fornecer feedback útil da forma como está atualmente? Se não, seria possível sugerir alguma adição ou alteração?
4. Tem alguns comentários a fazer sobre a solução de notas atualmente implementada? Se possível, seria possível sugerir melhorias?
5. Tem alguns comentários a fazer sobre a forma como pode definir diagnósticos primários e sobre investigação?
6. Durante a sessão anterior, tinham mencionado que estavam interessados em implementar um sistema onde recomendava certos tratamentos ao identificar pontuações fracas em certos tipos de assessments. Conseguiam dar algum exemplo real que pudéssemos implementar na plataforma?
7. Tem mais alguma sugestão que pudéssemos melhorar neste protótipo?

8. **(Opcional)** Tem alguns comentários a fazer sobre a reestruturação do código do paciente por clínica e número?

Conclusão (2 min)

Chegamos ao fim da sessão. Gostaríamos de agradecer pela vossa colaboração e tempo dispensado.

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