

# What Did I Do?: Innovation in the Anamnesis Process

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## Abstract.

Would it be possible to use Cloud Computing, mobile solutions and Data Analytics to create a record of the entire medical history of an individual? Would it be possible to give to the patient the power to share information, so that they could be attended by any clinic or hospital? In order to use modern technologies to provide health care through the creation of a medical history and with a focus on assisting doctors in the diagnosis (providing a graphic record that enables the monitoring and analysis of frequent cases of symptoms), a solution 'What Did I Do' was developed that encompasses the previous mentioned technologies. Through this application, the registration of symptoms, exams, consultations and medicine for each user is performed, generating a graphical analysis of the well-being patterns of the patient. One of the contributions of this platform is the participation of doctors and patients in the process, however the power of sharing data is defined by the patient, who shares his information with the doctors they trust. On the other hand, the doctor, when taking care of the patient, has access to an updated history. An experimental study was developed where it was possible to glimpse the capability of the developed platform to store and use data to find patterns of behaviors and frequencies of events, to help and study pre-dispositions and disease prevention. This contribution of the tool is given by the standardization of data collection that enables the use of Machine Learning and Data analysis for optimized patient management.

**Keywords:** Anamnesis, Cloud Computing, Mobile Solution, Prevention, What Did I Do?.

## 1. Introduction

With technologies such as Cloud Computing, Mobile solutions; Data Analytics so impactful on contemporary society, a question becomes plausible: would it be possible for a mobile solution to record all of the medical history of a patient? Such tool can be used for various purposes. Among them, it is possible that such solution can help the health care system to conduct the medical track of of an individual on a daily basis. This can provide

agility and ease, through an application, to record the entire clinical history and the result of events of each individual. According to the World Health Organization the meaning of health is: "a state of complete physical, mental and social well-being and not just the absence of disease or infirmity" (Who, 2006). But according to the Pan American Health Organization, health needs indicators for better assertive measurement and it is due to these indicators that it is possible to relate health to social inequality, dealing with factors such as chronic non-communicable diseases related to daily habits.

A medical follow-up for clinical diagnosis is essential for good health and one of the main methods of diagnosis is the medical interview, also known as anamnesis, where the trust relationship between the patient and the doctor is strengthened through the collection of crucial information, such as family history of illnesses (Balduino Et Al., 2012). Parallel to this scenario, there is a technological context very present nowadays, with various accessible resources, such as Cloud Computing, Mobile and Data Analytics solutions. It was through these technologies that a mobile solution was developed, in this research, that allows the user to periodically record their clinical history, such as a record of symptoms of malaise. The mobile solution proposed in this work, named What Did I Do? aims to solve the problem of communication and information exchange between doctor and patient, knowing that factors such as poverty, lack of information/education and age can impact data collection with the patient. Thus, the general objective is to promote a mobile solution that provides crucial information for the clinical diagnosis of physicians through a record carried out by the patient throughout their daily routine (Batista et al, 2020; Silva et al, 2021).

Among the specific objectives of this research, the aim is: to demonstrate the details of the development of a mobile structure for data collection and assistance in managing the well-being of patients; to present a Cloud solution where all data will be stored for posterior analysis (enabling strategies that help the physician to make a more assertive diagnosis and help the patient on understanding their daily health care habits); and finally, present a feasibility study with the developed tool. This work is justified by the importance of the assertiveness of the clinical diagnosis, the mismatch of communication between doctor and patient, misinformation or inaccessibility of health care due to social inequality and the qualification of public and private hospitals.

## 2. Theoretical Foundations

Four pillars underpin this research, namely care and well-being, medical diagnosis, technology requirements and the GDPR (General Data Protection Regulation). First, with regards to care and well-being, as already mentioned, according to the World Health Organization, health is defined as "a state of complete physical, mental and social well-being and not just the absence of disease or infirmity" (WHO, 2006). However, this is a definition rejected by several researchers, as well-being is used as a concept and does not have adequate target indicators for research, control and assistance for health services, so several researchers have defined indicators for the definition of health. With this concept in hand, the issue of medical diagnosis was defined and evaluated. It is given in some stages, one of which is the medical interview or anamnesis, where the signs and symptoms of patients are collected.

It is very important that when collecting patient information, the doctor obtains as much information as possible (Bruckert et al., 2020). Anamnesis, which represents the

consolidation of patient data, means bringing back memories of facts related to disease manifestations. The anamnesis (in Brazil) can be conducted as the following sequence of procedures: (a) repercussions of the disease on life, family and work; (b) similar experiences lived by the patient or by those close to him; (c) advice received for dealing with the illness; (d) measures taken by the patient to deal with the illness; (e) main current concerns; (f) to which the disease is attributed (causes); (g) how you feel about the disease; (h) perceptions about the treatment: difficulties and benefits; (i) perceptions about the doctor, the health team and the service; (j) doubts or issues that the patient deems relevant (Balduino Et Al., 2012). For greater assertiveness and correct diagnosis by the physician, it is essential that they obtains reliable information about the symptoms and have a trusting relationship with the patient (Bruckert et al., 2020).

Thus, for the development of a solution that would support this process, the following technologies were used (Taurion, 2013; Batista et al., 2020): Cloud Computing (a set of virtual resources such as hardware, software, development platforms and services); Mobile Solutions (the mobile phone has become a computerized multimedia center due to several resources available from a single technology) and Data Analysis (it is focused on analyzing the data obtained and evaluating its veracity, verifying if the data has any relevant pattern to be analyzed or if it is just irrelevant information).

And finally, to meet the demands for data protection in Brazil, the Personal Data Protection Regulation (GDPR – LGPD in Portuguese) was verified, which came into force on August 14, 2018, with the objective of protecting the fundamental rights of freedom and privacy by complying with a series of technical and lifecycle controls in the treatment of the use of information. GDPR must guarantee the legitimate, specific and explicit processing of the personal data provided, observing good faith. The law applies to all data processing, public and private companies, individuals and legal entities and is applied in one of the following elements: occur in national territory; that offers or provides goods or services, processing data of individuals located in the national territory; in which the data have been collected in the national territory (Pinheiro, 2020). In view of the General Data Protection Regulation, better known as the Civil Law for the Internet, the mobile solution proposed in this article guarantees that all data provided by the user will be of exclusive access to the user. The user may allow external viewing and consultation of this data by third parties, with prior authorization requested and the user may also delete all the data informed at any time, not leaving any personal information recorded in the database of the mobile application.

## 2.1 Related works

Works were found with the aim of helping medicine via mobile applications, data collection and information from patients who need to be monitored to identify their evolution in the proposed situations.

**EndocrinApp:** a new perspective for the diagnostic-therapeutic process of pubertal development from the use of mobile technology, aims to monitor the pubertal evolution of children and adolescents. For this purpose the development of a mobile application that collects data such as : date of birth, sex and specific information on pubertal evolution,

crosses these data with Tanner staging to obtain a graphic visual follow-up, comparing with the expected pattern for the age of the patient. The development of this mobile application

made it more understandable and simplified for both the physician's and the patient's prognosis (Alves Et Al., 2019).

**Mobile applications and discrete event systems:** in Batista et al. (2020), a work with the objective of optimizing the stock and availability of drugs and products of an orthopedic clinic in Belo Horizonte (Brazil) is presented. Through the collection of input and output data of the products, analyzes were performed to standardize the inventory. The mobile solution was developed to perform a statistical analysis of the scenario of a set of commonly used materials, simulating scenarios for forecasting material availability.

### 3. Methods

This article is characterized as an experimental study, which are studies that manipulate exclusion, inclusion or modification, in an intentional and controlled manner, in order to test hypotheses and efficacy through data collection, analysis and dissemination by the respondent (Dutra et al., 2016).

First, a structure was developed with the interaction between a mobile application and a cloud computing structure for data storage related to physical well-being. Second, from the moment the data is collected, while the application is being used, it will be stored in the cloud to be organized in such a way that it is possible to point out a pattern in order to find an efficiency to aid in medical care. With a focus on assisting, optimizing and maximizing information regarding anamnesis and medical diagnosis, Data Analytics is used in the collected data to classify which moment presents the most deficit, why this occurs and propose a method or complement in medical care.

### 4. Results

#### 4.1 Mobile Structure

A mobile solution was developed that records data about the health and well-being of the user/patient that allows the generation of a history with the possibility of analyzing the recorded data to improve the accuracy of the medical diagnosis. A survey of the agents involved was necessary to guarantee that the mobile solution could be developed. The parameters were consolidated in: the agents involved, namely, the user/patient as the requesting agent and physicians as the service provider.

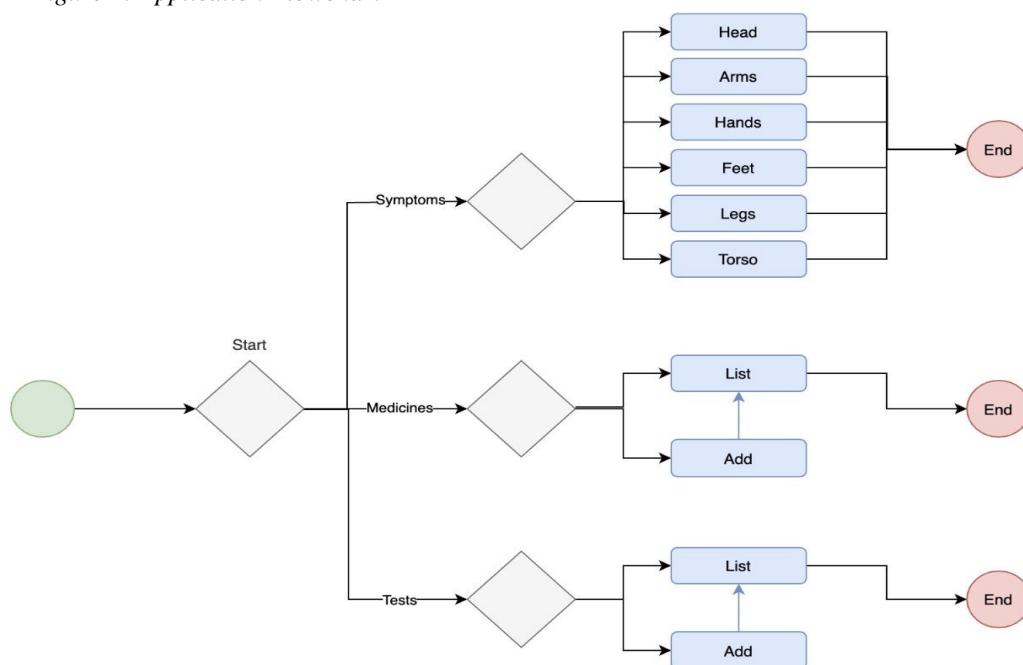
When using the application, the user has the possibility to register and view the registered information about their health and well-being, such as medication, symptoms and exams, as shown in Figure 1, which demonstrates the flowchart of the activities of the application. Figure 2, in addition to Figure 1, is the diagram of the mobile solution, showing details of the features available in the solution according to its flow of interfaces. In Figure 3, the infrastructure of the application is presented. The mobile and web solution were developed using the ReactJS interface library and made available by the Progressive Web App (PWA) technology, which are web applications presented as a native mobile application through



Service Workers. The structure of the mobile and web application consists of communication in the backend using HTTP protocol endpoints in the Restful architecture pattern stored in the cloud by the PasS service platform, Heroku, and has its data stored in the PostgreSQL relational database.

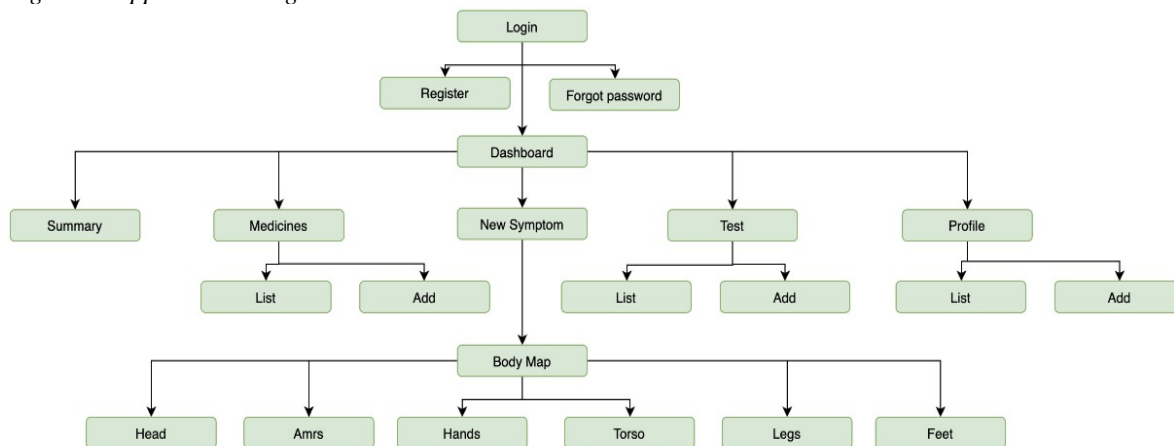
Thus, the communication flow of the mobile and Web application infrastructure is shown in Figure 3. There is a flow hierarchy in the use of the application that is available through the collected data, the initial screen being the login screen, where the user will perform the login via an email and password. The login screen also has two other features, being the forgot password option, where the user must register a new password for access, and the register option, where the user must enter their data, such as full name, email, password and other information to access the application.

Figure 1: Application Flowchart



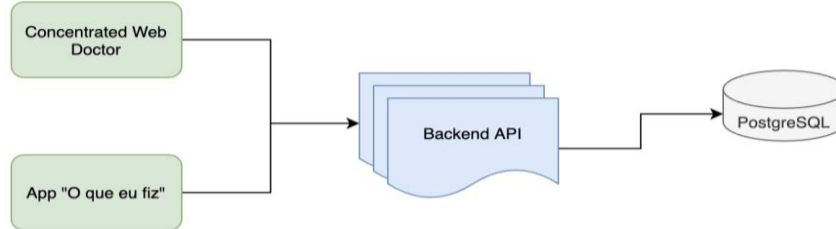
Source: Authors, 2021.

Figure 2: Application Diagram



Source: Authors, 2021.

Figure 3: Application Infrastructure

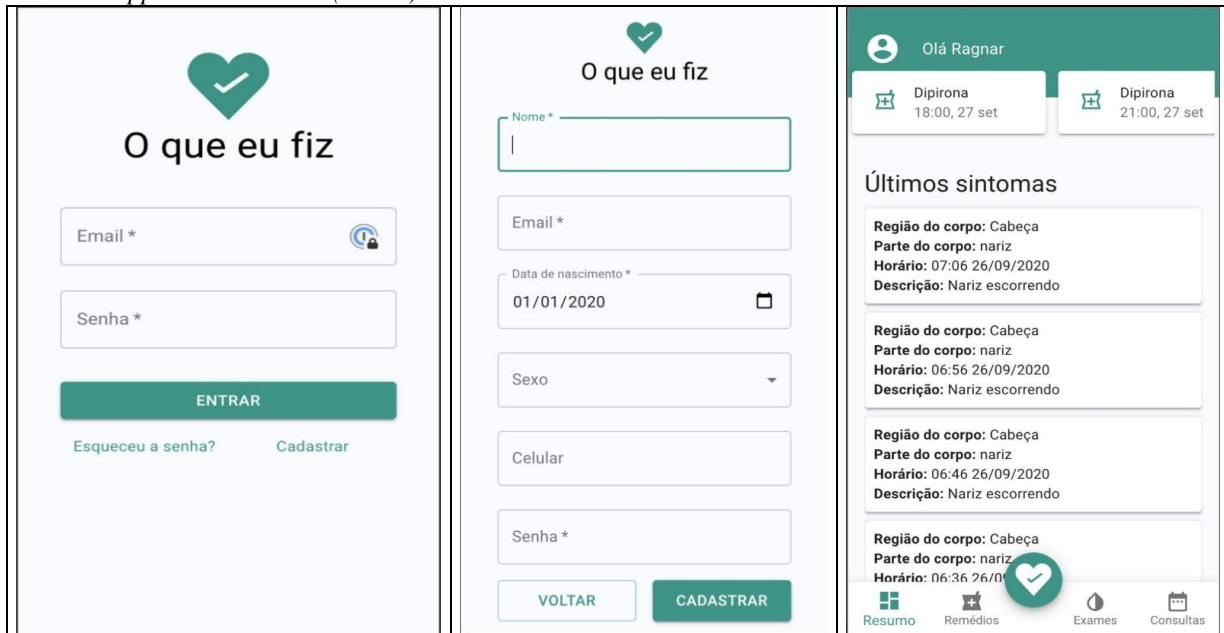


Source: Authors, 2021.

After logging in, the user is directed to the summary screen, which, if it is the first access, will not contain any information, but otherwise, the summary screen will contain all the data already registered by the user in the application. The Summary screen has some menus, such as: Medicines, Exams, Consultations and Symptom Record. In these menu options all the corresponding information is registered by the user for later consultation. On the symptoms screen, the user will be presented with a humanoid silhouette with the option front and back. This silhouette is accompanied by clickable dots on certain parts and its function is to record the location of the body that has any symptom. When clicking on a point, it will be directed to the registration screen for symptom description, which will have options such as intensity, date, description and specific part of the body that presents this symptom.

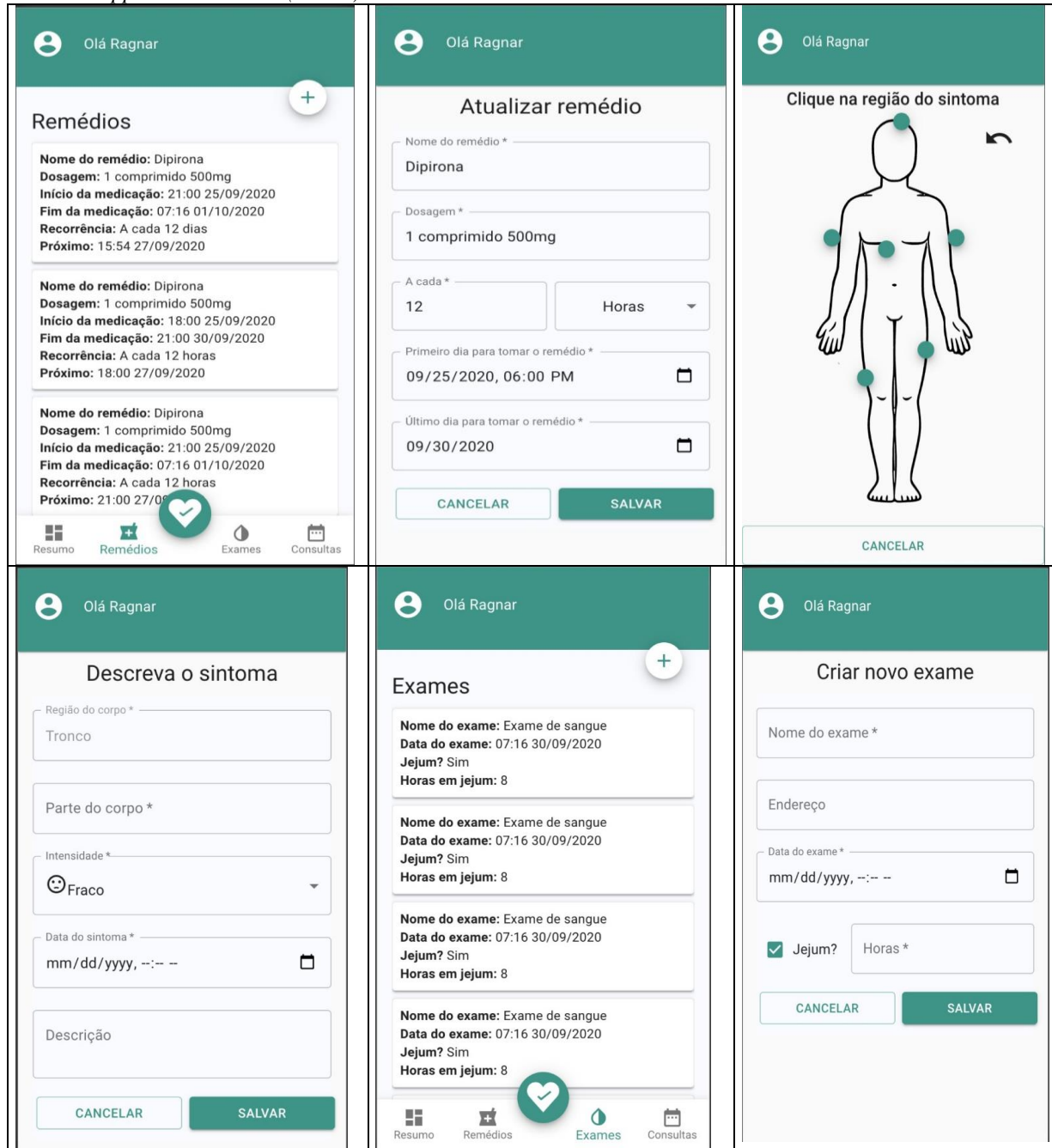
On the drug screen, it is possible to register information such as: name, dosage, period of ingestion, start date and end date of use of the drug. On the consultations and exams screens it is possible to register the name, address, date and telephone number of both. The communication flow of the application follows the steps below: Step 1 (Password registration or recovery); Step 2 (Registration of symptoms, medications, exams and appointments); Step 3 (Symptom consultations, medications, exams and consultations); Step 4 (issuing reports based on registered data). Tables 1 to 3 show the screens of the mobile solution and its respective flow.

Table 1: Application Screens (Part 1)



Source: Authors, 2021.

Table 2: Application Screens (Part 2)



Source: Authors, 2021.



Table 3: Application Screens (Part 3)



Source: Authors, 2021.

## 4.2 Web Structure

A WEB structure was developed for consultation and monitoring of records made in the mobile structure by the medical professional. In this WEB structure it is possible to consult all exams, consultations, remedies and symptoms registered by the patient. In order to the medical professional to have access to this data, the application user will need to provide the physician with an access code to the WEB structure link. The medical professional must access the link and first login or register, as shown in Figure 4, after accessing the WEB platform. At this stage it is necessary to enter the access code and only then it will be allowed to make the query, and it will not be possible to change, add or delete any of the available data.

Figure 4: Code entry screen for data access



Source: Authors, 2021.

Data consultation will be allowed through tables or graphs, with the tables being available for each option: exam, consultations, remedies and symptoms and the graphs being available for each option or for a set of them. The screens shown below present the possibilities for querying the data.

In Figure 5, it is possible to observe the screen for entering the code of the patient, which is the only means available for the medical professional to have access to the data. Without the release of this code made by the user, access to data is restricted to users only, one of the ways to respect the GDPR. Below is an example of data query screens through tables (Figure 6) for each topic registered in the mobile application, being possible to select the date of the period in which is desired to perform the query. Screens such as evaluation of tests, medications, appointments and symptoms were implemented.

Figure 5: Code entry screen for data access



Source: Authors, 2021.

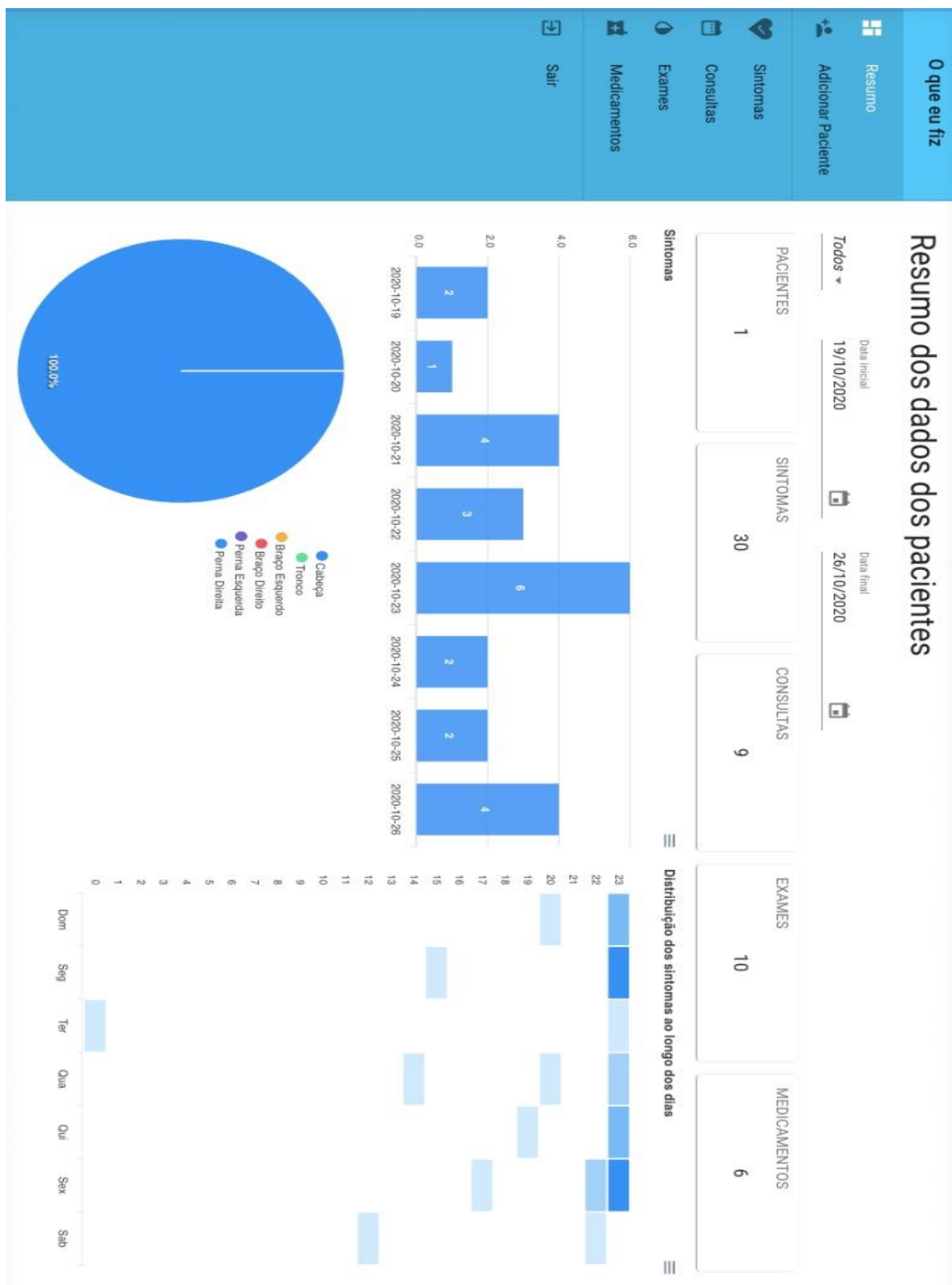
Figure 6: WEB Symptom Screen

Região do corpo	Parte do corpo	Parte de trás ou da frente	Intensidade	Descrição	Data de ocorrência
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:05 23/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:15 23/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	19:45 23/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	19:55 23/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:25 23/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:35 22/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:35 21/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:35 18/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:35 20/10/2021
Cabeça	nariz	Frente	Médio	Nariz escorrendo	20:35 19/10/2021

Source: Authors, 2021.

Figure 7 is a graphic representation of the symptom data. The representation of the data in the histogram graph is the number of symptoms per day, being able to always select the period of consultation of the data. In this graph it is possible to follow which day had more or less symptoms, being possible to analyze in which period the frequency of these symptoms.

Figure 7: WEB screen with data representation in Graph



Source: Authors, 2021.

The graph on the right (Figure 7): Distribution of symptoms throughout the day is a graph that allows the visualization of data on the symptoms experienced in the day, that is, how many symptoms were experienced, at what time of which day. Thus, allowing an analysis at which time of day the most symptoms are presented, making it possible for the medical professional to analyze when the patient is more predisposed to the presentation of symptoms and a possible development of a disease.

The pie chart is the chart with the greatest possibility of analyzing the symptoms, being possible to observe a group of symptoms in the selected period with their respective percentage. Thus, it is possible to check whether a combination of symptoms are related or not, if there is a relationship in the combination of symptoms, if this is related to any predisposition to diseases or daily habits, thus allowing a better understanding of the patient's case and providing a better result in the treatment.

### 4.3 Future Works

The mobile solution proposed in this article aims to help the anamnesis of medical diagnosis with the simplicity of recording symptoms, consultations and exams on a daily basis, thus allowing the availability of a health and well-being history of the user. A history of the health and well-being of patients, without the need to have this record only in hospitals and health posts, but in control of each individual, will allow for more accurate and effective analyzes in the guidelines of the necessary medical treatments, reducing investigation of diseases based only on the symptoms described in the interview of the anamnesis.

With the use of machine learning, a strategy of crossing data such as age, symptoms, exams and appointments will be able to predict imminent health risks. The possibilities are relevant when dealing with health-related predispositions when keeping a data record.

From the medical evaluation to the contact with the health and well-being history, it will be possible to devise several strategies for processing the data and obtaining predetermined results or new discoveries. Another possibility of impact will be how much the user, when checking their history daily, can cause changes in behavior that lead to a healthier life, considering that they will have control of their health information.

Many features can be implemented in the mobile solution, such as glucose control, allergy control, medication control, surgery records, diseases, vaccines, allergies. The possibilities within the medical field are almost immeasurable. It is not just about collecting and studying data, but also about being a tool that helps patients who need strict control of information regarding their illness.

## 5. Conclusion

A record of the medical history is made for each patient in the health units, thus, the patient does not have their medical history at hand, and cannot add it in their day-to-day with information about their respective health care and welfare. The objective of this study was to develop a mobile solution that would allow the recording of medical history to be performed by the patient, thus enabling a better anamnesis by the medical professional, going beyond the anamnesis and allowing the medical professional to carry out a study of the data reported by the patient. Based on the results obtained, it was possible to verify that if a patient records his daily life as a medical history of symptoms, it is possible to carry out a study of the data



obtained and thus predict, prevent and treat diseases, and it is also possible to monitor a group of symptoms by a group of patients and to obtain results on predisposition to diseases in a group of people and the reason for causing them.

Unlike the usual way in which the medical record of the patient is currently done, through an interview with the patient and a survey of the symptoms presented when the patient presents to the doctor, this mobile solution allows you to present yourself to the health professional already can follow the time of symptoms, the amount of symptoms, the medicines taken, exams done, a whole history that will help in the medical diagnosis, avoiding a deeper search of the symptoms to discover the treatment.

In addition to what the mobile solution already provides for registration, the possibility of adding functionalities to help both the medical professional and the patient is one of the future goals of this project.

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