The future of Brazilian healthcare:

Investigating the use of mHealth and video consultations in the Brazilian public health system

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ABSTRACT

Due to the COVID-19 pandemic, the rate of adoption for video consultations and mHealth tools within healthcare systems drastically increased. Brazil was no exception. The Sistema Único de Saúde (SUS) was established in 1988 with the purpose of providing universal healthcare to the Brazilian population. The high demand for specialized care, coupled with most specialist doctors being located in larger, urban areas, meant that providing secondary care during a pandemic became even more complicated. The administration of the SUS therefore was forced to consider other options, and began implementing the use of video concultations, when necessary, and other mHealth tools. However, it is uncertain whether this implementation will continue past the context of a global pandemic, instead of as a contingency. Therefore, this research paper aims to answer the following question: How can the increased use of video consultations and mHealth tools relieve the burden of medical specialists in Brazil?

In order to answer the research question the current literature relating to video consultations, mHealth tools, and the Brazilian healthcare system were analysed. This was used to build an interview guide in order to conduct semi-structured interviews with Brazilian healthcare professionals so as to gather the necessary information to answer the research question. The interviews were then transcribed and a thematic analysis of the data was performed in order to extract relevant themes and topics. The main findings indicated that video consultations were used significantly during the pandemic, and that future use is dependent on legislation and funding for infastructure and education. Nonetheless, interviewees were enthusiastic about this opportunity.

In terms of mHealth, this enthusiasm was also present, but current technology used within the SUS has to first catch up enough to allow for the digitalisation of patient information and data in a way that remains ethical. However, the use of mHealth tools could improve the quality of the SUS and allow for a more efficient system which would ultimately ease the burden of the medical specialists that employ them.

KEYWORDS: *healthcare, Brazil, mHealth, video consultation, public health*

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1. Introduction

The Sistema Único de Saúde (SUS) or Unified Healthcare System in Brazil was established in the Brazilian Federal Constitution of 1988. Within this document, it was recognized that healthcare is a universal right and a duty of the state (Abreu, 2020). With the creation of the SUS, every Brazilian citizen was given the right to free and universal healthcare (Abreu, 2020). The SUS now services over 220 million people (Abreu, 2020) and has implemented many successful healthcare policies and interventions that have led to improvements in health conditions and increased life expectancy for the Brazilian population (Marinho de Souza et al., 2018).

A study conducted by Viacava et al. (2018) evaluated the offer, access, and use of the services provided by the SUS in the past 30 years. While the number of medical professionals has indeed increased within that time frame, the effect of this is largely seen in urban and higher-income areas, with the more rural regions of the country still having a shortage of available doctors. The study carried out by Scheffer et al. (2020) indicates that there is not only a lack of medical specialists in Brazil, but also a lack of specialist training programs which, again, is especially prevalent outside of urban and higher-income areas.

The lack of human resources in the SUS requires steps to be taken to allow for the equal access to specialized medical services by patients all over the country, when required. Due to the nature of the SUS, family doctors and primary care facilities are readily available, meaning that a greater use of these resources can potentially reduce the burden of medical specialists, and shorten their patient waiting lists. Tools such as video consultations, as well as other mHealth applications, can transfer some of the burden of specialists to primary care physicians.

The COVID-19 pandemic has greatly accelerated the already growing research surrounding one of these technologies, namely virtual consultations. However, while there are certain growing applications, such as one seen in the state of Rio Grande do Sul, and private services, which do not include the majority of the Brazilian population, a nation-wide initiative provided by the SUS is still far from being realistically implemented. A system such as this could aid in distributing patients between specialists evenly, independent of patient or doctor location. Therefore, the research question proposed is: **How can the increased use of video consultations and mHealth tools relieve the burden of medical specialists in Brazil?**

In order to address this question, interviews were conducted with Brazilian medical professionals. This research question considers the gap in research regarding nation-wide

applications of viable video consultation platforms. While a small number of these platforms already exist, the research that surrounds them is often focused on patient satisfaction (Morgenstern-Kaplan et al., 2022). Yet, there is a lack of research that showcases the perspective of the medical professionals that provide their services in similar initiatives, which is what this study aims to accomplish.

According to the article by Agarwal et al. (2020), the slow adoption of telehealth and video consultations in Brazil is largely due to legislation that limits the way in which consultations that are not face-to-face can be performed. It is illegal to conduct a teleconsultation where a physician is not present at both ends, as it is deemed to be a threat to the traditional doctor-patient relationship (Agarwal et al., 2020). While legislation is changing on this subject, accelerated further by the COVID-19 pandemic, barriers to adoption of telemedicine practices include legal uncertainty, a lack of adequate technology acquisition, and insufficient internet connectivity.

The project RegulaSUS, which was implemented in Rio Grande do Sul, identifies high-risk patients who require immediate care to take part in the program and facilitates an e-consultation between primary care providers and specialists for cases that can be resolved virtually (Agarwal et al., 2020).

This is study provides an expansion of the current framework, as it focuses on a different group of stakeholders within the topic of healthcare, while still addressing well established theories and concepts such as the digital divide and how it can affect the patients that lack access to digital tools, or the education needed in order to use them or, how according to Nishijima et al. (2017) they are affected by digital illiteracy. Furthermore, other relevant theories include the digitalisation of the established SUS and how it can affect the healthcare system's data privacy and security measures. A potential negative effect on these aspects, according to Aagaard & Pedersen (2022), can be avoided by developing both concepts simultaneously.

The interviews that were carried out were semi-structured in nature. This choice was made because semi-structured interviews provided the opportunity to follow a set of predetermined questions that allowed the collection of the information that was needed, while, at the same time, gathering deeper insights into topics of high relevance and importance that the interviewee wished to develop further or that appeared to be important to answering the research question. The structured parts of the interview were determined after reviewing the present state of the academic research that has been done on the topic.

In order to properly accomplish the aim of this research paper, the following steps were taken. First, as mentioned above, an analysis of the current research that was done on the topic was carried out. This analysis included an overview of video consultations, mHealth and the present state and use of video consultation within the Brazilian health care system. This was followed by a thorough explanation of the method that was employed during this research. The covered sections included the research plan, sampling, operationalization, data gathering & review, and validity & reliability. The aim of this section was to provide a clear delineation of the structure that was followed throughout the writing of this paper.

The next section in the paper focuses on presenting the results of the interviews that were completed. This section was centred around the different themes and topics of importance that emerged during the interviews. Excerpts from the interviews themselves were included in order to improve the overall clarity of the discussion. The following section used the insights gained from the results section presented previously, and drew conclusions that helped shed light on the topic and, most importantly, answer the research question that was presented in the introduction. The final section included the limitations of the research paper and promising avenues for further research.

2. Theoretical Framework

The purpose of this section is twofold. Firstly, the relevant research into the topic of video consultations and mHealth will be laid out and discussed. In this way, the purpose of this study, and how it fits in with current research will be outlined.

Therefore, this section is structured in the following way. First, the broader topic of mHealth will be discussed, followed by a more specific look at video consultations and their current and potential uses within healthcare. Then, the degree of specificity will be increased once more by discussing video consultations in Brazil and finally a concluding subsection on the potential of mHealth and video consultations will be provided.

2.1. Potential uses, benefits, and concerns of mHealth

As a relatively recently established emerging technology in healthcare, mobile Health (mHealth) has been defined differently in academic settings. According to Adibi (2015), mHealth is "the practice of eHealth assisted by smartphones", eHealth (Electronic Health) being defined as "healthcare practices assisted by communication systems and electronic processes" (Adibi, 2015). Alternatively, Park (2016) defined mHealth as "the use of mobile devices to monitor or detect biological changes in the human body, while device management entities […] collect data and use them for healthcare and health status improvement", associating mHealth technologies more closely with the healthcare industry. Despite the differing definitions, mHealth can also be considered as a broader concept that covers both the views presented in the research carried out by Adibi (2015) and Park (2016).

Research into mHealth tools and their applications is extensive and is steadily expanding. However, the academic interest in mHealth really began increasing at the beginning of the 21st century (Fiordelli et al., 2013). During this time, researchers focused mostly on the simpler capabilities of smartphones such as messaging (Fiordelli et al., 2013). However, more attention was starting to be placed on mHealth applications and their use in healthcare, such as in the field of psychology (Becker et al., 2014; Fiordelli et al., 2013). Furthermore, discussions on the effectiveness of mHealth, its advantages and limitations, and ethical considerations were emerging (Becker et al., 2014). Nonetheless, it was already understood that interesting mHealth markets would be emerging economies and this topic should be approached as a global solution (PriceWaterhouseCoopers, 2012). This idea emerged due to the identified usefulness of mobile technologies in providing opportunities that were not offered in previous technologies, such as direct communication and fast connections

(Mechael, 2009). Thus, the focus was to build tools that would create value to relevant stakeholders and to focus on finding solutions rather than breeding unnecessary innovation (PriceWaterhouseCoopers, 2012).

As the research behind mHealth and medical technologies grows and expands, broader issues and theories are being tackled. An example of this is the quantified self movement, which allows users to understand more about their everyday habits through numerical values (Brinson & Ruthford, 2020). This movement also encapsulates the gamification of health, wherein users set goals and create games to increase the motivation to achieve a certain goal, such as weight loss, exercise, step count or a certain heart rate (Brinson & Ruthford, 2020). This is also related to the platformisation of healthcare, which aims at encapsulating as much information as possible about one user in a single platform through self-surveillance practices (Charitsis, 2019). These theories also bring into question ethical concerns such as data privacy and security and data ownership, as well as psychological issues such as the mental strain of setting unachievable goals, and over exhaustion (Brinson & Ruthford, 2020).

The article by Rowland et al. (2020) analyses the uses and effectiveness of several mHealth applications and raises problems concerning data privacy and security regarding the use of these applications by patients. The article found that mHealth applications had many uses. Firstly, they can aid in diagnostics and clinical decision making. This has been found to occasionally deliver inaccurate results. Some applications in this category use artificial intelligence to analyse pictures and provide a diagnosis. Although there is currently a large degree of error associated with this, improving the algorithm and training it further could allow for an accurate pre-diagnosis of certain visible diseases or illnesses. However, currently there are a lot of limitations with this type of mHealth application, yet significant improvements are being made as technology and artificial intelligence improve. Therefore, further research must be done on the factors and issues that affect the acceptability and usefulness of various features of mHealth services (Boceta et al., 2019). This is important in order to establish a baseline and standards for how an mHealth app works and how it can be used in a professional setting to aid providers in delivering healthcare to an acceptable standard. Another important thing to consider is how the use of mobile applications in diagnosis can change the relationship between a doctor and a patient. According to Morley and Floridi (2020), there is an increased desire to use these tools as a way to shift the doctor-patient relationship in order to offer enhanced autonomy. There is also a strong interest in preventative healthcare through the use of mHealth (Morley & Floridi, 2020). Therefore, further research should also be conducted in how mHealth tools can be utilised to aid both the

patient and the healthcare professional in different ways, and how the relationship between these entities can change and grow with the aid of these tools in a way that can benefit both parties.

Secondly, mHealth applications can be used for behaviour change interventions (Rowland et al., 2020). These often require wearable devices to form personalised recommendations but have shown to somewhat achieve the goal of changing a patient's behaviour in some way. Nonetheless, further research is required in order to understand how these can be utilised to effectively add value to clinical care. This is also a finding in the study by Bruno et al. (2018), who investigated the use of wearable technology, and how relevant stakeholders view these tools. The uncertainty regarding wearable technology and mHealth limit their current use in a professional healthcare setting, however there is significant interest in these tools from patients and healthcare professionals.

Another mHealth use is digital therapeutics. These applications support the self-management of a condition by digitalising traditional therapies (Rowland et al., 2020). Further research in these tools should focus on their clinical effectiveness and how they can be used as auxiliary tools to improve healthcare (Marzano et al., 2015). Furthermore, Marzano et al. (2015) also emphasise the possibility of increased use of mHealth tools further increasing inequalities due to potential lack of access of patients to the relevant technologies. This issue of the digital divide should also be considered in terms of the Brazilian healthcare system, and how many patients of the SUS can have trouble accessing or understanding these technologies.

Finally, mHealth applications can also be used for disease-related education. These provide structured and easy-to-understand education related to diseases and treatment (Rowland et al., 2020). They allow patients to share in the decision-making process in the clinic to a certain extent by increasing their knowledge of the disease or illness itself. Further research is required on the most effective way to transmit easily digestible information to patients with presumably no prior medical knowledge. Patients tend to understand more when a higher degree of involvement is encouraged and when the knowledge is directly related to their condition or situation, and when they are able to choose and suggest what they want to learn more about (Grosjean et al., 2019). Furthermore, mHealth tools can help those who have little to no access to healthcare by providing some education and the ability to search for symptoms (Henriquez-Camacho, 2014). While this solution is not currently equitable to receiving a proper diagnosis, care, and treatment, it can be extremely beneficial to those who do not have access to this at all.

Concerns about privacy were also expressed by other researchers, in particular by Nurgalieva et al. (2020), whose article reviewed the security and privacy of mHealth applications. It highlighted the importance of prioritising security and privacy when designing and evaluating mHealth applications, emphasising the need for "privacy by design" principles in the creation of these tools. The article by Osborn et al. (2020) investigated whether mHealth applications improve clinical outcomes of patients with cancer. The article found limited evidence for mHealth applications in cancer. The researchers identified several reasons for this. These include the relatively recent adoption of these applications by clinicians, which might mean that uses are still unclear. Furthermore, the lack of clinical input in the design of many mHealth applications suggests that clinicians and healthcare organisations are yet to optimise their use of these tools in a way that benefits all involved parties. Both studies also identified areas for future research. Both remarked on the need for better, more established techniques of evaluation for mHealth applications, in order to increase the possibility for comparison and provide a benchmark for researchers to follow (Nurgalieva et al., 2020; Osborn et al., 2020). These conclusions also point towards an interesting direction for further research where the effectiveness of mHealth can potentially be affected by the field of medicine it is used in.

Another important aspect of research into mHealth is how it can be used in developing countries. Several articles delve into this and provide results that differ from more common, Anglo-centric research paths. The quantitative study by Alam et al. (2020) investigated the factors affecting the adoption of mHealth services in Bangladesh. The researchers used a questionnaire and targeted younger, technologically adept consumers. The study found that performance expectancy, social influence, facilitating conditions, and perceived reliability all have a significant effect on the intention to adopt mHealth tools. The researchers identified other low-income countries as areas for future research into the factors affecting the adoption of mHealth tools. Furthermore, it highlighted that lack of access to an internet connection or technology such as smartphones can greatly limit how mHealth tools can be applied to developing countries (Alam et al., 2020; Morgenstern-Kaplan et al., 2022).

Furthermore, the quantitative study by Morgenstern-Kaplan et al. (2022) analysed all patients in the telemedicine program Coronaid, which offers free mobile consultations within Mexico. Patient satisfaction for this application was above 80% and the researchers found that the use of a mobile application telehealth program can remove commuting time and provide on-demand care. This research provides an interesting opportunity for Brazil, as it shows how mHealth and video consultations can be used country-wide to provide support for

medical professionals. However, research into this application focused on patient satisfaction, while not considering their approval of medical professionals. Therefore, research needs to be conducted into this and how mHealth can often blur the lines established between patients and doctors, such as communication being conducted outside of working hours. Furthermore, research should be conducted into the advantages of mHealth applications, such as allowing the patient more autonomy and efficacy of treatment (Qudah & Luetsch, 2019) and how these tools can provide a better experience for the patient overall. Moreover, a look into the ethics of mHealth and how this pertains to stakeholders is important.

2.2. Video consultations as perceived by patients and medical professionals

Although the use of video consultations was already growing rapidly and being implemented by many healthcare systems, the COVID-19 pandemic greatly increased the urgency of applying this worldwide (Car et al., 2020). The use of video consultations, when appropriate, allows healthcare facilities to limit exposures and prevent unnecessary contact. It also allows both the clinician and the patient to attend a consultation, even when self-isolating (Car et al., 2020).

Several quantitative studies have been conducted on the effectiveness of video consultations. The studies have discovered several insights into video consultations and mobile Health (mHealth). The study by Hansen et al. (2017) examined whether monthly video consultations with a nurse, supplemented with regular measurements of blood glucose, weight and blood pressure, could improve the diabetes control of patients with type 2 diabetes. The study by Hammersley et al. (2019) compared the content and quality of video, telephone, and face-to-face consultations. The article by Nair et al. (2021) investigated the feasibility, satisfaction and effectiveness of video consultations using mobile phones as a way to provide follow-up services for persons with epilepsy in the southern part of India.

To measure whether video consultations were effective and feasible, some researchers asked participants to fill out a survey to measure patient satisfaction (Morgenstern-Kaplan et al., 2022; Hammersley et al, 2019; Nair et al., 2021). Furthermore, video consultations in the studies by Hansen et al. (2017), Hammersley et al. (2019), and Nair et al. (2021) were analysed for feasibility and effectiveness.

The results obtained from the quantitative studies varied. The patient satisfaction in the study by Morgenstern-Kaplan et al. (2022) was above 80%, while in the study by Nair et al. (2021), the majority of patients were satisfied with video consultations. Furthermore, the

study by Hansen et al. (2017) found a significant improvement in diabetes control within patients. However, it was unclear whether these results were solely due to the teleconsultations, or whether it is the result of increased measurements and medical attention. Yet, while this could have been the case, the researchers point out that the use of telemedicine instead of physical consultations and checkups significantly lowers the amount of resources spent. The study by Morgenstern-Kaplan et al. (2022) also identified that the patient sample was of a lower mean age than other similar telemedicine programs, which could be attributed to the fact that the program used a smartphone application. This shows that mHealth might be less accessible to older patients. The study by Nair et al. (2021) also found limitations in providing video consultations due to the lack of adequate infrastructure in India which may lead to poor network connectivity in some rural areas. Further, they noted that the low-income population of India might not be able to buy a smartphone, therefore not being able to use mHealth. Contrary to the other studies, the study by Hammersley et al. (2019) found that patient experience and information and advice received were better in face-to-face consultations than in video or telephone consultations.

Several qualitative studies have also been performed on the effectiveness of video consultations. The study by Galpin et al. (2020) employed a design thinking tool to explore the strengths and limitations of using video communication software to provide continuing care for cardiology patients. The study by Donaghy et al. (2019) analysed the benefits and challenges of video consulting in primary care. Patients were invited to participate in a follow-up consultation using a video consulting platform, which required them to own compatible hardware. Finally, the study by Zilliacus et al. (2010) focused on the practitioners' experience with video consultations for genetic counseling in Australia.

All three studies conducted semi-structured interviews. The study by Galpin et al. (2020) used interviews to obtain information from relevant stakeholders, including nurses, patients and cardiologists. The study by Donaghy et al. (2019) interviewed both patients and primary-care physicians after the video consultation. A thematic analysis was then performed. The study by Zilliacus et al. (2010) interviewed practitioners.

The study by Galpin et al. (2020) used the insights gained by interviews and product testing to determine the best path for several aspects of the system. Firstly, they decided on the easiest possible platform for the patient to be able to use, to prevent confusion and improve accessibility. The importance of having a secure, encrypted media was also highlighted. Finally, it was also deemed important that the software was easy to use by care providers, such as nurses and doctors. The study by Zilliacus et al. (2010) further investigated

this, and determine that, while the practitioners were very satisfied with the service, due to its efficiency and convenience, some participants felt that the video consultations made it harder to build rapport, made the interaction with patients feel more structured, and did not provide an adequate environment for delivering bad news.

The study by Donaghy et al. (2019) revealed that video consultations worked well when no physical examination was required, but the consensus was that face-to-face consultations would always achieve better results. Participants emphasized that reliable technology was an essential for video consultations. Patients opting into the video consultation tended to be younger and confident with technology. Since hardware was not provided, this could exclude patients that could not afford it, did not want to invest in it, or did not understand how to use it. However, in the study by Zilliacus et al. (2010), the participants also appreciated that the system allowed for an increased access to rural and outreach areas and that there were lower travel costs overall. Furthermore, the system also accommodated impromptu or urgent calls better than face-to-face consultations.

Research into the effectiveness of video consultations shows that, while this method is seen as efficient, time saving, cost saving and sometimes more accessible to those who live in rural areas, it is also often considered less effective than face-to-face consultations by patients and practitioners. In Brazil, medical specialists are often lacking outside of larger cities, and some find themselves with waitlists that can be measured using years. Providing video consultations, when possible, could help to alleviate the burden of these specialists by distributing patients more evenly.

As it was laid out, extensive research has been done on the topic of video consultations as a tool to assist in providing proper health services to patients. Having established that, it is also to be noted that for the most part the existing research focuses on the patient's perspective on the implementation of video consultations. Of all the studies it is only the one carried out by Zilliacus et al. (2010) that focuses solely on the perspective of the medical professionals and even this study was carried out in Australia which has a different health care system and socio-economic situation as compared to Brazil. This is the reason why this study aims to provide insights into the seemingly overlooked perspective of medical specialists that provide these services and have to do so via video consultations in countries like Brazil.

2.3. The use of mHealth and video consultations in Brazilian healthcare

There is a limited number of studies that have been done on the use of video consultations and telemedicine within Brazil. However, while the number is limited, the results of these studies still lead to insights that are important for future research.

The Brazilian SUS is unique in that it organizes its health services into regional-based networks. This means that municipalities are responsible for organizing the healthcare network for their population (Vargas et al., 2016). Essentially, the system is decentralized into the different levels of the government (Vargas et al., 2016). While primary healthcare is often more readily available and accessible to the population, specialist care involves extensive waiting lists and sometimes long travel time. Furthermore, regional inequalities are very prevalent in the SUS, including unequal distribution of doctors within national territory and isolation of municipalities (Catapan & Calvo, 2022). This must be considered in the planning and execution of virtual consultations at a larger scale (Catapan & Calvo, 2022). Nonetheless, in this context, video consultations with specialists can decrease travel time and costs and does not rely on specialists being at a certain location. Furthermore, Ramírez-Rivas et al. (2021) stated that the shift to telemedicine in developing countries could be an effective solution for patients who have trouble receiving medical attention. This was a positive factor also identified by Catapan and Calvo (2022), who stated that inequalities in healthcare could be tackled by mHealth, if users are provided with diverse channels of communication and if there is a prioritisation of citizens who have difficulty of access, less resources, and lower education, in order to promote equal and total access throughout the country.

Nonetheless, a significant barrier to entry of the adoption of mHealth and video consultations is the financial costs of implementation that it would bring to the SUS and, ultimately, to the Brazilian government (Camilo et al., 2021). However, during the pandemic, it provided relief to healthcare facilities overwhelmed by patients and cases, and lowered the consultation time for patients, monetary costs, and allowed for better remote monitoring of patients (Camilo et al., 2021).

The study by Lutz et al. (2020) investigated whether a telemedicine initiative where a primary care physician in a primary care centre can request a tele-eye exam with a remote ophthalmology specialist was beneficial. The study found that over two thirds of patients could be treated at a primary care level with the aid of a remote specialist consultation. However, these results are hindered by the lack of development of mHealth and telemedicine developments currently being made in Brazil, as well as laws preventing advancements being made in this field (Moura et al., 2022). While the COVID-19 pandemic brought along certain

temporary changes in this, such as the ability to perform virtual consultations, in some cases, it is uncertain whether these practices will be allowed to continue past the pandemic (Moura et al., 2022). Moreover, there are other limiting factors to the implementation of mHealth and video consultations in the SUS. For example, the inability to perform a physical exam hinders the effectiveness of a tele/video consultation, when compared to a face-to-face encounter (Catapan & Calvo, 2022; Moura et al., 2022). Additionally, virtual consultations, especially when it is the first contact between patient and doctor, can be risky when establishing a relationship between entities (Catapan & Calvo, 2022). Therefore, follow-up consultations are more favoured to take part virtually, provided no physical exam or treatment is needed.

2.4. The potential of mHealth and video consultations

Research performed on video consultations and telemedicine has had varied outcomes. While some studies have found that video consultation leads to high patient satisfaction, almost all research maintains that face-to-face consultations are still preferable. However, these studies still support the use of telemedicine practices as a valuable tool to supplement primary care and physical consultations. Due to legislation in Brazil most video consultations that are taking place in the SUS require a primary care physician to be with the patient. Moreover, due to the additional qualifications needed by specialists over primary care physicians, the latter is more readily available (Agarwal et al., 2020). However, primary care physicians are still medical professionals and therefore able to somewhat relieve the burden of specialists regarding, for example, medical explanations that are not entirely clear to the patient and prescriptions that cannot be provided over video consultations (Lutz et al., 2020).

However, there does not seem to be a clear consensus on certain issues involving medical professionals and their degree of adoption of mHealth and video consultations. Namely whether they are willing to employ these methods, if they are equipped to handle large amounts of information from mHealth apps, and if it will ultimately relieve their burden.

Therefore, this study will examine how video consultations and mHealth can be used as a supplement to primary care consultations in order to ensure that medical specialists do not become overwhelmed with patient appointments, and that patients themselves are able to access specialized care in a cost effective and timely manner.

3. Method

The goal of this research paper is to examine how video consultations and mHealth can be used as a supplement to primary care consultations in order to ensure that medical specialists do not become overwhelmed with patient appointments, and that patients themselves are able to access specialized care in a cost effective and timely manner.

Therefore, this research aims to understand how digital tools can be implemented nationwide in a way that relieves the burden on medical specialists. It is important to understand the perspective of medical professionals from all over the country in order to tackle the size and diversity in culture of the country. This will be achieved through the use of qualitative methods in the form of semi-structured in-depth interviews.

This section will therefore explain the reasoning behind the choice of the method and provide a description of the sample and how it was obtained. Furthermore, the operationalisation of the theoretical approach will be discussed, as well as the data gathering and review process. Finally, validity and reliability of the approach will be considered.

3.1. Research plan

To answer the proposed research question, qualitative methods were employed. This choice was due to the fact that qualitative methods are considered to provide a deeper understanding of phenomena than quantitative methods (Silverman, 2000). Employing qualitative methods allowed for a stronger focus in understanding the context of the problem (Queirós et. al., 2017), and allowed for the knowledge provided by experts in the relevant field to be gathered and interpreted. Furthermore, qualitative methods are more concerned with increasing the understanding of a specific issue and are better suited when dealing with aspects of reality and concepts that cannot be as easily quantified (Queirós et. al., 2017).

According to the article by Gill et al. (2008), the purpose of a research interview is "to explore the views, experiences, beliefs and/or motivations of individuals on specific matters". Semi-structured interviews allow for the use of several pre-determined questions, as well as the ability for the interviewer to ask probing question so that the interviewee can develop when needed in order to pursue a relevant idea or response (Gill et al., 2008). Therefore, semi-structured interviews were chosen for this research project in order to understand how video consultations would work within the context of Brazil's healthcare system by interviewing medical professionals who would be using the system.

To construct the interview guide, it is important to construct an outline of planned topics, with relevant questions that need to be addressed and the order in which these questions should be asked (Adams, 2015). Furthermore, it is vital to prioritise the questions that are the most important to the research and also to ensure that open-ended and probing questions are asked (Adams, 2015). Ice-breaker questions are a good idea to ask at the start of the interview, to make the interviewee more comfortable and to determine the flow of the conversation and establish rapport (Adams, 2015). It is also important to ensure that the interview guide is not set in stone and should always be open to feedback and improvement (Adams, 2015). Therefore, the interview guide started with ice-breaker questions, before moving on to the interviewee's experience with the Brazilian SUS. Following this, the interviewer then asked questions about the feasibility of mHealth and video consultations within the national healthcare system. Using semi-structured interviews for this research allowed for the expertise of the interviewee on this topic to be adequately utilised.

Before the interview, the interviewees was informed of the approximate duration of the interview and the aim of the research. The interviewees also signed a consent form before the interview was conducted and was informed that the interview would be recorded and that answers would be used for academic research purposes.

3.2. Sampling

For this research, interviews were conducted with medical specialists in Brazil in order to answer the research question proposed above. Since the sampling involved experts with limited accessibility, 7 interview were conducted. The interviews were done in Portuguese, in order to ensure that information was not lost due to inferior knowledge of a second language. This was facilitated since all interviewees were Brazilian by nationality and the interviewer was Portuguese. However, there were certain cases where translation between the different dialects led to certain temporary and unavoidable misunderstandings. To ensure this issue was minimised, the interview guide was written in Portuguese and reviewed by a Brazilian native before use.

The interviews all took place online, due to the inability of the interviewer to travel to Brazil. This also led to minor communication issues caused by bad internet connections and other technical problems. However, this was not considered significant as interviewees were asked to repeat what was missed and the issues were not frequent. The interviews took place

on Microsoft Teams and lasted around 45 minutes each, with the exception of one, which was shorter due to scheduling issues and a delay on the part of the interviewee.

The sampling technique used was purposive sampling and took advantage of a personal network. The personal network was based on strong ties to doctors in Portugal, who have professional relationships with many specialists in Brazil. Snowball sampling was also used with participants to reach other medical professionals.

Since it was likely that participants would have busy schedules, a large availability was provided when interviews could take place. It was important for the researcher to show flexibility in order to be able to accommodate the interviewees. This meant that some interviews took place late at night or during the weekend, as that was the only time that the interviewees were available.

Furthermore, the interviewer attempted to keep as much focus as possible during discussion, while maintaining relevant questions open. This kept interviews as short as possible (45 minutes) in order to lower the inconvenience to participants.

The following table shows an overview of the interviewees:

Interviewee	Gender	Age	Place of Birth	Place of Work	Medical Specialty
1	Female	45	Natal, Rio Grande do Norte	Recife, Pernambuco	Radio oncology
2	Female	50	Recife, Pernambuco	Recife, Pernambuco	Oncology
3	Female	44	Salvador, Bahia	Recife, Pernambuco	Mastology
4	Male	42	Recife, Pernambuco	Recife, Pernambuco	Surgery
5	Male	36	Recife, Pernambuco	Recife, Pernambuco	Geriatrics
6	Female	34	Recife, Pernambuco	Recife, Pernambuco	Haematology
7	Female	32	Criciúma, Santa Catarina	Florianopolis, Santa Cristina	Enocrinology

Table 3.1. Interviewee sample demographic

3.3. Operationalization

This section will outline the different variables that this study aimed to identify and how they would, in turn, be measured. The goal of this study was to determine whether mHealth and video consultations would help relive the burden of medical professionals in Brazil. This goal, along with the information presented on the theoretical framework, led to the creation of three variables.

First, was the degree of feasibility of video consultations and mHealth. This was determined by acquiring information on how well-equipped medical professionals are in terms of knowledge and tools for this type of system, and how their current booking schedules look like, which would help determine how challenging it would be for them in the future to carry out video consultations and mHealth interactions without disrupting their already scheduled appointments.

Second, was effectiveness. To measure this, the information needed was in regard to how the pandemic affected the type of interactions practitioners had with patients. Meaning,

whether they had less face-to-face interaction, how these "not in-person" interactions went and whether they felt this was easier to do than normal consultations done in-person.

The last identified variable was willingness. This referred to how willing medical professionals were to implement such a system. If there wa a lack of tools and knowledge, would they be happy to learn or would they feel more apprehensive? Were there fears that a system such as this would affect their ability to provide the best service possible?

These were the guiding variables that helped shape and build the interview questions and structure.

3.4. Data gathering and review

To gather the relevant data, 7 interviews were conducted with doctors in Brazil. In order to organise this, communication was established with the participants and the interview date and time was decided. Due to the fact that most, if not all, interviewees were in Brazil, the interviews were conducted online through Zoom or Microsoft Teams. The interviews were recorded, with the participant's consent, and were then transcribed.

To analyse the collected data, a thematic analysis was performed. This method was chosen because it identifies and describes implicit and explicit ideas that are discussed during the interview process (Guest et al., 2011). According to Vaismoradi et al. (2013), the aim of thematic analysis is to identify, analyse and report themes within the data and is appropriate to search for and identify common threads that extend across the data. Thematic analysis provides a detailed and nuanced account of the data (Vaismoradi et al., 2013). The method aims to identify themes, which "capture something important about the data in relation to the research question and represent some level of patterned response or meaning within the data set" (Braun & Clarke, 2006). Braun and Clarke (2006) outlined a step-by-step guide on how to conduct thematic analysis, which incorporated six phases: familiarising yourself with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

To conduct the thematic analysis, the software ATLAS.ti was used. According to Soratto et al. (2019), the software provides greater data management security and eliminates manual tasks, which allows researchers to spend more time analysing the data. Furthermore, the available tools offer more advanced ways of analysing data. Soratto et al. (2019) also mention that, since the software does not perform automated data analysis, the relationships

created during the analysis process are based upon the researcher's judgement, which means that the researcher is able to remain a critical analyst during the research process.

3.5. Validity & Reliability

According to Roberts and Priest (2006), reliability and validity are useful to illustrate the rigorousness of the research process and to convey how trustworthy the research findings are. Reliability determines the extent to which the method can be replicated to produce similar results and validity refers to how close the method is to measuring what is intended to be measured (Roberts & Priest, 2006). While the concepts of validity and reliability in quantitative research can be measured mathematically and are vital to the research process, these concepts are harder to define and measure in qualitative research (Roberts & Priest, 2006). However, the analysis of qualitative data through methods such as coding (Roberts & Priest, 2006), and in the case of this research paper specifically, thematic analysis and coding, allow for a certain standardisation in the analysis of qualitative data collection and results. Therefore, qualitative research should maintain a constant and rigorous analysis of both validity and reliability throughout the entire research process.

According to (Stiles, 1993), reliability in qualitative research refers to the trustworthiness of the method used. It concerns the extent to which results can be replicated (Roberts & Priest, 2006). Reliability is important in order to determine the quality of the research and how it can generate understanding (Golafshani, 2003). To maintain a strong reliability in qualitative research, one must consider how researcher bias in data collection and analysis can affect the interpretation of results (Roberts & Priest, 2006). Furthermore, keeping detailed notes throughout the entire research process (Roberts & Priest, 2006) can allow the researcher to be more introspective and recognise potential bias in the method used as well as allow for the process to be better replicated in a different research project. Moreover, the use of qualitative content analysis is useful to increase reliability as it utilises specific codes to interpret data and follows a method involving standardised steps. This can be further improved by using software, such as ATLAS.ti, to further standardise the data analysis process (Roberts & Priest, 2006). Other relevant techniques to improve reliability are the rigorous transcription of data, including recording pauses and relevant non-worded communication, a systematic review of the data during analysis, and making concrete links between the data and the interpretation using examples such as direct quotes from interviewees (Roberts & Priest, 2006).

The relevance of validity is often questioned in qualitative research. While some researchers deem it relevant, many express concerns and believe it is either irrelevant or, more often, agree that it must be redefined to better fit qualitative research and its purpose (Golafshani, 2003). According to Golafshani (2003), validity in qualitative research should be measured by considering reflexivity, as well as the idea of trustworthiness and the ability to establish confidence in findings.

4. Results

To answer the research question, this section will be presented in the following way. Firstly, the organisation of the Brazilian SUS will be discussed, especially in the context of changes during the pandemic and medical specialists' understanding of how the system works. Secondly, the use of technology within the SUS will be outlined. Next, possibilities for the future of the SUS, in relation to mHealth shall be presented. Finally, the barriers to adoption of mHealth in the SUS will be discussed.

4.1. Organisation of the Brazilian public healthcare system (SUS)

Several important insights were obtained from this theme. Firstly, the proportion of SUS patients in Brazil is significantly higher than private healthcare patients. Interviewees claimed that 70 to 80% of their patients were in public healthcare. However, the Brazilian health system has often been underfunded, resorting to contracting services from the private sector, a practice that has happened and continues to occur due to the superior infrastructure and resources of the private sector (Gómez et al., 2018; Paim et al., 2011).

Within the interviewee's SUS patients, most came from within the metropolitan region, where their workplace was based. However, the rest of the patients often come from very far and sometimes come from different states, travelling over 1000km in some cases. Research into this has shown that, although numbers vary greatly depending on the region, in many cases over half the population live significantly far away from higher complexity care services such as hospitals (Benevenuto et al., 2019; Guimarães et al., 2019). This is especially the case with lower-income populations, who have a considerably higher difficulty in accessing public healthcare services (Benevenuto et al., 2019).

Although travel in order to receive care is provided for and funded by the government, one interviewee mentioned that, because of this, patients would often have to spend time waiting for others to finish their consultations before heading back home. Therefore, one short visit to the specialist could end up taking 48 hours.

Excerpt 1

So [the patient] leaves at dawn, spends the whole morning, waits for everyone and then takes the whole [next] morning to return. So [the patient] spends 48 hours doing that for a one-hour appointment. (Interviewee 7)

According to an interviewee, this inconvenience was furthered if a patient had a long-term treatment plan, such as radiotherapy. In these cases, the large distances mean that the patient will have to be away from home for a significant amount of time, potentially not working, and away from family.

It was found that all the interviewees agreed that the SUS´ waiting times were very lengthy. This can sometimes have drastic consequences for the patients.

Excerpt 2

The waiting line for an oncological treatment [...] is around 3 months. [...] A lot of deaths have occurred before treatment. (Interviewee 1)

This is the case mostly in the first appointment setup with a specialist. The hierarchy in place in the SUS involves the patient first receiving a diagnosis from a healthcare centre. In the way that the SUS is structured, a significant amount of the population has ready and easy access to basic healthcare through a program called the Family Health Strategy (FHS) (Macinko et al., 2018).

Excerpt 3

Some do not even have doctors in that healthcare centre, but they always have a healthcare centre. (Interviewee 7)

After a relevant diagnosis is obtained, the patient will then be redirected to a medical specialist. According to several interviewees, this is the process that takes the longest. Depending on the hospital, there is a limit to this, in theory, but several interviewees observed that their departments often inevitably went past this limit. Four interviewees stated that patients would wait at least three months and one said that it could take up to six months for a patient to get an appointment with a medical specialist in certain, more complex, cases. Moreover, one participant claimed to have a waiting list of over a year for a geriatric consultation in the hospital where they worked. This falls in line with the research by Goméz et al. (2018), which found that the long waiting times in hospitals suggest lack of personnel and equipment. This is especially prevalent in the northeast of Brazil (Gómez et al., 2018).

Furthermore, due to some hospitals not having a way in which patients can set an appointment digitally, often patients would have to wait in long lines to set this up.

Excerpt 4

Sometimes we see huge lines in the public hospital, where I work. People come at night, the day before, to be able to get a place in line to be able to set up an appointment that will happen in a few months (Interviewee 5)

However, participants also stated that after the first appointment was set, follow-up visits and check-ups were scheduled by the doctor when needed and did not experience large delays. Therefore, the delay is experienced due to a lack of proper communication channels and efficient scheduling between primary, which is essential healthcare, and secondary, which relates to specialist treatment, healthcare locations.

Nonetheless, this delay in receiving an appointment was not the only identified issue within the SUS by the participants. The conditions of the patient waiting area were also mentioned as being inadequate, with patients from any specialty being clustered into corridors without air-conditioning, leading to discomfort especially during the summer.

Two interviewees also mentioned that, if a hospital had an electronic database and agenda, which was not always the case, that this database was not available in other healthcare centres. Therefore, information about patients cannot be easily shared between hospitals. This is especially inconvenient since the establishing of the SUS made it possible for patients to be treated wherever they desire, independent of where they live. It was also mentioned that in many hospitals where the interviewees worked at, that non-digital agendas and prescriptions, among other resources, were being still being used. There are many benefits to the digitalisation of healthcare data, including the ability to practice evidence-based medicine, the reduction of cost and space requirements and the ability to easily transfer information when requested by the patient (Celestino & Valente, 2021). Furthermore, it also aids the doctor and hospital administrators to be able to handle and care for patients with more efficiency, allowing for the service to better meet the demand for care, and ensures information is not misplaced or lost and is available to those who might need it (Neta et al., 2019). However, digitalisation of data also comes with certain drawbacks, especially when centralising data so it is readily accessed by healthcare providers. The issues of data privacy and security must be raised when discussing this matter. Digitalisation efforts could be met with public distrust and therefore must attempt to include privacy by design and ensure proper consent is asked for from patients, while also guaranteeing that the data is kept secure (Aagaard & Pedersen, 2022).

Interviewees highlighted that specialists were rarely available outside of metropolitan areas. One interviewee stated that specialists did not want to leave these areas due to less opportunity, as in the centre they can work in many different locations, including private healthcare, and that the facilities seen in more rural areas were often lacking.

However, even within large hospitals, some interviewees highlighted the lack of specialists as another reason for long waiting times and delayed treatment.

Excerpt 5

That demand often happens because access to a specialist [...] is hard (Interviewee 4)

Notably, one interviewee claimed that the issue was in the organisation of the SUS, since the waiting list did not go down independent of more doctors being available. The participant suggested that an issue could be the lack of space or rooms with proper equipment as a possible reason for the long wait.

It is important to note, however, that while the interviewees pointed out several problems in the SUS, several also gave praise to the system, claiming that the advantages outweigh the problems.

Excerpt 6

In the past, they would die at the entrance [...] because they did not have the right to enter the hospital itself. That, pre-SUS would happen (Interviewee 1)

Furthermore, this finding is in line with the research conducted by Guimarães et al. (2019), who established that high quality and effective healthcare expectations can compensate for issues such as longer travel times and substandard conditions. This shows that, although patients might not perceive the services provided by the SUS as ideal and unimprovable, there is a certain amount of sacrifice that many are willing to take in order to receive quality treatment from medical specialists. The research by Guimarães et al. (2019) also found that patients in Brazil would often opt for receiving treatment further away, if this was perceived to be of superior quality, even when there is availability closer to them.

Two interviewees also acknowledged the benefit of a healthcare system that is available to every Brazilian citizen regardless of who they are.

Another very relevant concept discussed extensively during the interviews was changes in the SUS during the pandemic. Several interviewees noted that there was a significant

decrease in demand during the first lockdown in Brazil. However, they also noticed that the number of patients is increasing again. One interviewee expressed a worry that patients have been obtaining diagnoses significantly later than before, with illnesses, such as cancer, being found at later stages.

Excerpt 6
Studies are showing that [...] we are looking at a setback of around 10 years (Interviewee 1)

However, several positive results of the pandemic were also discussed. One interviewee stated that COVID allowed for a restructuring of the SUS. All interviewees mentioned the increase in digital communications, including starting to use video consultations in some occasions. There were differing opinions on whether this was a positive consequence, but most agreed that it was convenient and useful in certain circumstances. Therefore, the increased use of technology within the SUS will be further discussed and analysed in the following section.

4.2. Use of technology within the SUS
The interviews conducted revealed many interesting and important developments regarding the use of technology within the SUS. One insight was that, as briefly mentioned before, the pandemic facilitated a journey toward a larger degree of digitalisation of the SUS.

Excerpt 7
Today the unified healthcare system is being digitalised (Interviewee 1)

However, the adoption of video consultations[1] was not equal through every hospital, according to participants. This calls into question how equal the unified healthcare system in Brazil truly is, since there is unequal access depending on where a patient lives, and how they can receive their healthcare (de Fatima Marinho de Souza, 2018). This is now magnified into the inequality of access to technologies, known as the digital divide. The study by Nishijima et al. (2017) investigates this divide within Brazil in two different dimensions: inequality of

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[1] The interviewees used the term "telehealth" to describe video consultations. This was clarified during every interview.

access, and inequality in the ability to use digital tools. The factors that increase this divide include disparity in the quality and amount of education and inequality of income and employment, as well as the number of dependents within a household and the age of users (Nishijima et al., 2017). Nonetheless, the digital divide is decreasing, due to attempts to improve education and the decreasing costs of digital tools (Nishijima et al., 2017). This also calls into question whether offering the opportunity for virtual consultations will increase the rural-urban divide. As the study by Hammersley et al. (2019) claims, face-to-face consultations are preferable to tele/video consultations. This was also agreed upon by several interviewees. Therefore, with larger travel times and more inconvenience, virtual consultations could be favoured by patients further away from specialised care centres, lowering their overall quality of healthcare.

According to two interviewees, video consultations were used too much. One mentioned that, in their specialty (geriatrics) face-to-face communication as well as visual and physical examinations were vital but not present in video consultations. However, the interviewee did admit the usefulness of this consultation method for follow-up consultations and the convenience it provided. Another interviewee also complained about the increase in video consultation preventing physical examinations.

Nonetheless, several interviewees acknowledged the benefits of video consultations, especially in their convenience for both the specialist and the patient, and some remarked that it was just as effective as a face-to-face consultation, when a physical examination is not needed. When asked if a certain degree of communication was diminished through video consultations, Interviewee 4 responded with the following:

Excerpt 8
I think it depends on the professional that is realising [the consultation] [...] I do not see it as a limitation [...] because I think it depends much more on the empathy of the doctor conducting the consultation (Interviewee 4)

This is interesting as the interviewee, with significant experience in both video consultations and physical consultations sees no real difference, beyond the inability to perform a physical exam, in the medium used. The field of medicine is often considered to be rooted in empathy and understanding (Decety, 2020). It is considered very important for a doctor to express empathetic concern and compassion to a patient (Decety, 2020). It is important to consider that the limitation might not be the medium in which a consultation is

conducted itself, but the inability of a physician to offer the same empathy through a virtual barrier that they have been taught to deliver in person. However, it is not certain that empathy improves the actual care provided to a patient, as much as it is beneficial to gain a patients trust and make them feel safe (Decety, 2020). Nonetheless, implementing video consultations will require investment in training for healthcare professionals into how to interact with a patient professionally and to the same standard as a physical consultation in different mediums.

Beyond video consultations with patients, some interviewees also mentioned using video conferencing services for online departmental meetings or meetings with healthcare professionals. One interviewee mentioned that this led to increased efficiency:

Excerpt 8

They became online [...] and they became better I think. The participation is greater. Arriving late, that was a routine pre-pandemic. [...] Today its easier, to have a forum. An adequate number of participants at the correct time (Interviewee 2)

The pandemic also hastened the digitalisation of the SUS in other aspects. Several interviewees commented that certain aspects of their workplace were now digital, including agendas, patient charts and prescriptions. One interviewee, who was directly working on this aspect at their workplace mentioned that a significant barrier to the adoption of a digitalised system was the lack of available database. However, it was also mentioned that this was a work in process. One interviewee also stated that they did not see an increased effort to improve the online service.

One interesting product of the pandemic in Recife, Pernambuco was the use of a mobile application to share COVID vaccination status:

Excerpt 9

An application was created called Conecta Recife*, which was an application for vaccination [...] and everyone was vaccinated through that* Conecta Recife *with a SUS card [...] and there you would have a sort of chart, you would be getting vaccinated, and there was your vaccination card. And that proved that you can make an application [...] Its possible. I think its possible (Interviewee 4)*

Furthermore, several interviewees mentioned the increased use of communication methods to interact with their patients. This involved opening up channels of communication with technicians, assistants, nurses and, in some cases, with the specialists themselves.

However, most interviewees showed certain discomfort at being so easily accessible to patients at any time, and sharing their personal phone number and being contactable through text message, phone call or WhatsApp, which was frequently mentioned during the interviews. One interviewee expressed their discomfort when asked about this:

Excerpt 10

This is quite a problem for me. [...] Eventually, we can lose an important message there in the middle of a mountain of personal information. [...] Sometimes it is an invasion, you know, of patients and families at inappropriate times with inappropriate behaviour toward a professional (Interviewee 5)

This ties into the theme of digitalisation within the SUS. There are clear advantages to this, including the ability to transmit results to a patient digitally and the possibility for the patient to have a direct line of communication with their doctor, without having to go through convoluted, bureaucratic channels (Mano & Morgan, 2022). However, there are also disadvantages to this. For example, a patient that receives their results digitally, might not have the capability of understanding them without a clear explanation by a healthcare professional, which could lead to misunderstandings and unnecessary stress (Mano & Morgan, 2022). The direct line of communication may also lead to patients communicating at innapropriate times and the blurring of personal and professional relationships from the part of the doctor, as was mentioned by some interviewees. Furthermore, it is possible that communication at innapropriate times, such as late at night or during the weekends could lead to a mistake being made by the professional, or incorrect information being transmitted. The study by Mano and Morgan (2022) also found that communication via instant message, or most forms of written communication, can remove nuance from conversation and will not be able to effectively transmit tone, which could potentially lead a patient to perceive a professional as cold or unempathetic.

Nonetheless, WhatsApp Business was mentioned as a positive and important service, allowing them to separate personal and professional communication. Many interviewees mentioned this service:

Excerpt 11

Now we have WhatsApp Business. *[…] I haven't separated that but it is very important because if not, any patient has access to you 24/7 (Interviewee 6)*

This path toward the digitalisation of the SUS brings with it several questions. Most importantly, what will change and what can be improved? The following section will focus on the future of technology within the SUS, specifically relating to mHealth and video consultations.

4.3. The digital future of the SUS

The SUS has already seen a large amount of digitalisation in recent years, as was outlined in the previous section. However, due to a lack of specific services and dedicated channels, most of the digitalisation was done through informal channels, such as WhatsApp to communicate with patients and sometimes even to conduct video consultations. Therefore, this phenomenon highlights the need for a dedicated platform for mHealth and video consultations in the SUS, as was mentioned by an interviewee:

Excerpt 12

So in an informal manner, we managed to resolve some things through the phone, or through some communication channels, such as WhatsApp, *for example. And it showed, […] how important it was to officialise a communication channel (Interviewee 4)*

Many interviewees also acknowledge that the digitalisation of the SUS can directly tackle and solve many issues that are present in the public healthcare service today. This is the case with the long waiting times and the lack of sufficient facilities, as was highlighted by one interviewee:

Excerpt 13

It would be very good (sigh) telemedicine in the public system and avoiding those huge lines, those waiting rooms with, like, 100 people (Interviewee 7)

The increased use of video consultations was met with many different reactions by interviewees. However, one point that was universally agreed upon was the fact that they are

extremely convenient for both the patient and the specialist and that they provide a solution for many SUS problems.

Several interviewees highlighted the importance of having a dedicated communication channel to patients, in a way that did not seep into their personal life. They also appreciated the idea of a mobile application that would allow patients to communicate with specialists, set up consultations remotely, receive results, and access prescriptions, among other possible features.

However, the interviews conducted also shed light on some barriers into digitalising the SUS, which will be covered and analysed in the following section.

4.4. Barriers to the digitalisation of the SUS

When discussing the potential digitalisation of a service, it is important to look at the customers, or patients, to determine how this platform can be used. During the interviews, there was a lot of discussion surrounding the average SUS patient's access to technology. Some patients, especially in rural areas, do not have access to the internet or to a mobile device, such as a smartphone. However, the large majority of the relevant demographic does have this access, as was emphasised during the interviews:

Excerpt 14

Technology, today, it has reached even that poorer part of the population, that more needy part. Today, they have access to the internet. They are very rare, I think, the people that, today, do not have access to the internet (Interviewee 2)

However, a patient's understanding of how to use certain technology was not so prevalent. Many interviewees experienced this when conducting video consultations, discovering that some patients just could not understand the platform. One interviewee offered a suggestion on how to solve this:

Excerpt 15

I think there would have to be a location for the patients of the SUS to go to take a medical consultation through video conference. Because at home […] there are 10 people living together, imagine, grandson, son, everyone together. […] It has to be in a specific

location and then it would work properly. And more, it would solve problems
(Interviewee 7)

This is a suggestion that lies in the basis of how the SUS works in providing healthcare. Acording to Guimarães et al. (2019), primary healthcare is readily available to a large portion of the population, with secspecialised healthcare being significantly more scarce in comparison. However, according to Benevenuto et al. (2019), over half of the rural low-income population in Northeast Brazil are still located over 5 kilometers away from the closest primary healthcare provider. This means that, since a lot of this population does not have the means to travel large distances, they will still find a significant amount of healthcare to be inaccessible (Benevenuto et al., 2019). Nonetheless, this opportunity still provides a large amount of the population with the opportunity to receive specialized care, while not being required to travel significantly and not needing to own a mobile device, have a stable internet connection, have a designated, comfortable space without significant distractions, or understand how to utilize the technology properly.

Most interviewees agreed that patients would have to be educated on how to use such a platform. However, a few interviewees also concluded that not all patients would be able to use this platform, even with training. Several of the interviewees' patients are illiterate and some have difficulty in understanding technology.

Lastly, an important discussion to have with regard to adopting technologies is the question of data privacy. Interviewees shared several important insights into how data privacy is perceived within the SUS, as well as in Brazil as a whole. Five participants remarked that public healthcare patients did not express any concerns for the privacy of their data:

Excerpt 16
I don't think this would be a worry for them, no. I think that [...] maybe it doesn't even occur to them (Interviewee 5)

This outcome deviates from the research by Santos et al. (2019) who found that most Brazilian social media users were aware of data privacy and possible steps to take in order to protect personal information. However, this article did not investigate less technologically literate populations. An older study by Britto-da-Silva et al. (2015) did look into a broader population and found that higher income, highly educated populations, who were

predominantly from the south of Brazil, tended to be the most worried about privacy, while lower income, less educated people from the North were less concerned.

In fact, several interviewees mentioned that the data privacy worry came from the side of the hospitals and medical professionals, rather than the patients. Some mentioned that the hospital made a conscious effort to use secure services and maintain patient data as private as possible:

Excerpt 17

All doctors know the ethical code of medicine, that they need to protect the privacy of the patient. So that is a worry that we have, yes (Interviewee 1)

Research has shown that the use of digital tools, including telehealth, mHealth, video consultations, among others, has fundamentally changed the relationship between patient and healthcare professionals (Kuziemsky et al., 2020). Therefore, the traditional ethical code of medicine, as mentioned by Interviewee 1, could benefit from being reviewed, questioned, and potentially even improved upon taking into account innovation within the healtcare sector.

Several studies have highlighted that existing guidelines may not be appropriate when digitalising healthcare due to changes in context, impact on quality, ethical issues, effectiveness, among other reasons (Keenan et al. 2021; Kuziemsky et al., 2020). Furthermore, mHealth and video consultation services must be compared to traditional methods to determine appropriate practices using digital tools (Kaplan, 2020a).

Therefore, it is recommended that an evidence-based and value-based approach to decision making is taken, wherein past situations are taken into account and closely studied (Kaplan, 2020a; Kuziemsky et al., 2020). Guidlines should narrow the gap between healthcare providers and larger institutional guidance, since priorities of practitioners often deviate from what is considered the overall objective (Kaplan, 2020b; Kuziemsky et al., 2020). It is clear that, the more specific and understandable these guidelines become, the less room for error and incorrect judgement will occur from the side of the medical practitioner (Keenan et al. 2021).

5. Conclusion

In this final section, the results that were presented will be gathered into a few concluding findings, and then the limitations and potential avenues for future research will be lined out.

This research paper investigated the possibility of utilising mHealth and video consultations to relive the burden of medical specialists and to improve SUS patients' accessibility to secondary care. The aim of this research was to answer the following research question: **How can the increased use of video consultations and mHealth tools relieve the burden of medical specialists in Brazil?**

The results of the analysis showed that digitalisation of the SUS is already well underway, although this is highly dependent upon the hospital in question, as each of them operate very differently. The interviewees all mentioned the decentralized nature of the SUS and it was also clear during the interview analysis process that each practitioner interviewed had very different experiences regarding the degree of digitalisation of healthcare. This is in line with the study by Vargas et al. (2016), which describes the decentralised structure of the SUS and how this can lead to large discrepancies between how each care providing facility operates.

Furthermore, the research also found that there were plenty of barriers to the implantation of digital platforms, such as patient lack of access, and sometimes also understanding, of technology (de Fatima Marinho de Souza, 2018.). These differences give rise to a digital divide which can have direct consequences in the quality of care provided by video consultations and mHealth. This was also found to be a prevalent motif during the data collection process, with interviewees describing an average profile of their public healthcare patients, which was often extremely varied in terms of education and income.

Another important issue raised, both in existing research and during the interview process was the change in doctor-patient relationship that inevitably occurs with the increased use of mHelath tools and video consultations. This is in line with the article by Morley and Floridi (2020) which highlights the advatages of this, including a patient's enhanced autonomy and the increased shift towards preventative healthcare. On the other hand, Mano and Morgan (2022), mentioned the disadvantages of certain mHealth, especially from the side of the medical practitioner. An example of this is the establishment of a direct channel of communication between the doctor and patient, which, while it can be useful for receiving test results, clearing up doubts and setting appointments, might blur the lines between a professional and a more personal relationship (Mano & Morgan, 2022). This was a concern

expressed by some interviewees, whose patients would contact them through informal means such as WhatsApp or voice calling..

It is these types of issues that make a case for evaluating the current ethical guidelines of the SUS. This evaluation should be carried out with the goal of identifying and creating new ethical guidelines (Keenan et al. 2021; Kuziemsky et al., 2020). It is also emphasized in the research how important it is for the new guidelines to be built by using an evidence-based approach that would allow a look at specific events that occurred in the past.

It was found that interviewees believe their patients did not have many concerns about privacy in relation to the digitalisation of their private data. This deviated from past research into data privacy concerns within the Brazilian population (Santos et al., 2019). It was considered that the privacy concerns came mostly from the side of the healthcare professional and hospital administrators rather than the patient.

Nonetheless, several solutions were suggested, such as the use of primary healthcare facilities as locations for video consultations, in order to remove the need for access to or understanding of a platform, and providing training in order to use mHealth applications. However, these solutions are costly and require a level of organisation between different primary and secondary healthcare provider locations that would be extremely complicated, considering the decentralized nature of the SUS.

In conclusion, from the data collection process, it was gathered that video consultations were used abundantly during the pandemic. Currently, their use has been implemented in some specialized healthcare centers, ans in certain specialties that allow for it. A larger, more widespread, adoption of video consultations is dependent on legislation implemented at a higher level and acquiring the proper funding for infastructure and education of all parties involved. Nonetheless, interviewees were enthusiastic about this opportunity, and its ability to decrease patient travel time and cost and increase efficiency among other benefits.

In terms of mHealth, this enthusiasm was also present and prevalent but the current technology used within health care facilities in the SUS has to first catch up enough to allow for the digitalisation of patient information and data in a way that is adequately private and sufficiently secure. However, the use of mHealth tools could greatly improve the service offered by the SUS and allow for a more efficient system.

Both of these opportunities also have the potential of increasing accessibility of healthcare, especially to those who live significantly far away from a healthcare facility. Furthermore, given the enthusiasm of the participants of this study it appears that they also have the potential to help ease the burden of medical specialists. However, it is important to

note that the COVID-19 pandemic reduced the demand within some specialities, as was remarked upon by several interviewees. Therefore, it remains unclear whether the easing of this burden is entirely due to the increased use of digital tools.

5.1. Limitations and future research

This study has a number of limitations. Firstly, issues regarding the reliability of this research should be addressed. The use of semi-structured interviews decreases the replicability of research due to the unpredictability of the discourse involved and the follow up questions that might arise during a conversation. This limitation was somewhat tackled by the use of an interview guide (Appendix A), but this cannot be avoided completely using this method. Future research should aim to use different methods in order to further investigate and develop the findings of this study.

Another limitation of this study was the interviewee sample which was gathered by using purposive sampling and a personal network. The sample almost exclusively contained medical specialists working in Recife in the state of Pernambuco. This means that insights into the SUS are limited to this specific area. Future research should focus on different areas and states in Brazil, especially in bigger, more rural states with a more dispersed population.

It might also be of interest to conduct research into the perspectives of healthcare professionals other than specialists in irder to gain a holistic view of how mHealth and video consultations are percieved by a larger variety of stakeholders.

Finally, a limitation of this study was the collection of data, which was completed by one researcher only. This decreases the validity of the study, especially in qualitative methods, as the thematic analysis could have benefitted from multiple perspectives and opinions. Therefore, future research should also aim to use multiple researchers to increase the validity of the study's findings.

The findings regarding the perception of data privacy by the Brazilian population are another important area of future research. Interviewees stated that most SUS patients did not express concerns about the digitalisation of their public data.

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7. Appendix A – Interview Guide

Obrigada por concordar em fazer parte desta entrevista. Antes de começar, é importante estar a par de certas informações. Primeiro, se consentir, esta entrevista será gravada apenas por áudio. O material da entrevista será utilizado apenas no contexto académico. No entanto, o seu nome não será utilizado em associação com a informação dada nesta entrevista, a não ser que prefira que seja utilizado. Nesse caso, pode me informar durante ou depois da entrevista, mas antes de 1 de Junho. Se não, a sua privacidade individual será mantida em quaisquer dados resultantes desta pesquisa.

Não há riscos identificados em participar nesta entrevista, mas pode não responder a qualquer pregunta, ou parar a entrevista a qualquer altura, sem qualquer penalidade. A sua participação demorará cerca de 30 minutos.

1. Introdução
    a. Pode me dizer algumas coisas sobre si?
        i. Onde nasceu?
        ii. Onde estudou?
        iii. Onde trabalhou?
        iv. Especialidade?
    b. Os seus pacientes vêm maioritariamente de onde?
    c. Você acha que especialistas têm dificuldade em controlar a procura exigida deles?
        i. Em que maneira?
    d. Como é um dia típico para si trabalhando no SUS?
    e. Tem muito contacto com os seus pacientes fora de consultas?
        i. Por telemóvel, email ou qualquer contacto sem ser presencial?
    f. Que diferenças notou durante a pandemia no seu trabalho?

2. Vídeo consultas
    a. Tem alguma experiência fazendo vídeo consultas?
        i. Se sim:
            1. Privado ou público?
            2. Só no contexto da pandemia, ou antes/depois
    b. Acha que fazer vídeo consultas é uma possibilidade no SUS

        i. Na sua especialidade

  c. Se não: possibilidade de fazer consultas com especialistas dentro de centros de saúde

3. mHealth

  a. Já ouviu falar do conceito de mHealth

        i. Se não, explicar

  b. Que atividades no SUS requerem aplicações mHealth

        i. Há alternativas?

  c. Quais recursos mHealth serão possíveis no SUS

        i. Comunicação com pacientes

        ii. Marcar consulta

        iii. Fazer prescrições

        iv. Mandar resultados

  d. No caso de aplicações mHealth serem utilizadas, há preocupações de privacidade associados com elas?

  e. Tem alguma experiencia com tecnologia utilizável (monitor de diabetes, monitor de batimento cardíaco?)

8. Appendix B – Consent Form

CONSENT REQUEST FOR PARTICIPATING IN RESEARCH

FOR QUESTIONS ABOUT THE STUDY, CONTACT:

Helena Aires de Campos – 496078mb@student.eur.nl

DESCRIPTION

You are invited to participate in a research about the use of video consultations and mHealth applications in the Brazilian SUS. The purpose of the study is to understand how the increased use of video consultations and mHealth can relieve the burden of medical specialists in Brazil.

Your acceptance to participate in this study means that you accept to be interviewed. In general terms, the questions will relate to the participant's experience within the SUS and possibilities for the future.

Unless you prefer that no recordings are made, I will make a video recording of the interview. I will use the material from the interviews and my observation exclusively for academic work, such as further research, academic meetings and publications.

RISKS AND BENEFITS

As far as I can tell, there are no risks associated with participating in this research. I will not use your name or other identifying information in the study. To participants in the study will only be referred to with pseudonyms, and in terms of general characteristics such as age and gender, etc.. You are always free not to answer any particular question, and/or stop participating at any point.

TIME INVOLVEMENT

Your participation in this study will take approximately 45 minutes. You may interrupt your participation at any time.

PAYMENTS

There will be no monetary compensation for your participation.

PARTICIPANTS' RIGHTS

If you have decided to accept to participate in this project, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. If you prefer, your identity will be made known in all written data resulting from the study. Otherwise, your individual privacy will be maintained in all published and written data resulting from the study.

CONTACTS AND QUESTIONS

If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact –anonymously, if you wish— Dr. Payal Arora - Erasmus School of History, Culture & Communication, arora@eshcc.eur.nl

SIGNING THE CONSENT FORM

If you sign this consent form, your signature will be the only documentation of your identity. Thus, you DO NOT NEED to sign this form. In order to minimize risks and protect your identity, you may prefer to consent orally. Your oral consent is sufficient.

I give consent to be recorded during this study:

Name:

Signature:

Date:

I prefer my identity to be revealed in all written data resulting from this study:

Name:

Signature:

Date: