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BUILDING A DIGITAL CLINIC FOR BREAST CANCER PATIENTS – VIABILITY AND FIRST STEPS

Insights from physicians
Insights from patients and supplementary research

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Abstract

Breast cancer is the world’s most prevalent cancer and the leading cause of cancer-related death among women. The objective of this work project is to study the viability of building a digital clinic to support breast cancer treatment and define what it should comprise. By means of 21 semi-structured interviews with patients and clinicians, the project explores deficiencies within the current treatment pathways and evaluates the receptivity to a digital solution. Findings showed shortcomings in doctor-patient communication and difficulty navigating hospital systems. Despite some reservations from stakeholders, the project proved to be feasible, therefore, we evaluated the existing market for breast cancer support and explored implementation options for the digital clinic.

Keywords:

Digital Clinic, Breast Cancer, Patient-Centered Care, Entrepreneurship, Digital Innovation

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1. Introduction

In 2020, there were 2.3 million women diagnosed with breast cancer and 685,000 deaths globally. As of the end of 2020, there were 7.8 million women alive who were diagnosed with breast cancer in the past five years, making it the world's most prevalent cancer. Globally, there are more lost disability-adjusted life years by women to breast cancer than any other type of cancer. (World Health Organization 2021)

Addressing the physical demands of this disease is a fundamental part of the treatment process for breast cancer. However, the treatment must account for the patient's psychological needs as well. According to the American Cancer Society, mortality rates are near "26 times higher in patients with depressive symptoms and 39 times higher in patients diagnosed with major depression" (Satin, Linden, and Phillips 2009). Patients who receive a cancer diagnosis often experience various levels of stress, anxiety, and fear over what the future holds as well as self-image issues. A comprehensive literature review published in Oncology Nursing Seminars concluded that psychological health in cancer survivors is determined by the balance between two factors: the stress and burden posed by the cancer experience and the resources available for coping with this stress and burden (Andrykowski et al. 2008). It is crucial to address breast cancer care in a comprehensive, patient-centered way, which focuses on psychosocial aspects.

Digital Health Cancer Platforms

A 2021 study by the Organisation for the Review of Care and Health Apps (ORCHA) revealed that there were 3063 cancer-related applications available in app stores. Worryingly, 74% of those had not been updated in the 18 months prior to the study. This indicates that the great majority have fallen behind in terms of medical updates, data, and usability criteria.

The study explored those that are in line with the current medical guidelines and presented a few names considered good examples for supporting patients with breast cancer and other types of cancer. Among them are Vinehealth, OWise, and BELONG, which we explore later in the project. These applications focus on ensuring better communication between patients and their medical teams and on creating a digital space to share experiences. Additionally, the apps display reviewed clinical papers and frequent symptom lists. To the best of our knowledge, none of them focus on assisting the diagnosis or treatment process, and neither allow for online consultations. Hence, this work project explores the following research question:

"Is a digital clinic for breast cancer treatment viable? If so, what first steps should be considered to build it?"

The development of a digital clinic for breast cancer would facilitate access to health care in areas where it is harder to reach, allow a better organization of care and decrease unnecessary burdens to clinicians. For example, by cutting out unneeded hospital visits through online appointments. The digital clinic as we see it would introduce Value-Based Health Care concepts and promote clinical care delivery through Integrated Practice Units. Our main objective is to understand what the current deficiencies in the care process are, to outline what the care pathway would look like, and then, evaluate the receptivity from patients and physicians to a digital breast cancer clinic.

2. Literature Review

2.1. Breast Cancer

Breast cancer develops when the breast cells grow and divide at an uncontrolled and accelerated rate, creating a mass of tissue or tumor. Like other cancers, breast cancer can grow into the tissues surrounding the breast or progress to other parts of the body, forming new tumors - referred to as metastatic or advanced cancer.

According to the European Cancer Information System, breast cancer represents 13.3% of all new cancer cases diagnosed in EU countries in 2020, making it the most frequently occurring cancer. It is estimated that it accounts for 28.7% of all new cancers in women. ("European Cancer Information System" 2020). In Portugal, around 7.000 new cases of breast cancer are detected each year with 1.800 women dying from the disease ("Impacto Económico E Psicossocial Do Cancro Da Mama Em Portugal: Liga Portuguesa Contra O Cancro" 2021).

The growing cancer incidence is attributed to poor lifestyle habits, such as following an unhealthy diet, insufficient physical activity, smoking and alcohol consumption, as well as genetics, hormone therapy, and exposure to toxins or radiation ("Mama | Champalimaud Foundation" 2022). The growing number of cancer cases is also attributed to increased longevity since the risk of developing cancer rises with age. These factors reinforce the need to invest in prevention, early detection, and control.

Stages and Treatment Courses

To determine cancer's stage, physicians evaluate its characteristics, such as where it is located, its size, if it has spread to nearby lymph nodes or other parts of the body and whether or not it has hormone receptors. Staging helps in the prognosis, deciding the best treatment plan, and determining whether clinical trials are a good option (Khan, Afaq, and Mukhtar 2010). Breast cancer stages are expressed on a scale of 0 through IV, with stage 0 describing non-invasive cancers that remain within the breast ducts and stage IV describing invasive cancers that have spread to areas away from the breast (DePolo 2022). For a diagnosis to be made, screening is necessary. Screening programs began in Europe in the 1980s when several studies and trials demonstrated the effectiveness of screening for breast cancer (Deandrea et al. 2016). Breast cancer screening using mammography is the most common approach for early identification of breast cancer and is widely used in Europe (Mathioudakis et al. 2019).

Mammography is an imaging method that is specialized for breast tissue and employs low-energy X-rays to screen for breast cancer in people who have no indicators or symptoms of the disease. In most screening programs, mammography consists of two X-ray images of each breast and a double reading. This process allows for the early diagnosis of malignant tumors before they spread (Mušić and Gabeljić 2019).

With the final results and the process of the diagnosis done, when deciding the best treatment path, physicians analyze the stage and grade of cancer, as well as the general health of the patient. Doctors specializing in various areas of cancer treatment, such as surgery, radiation oncology, and medical oncology, collaborate with radiologists and pathologists to develop the patient's treatment plan. These are commonly referred to as multidisciplinary teams. Other healthcare professionals on cancer care teams include physician assistants, oncology nurses, social workers, pharmacists, psychologists, and dietitians.

When deciding on therapies, the primary treatment is often surgery (Cleveland Clinic 2022). It can be breast-conserving surgery (BCS) also called lumpectomy, where only the cancerous lump is removed, or modified radical mastectomy (MRM), where all breast tissue is taken out. It is common that after a surgical intervention, patients undergo chemotherapy, radiotherapy, and in some cases, hormonal therapy.

These adjuvant therapies, meaning after-surgery treatments, are crucial to managing early-stage breast cancer, lowering the recurrence risk, and eliminating remaining malignant cells in the body.

Psychological effects

With the increasing cancer prevalence, several studies have been developed to understand the psychological and social effects that a diagnosis generates for patients and others involved.

According to the Journal of Breast Health, the prevalence of psychiatric disorders in breast cancer patients who experienced surgical procedures ranges from 29% to 47% (Cleveland Clinic 2022), without any significant difference between those who underwent breast-conserving surgery and those who underwent radical mastectomies.

The main reasons why breast cancer patients suffer from psychological problems are uncertainty about the treatment, physical symptoms, fear of recurrence and death, body image, changes in female identity and sexuality, difficulties in daily activities, family problems, and lack of emotional support (İzci et al. 2016).

For patients developing psychological problems during treatment, it is harder to develop coping methods and it becomes increasingly difficult to build social interactions. These negatively affect the course of the disease, reduce treatment compliance, and increase the length of hospitalization, leading to increased treatment costs. (Ganz 2008). Therefore, it is extremely important to focus on psychological support through the treatment course.

2.2. Market Overview

For the sake of this analysis, we describe digital health as the usage of digital health-improving technologies (World Health Organization 2021).

Whether from medical systems, mobile devices, wearables, or sensors, healthcare has become more digital and data-driven (Kostkova et al. 2016).

The first 100% online treatments offered via the internet were launched at the end of the 1990s, but the trend of online treatment has grown in recent years (Stoll, J. et al., 2020). Treating clients online has several unique advantages: gives control to the client, it is flexible and accessible, provides fast help, is also an important solution for long waiting times and it contributes to the reduction of stigma and to reaching isolated groups (Fagherazzi et al. 2020). In addition, it enables professionals to live and work around the world.

Many scholars have shown that the adoption of new technologies in healthcare, to a large extent, is influenced by the characteristics of the individuals related to the technology. Knowledge, beliefs, and expectations of individual healthcare professionals and clients have a great influence on the acceptance and success of the implementation of e-health technology (Carlqvist et al. 2021). Expectations, and future-oriented abstractions, are among the most important research objects for scholars (Borup et al. 2006).

Overall, medical treatment in Portugal is of high quality, being ranked by the Euro Health Consumer Index in 2018, as the 13th best healthcare system in Europe ("Euro Health Consumer Index 2018" 2018). This annual index assesses the health systems of 35 European nations from the perspective of the customer. Portugal, through the Directorate-General of Health, has contributed to the Health Consumer Powerhouse study.

Portugal's EHCI score has risen consistently, reaching 754 points in 2018, 31 points behind Germany, and 23 points ahead of the Czech Republic. The criteria for the 2018 and 2017 EHCI have been tightened even further, suggesting that Portugal's ranking has gained weight. European healthcare is continuously improving child mortality rates, as well as survival rates for heart disease, stroke, and cancer. Patient choice and involvement in care and decision-making are becoming increasingly important.

2.3 Market Players

The Portuguese health system is comprised of three coexisting systems: the National Health Service (SNS), unique social health insurance plans for specific professions (health subsystems), and private health insurance.

The most recent data on hospital counts in Portugal are for 2019, provided by the National Statistics Institute - INE, which indicates a total of 238 hospitals in that same year

(Instituto Nacional de Estatística 2019). This figure comprises 108 public hospitals, 127 private hospitals, and 3 hospitals in public-private partnerships.

The Portuguese National Health Service (Serviço Nacional de Saúde or SNS) administers public hospitals, while large private healthcare corporations run private hospitals. The SNS healthcare system is residence-based and open to all legal residents, comprising the entire range of primary and differentiated healthcare.

It is completely free for anyone under the age of 18 and over the age of 65, and health care is heavily subsidized. There are health centers and public hospitals in Portugal's public health framework. The health centers offer primary care consultations with family doctors as well as general care services. In contrast, hospitals offer specialty consultations, examinations, hospitalization, and several other more complex medical interventions.

Despite the benefits of the public health system, the speed of access to medical care and the impossibility of choosing a doctor is among some of the reasons why users prefer private health service. As such, and due to the lack of timely response provided by the national health service, about 40% of the Portuguese population pays for health care in the private sector (Lusa 2021).

Within the possibilities of choice of medical facilities for the treatment of breast cancer, Portugal has some that stand out for their effectiveness, technology used, and success rate. Among these are the Champalimaud Clinical Center, which had its Breast Unit as the first one to be certificated by ITALCERT in Portugal; the Portuguese Oncological Institute – IPO, a public facility, which has significant social, medical, technological, and scientific resources, and is highly appreciated by patients and families, who emphasize and respect the humanistic delivery of health care, which is a distinguishing feature of this institution.

As previously mentioned, screening is a fundamental part of the process of diagnosing the disease. In this sense, it is important to highlight the great work done by the

Portuguese League Against Cancer (LPCC). The League was established on April 4th, 1941, at Francisco Gentil's suggestion (Guldager et al. 2021). It is a national organization noted for supporting oncology patients and their families, promoting health and cancer prevention, and advancing oncology research and training. The growing emphasis on patient care and early illness diagnosis resulted in the development of one of the league's greatest initiatives: the National Breast Cancer Screening Program. Presently, the LPCC is in charge of most population-based breast cancer screenings in Portugal.

2.4 Challenges

Taking what was in the past decades the largest endemic, epidemic, and pandemic outbreaks, and reflecting on the impacts they have had on the population and medical advances, we realized that during the covid-19 pandemic there was a growing need for the introduction of digital solutions, given how infectious the virus was. In 2020, 18.5 million non-face-to-face consultations were performed in primary care, more than double the previous year's total. According to SNS statistics, 9.3 million distant consultations were done in the same units by May 2021, representing an almost 60% increase over the same timeframe ("Transparência" 2022).

In addition, it showed an opportunity to progress in terms of data collection and administration. However, the lack of connection between databases during that period, where consults were made through specialized phone lines, meant that the online screening of individuals suspected of carrying the virus did not consider medical records in electronic form and other health-related data. Even with the opening left by the pandemic for integrating more technology into healthcare, there are still many challenges when it comes to this matter.

Consumers are now more aware of the ease, speed, and efficiency with which they can take care of everyday matters without inconvenient trips or wasted time. These expectations apply equally to healthcare delivery. As a result, digital platforms providing healthcare services will have to redouble their efforts in trying to meet these requirements, especially given the fact that new technologies are often slowly embraced and accepted by the general population (Lennon et al. 2017).

Another difficulty that many businesses confront is professionals who are reluctant to change throughout the digitization process. As a result, it is critical to assess the amount of openness of the management team, service, and clinical personnel, address concerns about the process, and demonstrate the benefits of adapting.

Furthermore, there are many risks associated with the release of confidential patient and healthcare institutional data. To fully realize the benefits of digital health, patients and clinicians should trust digital technologies to keep health information private and safe (Fagherazzi et al. 2020). To preserve patient privacy, the most advanced data security and encryption solutions must be used. Patients must be informed of the privacy choices they make to guarantee data security and avoid revealing sensitive personal information.

Finally, perhaps the biggest and most difficult barrier to overcome, which raises several questions among professionals about the viability of digital solutions in healthcare, is the lack of physical contact between the patient and the medical doctor. Studies done on this issue have revealed that the lack of physical examination, as well as a loss of physical presence and touch, harms provider-patient communication, patient willingness to express concerns about their treatment, and, ultimately, patient health outcomes (Gomez et al. 2021).

2.5 Definitions and Concepts

Electronic Health Records

An electronic health record system (EHR) contains patient-centric, electronically maintained information about an individual's health situation, focuses on tasks and events directly related to patient care, and is optimized by clinicians.

EHRs were formulated to integrate multiple electronic medical records, to be collected over time, and to be comprehensive. EHRs facilitate the optimal management of an individual's health and allow sharing of information between all authorized providers. A patient should be able to enter any healthcare setting, provide authorization, and then consult with any provider who has immediate access to his complete health record (Ambinder 2005). EHRs promote connection and transparency between the patient, clinics, imaging centers, hospitals, health plans, and pharmacies in a confidential, secure, and standardized manner.

Specifically, in cancer care, EHRs facilitate collaborative approaches among physicians and enhance the tracking and monitoring of quality care. In oncology, there is a staggering amount of data that is collected and needs to be communicated among clinical teams. Using EHRs will enhance the decision-making process, decrease medical errors and facilitate the communication of decisions to all involved.

PROMs and PREMs

Patient-Reported Outcome Measures (PROMs) are reports of the status of a patient's health condition that come from the patient himself. These reports are designed with patients and clinicians for specific diseases or general health and quality of life. PROMs questionnaires address the pre-and post-treatment period and are meant to be applied over time. Condition-specific PROMs are particularly useful for clinicians to understand their patients' problems, assess the effectiveness of an intervention, and provide more personalized care (Withers et al. 2020). PROMs questions are usually multiple-choice, with most questionnaires having a scoring system that helps understand different areas of health and well-being.

Patient Reported Experience Measures (PREMs) address the patients' experience while receiving care and promote service improvement by reporting on objective patient experiences. PREMs consider the impact of the process of receiving care on the patient's experience, such as communication and timely assistance. When combined, PROMs and PREMs provide the patients' perception of both the process and outcome of care.

ICHOM

A major challenge in Value-Based Health Care is the lack of these standardized outcome measures, blocking optimal monitoring and comparison of health care quality. To address these challenges, the International Consortium for Health Outcomes Measurement (ICHOM) works towards systematic outcome measurement by developing "standard sets" for specific medical conditions. These sets include outcomes on which international working groups, including experts and patient advocacies, have agreed by consensus. To date, ICHOM has developed 39 standard sets, one of which is for breast cancer. The implementation of these outcome sets facilitates standardization and promotes benchmarking across different settings, organizations, and countries ("Patient-Centered Outcome Measures" 2020).

The ICHOM breast cancer standard set encompasses survival and cancer control, the disutility of care, such as treatment complications and reoperation, and the degree of health outcomes, including depression, sexual dysfunction, and pain.

According to the Consortium, the standard set represents what matters most to patients with breast cancer.

Integrated Practice Units

IPUs are described as "organized around the patient and providing the full cycle of care for a medical condition, including patient education, engagement and follow up. IPUs encompass inpatient, outpatient, and rehabilitative care as well as supporting services". (Porter and Teisberg 2006) IPUs have been presented as a framework to reform multidisciplinary teams and help health providers deliver greater value.

There are four key elements in assembling an IPU. The first is defining the condition and set of related conditions, including comorbidities, as well as the patient needs, and all the processes involved. The second element is assembling a multidisciplinary team with both clinical experts and patient support personnel. The third key element is to create mechanisms that support care integration across the team. These mechanisms include having designated facilities, a common scheduling system, common administrative infrastructures as well as a leadership team focused on managing the IPU as a unit, not tied to specialties or departments. The fourth key element is to develop mechanisms to measure costs and outcomes and to design processes that enable data integration.

Specifically for breast cancer, care delivered through an IPU connects clinicians such as surgical oncologists, medical oncologists, radiation specialists, reconstructive surgeons, pathologists, and radiologists, who are supported by specialized nurses, pharmacists, social workers, dietitians, and others. Ideally, these professionals are co-located in a single breast cancer center with unified scheduling and coordinated after-hours care.

As defined by Porter and Lee, in an IPU, personnel assume responsibility for engaging the patients and their families and working together to maximize the patient's outcomes as efficiently as possible. They specialize in the condition, trust one another, and coordinate to optimize time and resources. Clinicians meet frequently, both formally and informally, and review their performances together. Armed with data, they work to improve care, establish new protocols and find better ways to engage the patients, like group visits or virtual interactions. As referred, IPU members are ideally co-located to facilitate communication, collaboration, and efficiency for the patients, but they work as a team even if at different locations.

There is a complete cycle of care, covered through the IPU model, from prevention through early detection, diagnosis, treatment, recovery, and rehabilitation through long-term health sustainability. Even when the care path differs, there are common aspects in the care delivery, such as who engages with the patients at each stage and what to measure to assess success.

3. International References

Even though there are no digital cancer clinics in Portugal at the present moment, there are international projects worth exploring.

The first is Vinehealth, a digital health startup that uses technology to support patients across a wide range of cancers. It leverages AI and behavioral science to optimize cancer outcomes through patient-generated data. The app enables patients to track their medication and appointments, and monitor symptoms, mood, and activity levels. It was founded in 2018 and is part of the Digital Health London Accelerator program.

Vinehealth works with oncologists, specialist cancer nurses, and patients, offering personalized support while gathering patient-reported outcome data, later used for drug development and clinical trials. The platform also acts as a channel through which patients can be remotely monitored by their clinicians as they provide feedback on symptoms and report on treatment side effects.

Specific to breast cancer, there is OWise, a mobile app and website created to help patients feel more in control from the beginning of their diagnosis.

OWise was created by Dr. Anne Bruinvels, an expert in personalized medicine, and her brother, David Bruinvels, a physician who specialized in oncology. Anne worked as Executive Director at the European Personalised Medicine Association, where she realized that the experience of cancer patients following diagnosis was much poorer than it needed to be. David owned a breast rehabilitation clinic and became aware that the patients were strongly asking for support. OWise addresses these points by informing and supporting the patients through treatment and recovery, to improve both patient experience and clinical outcomes.

The platform allows patients to enter and view their upcoming appointments, record or take notes during consultations, look up medical terms, track their side effects, and store photos. These features help patients monitor their well-being over time and improve communication with their medical teams, which in turn will be able to provide prompt and more personalized care.

OWise was selected by the NHS (England) Innovation Accelerator and used as a case study by the National Institute of Health and Care Excellence (NICE). It has undergone significant scientific validation, resulting in collaborations with academic researchers and publications in peer-reviewed medical journals.

Lastly, we looked at BELONG, a digital platform whose mission is to improve the patient's quality of life and care, through technology, data, and AI. It is the largest network for patients with cancer and their caregivers. Through this app doctors and clinical experts can address patient questions in matters of oncology, radiology, and research.

BELONG offers a Care Planning and Treatment Management feature, which gives reminders and helps patients prepare for subsequent steps. The goal is to help them understand what worked for others in similar situations, decide on relevant alternatives, and make informed decisions, according to each treatment stage. There is also a Digital Binder where the medical records are digitally organized and can be easily shared with designated caregivers and medical professionals.

Among the most relevant features of this app, there is a Clinical Trial Matching Service, which uses machine learning and specific clinical trial algorithms to analyze and notify patients of suitable clinical trials around the globe. Lastly, there is an Interactive Patient Community where users are able to share their specific needs, personal experiences, and tips, supporting one another to cope with daily challenges and recovery.

BELONG is used by the Israeli Ministry of Health, most of the top pharma companies, and many patient associations. It has contributed to global cancer research and published several papers in leading peer-reviewed journals. It recently won Best App & Software for Patient Engagement and Research at the MedTech Visionaries Awards in 2021 and Best Use of Artificial Intelligence at the Health Tech Digital Awards in 2020.

We will revisit some of these digital clinics later when discussing financing options and the features for the platform.

4. Methodology

Selection of Methods

As previously stated, this work explores the viability of opening a digital clinic for the treatment of breast cancer which would require the support and validation of healthcare institutions, medical professionals, and, of course, openness from patients. In this sense, the stakeholders are the major providers of information about how the current system works for breast cancer care. They are also a way to understand public receptivity regarding a digital solution, which, as we have already seen, can generate distrust.

The data collection technique used was semi-structured interviews with medical doctors, patients, and patient relatives. To encourage interviewees to share personal experiences and ideas, the questions were largely open-ended, such as 'what' or 'why' queries (Saunders, Lewis, and Thornhill 2019).

Due to the stakeholders' different expertise and knowledge, three distinct interview guides were developed. One for the physicians, one for the patients or former patients, and one for the non-patients who have a family history or contact with someone with breast cancer. Even though the interview guides are substantially different, there are common questions among them.

The following categories were included in all three guides:

- Deficiencies in the current breast cancer treatment process
- Adherence and trust in a digital clinic
- Advantages and drawbacks of the project

The interview guides for clinicians, patients, and non-patients can be found in appendixes 1, 2, and 3, respectively.

Study Sample

Our study population consisted of seven clinicians, eight breast cancer patients, and six non-patients. The clinicians had diverse medical specialties, one anaesthesiologist, one immunologist, one general breast surgeon, one hematology resident, one radiologist, and two general practitioners, working in the private and public systems. The cancer patients were women between the ages of 38 and 77, also treated in both private and public hospitals. The entire sample is Portuguese and was also treated in Portuguese hospitals, except for one former patient who was treated in England. Further sample details can be found in appendixes 4, 5, and 6.

Research Design

The interviewees were asked to take part in individual semi-structured interviews with mostly open-ended questions and some descriptive research questions. The interview guides were developed to help conduct the interviews yet allow the conversations to develop without restraints. The interviews took place in October and November 2022, in person and through video calls, lasting between 30 and 80 minutes, depending on the interviewees' availability and openness.

5. Findings

5.2 Insights from patients

Initially, there were some complications regarding the interviews that will be explored below. These complications stem from how sensitive this topic is for those who have experienced it. On the part of the former patients, because there was some distance in time from when they experienced the disease and because they were a success story, there was more openness to talk about the topic. However, for those who are currently going through the disease and have with them a set of fears and uncertainties about the outcome, there was less openness. In these cases, we ended up not exploring in such detail some questions in order not to be invasive and out of respect for the present situation.

Deficiencies within the current system

Cancer impacts all areas regarding patients´ quality of life, and it is presently a big concern around the world. Patients face physical and mental challenges during the diagnosis process, the early phases of treatment, and the period following treatment completion. Poor adaptation and lower life quality in breast cancer patients are common throughout these times (Mokhatri-Hesari and Montazeri 2020).

For this very reason, it is highly necessary to investigate the patients' perspectives along this path, what worked, and what was a problem during the process that they would like to see improved. This research is done in an attempt to find solutions to these specific problems, improving the quality of life of patients and allowing the whole experience with breast cancer to be short, lived least painfully, guaranteeing the best follow-up by the medical team and the best treatment available.

Throughout the interviews, one of the topics covered in greater depth was the deficiencies of the current system. From the answers we obtained, it was possible to see that, although in general, the patients are happy with the treatment they are having or have had, there were many things that they would like to see improved in this same system.

Long waiting times

Being diagnosed with cancer may alter one's perspective of time; hence, while health professionals may perceive time conventionally, patients' experiences may differ and involve things other than clock time, such as viewing time as existential (Guldager et al. 2021).

With that being said, one of the issues mentioned by the patients as a frustrating part of their treatment was the waiting times. Especially in a phase where, due to the secondary effects of treatments and the psychological impact the disease has on them, they are low on social and physical energy. For this reason, getting out of the house, making another visit to the hospital, and keep waiting for a long time for a simple exam can impact the quality of life of the patients, as stated by one of our interviewees.

> "I *would decrease the waiting times for exams and treatments, especially because at times I did not want to be outside, especially in waiting rooms for hours at the hospital with other patients trying to socialize."*

Lack of psychological support

In addition, regarding the psychological support provided during the process, some complaints were also made by the patients, because even in cases where the patients felt that there was no need for this kind of support from a professional, the possibility was not presented to them at any time. We were also told that in some situations the patients themselves have asked their doctors about the possibility of being accompanied by a psychologist, and although initially, they were willing to help, they never really provided them with information.

> *"In my case I didn't feel it was necessary, but it wasn't discussed or offered either. To*

> *have some emotional comfort, I feel that at the time I wanted to read everything and know everything, but it became too much, and I stopped doing it."*

Fear of losing the physical component in a digital context

One of the aspects that was highlighted by us during the literature review and that we saw reinforced by the patients' perspective was the need for and importance of physical interaction in the doctor-patient relationship. Based on a theoretical model of physiological connection, the physiological linkage should occur during physician-patient interactions when doctors and patients share information about their own physiological and emotional circumstances. This information might come from several sources, including actions, body language, and voice (Cherry et al. 2018). In this context, many fears have arisen from the patients' point of view since during online consultations all these elements can be compromised. As a consequence, there is some fear that the lack of these elements will impair the quality of the appointments.

> *"I very much prefer human contact and it was extremely important during my journey to have appointments in person, to hug the doctors and to essentially feel like I was being supported. On top of everything I feel like this support passes a lot by human interaction in person."*

Poor sharing of information with the patient

The connection and degree of proximity between doctor-patient and the sharing of information and possible decision-making are interconnected, as patients are less inclined to listen to counsel, act on advice, or even interact with the system of care if they have a low level of confidence in their providers (Gregory and Austin 2021).

Throughout the process, patients end up feeling that they are living an experience that is not theirs since they do not have all the information about the diagnosis, procedures, tests, and further explanations being shared with them. They feel that there are miscommunication and a lack of dissemination of information by the doctors in charge of the case and the rest of the professional team. Even though a minority prefer to keep their distance when it comes to the details of the process because they feel they do not have enough knowledge to be an integral part of the decision-making (Waddell et al. 2021), studies show while some patients might be reluctant to make the ultimate treatment decision, many would like additional information (Coulter, Parsons, and Askham 2021).

"Little guidance during the treatment because I was often the one who had to insist to get answers, I was not prepared for side effects. For example, I developed a stomach problem as a result of chemotherapy. I think they could have anticipated this reaction or at least alerted me to this possibility."

Overload of obligations for the patient to deal with

Finally, the overburden placed on the patient concerning all procedures that could be automated through the application, such as the scheduling of exams and consultations, was also mentioned by patients as an issue with the current system. Some of the patients who were interviewed reported that there was a lot of disorganization within the hospital where they received care, that appointments were frequently forgotten by either the doctors or the administrative staff, and that it was their responsibility as the patients to make sure that all consultations and exams were carried out. The doctors did not express any concern in this regard.

The inconvenience of the process in which patients must make hospital transfers and move from specialty to specialty to complete all the procedures ordered by their doctors was also recognized.

"One thing that irritated me and that I would change in the current system was that I had to schedule everything myself. The doctor would prescribe a test or appointment,

but I was the one who would go back and forth from specialty to specialty to schedule tests and appointments. I also felt some disorganization in the hospital and lack of communication between them, I had to be the one to remember."

Advantages and drawbacks of a digital platform

When asked how comfortable they would feel with using a digital platform, the response among the patients was homogeneous. In general, all agreed that they would feel comfortable with its use as long as it was only a complement to face-to-face consultations and not if the whole process was developed through the platform. This preference is due to fears that communication with the physician and the emotional support that physical contact brings would be compromised. Some fears also arose regarding the difficulty of adapting to a digital aspect, in which mainly patients over 70 years of age made it clear that this is an area they do not master.

"I would feel comfortable in using a platform like this if it was only for additional contact with health professionals and not for replacing appointments."

"The adaptation to a digital platform would be a great difficulty for me, so maybe I would use it but as a complement if it was simple to access and not as a substitute to the current system."

Despite the reluctance previously presented by the interviewed patients, many were the advantages they presented for a project like this, especially as a way to bridge the gaps that currently exist in the support system for breast cancer patients. Among them were the possibility of being able to handle the scheduling of tests and appointments directly through the platform and without the need to travel, and having the whole process gathered in a single place, easily accessible.

"The schedule and possible reminders of check-ups can make the process more manageable."

5.3. Supplementary research from non-patients

In research done as a complement to those done to patients or former patients, we decided to also interview individuals who have never had breast cancer but have a family history or know someone that had the disease. This decision was made after feedback from the doctors we interviewed, who emphasized the emotional attachment that is created by patients to the type of treatment and medical team they had during their experience with breast cancer. This way, in case they have a recurrence of the disease, they would be very unlikely to resort to a solution other than the one that was successful at the time.

Therefore, the bet on these individuals as users of the platform would be for them to be followed in a breast cancer screening process, which should be supervised more regularly by family history, and eventually, when given a diagnosis they would become patients with the follow-up and treatment to be done through the platform as well.

Through these interviews, we were able to obtain dimensions of analysis that had not been previously addressed, mainly regarding the advantages and disadvantages of the digital platform. At first, all individuals agreed that due to the cases of breast cancer in the family they should have checkups much more regularly, although not all do this type of exams with the necessary regularity. Also homogeneous was the knowledge of symptoms and treatment pathways by this group.

"In the context of my last answer, yes, I have a family history of breast cancer. Due to the fear of having it, mostly because I have accompanied the process of people that I love having to deal with the consequences of treatment and the anxiety of the diagnosis, I would feel safer by doing regular check-ups for the disease."

According to the literature, patients do not participate in logical behavior when looking for clinicians. Instead, they rely significantly on referrals from relatives and friends and do limited searches for other providers (Kozikowski et al. 2022). This was confirmed by the testimony of some interviewees, as we can see below.

“I would feel comfortable if my gynecologist (who would eventually diagnose the cancer) referred me to this digital clinic, either because it has the best staff or successful outcomes. Or if I had references of positive experiences from people I know. On my own initiative, without advice to do so, no.”

Advantages and drawbacks

In addition to the last information added to the analysis, the interviews were also very helpful in perceiving more advantages and disadvantages of a digital platform.

As we saw earlier, there is a great appreciation of the opinion of family and friends when it comes to choosing a doctor. Analogously, there is also a great need to have these people around during the whole process of fighting the disease. With the current hospital conditions, it is difficult that the patient takes more than one or two people to accompany him/her to appointments and treatments, especially if he/she is of legal age. In this sense, one of the advantages presented for this platform was the possibility of always having the people who are important to the patient close by. In this sense, during the consultations, which take place online, from the most convenient location for the patient, they can be surrounded by as many people as they need to be present.

“To be accompanied by those I care about at all times throughout the process.”

We also saw presented as advantages some answers given by the digital platform to the problems expressed by patients and former patients to the current system. One of them was the possibility of having constant contact with health professionals and psychologists.

“The biggest advantage, in my opinion, is how easy it is to have access to a team of professionals through the app, either medical or psychological advice, and having a

huge support at any time that a doubt or fear comes around.”

Finally, was mentioned the opportunity of sharing the information they wanted with whomever they saw as appropriate since the patient has the whole process aggregated in a single place and with easy access. This advantage arose from a context in which several times, after having taken exams, patients must wait for an appointment to have the results analyzed by their doctor. In these circumstances, since the patient already has the test results available in the application, he or she could ask a doctor close to and trusted by the patient to analyze them, to alleviate the anxiety caused by waiting until the appointment.

“The possibility of being the real owner of all my medical information and being able to make it accessible to any health professional I decide to consult at any given moment, or even with third parties, family or friends that I think should have access to all the information would be a huge asset for me and I certainly wouldn't hesitate to use it.”

As far as the disadvantages are concerned, some of those that were mentioned, although not previously stated by either doctors or patients, were explored and foreseen by us at the time of exploring the challenges for the implementation of the project.

Considering these weaknesses, the high sensitivity of health data and how difficult implementation can be due to gaps in the system concerning the number of available medical personnel and the high costs associated not only with hiring professionals but also with database implementation and partnerships were presented.

“Hard to implement due to the small number of medical staff available and high costs it would take to ensure its promised continuous functioning.”

Finally, after the project was presented to the study group and the need for a face-to-face component to perform the exams and treatment was reflected upon, it was highlighted by some interviewees the problem that, in the case of a partnership made with a single hospital and clinic, the access for many patients would be difficult. When considering what would be the solution for the physical component, we did not take this factor into account, but after receiving this feedback, we realized that we have to ensure that partnerships are made with clinics and hospitals more distributed throughout the national territory, so as not to limit the access of patients to it.

> *"If only one hospital has a working agreement with this platform it could lead to some patients having to travel long-distances to reach it."*

In conclusion, the study of the patient and non-patient interviews made us understand what the focus segment for the digital clinic should be. Patients, no matter how receptive they are to a digital solution in case they have a recurrence, will always have a link to their previous treatment. Not only for emotional reasons but because it is a service they already know and are familiar with. The vast majority confirmed that they would not even look for new options but rather use the contacts they already had from the old treatment. In the case of non-patients, besides starting with the use of the platform for screening, without any previous treatment reference, they will much more easily consider it as a solution. We conclude that this group is the target of the project, the second opinion market.

By linking patients with medical specialists around the country, medical second opinion technology increases treatment quality. Diagnostic accuracy can be considerably enhanced with more opinions from medical specialists. As a result, patients will have a better chance of receiving appropriate therapy and experiencing beneficial medical results (Halasy and Shafrin 2021).

6 Discussion

We will now introduce the features and menus we have developed to include in the platform, both from the patients' perspective and the physicians' perspective. We will explain the intention behind each feature and their functionalities. This will help users and stakeholders understand our idea and demonstrate that although some patients might be reluctant to use a digital platform, access should be intuitive. Additionally, we discuss the approaches to be considered in the business plan and the significance of having the digital clinic function as an Integrated Practice Unit. Finally, we discuss which subjects should be deepened in a future analysis in order to successfully implement the clinic.

6.1 The platform

After gathering information about the needs that the stakeholders presented, we structured the platform in a way that could address them. The platform would be available in a web-based format to facilitate video conferencing and viewing of medical exams, and also as a mobile application, allowing faster and more convenient access to the patient.

From the patient's perspective

1. Medical reports and exams - Digital Binder

Through this menu the patient will be able to access his digital diagnosis reports, previous medical history that is considered relevant, the exams performed under the clinicians' recommendations and his medical prescriptions. Below we will also explore the reasons for integration of EHRs in the clinic's platform.

2. Next appointments
    - 2.1 Exams
    - 2.2 Consults
    - 2.3 Treatments

Under "Next Appointments", the patient will see the time and location, either online or in person, of his future appointments as well as a brief introduction of who his medical doctor is at each stage. The platform will also show the patient what the main intent of the consultations is and what he can expect.

3. Book a call

Through this menu, the patient will be able to book a quick consultation with a medical doctor, depending on his specific needs. This physician could be his main clinician, a gynecologist, phycologist, dietitian, or general practitioner. The purpose of this menu is to answer the patients' concerns as quickly as possible, avoiding unnecessary hospital visits.

4. Patient forum

The patient forum is a digital space where patients will be able to connect, share their experiences and support each other through the treatment path. On a weekly basis, there will be scheduled group calls, led by a medical specialist, to either address specific topics on radiology, hemotherapy, nutrition, surgery options, among others, or answer patient questions directly. We will explore the reasons for and advantages of integrating this forum in the platform below.

5. How am I feeling

On this menu, patients will be able to report on their symptoms and treatment side effects. There will be medical reports and studies available on the usual symptoms and side effects of the disease so that the patient will be well informed before even experiencing any of them. In the case of their appearance, the patient, by being informed, will not have the same level of anxiety that he would have in the case of not being aware of them at all. The objective here is to facilitate communication with the medical doctors and promote patient awareness.

6. Digital pharmacy

The clinic will be connected to the National Pharmacies System, making it easier for the patients to save their prescriptions digitally and get them dispensed. On this menu the patient will be able to see the medications he is supposed to take at which time. Optionally, the patients will be able to set alarms working as medication reminders.

7. PROMs and PREMs

Lastly, under this menu, the patients will be asked to answer PROMs and PREMs questionnaires at the appropriate time points, which will be measured according to the ICHOM standard set. Below we will explore the advantages of measuring treatment outcomes and explain how to adopt the ICHOM standard set.

From the physician's perspective

1. Patients

Through this menu, all physicians working at the clinic will be able to access the full picture of their patient's journey. This will include medical records, planned

appointments, medical prescriptions, reported symptoms, and treatment plans. This will give the medical doctors a complete understanding of each patient's situation, assist them in preparing for the appointments, and facilitate discussion among the clinic team. This feature will be useful not only to provide the physician with all the clinical information about the patient but also for better organization and to decrease time wasted during consultations. In addition, it allows all doctors to have the same level of information about the patient's case at multidisciplinary team meetings.

2. Schedule

Under this menu, physicians will access all their commitments. Including patient consultations, general meetings with other medical doctors and overall time to be dedicated to clinical work.

3. Medical Forum

Similarly to the Patient Forum, physicians will have a digital space to communicate with each other outside the meetings. This forum would be used to share medical information, changes in legal procedures, relevant clinical trials, and medical breakthroughs. It could also work as a complement and support channel to the regular general meetings.

4. Outcomes

Under this menu physicians will be able to access the results of the PROMs and PREMs questionnaires filled out by the patients. The objective is that physicians will study and discuss these outcomes with each other, allowing them to make informed discussions on how to improve techniques and treatment approaches.

EHRs in the breast cancer treatment process

As mentioned, the clinic wants to ensure patients have all their medical information gathered in one place, let us call it a Digital Binder. The objective is to release responsibility from the patients and to support the workflow of medical teams. The advantages of EHRs were already explored in the literature review, however, there are specific challenges in oncology care that determine the most important features to adopt. The Association of Community Cancer Centers recently conducted a study regarding the features that oncology practices consider most necessary in EHRs. The respondents reported on the following: care coordination among an increasing number of sub-specialists, symptom management, and screening services. According to them, these should be the investment priorities. Assuming implementation of EHRs in the clinic, we found the following products to be the most interesting in the market: Oncology EHR developed by CureMD, MOSAIQ by Elekta and OncoEMR developed by Flatiron.

Oncology EHR offers cloud-based customizable EHR, billing, scheduling, and practice management solutions. It includes multiple automation features to improve workflows, including monitoring lab work to ensure chemotherapy plans are adjusted to hepatic or renal adversities, as well as improved chemotherapy ordering efficiency and imaging analysis.

MOSAIQ is also an EHR management system designed specifically for oncologists. Users report that it is easy to use for both administrators and clinicians and that it is ideal for practices looking for a flexible and scalable solution that lives up to the current market challenges.

Lastly, OncoEMR, a cloud-based electronic health record that optimizes oncology workflows. The platform performs data analytics, features a patient portal, and supports integrated billing management. It also integrates evidence-based oncology pathways in the clinical workflow which supports clinicians' decision-making.

Integrating PREMs and PROMs

Given the importance of measuring the patient's care experience and its outcomes, the digital clinic will integrate PREMs and PROMs questionnaires, allowing comparison to other organizations and promoting continuous service improvement.

The clinic would implement the aforementioned ICHOM Set of Patient-Centered Outcome Measures for Breast Cancer, which include depression and anxiety, body image, vaginal symptoms, physical, emotional, cognitive, and social functioning, ability to work, and overall well-being. Appropriately, these outcomes match the most frequent symptoms and side effects described by the patients we interviewed. All the basic information needed to implement the standard set is provided by ICHOM and additional implementation support is offered if required.

Patient Forum

Oncological patients are increasingly seeking assistance on internet cancer forums. A forum is a place for online discussion where people can share their experiences, ask questions, clear doubts, or simply talk about matters of mutual interest. In the specific case of supporting cancer patients, the platform must have such a solution available. One of the problems that patients going through oncological diseases face is incomprehension from those around them, for not sharing the same experience. Research on the subject shows that members of these forums are often the relatives or friends of patients, who are seeking help from other patients and health professionals on how to best support the people in question. In the framework planned for the platform, the forum will be accessible to patients, and anyone whom they grant access, like relatives and friends, as well as healthcare professionals. In the circumstance where there are topics of a more sensitive nature and members are unwilling to address them openly, there will be the possibility to later move to a private forum with only selected members.

6.2 Working as an IPU

As we could see from the testimonies of the medical doctors, even those whose area of specialty was not oncology, in most cases, were aware of the treatment paths for breast cancer. This happens because cancer, with special attention to breast cancer, is a disease where the intervention of a medical team from several specialties is necessary, including hematologists, radiologists, physiotherapists, and pathologists, among others.

Because IPUs use a patient-centered approach, they not only treat the disease but also the associated symptoms and comorbidities. With this approach, we can see some of the current problems reported by the patients being solved, such as the lack of support and information at the clinical level, and also the side effects that many of them suffered due to the treatments, which could have been foreseen and shared by the medical teams responsible for their case.

Moreover, IPUs are responsible for involving both patients and their families in care (Gupta 2016) such as through therapy, promoting compliance with treatment, and assisting essential changes in lifestyle patterns such as diet, smoking cessation, or weight management. All these changes, added to those already experienced by the patients throughout the diagnosis and treatment, have a great impact on quality of life and well-being. It is necessary that the patient feels that he or she is not going through this journey alone and that he or she is surrounded by those who are most important, not only as extra support but as an integral part of the process they are going through.

In addition to the approaches taken by an IPU that were already mentioned, one of the key features of this framework that we would like to see implemented in the digital clinic is the frequent meetings between multidisciplinary teams for follow-up of each case. It is essential that these meetings are not only made for an initial situation point in which the diagnosis is formulated but that they take place throughout the treatment to predict and avoid unpleasant situations for the patients and where various perspectives add value to the care provided.

6.3 SWOT Analysis

To gain deeper insights into the project and its characteristics, we proceeded with the development of a SWOT analysis. This was developed through research on the current digital context and using the insights provided to us by the study groups in the interviews. This allowed us to discover key internal and external forces as well as strategy and planning tools for the platform, which will be analyzed throughout the discussion.

Internal factors:

Strengths

- Time-saving for both medical staff and patients. The impacts of time savings for doctors and patients per consultation have been studied in the digital context, ensuring that the quality of consultations is not impaired by this variation. With a digital solution, the process in which doctors have to spend time filling in paperwork can be simplified, giving doctors more time to see patients.
- Patients are using online health data to acquire information about specialists, hospitals, and health clinics, as well as to schedule consultations. In this way, they are more open to digital solutions when they find them.
- Data is everywhere and can be used for many purposes, including trend analysis and forecasting. Big data in healthcare delivers various benefits, including decreased rates of mistakes owing to incorrect medicine prescriptions or dosage, preventative treatment, and hospital facilities management.
- Avoids unnecessary exposure to the virus and other diseases, especially because during cancer treatment the patient´s immune system is fragile.
- Access to data via digital technologies provides clinicians with a more holistic perspective of patient health while providing individuals greater control over their health.

Weaknesses

- Senior patients experience more difficulties navigating a digital environment. Although breast cancer shows higher incidence in women between the ages of 40 and 60, the difficulty that more senior patients have in interacting with digital platforms is a cause for concern.
- In digital transformation there is often a lack of interaction and integration between different systems, as well as a lack of uniformity across different

healthcare companies. It can happen that one hospital's electronic medical records are not accepted by another.

- The healthcare sector is intricate, there is no one-size-fits-all approach. Healthcare plans, various medical treatment alternatives, and the need of human contact with patients all make it challenging to establish a universal comprehensive digital system that is accessible and beneficial to every patient.
- The healthcare sector is heavily regulated, with compliance and legislative standards varying by nation. As a result, creating a worldwide system that functions across regions is demanding. At first glance, this may not be considered a weakness since implementation is for the national level. However, with prospects for future expansion, it may become a problem.

External Factors:

Opportunities

- Given how fundamental the screening process is, it is essential that people do it as a precautionary step. Check-ups are often delayed by logistical issues associated with appointments, scheduling, and trips to the hospital. Access to a digital health platform facilitates this process and gets patients to take these preventive measures quickly.
- Easily accessible health care is in high demand. Since the pandemic, the world has been forced to transition to digital solutions, especially when it comes to healthcare. Today, as in all other sectors, people want to access healthcare at their convenience, at their own pace, and from wherever they are located.
- The market for smart technologies is expanding and with-it investors.
- There are still few competitors in the digital healthcare sector, particularly in cancer care and especially in Portugal.

Threats

- Legal compliance is the most serious obstacle to the healthcare industry digitalization. A little error or data leak involving a patient's personal information might cause major financial problems or even business shutdown.
- Another element that might be damaging to firms undergoing a complete digital implementation is costs. Companies have to incur enormous expenditures in integrating medical IT platforms and database systems.
- Consumer reluctance to digital platforms. Despite the increased acceptance of digital solutions by consumers, partly as a result of the demanding public health circumstances of recent years, there is still a lack of receptivity to these types of solutions and an attachment to the traditional, face-to-face context.
- Low development on device interoperability.

8. Conclusion

Digital health technologies have great potential to benefit patients and healthcare systems however there is often resistance from institutions and clinicians to change. With breast cancer incidence growing and with hospitals having to manage care with limited resources, we explored how a digital breast cancer clinic could improve patient care.

We decided to interview clinicians and breast cancer patients with the objective of understanding treatment pathways for breast cancer, faults in the current system, and their receptivity to a digital clinic. Having received a positive response from these stakeholders and knowing what they would value in a digital solution, we considered the project idea to be viable. Therefore, we proceeded to evaluate the current market for breast cancer support and defined options for the implementation of a digital clinic.

We explored international platforms already giving support to cancer patients, such as OWise, Vinehealth, and BELONG. However, none of them addressed the full care cycle and did not focus on the treatment process itself. Still, we were able to benefit from some of their app features as a reference to add to our initial ideas.

A group of seven physicians was interviewed to understand their perception of the current system, their receptivity to the idea of a breast cancer digital clinic, and their thoughts on patients' adherence to the same. The following system deficiencies were identified by most: lack of psychological support to the patients, difficult access to treatments outside the bigger cities, less than optimal response time, and lack of organization within the hospitals. Physicians believe the clinic will improve doctor-patient communication, facilitate access to care, and benefit clinical management. As reservations, they feared the loss of personal contact, the inability of some patients to navigate a digital platform, and showed data privacy concerns.

Additionally, a total of 14 patients and non-patients were interviewed. As current system deficiencies they identified the waiting time to get test results and start treatment, lack of organization in some hospitals making it their responsibility to organize appointments and exams, as well as lack of psychological support offered. When presented with the idea of the digital clinic, patients and relatives feared losing connection with their doctors but recognized the benefits of having a single platform with all medical information and connection to pharmacies. They also highlighted the end of unnecessary hospital visits, having complete ownership of their medical information, and the possibility of quickly speaking with a clinician about their doubts.

After conducting the interviews, we developed the structure of the platform for both doctors and patients and added some features to the initial idea, like reminders to take medication and a digital recorder of symptoms and side effects. We believe it is essential that the clinic works according to VBHC principles, therefore we explained how to integrate Electronic Health Records and why it is important to measure PROMs and PREMs.

For us, the digital clinic should follow the working model of an IPU as much as possible, so we explored the importance of having a patient-centered approach through the entire care process, why multidisciplinary teams, measuring outcomes and costs, and having an integrated IT platform.

For the implementation of the clinic, our first option was to incorporate the app into an existing healthcare provider, either public or private, as a benefit to the work they already do. The second option, harder to execute, we believe, was to establish the clinic from scratch, as an independent business. After, we looked at how any of these approaches would be funded, at which point we evaluate Venture Capital options and Digital Accelerator Programs.

Ideally, as the next steps, we would get the platform fully developed and running and we would be able to take the project to existing healthcare players and business advisors. In the long term, the goal is that the project would be successful, scalable, and continuously improve cancer care for patients. In future medical articles, writers will call it a Breast Cancer Digital Clinic from Lisbon to the world.

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10. Appendix

Appendix 1: Interview Guide for Clinicians

1. What is your medical specialty?
2. Do you work mostly for a public or private facility? Could you share which one?
3. Have you had any contact with breast cancer patients? If so, what was your contribution and/or experience?
4. How well do you know the care pathway for treatment of breast cancer? Could you explain the fundamental steps?
5. From your experience, what do you think could be improved in the care pathway?

Brief introduction of the project

In what regards our project, think of a digital platform that will be the main source of contact between a breast cancer patient or a non-patient who wants their health screening done and a team of doctors responsible for their care. On the platform, the patients will be able to have their appointments, a data base containing all their exams, a personal schedule for the upcoming check-ups, 24h available clinicians to answer questions, psychological support, a forum with other patients to share their processes, doubts, etc. If there is the need to do presential consults, exams or surgery, there is an hospital working directly with this platform where it could be done.

6. How comfortable would you feel working in a digital platform focused on the treatment and support of patients with breast cancer?
7. On a scale of 1 to 5 how would you rate the project in terms of and why:
    7.1 Applicability

    7.2 Usefulness for the patient

    7.3 Ability to facilitate the diagnosis and treatment

8. What do you think are the advantages and down-sides of this option?

Appendix 2: Interview Guide for Patients

1. How did you discover you had breast cancer?
2. Could you please describe your diagnosis path?
3. What was the stage of your cancer at diagnosis time?
4. Were you treated in a public or private medical facility?
5. Could you please describe your treatment path?
6. On a scale of 1 to 5 how would you rate your experience in terms of and why:
    6.1 Overall treatment quality
    6.2 Realization of medical exams
    6.3 Guidance trough the treatment
    6.4 Doctor-patient communication
    6.5 Psychological support
    6.6 Follow-up support
7. What would you change in the care process for future cancer patients?

Brief introduction of the project

8. Have you ever used a medical app, either for booking appointments or for online consultations?
9. How comfortable would you feel in using a digital platform that would give you the ability to talk to health professionals at any time to receive additional support?
10. If that was the possibility for your journey as a patient to be done through this digital platform, from the moment of the diagnosis until the follow-up support, would you consider it an option? Please explain your answer.
11. What do you think are the advantages and down-sides of this option?

Appendix 3: Interview Guide for Non-patients

1. Are you aware of the implications, symptoms, and treatment for breast cancer?
2. Do you know someone that has or had breast cancer?
3. If you had or have a family history of breast cancer, would you feel the need to do more regular check-up exams?

Brief introduction of the project

4. Have you ever used a medical app, either for booking appointments or for online consultations?
5. How comfortable would you feel to resort to a digital clinic to be guided through the process of the health screening, eventual diagnosis and treatment?
6. What do you think are the advantages and down-sides of this option?

Appendix 4: Physician Data

Region	Facility Type	Professional Position	Facility
Setúbal	Public	Anesthesiologist	Centro Hospitalar de Setúbal
Lisbon	Private	Immunoallergologist and Occupational Medicine	CUF Alvalade Clinic
Setúbal	Public	Oncological Breast Surgeon	Centro Hospitalar de Setúbal
Lisbon	Public and Private	Hematology resident	CHLO and Lusíadas
Lisbon	Private	General Practicioner	CUF Descobertas Hospital
Lisbon	Public	Radiologist	CHLO
Faro	Pubic	General Practicioner	Hospital de Faro

Source: Mariana Mateus (2022): Own elaboration.

Appendix 5: Patient Data

Region	Age	Gender	Cancer Stage	Facility Type	Facility	Use of medical apps
Setúbal	77	Female	Stage IV	Public	IPO	No
Lisbon	56	Female	Stage II	Public	Norfolk & Norwich University Hospital	Yes
Lisbon	58	Female	Stage II	Private	CUF Descobertas Hospital	Yes

Lisbon	54	Female	Stage III	Private	Hospital Lusíadas	Yes
Évora	52	Female	Stage III	Public	Fundação Champalimaud	No
Lisboa	45	Female	Stage II	Public	IPO	Yes
Setúbal	39	Female	Stage II	Private	Hospital da Luz	Yes
Porto	63	Female	Stage III	Private	CUF Porto Hospital	No

Source: Laura Rosa (2022): Own elaboration.

Appendix 6: Non-Patient Data

Region	Age	Gender	Family History	Use of medical apps
Porto	23	Male	Yes	No
Lisbon	57	Male	Yes	Yes
England	28	Female	Yes	Yes
Lisbon	43	Female	No	Yes
Lisbon	52	Female	No	No
Setúbal	35	Female	Yes	Yes

Source: Laura Rosa (2022): Own elaboration.