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Understanding the Acceptance of Multisided Teleconsultation Platforms: A Critical Analysis and Proposal of a Theoretical Model

Entendendo a Aceitação de Plataformas Multilaterais de Teleconsulta: Uma Análise Crítica e Proposta de um Modelo Teórico

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Advisor / Orientador: Prof. Dr. Alexandre Cesar de Souza

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“The only way to do great work is to love what you do”

Steve Jobs

I dedicate this achievement to my family
who inspired and supported me to be better.

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Abstract

Teleconsultation gained substantial traction after the COVID-19. The ability to have healthcare services anywhere, anytime, saved thousands of lives in the process. One important aspect to scale teleconsultation is using multisided platforms. Multisided platforms create value by matchmaking two or more different sides, patients, doctors, nurses and other healthcare professionals and players, so that a consult can happen remotely. Several barriers and risks are present in such arrangement, ranging from technology risks on the capacity of the participants to use the software to access the platform, how the costs work and payments are made and the best combination of participants. There is little research on how the elements of a multisided teleconsultation platform impacts the intention to use and recommend a platform to another patient. This thesis used a combination of quantitative methods, creating a PLS-SEM model and performing a Necessary Condition Analysis (NCA) to evaluate the relation between the constructs. Overall teleconsultation platforms are helpful extending the reach and capacity of healthcare delivery and has the power to improve the life of several patients.

Keywords

Teleconsultation; Digital Platform; Healthcare Barrier; Multilsided Business Model

Resumo

Teleconsulta ganhou uma tração substancial após a COVID-19. A capacidade de ter acesso a serviços de saúde em qualquer lugar, a qualquer hora, salvou milhares de vidas. Um aspecto importante para escalar as teleconsultas é usar plataformas multilaterais. Plataformas multilaterais criam valor ao combinar dois ou mais lados diferentes, pacientes, médicos, enfermeiros e outros profissionais e participantes de saúde, para que uma consulta possa acontecer remotamente. Várias barreiras e riscos estão presentes em tal arranjo, variando de riscos tecnológicos na capacidade dos participantes de usar o software para acessar a plataforma, como os custos funcionam e os pagamentos são feitos e a melhor combinação de participantes. Há pouca pesquisa sobre como os elementos de uma plataforma de teleconsulta multilateral impactam a intenção de usar e recomendar uma plataforma a outro paciente. Esta tese usou uma combinação de métodos quantitativos, criando um modelo PLS-SEM e realizando uma Análise de Condição Necessária (NCA) para avaliar a relação entre os construtos. No geral, as plataformas de teleconsulta são úteis para estender o alcance e a capacidade da prestação de cuidados de saúde e têm o poder de melhorar a vida de vários pacientes.

Palavras Chave

Teleconsulta, Plataformas Digitais, Barreiras à Saúde, Modelos de Negócio Multilaterais

Table of Contents

List of Figures

List of Tables

List of Charts

1. Introduction

The acceptance of multisided teleconsultation platforms in healthcare is a topic of growing interest, particularly in the context of the COVID-19 pandemic. Teleconsultation platforms have the potential to revolutionize healthcare delivery by providing patients with convenient access to medical advice and treatment. emphasize the impact of perceived justice on patient satisfaction and word-of-mouth in the context of teleconsultation management during the pandemic (Baudier et al., 2023). This highlights the importance of understanding the factors that influence patient acceptance of teleconsultation platforms, particularly in times of crisis.

Additionally, the potential for multisided platforms to unlock innovation in healthcare by empowering patients as innovators and facilitating the commercialization of patient-driven innovations. This underscores the need to critically analyze the role of multisided platforms in driving healthcare innovation and the implications for patient acceptance (Shahare, 2024).

Furthermore, the concept of multisided platforms and their relevance in various industries, including healthcare, has been the subject of scholarly inquiry. explores the link between multisided platforms and the circular economy, emphasizing the importance of understanding the role of platforms in contributing to environmental sustainability (Ardolino et al., 2020).

The last decade has changed the way people relate to each other, how they work, and their consumption habits. Remarkably, perhaps the most significant change left as a mark of this period was the perception and how people take care of their health. Despite being debated since the beginning of the last decade, telehealth has come into prominence as a legacy of the pandemic. What was once a discussion has become a primary and emergent necessity. A study conducted by the Allianz Partners Group with 25,000 respondents pointed out that before the health crisis, 7% of the interviewees used teleconsultations, which translates to an average of 1 in every 10 people. After the pandemic, 17% of the respondents said that they had incorporated telehealth services into their routine, resulting in nearly 2.5 out of every 10 people using this service (Distrito, 2023).

If the current health care problems were not enough since the end of 2019 a global pandemic is in place. The COVID-19 pandemic has resulted close to 700 million confirmed cases and over 7.000.000 deaths globally (*COVID - Coronavirus Statistics - Worldometer*, 2023). It has also sparked fears of an impending economic crisis and recession. Social distancing, self-isolation and travel restrictions have led to a reduced workforce across all economic sectors and caused many jobs to be lost.

Before the pandemic causes it impacts, chronic conditions accounted for more than half of the global disease burden and are a primary challenge for 21st century health care systems (WHO, 2000). This is a dramatic shift from the health concerns of the 20th century when acute infectious diseases were the primary focus in every country. While the world is experiencing a rapid transition from acute diseases to chronic health problems, training of the health care workforce, however, relies on early 20th century models that emphasize diagnosis and treatment of acute diseases (Pruitt & Epping-Jordan, 2005).

It is almost requisite that any discussion about the future of health care begin with a reference to the unsustainable growth rate of global medical spending. Charts and graphs expound on health care's accelerating share of gross domestic product (GDP), depicting a voracious beast that threatens to swallow what little money remains for other vital services. And yet, although deliberations about how to curb this dramatic increase in spending are imperative, a related, but equally important, question is often lost amid these debates.

On the other side, health care providers must adapt to this increasingly complex environment. This adaptation goes beyond the health care delivery practices and ventures in the realms of technology and business design and management. Recent research indicate a close positive correlation of a company's business model evaluation with its success (Simunaniemi et al., 2022).

When studying a broad issue such as healthcare access, approaches focused on how the business in this industry organizes itself is relevant. An objective definition for business model is "a business model is nothing else than the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams." (Osterwalder & Pigneur, 2002). Although a consensus about the correct definition of Business Model is yet to be achieved (Osterwalder et al., 2005), this definition is broad enough to fit this research purpose.

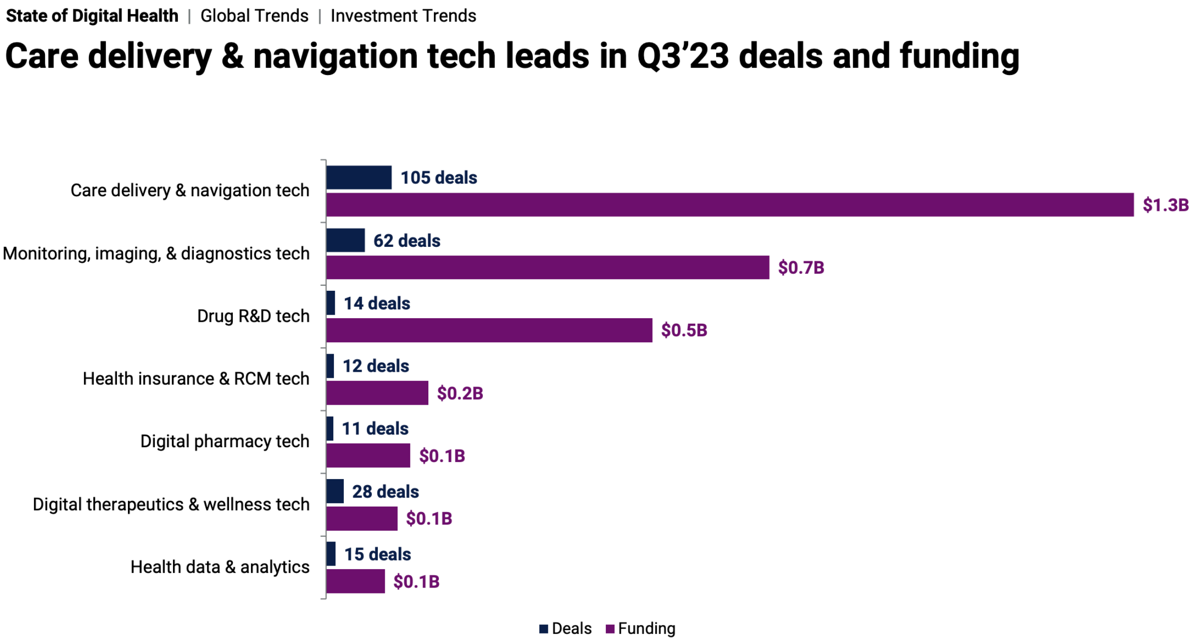
One particular configuration of business model often referred as Multisided Business Models or Platform Business Models has as its main advantages it's scalability (J. Zhang et al., 2015), partially enabled by the Networking Effect (Andersson Schwarz, 2017) and its potential for cost reduction due to a better Transaction Cost relation (Staykova & Damsgaard, 2015).

Key studies such as the one published by (Svarts, 2017) show that the economy of scale enabled by the networking effect have different effects when considering the different types of healthcare services. For surgery for eg., significant scale effects related to spreading of fixed cost, the experience curve, and potential for process improvement. For inpatient care, moderate scale effects related to spreading of fixed costs and costs of doctors on on-call duty. For outpatient care, small or no scale effects.

Considering that this type of business model is usually implemented with the support of an information system, understanding the critical success factors that enable this IS to deliver value is an important matter. Thus, the current trend in IT solution providers (encompassing more than just the health sector) is to move from fragmented services to progressively more integrated services, which are likely to be provided by multiple stakeholders through well-elaborated collaboration mechanisms (Marcos-Pablos & García-Peñalvo, 2019) also known as Digital Platforms.

When evaluating the market aspect of digital platforms focused on healthcare, Figure 1 shows that in the third quarter of 2023 most of the Global Deals and most of the funding went to Care Delivery & Navigation Tech companies. Teleconsultation platforms falls on the Care Delivery category making it part of the most sought after investing in Startups and Venture Capitals.

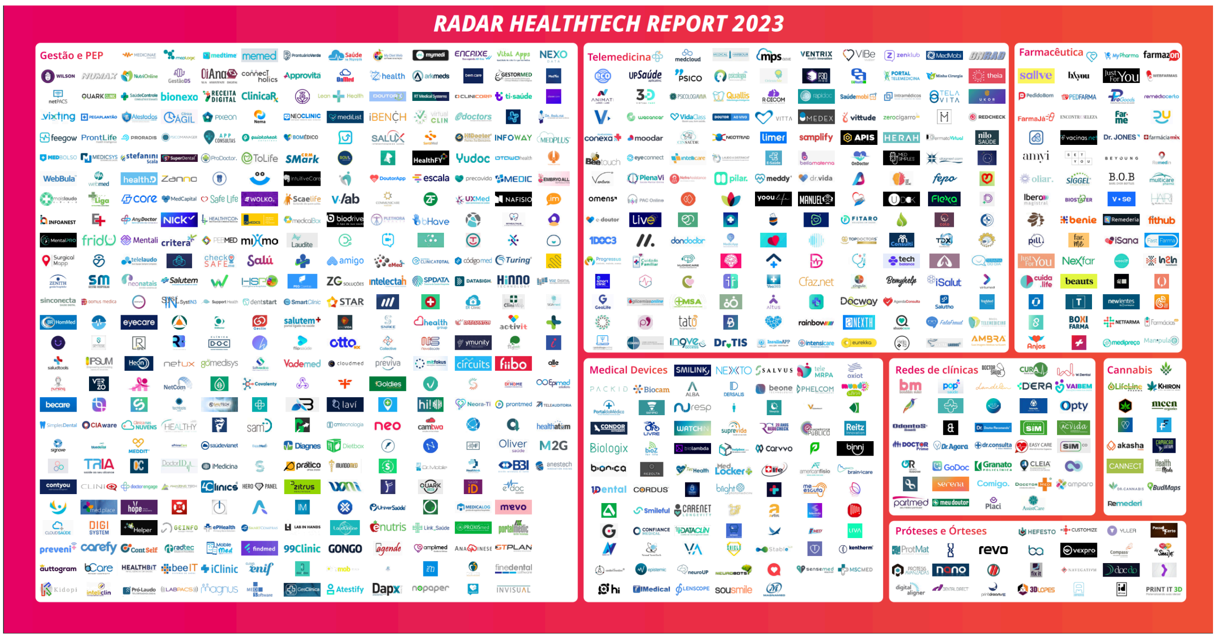
Figure 1 - Investments in Healthcare Technology Q3 2023



Source: (CB Insights, 2023)

When evaluating the Brazilian market the Healthcare Report 2023 from Distrito (2023), shows more than 150 startups on Figure 2 focusing only in the teleconsultation aspects of telemedicine, demonstrating a large market appeal:

Figure 2 - Healthcare Report 2023



Source: (Distrito, 2023)

Starting from this Healthcare report and performing additional research, Table 1 presents a list of Brazilian teleconsultation platforms with their respective segments (Bhaskara, 2021; Distrito, 2023; Rubin, 2022; Vindi, 2020):

Table 1 - Teleconsultation Platform List

#	Platform name	URL
1	iMedicina	https://imedicina.com.br/
2	Conexa	https://www.conexasaude.com.br/
3	Amplimed	https://www.amplimed.com.br/
4	Doutor ao Vivo	https://www.doutoraovivo.com.br/
5	Doctor Konnect	https://doctorkonnect.com.br/
6	Telemedicina Morsch	https://telemedicinamorsch.com.br/
7	Conecta Médico	https://conectamedico.com.br/
8	Dandelin	https://dandelin.io/
9	GestãoDS	https://www.gestaods.com.br/
10	N2B	https://www.n2bbrasil.com/
11	TopMed	https://topmed.com.br/
12	Shosp	https://www.shosp.com.br/
13	Boa Consulta	https://www.boaconsulta.com/
14	ProDoctor	https://prodoctor.net/
15	Médico 24h	https://medico24hs.com.br/
16	Vale Saúde	https://www.valesaude.com.br/
17	Doc4Doc	https://doc4doc.com.br/
18	DoutorPass	https://www.doutorpass.com/
19	eSaudeSP	https://www.prefeitura.sp.gov.br/cidade/secretarias/saude/
20	You Teleconsulta	https://youteleconsulta.com.br/

Source: Adapt. from (Bhaskara, 2021; Distrito, 2023; Rubin, 2022; Vindi, 2020)

1.1. Motivation

The COVID-19 pandemic has highlighted the importance of teleconsultation platforms in healthcare. Telemedicine has become a crucial tool in providing medical services remotely. The role of teleconsultation was undermined in the pre-COVID era (Patil et al., 2021). However, the pandemic has accelerated the adoption and utilization of telemedicine platforms, leading to unprecedented use in various medical specialties (Triantafillou et al., 2020).

One of the key benefits of teleconsultation platforms is the ability to provide healthcare services remotely, ensuring continuity of care even during times of crisis. Telemedicine allows patients to consult with healthcare professionals without the need for in-person visits, reducing the risk of exposure to infectious diseases such as COVID-19. This is particularly important for vulnerable populations, including the elderly and those with underlying health conditions, who may be at higher risk of severe illness (Latifi & Doarn, 2020).

Teleconsultation platforms also offer convenience and accessibility. Patients can access healthcare services from the comfort of their own homes, eliminating the need for travel and reducing waiting times. This is especially beneficial for individuals in rural or remote areas who may have limited access to healthcare facilities. Telemedicine can bridge the gap between patients and healthcare providers, ensuring that individuals receive timely and appropriate care

Furthermore, teleconsultation platforms have the potential to improve healthcare efficiency and reduce healthcare costs. By reducing the need for in-person visits, telemedicine can optimize healthcare resources and alleviate the burden on healthcare systems. It can also minimize unnecessary hospital admissions and emergency room visits, leading to cost savings for both patients and healthcare providers (Latifi & Doarn, 2020).

As we move forward beyond the pandemic, the importance of telemedicine in healthcare delivery is likely to persist, offering opportunities for enhanced patient care and healthcare system efficiency.

In US criticisms of the government's response continue, as several states have complained about a lack of coordinated national response and confused messaging from the White House that have had huge impacts on the ground (Saini et al., 2023).

Msemburi et al. (2023) estimates that 14.83 million excess deaths globally, 2.74 times more deaths than the 5.42 million reported as due to COVID-19 for the period. There are wide variations in the excess death estimates across the six World Health Organization regions.

Some countries seem to be well placed to implement the necessary actions to cope with increased health-care needs, but others are struggling. One important aspect affecting the efficacy of national responses is the capacity to endow the health-care system with necessary resources in a timely manner.

It is clear that traditional approaches to solving this problem are not enough and every effort direct towards an improvement is welcome. Some notable and innovative solutions have been popping up all around the world. China based WeDoctor health platform that offers online consultation and Internet hospital received 20 million visits in its first month alone (H. Wang et al., 2020).

The company Ping An Good Doctor has merged both virtual and physical worlds by allowing a physician and other healthcare professionals to work remotely and perform consultations over an Internet enabled platform that could be accessed by the public on their homes or special kyosks distributed around the city (Meffert & Swaminathan, 2017). It effectively created a network of services to delivery full healthcare coverage from the consultation to drug administration, with the physical component shown in **Erro! Fonte de referência não encontrada.**.

In China, the government relies on Health Code, developed by Alipay and WeChat, for identifying people potentially exposed to COVID-19. The color-based code can determine people’s exposure risks and freedom of movement based on factors like travel history, duration of time spent in risky areas, and relationships to potential carriers.

Figure 3 - Ping a Good Doctor booth

Source: (*Company Overview - Ping An Good Doctor*, 2023)

On a recent publication, (Liang, 2020) explains that the Health Code aggregates three types of data to convert exposure risks into color-based codes. First, each user needs to provide personal information, including name, national ID number, and physical conditions (e.g., fever, tiredness, dry cough).

Citizens also need to register with facial recognition and update their physical conditions every day. The second data sources are spatial-temporal data recorded by Alipay, WeChat, and other apps in daily routine usage. Geolocation data relying on smartphones' Global Positioning System (GPS) and network carriers can determine whether users visited areas with widespread or ongoing spread, whereas temporal data can examine the duration of time spent in risky areas. Finally, Health Code adopts user networks and online transactions to evaluate whether people had contacted potential carriers of COVID-19.

In Brazil, in order to keep up with the increasing demand for physicians and health care personnel a local Brazilian startup called "Missão COVID[1]" was founded focusing on connecting patients and those who shown any COVID symptoms with volunteer doctors to perform a remote diagnose using telemedicine. This kind of platform enable quick health care access, very low physical barriers to access the service and since all doctors are volunteers, there is no associated cost for the patient.

Still on Brazilian scenario, Maldonado and Cruz (2023) describes the changes in the legal environment involving telemedicine and teleconsultation platforms. To this end, the Federal Council of Medicine (CFM), through Announcement No. 1.756 issued on March 19, 2020, allowed for the exceptional provision of remote medical care in the fight against the novel Coronavirus, in addition to the provisions set forth in CFM Resolution No. 1.643/2002, which remains in effect.

This announcement outlined that telemedicine could be carried out in the following modalities: tele-orientation / teleconsultation, enabling doctors to remotely guide and refer isolated patients; telemonitoring, allowing for the remote monitoring of health and/or disease

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[1] https://missaocovid.com.br/

parameters under medical supervision or guidance; and teleinterconsultation, facilitating the exchange of information and opinions exclusively between physicians for diagnostic or therapeutic assistance (CFM, 2020).

Subsequently, through Ordinance No. 467 dated March 20, 2020, the Ministry of Health (MS) authorized the provision of telemedicine services that were not yet regulated, solely during the pandemic, for pre-clinical care, care support, consultation, monitoring, and diagnosis, in both the Unified Health System (SUS) and private healthcare networks. This authorization was later incorporated into Federal Law No. 13,989 (Brazil, Mar. 20th 2020; Apr. 16th 2020).

Amongst all this conditions, further researching Teleconsultation Platforms becomes necessary to ensure that true value can be delivered from these solutions.

1.2. Research Objectives

To narrow the scope and facilitate a manageable research endeavor, as well as to simplify the exploration of a complex subject, we have established the following primary research objectives. The objective is designed to provide answers to our overarching research question.

The key objective of this research is to understand the patient's acceptance of multisided teleconsultation platforms.

In addition to the primary objectives, this thesis encompasses secondary goals that complement the overarching aims, including:

a) Clarifying terms and concepts related to Multisided Digital Platforms from the perspective of Business Model, with the intention of clarifying misunderstandings surrounding the subject.
b) Examining the present state of academic research within the context of Applied Social Science, particularly in the realm of business, concerning Teleconsultation Platforms and its associated implications.
c) Assessing the existing corpus of knowledge pertaining to the subject.
d) Develop and validate a scale that measures the specific characteristics of multilateral business models applied to digital teleconsultation.

e) Propose a theoretical model that captures the relationship among key factors of acceptance, technological risk, multilateral model factors, and recommendations for teleconsultation platforms.

Overall, the research goals and objectives encompass a comprehensive assessment of teleconsultation platforms, including their impact on healthcare access, the factors influencing user intention and adoption, regulatory challenges, and mechanisms for maintaining quality and accountability.

1.3. Research Question

This thesis is situated within the realm of Business, Management, and Accounting, with a specific focus on the fields of Information Technology and Information Systems, particularly emphasizing the relation between Multilateral Business Models and Digital Teleconsultation Platforms as its central subject. It is considered applied social sciences research, taking a human and business-oriented approach to explore how Teleconsultation Platforms may impact individuals and organizations. Therefore, it does not delve into technical discussions regarding the underlying technologies and advanced mathematics, nor does it engage in philosophical debates concerning medical ethics.

Considering the research context aforementioned, the scope for this work is set the following research question:

RQ: What factors affect the intention of patients to use and recommend multisided teleconsultation platforms?

By Multisided Teleconsultation Platforms we mean a digital platform that connects multiple groups of users, such as patients, doctors, hospitals, insurers, and pharmaceutical companies. The platform provides value to each of these user groups by enabling them to interact and exchange value with each other (Ardolino et al., 2020; Bakshi & Tandon, 2022; Mensah, 2022).

Multisided teleconsultation platforms are becoming increasingly popular as a way to deliver healthcare services more efficiently and affordably. By providing value to all of its user groups, a multisided teleconsultation platform can create a network effect where the value of the platform increases as more users join.

The factors aforementioned represents elements that prevent people from accessing the healthcare they need. These issues can be financial, social, geographic, technological, privacy and security. These risk perceptions can influence patient attitudes and willingness to adopt telemedicine services (Mensah, 2022).

By intention to use and recommend the service we mean that the patient has both behavior intention to use the platform (Bakshi & Tandon, 2022; Hossain et al., 2023; Ouimet et al., 2020) and intention to recommend the service to a fellow patient, based on his previous experience (Hartono et al., 2021; Mensah, 2022; Octavius & Antonio, 2021).

When defining the overarching research problem, we encountered a significant challenge concerning the formulation of a research question using the future tense. This concern was rooted in the criticisms associated with constructing research based on speculations and predictions that might lack reliability, validity, and reproducibility, which are fundamental attributes of scientific research and scholarly papers.

It's worth noting that this work possesses distinctive characteristics that set it apart from other research of a similar nature. It takes a proactive, forward-looking, and propositional approach to the study of a subject that represents the cutting edge of knowledge and is currently undergoing transformation.

However, as we will elaborate in the subsequent chapters, we believe that we have also adhered to the fundamental "principles and procedures for the systematic pursuit of knowledge," which encompass the recognition and formulation of a problem, data collection through observation and experimentation, and the formulation and testing of hypotheses. These principles serve as the foundation of scientific research.

1.4. Methodological Approach

A multi method approach was used for this thesis. An initial Bibliometric Analysis was chosen. It is a quantitative method for studying the patterns of scholarly communication. It uses mathematical and statistical techniques to analyze bibliographic data, such as the number of citations, co-authorships, and publication venues, to identify trends and patterns in research (Aria & Cuccurullo, 2017; Okubo, 1997; Teixeira et al., 2013).

The findings of the Bibliometric Analysis will guide the creation of the reference material used to construct a PLS-SEM model.

Using the guidelines by Hair et al. (2021), we can define PLS-SEM (Partial Least Squares Structural Equation Modeling) is a statistical technique used to estimate and analyze complex models with latent constructs and multiple indicators. It is a variance-based approach to structural equation modeling that allows for the estimation of relationships between latent variables indirectly observed by multiple indicators.

An SEM-PLS model is made up of two elements, the outer model (also called the measurement model), which describes the relationships between the MVs and their respective LVs, and the inner model (also called the structural model), which describes the relationships between the LVs.

The use of PLS-SEM is a suitable method when the research objective is prediction. It is particularly useful when the focus is on understanding the relationships between latent variables and predicting outcomes. PLS-SEM allows for the estimation of complex models with smaller sample sizes, making it a practical choice for research with limited data (Shiau et al., 2019).

Additionally, the use of PLS-SEM in a thesis is recommended when the research objective is prediction, the model is complex with multiple constructs and indicator variables, the population structure contains cross-loadings and/or correlated errors, or when theory development is the goal. It is also important to follow recommended guidelines and consider the specific challenges in the field of study (Hair et al., 2016).

To complement the use of PLS-SEM, the Necessary Condition Analysis (NCA) was performed. NCA provides a unique perspective on causality by focusing on necessary but not sufficient conditions (Dul, 2019). It complements other approaches such as correlation or regression analysis by emphasizing the identification of factors that are essential for an outcome to occur (Richter et al., 2020). This approach is particularly valuable when studying complex phenomena where the presence of certain conditions is necessary for the occurrence of an outcome.

The use of PLS-SEM and NCA allows researchers to identify the (must-have) factors required for an outcome, that is necessity logic, as well as the (should-have) factors that contribute to a high-level outcome, namely additive sufficiency logic. The combination of both logics enables researchers to test their theoretical arguments more precisely and offers new avenues to test theoretical alternatives for established models (Richter et al., 2020).

1.5. Thesis Structure

This thesis is divided in 9 chapters. In this initial chapter, we have introduced the thesis. This introduction encompasses several key aspects, including the research's background and its broader context, the formulation of the research question, and the primary objectives guiding the study. We have also outlined the methodological approaches that will be employed to fulfill these objectives. Lastly, we have discussed the crucial justifications and motivations for this research, elucidating its significance across various dimensions, such as societal, economic, academic, and individual perspectives.

In Chapter 2, we undertake a comprehensive review of the existing academic literature on the subject, using a Bibliometric method, approaching it from an applied social science perspective and emphasizing its practical implications. Our review commences with a thorough examination of prominent journals in the fields of Information Systems and Information Technology and Medicine. Subsequently, we broaden our exploration beyond these initial sources.

In Chapter 3, we provide a comprehensive literature review of the central themes under consideration, offering an interactive and critical analysis of various authors and their perspectives. We initiate this chapter by delving into the primary subject of this research, beginning with a concise historical overview of Multisided Business Models, with a particular the distinct multilateral aspects of the model. This framework context sets the stage for the subsequent section, where we engage in a discussion regarding the definitions of Telemedicine and more specifically Teleconsultation Platforms.

Subsequently, we delve into a comprehensive discourse on the distinctions between the Risks and Barriers that Teleconsultation Platforms must overcame, both of which are pivotal concepts in this domain. Several real-life practical examples are presented to illustrate both the platform aspects and the risks aspects of the theory.

Chapter 4 is dedicated to the methodological aspects of this thesis. Within this chapter, we delve into the foundation, definitions, and fundamental attributes of the theorical model. We define each of the constructs that compose the model alongside the hypothesis that were made based on their relations. The constructs Perceived Usefulness and Ease of Use, Technology Risk, from the Platform aspect we have Sides Diversity, Revenue Model, Control and Architecture as well as Behavior Intention and Intention to Recommend the platform.

In Chapter 5, we delve into the design, planning, and execution of the research method. We initiate with the creation and validation of a new scale for the Platform aspects of the model, explain the instrument development and how the data collection happened. The tests for common method and nonresponse bias are presented alongside collinearity and normality as well. The reasons why SEM-PLS and NCA were used are also presented in this chapter as well as the description of each stage on how these methods will be applied.

Chapter 6 delves into the data and findings derived from the field research. We commence by analyzing the characterization of the respondents' providing insights into our initial considerations and offering guidance on the analytical process used to interpret the results. Subsequently, we present comprehensive statistics that encompass the aggregated responses and proceed to present the results on the SEM-PLS and NCA.

On Chapter 7 the discussion of the results is done by presenting the findings from using descriptive statistics to better understand the population and sample as well as discussing each of the hypothesis and how the behave after the models were executed.

Chapter 8 present and discuss the key conclusions and final considerations, linking them back to the initial research question and the primary objectives of this thesis. This chapter also evaluates the research limitations. The manuscripts are concluded with a discussion regarding the implications and contributions of this research, along with recommendations for future studies.

Lastly, the bibliography used on this thesis is presented on Chapter 9.

2. Bibliometric Analysis

The term "bibliometrics" was coined by Paul Otlet in 1934, but it did not become widely used until 1969 (Vanti, 2002). Bibliometrics is a quantitative and statistical technique for measuring the production and dissemination of scientific knowledge (Araújo, 2006). It can be used to track the number of publications in a particular field, the number of citations to those publications, the collaboration patterns of researchers, and the impact of research.

Bibliometric studies are more complex than just a simple statistical survey. They can be used to:

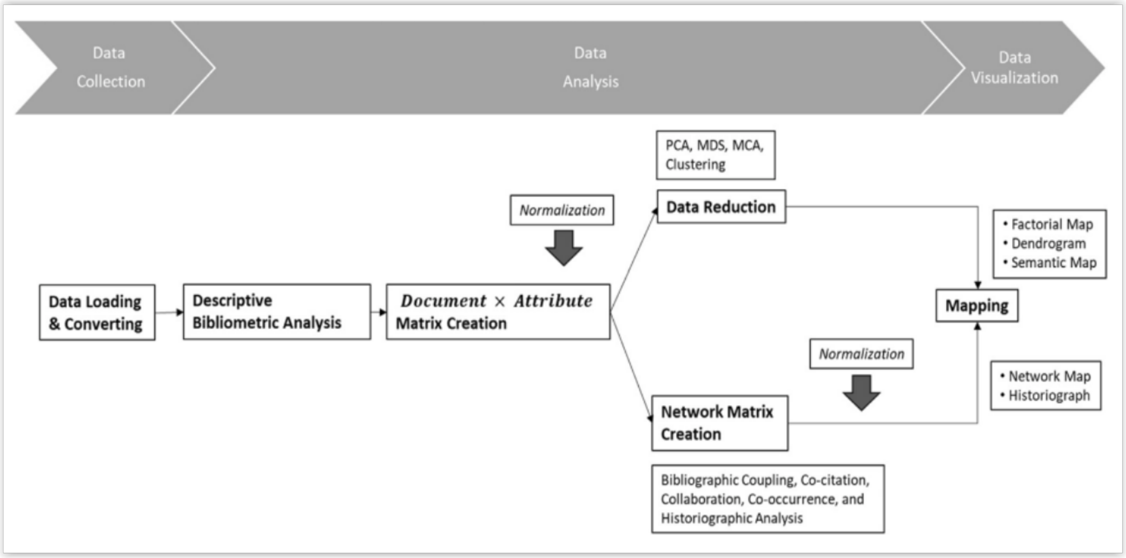
a) Identify emerging fields of research;
b) Track the evolution of scientific knowledge over time;
c) Assess the impact of individual researchers, research teams, and institutions;
d) Compare the research output of different countries and regions;
e) Inform research funding decisions;
f) Identify potential collaborators;
g) Bibliometrics is a valuable tool for a wide range of stakeholders, including scientists, policymakers, funding agencies, and librarians.

In addition to the above, bibliometric studies can also be used to:

a) Analyze the relationship between different fields of research;
b) Identify trends in the use of research methods;
c) Assess the quality of scientific publications;
d) Detect research misconduct;
e) Inform the development of new scientific journals and databases;
f) Bibliometrics is a dynamic and rapidly evolving field, with new applications being developed all the time. It is a powerful tool that can be used to gain new insights into the scientific landscape and to inform evidence-based decision-making.

The workflow presented on Figure 4 was designed as an updated protocol for this study type and was followed to ensure that all the necessary steps to collect and analyze data were performed.

Figure 4 - Science Mapping Workflow



Source: adapted from (Aria & Cuccurullo, 2017)

The key indicators analyzed on a bibliometric study (Okubo, 1997) are presented on Table 2.

Table 2 - Key bibliometric indicators

Indicator	Concept
Bradford Law	It analyzes the frequency distribution of the number of articles published by journals in the field.
Lotka Law	It assesses the frequency distribution of authorship of articles within that domain.
Zipf Law	It examines the frequency distribution of vocabulary in texts related to the topic.
Number of publications by author, journal or theme	It investigates the volume of publications, focusing on authors, journals, institutions, and specific topics within the study area.
Number of co-authors / collaborators	It analyzes the dynamics of research collaborations, encompassing both individual and group collaborations, both at the national and international levels.
Copublications with authors from different countries	It research investigates the cooperation between representatives of institutions and countries in joint research endeavors, with the goal of creating a matrix that highlights key partners and provides a description of the scientific network.
Citations quantity	It evaluates the impact of articles, journals, and researchers based on the number of citations received.
Affinity index	It studies the relative rate of scientific exchanges, including exchanges between countries and institutions through citations.
Scientific affiliation	It investigates and measures the influence of networks between different scientific communities in the field of interest.
Co Citations	It analyzes the number of times two or more articles are simultaneously cited in the same article, examining connections and references between academic works in the specific thematic area.

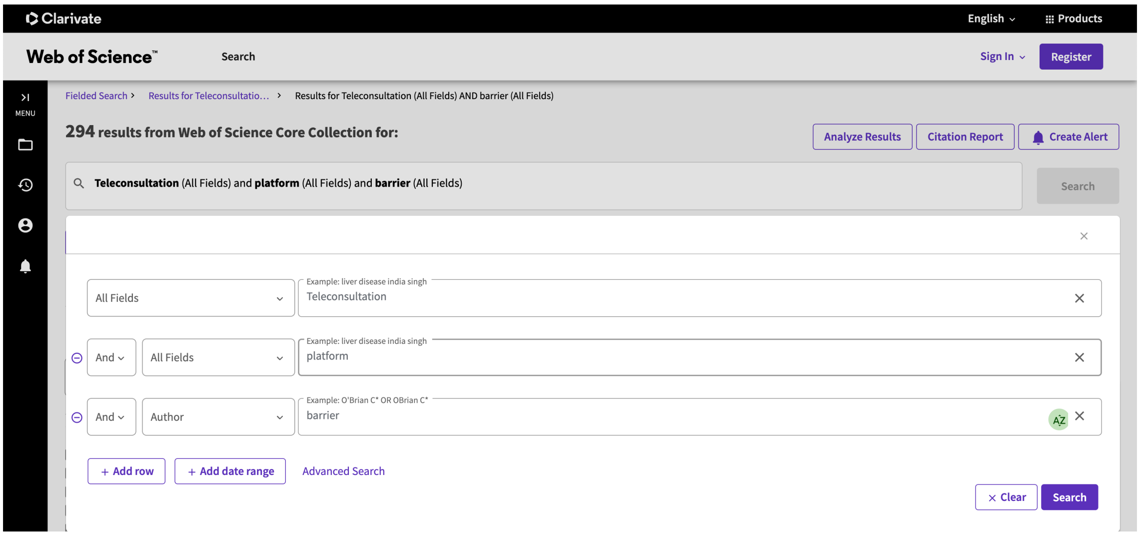
Source: adapted from Okubo (1997)

The authors and developers of the Bibliometrix package, (Aria & Cuccurullo, 2017), state that it includes all the major bibliometric analysis methods, primarily used for scientific mapping and not for measuring science, scientists, or scientific productivity. For these purposes, other analysis procedures employing different methods are required.

The choice of bibliometric indicators is justified as it complements the theoretical essay by providing the opportunity to include works to be discussed or practical examples that have been the subject of studies in high-impact articles and are present in major databases, representing the state of the art in the field. The inclusion and analysis of these articles identified through bibliometric indicators will enhance the research's legitimacy, further expanding the discussion already addressed in the theoretical foundation section. Additionally, it is necessary to establish a specific time frame for the selection of works (Zupic & Čater, 2015).

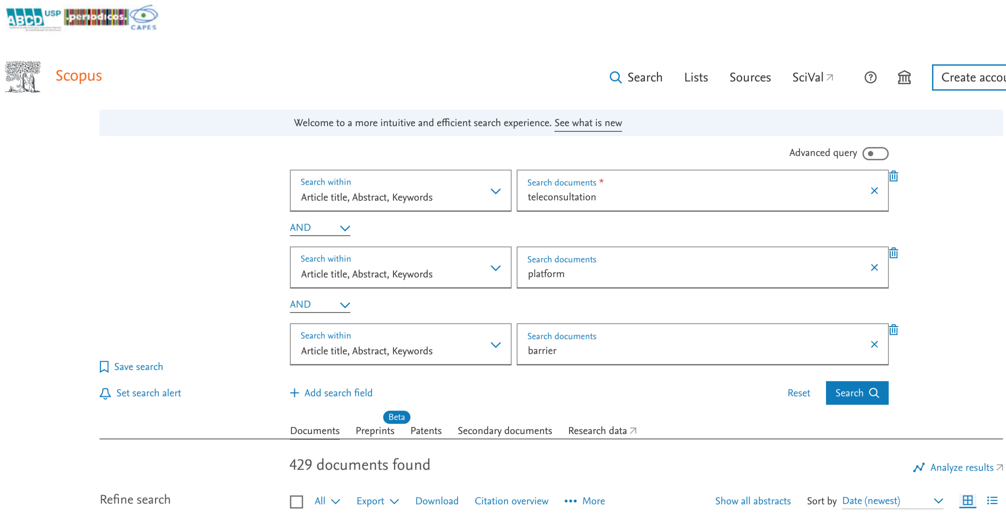
In light of this, the 'Web of Science' and 'Scopus' databases were accessed through a CISCO SSO application provided by the researcher's university (University of São Paulo - USP). The selection of these databases was based on their comprehensive coverage across all thematic areas, high technical quality, and high impact factor (Prins et al., 2016).Screenshots of both the 'Web of Science' and 'Scopus' interfaces are shown in Figure 5 and Figure 6, respectively.

Figure 5 - Search on Web of Science Database



Source: the author

Figure 6 - Search on Scopus Database



Source: the author

The search was performed based on the article title, abstract and keywords and the employed query string was (Aria & Cuccurullo, 2017) the result of the combinations of the following key terms: “teleconsultation” AND “platform” AND “barrier*”. From this initial sample, some filters were used to refine the results.

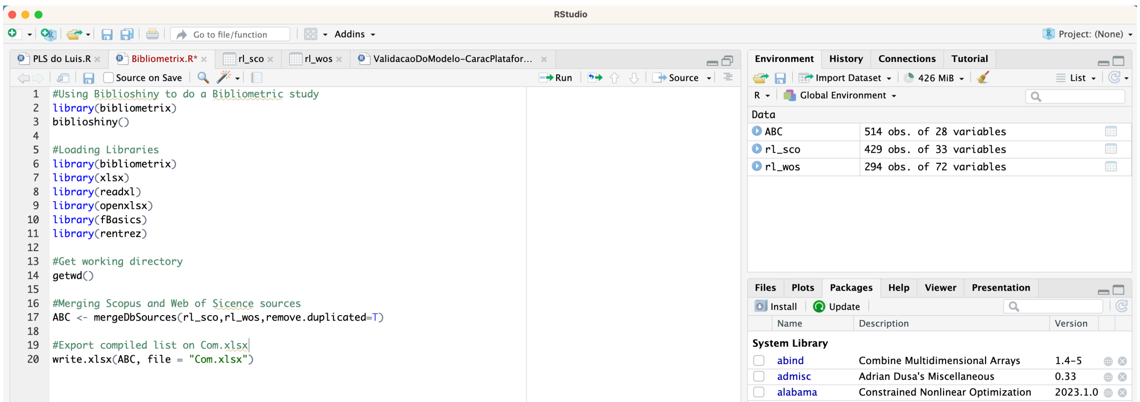
The bibliometric indicators presented in Table 2 were to be obtained with the support of the open-source software RStudio and exported to the Bibliometrix/Biblioshiny platform/package, which assists in data processing and facilitates the verification of the bibliometric review. The Bibliometrix package, by default, is a command-line interface, but it provides a graphical interface called Biblioshiny, enabling its use without programming knowledge. Therefore, the analyses were conducted within this interface rather than using script-based tools. The execution will be carried out through the following commands: install.packages("bibliometrix"), library(bibliometrix), and biblioshiny().

The tools in RStudio allowed for the generation of graphs and statistical indicators, enabling the measurement of scientific output on the subject and compliance with fundamental bibliometric principles to validate the results. The data collected in the quantitative format through Biblioshiny were exported to Microsoft Excel for further analysis.

With this methodological process, the aim is to provide greater confidence in the analyses of this study, allowing for the identification of the evolution of studies on dynamic systems when applied to a family of functions.

Figure 7depicts the use of RStudio software with the bibliometrix package (Aria & Cuccurullo, 2017). In the Web of Science database, 294 results were found, and in Scopus, 429 results were identified. By employing the 'mergeDbSources' command, which involves creating a third file that consolidates the database by merging distinct data and eliminating 209 duplicate documents, the final result yielded 514 results within the temporal scope of 2003-2023.

Figure 7 - R source code to merge Web of Science and Scopus databases



Source: the author

Figure 8 shows that the number of publications in both databases has been growing steadily over time, with an average annual growth rate of 24.42%. In 2022, there were a total of 107 publications, an increase of 6.4% from the previous year.

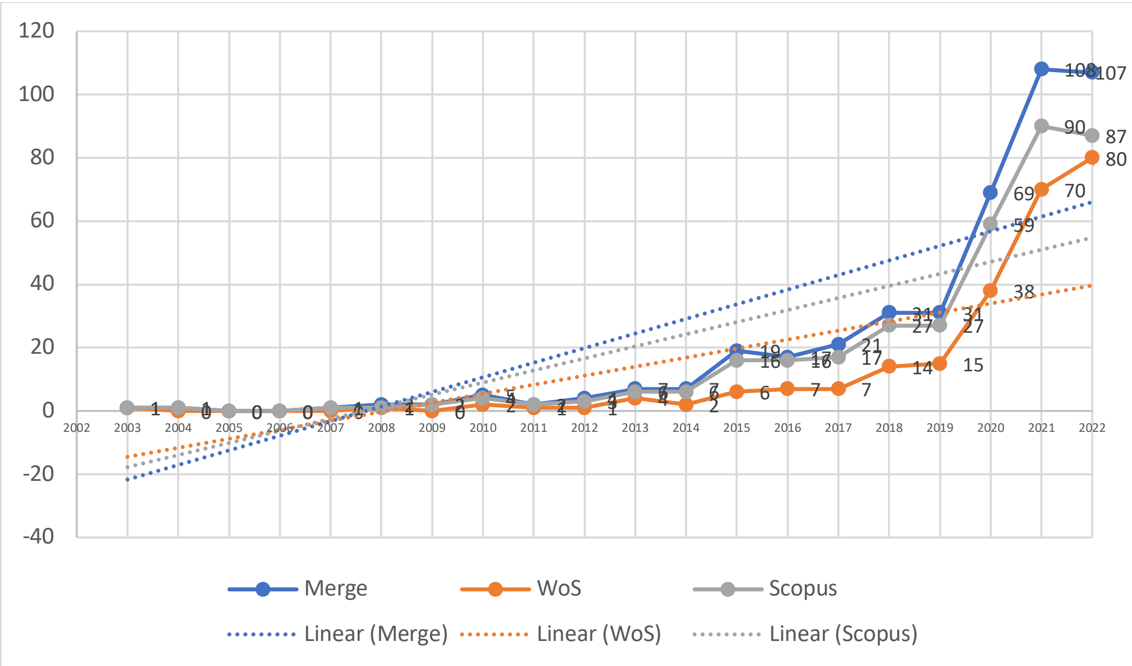
The apparent decline in 2023 is likely due to the fact that the year is not yet over. Many international journals publish their final issues in December, so the number of publications for that year is likely to be higher than what is shown in the figure.

The average number of documents published per year was 25.7, which is a relatively small number. This suggests that the field of research is still relatively new and that there is still room for growth.

The average number of citations per document was 17.47, which is a relatively high number. This suggests that the research in this field is highly cited, which is a positive indicator of its impact.

The total number of references was 3690, which is a large number. This suggests that the research in this field is well-cited by other researchers.

Figure 8 - Annual Publications in the Primary Databases: WoS, Scopus, and Merge (Database Union)



Source: data extracted from Biblioshiny (2023)

When analyzing the authors of the documents (Table 3), it was observed that they represented a total of 3190 authors during the specified period. Out of these documents only 18 had a single author. The average number of co-authors per document is approximately 6.72, and collaboration with international authors, distinct from the first author, accounts for around 4,08%.

Table 3- Quantity by document type

Document type	n	%
article	371	72,18
article article	3	0,58
article review	1	0,19

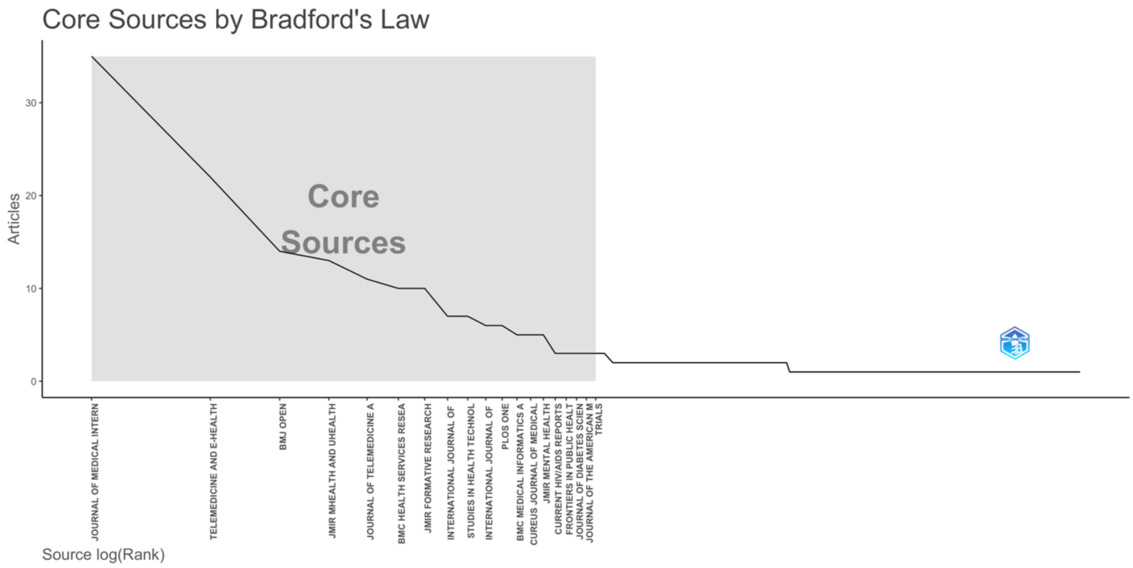
Document type	n	%
article; early access	9	1,75
book chapter	5	0,97
conference paper	24	4,67
conference review	3	0,58
editorial	3	0,58
editorial material	1	0,19
note	5	0,97
proceedings paper	2	0,39
retracted	1	0,19
review	85	16,54
review; early access	1	0,19
Total	514	100%

source: data extracted from Biblioshiny (2023)

2.1. Source Analysis

The Bradford's Law (focused on journals), also known as the Law of Scattering, examines the productivity of journals as depicted in Figure 9. In this context, it enables, through the measurement of journal productivity, the establishment of a core and areas of scattering within a specific subject across a set of journals (Vanti, 2002). The statement of Bradford's Law states that if journals are arranged in descending order of article productivity on a specific subject, they can be distributed into a core of journals particularly devoted to that subject and into various groups or zones containing the same number of articles as the core, provided that the number of journals and successive zones follows a 1: n: $n2$ ratio (Pinheiro, 1983).

Figure 9 - Main sources: Bradford laws application



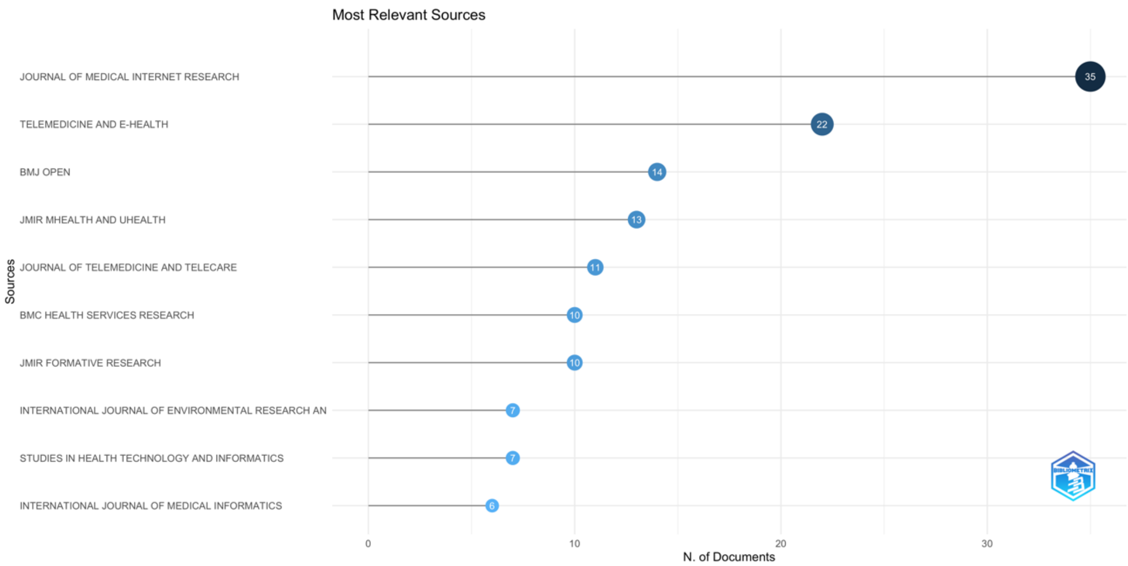
source: data extracted from Biblioshiny (2023)

In this study, as seen in Figure 10, the journal that ranked first with the highest number of publications was the "Journal of Medical Internet Research" (n=35) from USA. In 2023, JMIR received a Journal Impact Factor of 7.4 (5-Year Journal Impact Factor: 7.6) according to the latest release of the Journal Citation Reports from Clarivate, 2023. JMIR continues to be a Q1 journal in the categories of 'Medical Informatics' (ranked 5/31) and 'Health Care Sciences and Services' (ranked 3/105).

It is followed by "Telemedicine and E-Health" (n=22) from Canada, "BMJ Open" (n=14) from the United States, among others located in "Zone 1". This zone corresponds to concentration and is considered as the "core sources".

From the journals analysis it became clear that the topics in question intersect both Health and Technology fields.

Figure 10 - Most relevant sources



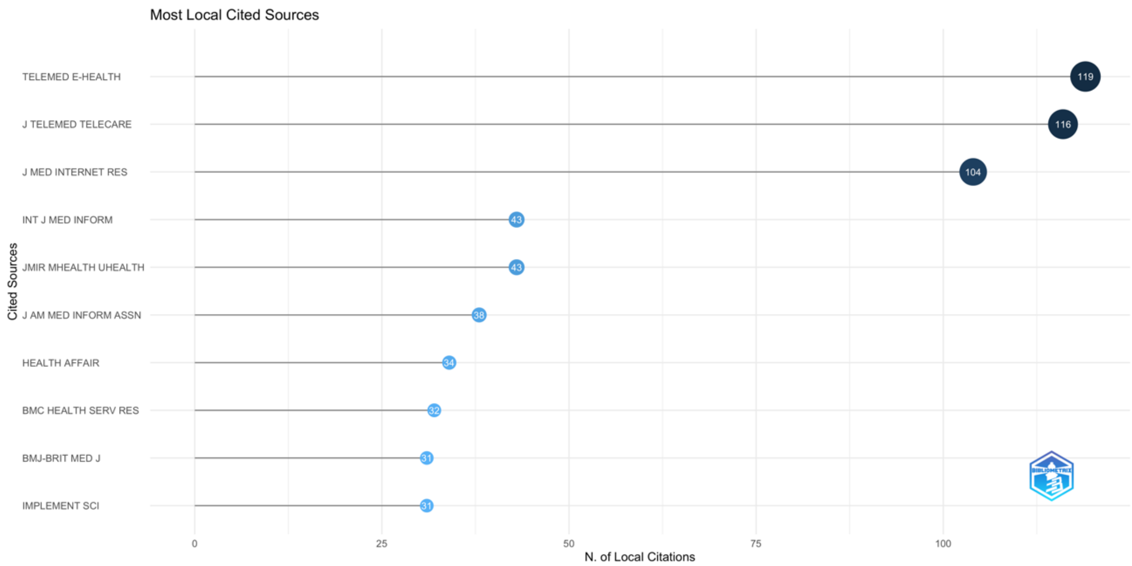
source: data extracted from Biblioshiny (2023)

In addition, the main sources cited in the references by the documents presented in Figure 11 are also observed. In this sense, the journal “Telemed E-Health” appears as the most cited (n=119), followed by the “Journal of Medical Telecare” (n=116), “Journal of Medical Internet Research” (n=104), among the main ones.

Telemed E-Health is a peer-reviewed journal, published by Wiley, that publishes original research on the development, implementation, and evaluation of telemedicine and e-health technologies and services. The journal covers a wide range of topics, including clinical applications of telemedicine, public health applications of telemedicine, telemedicine for special populations, and the ethical and legal implications of telemedicine.

Both Journal of Medical Telecare and Journal of Medical Internet Research covers a wide range of topics, including clinical applications of telemedicine, telemedicine for special populations, and the economic and organizational aspects of telemedicine.

Figure 11 - Most Local Cited Sources

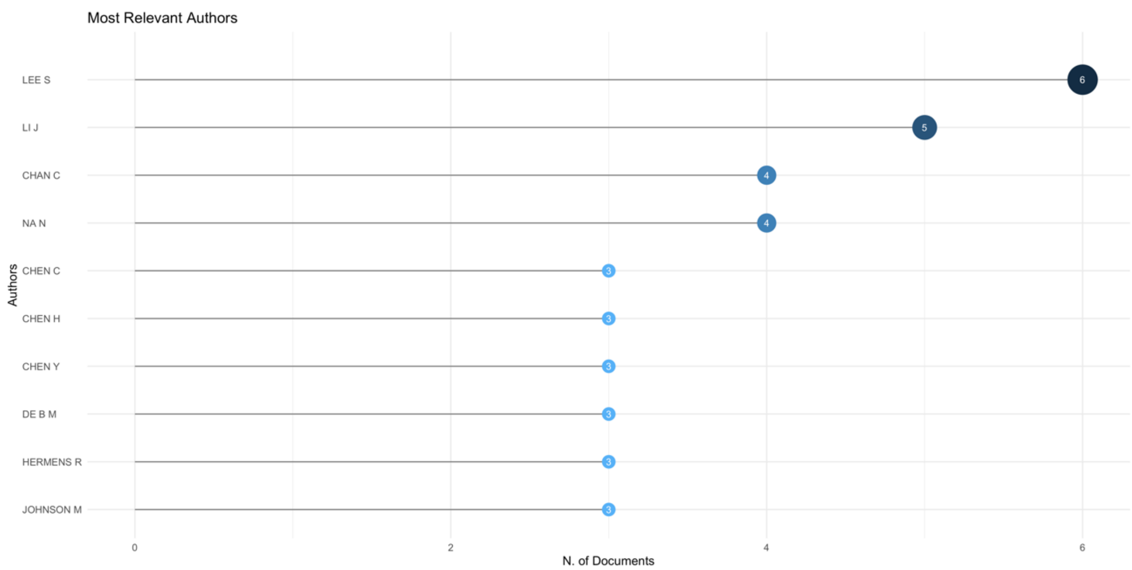


source: data extracted from Biblioshiny (2023)

2.2. Authors Analysis

Figure 12 illustrates the publication trends of the most productive authors per year among the top 10 authors in the database. The size of each circle represents the number of articles published, and the intensity of the blue color reflects the research impact in terms of the number of citations. LEE S was the most prolific author in the analyzed data and is regarded as the most significant in terms of the number of published documents (Figure 9).

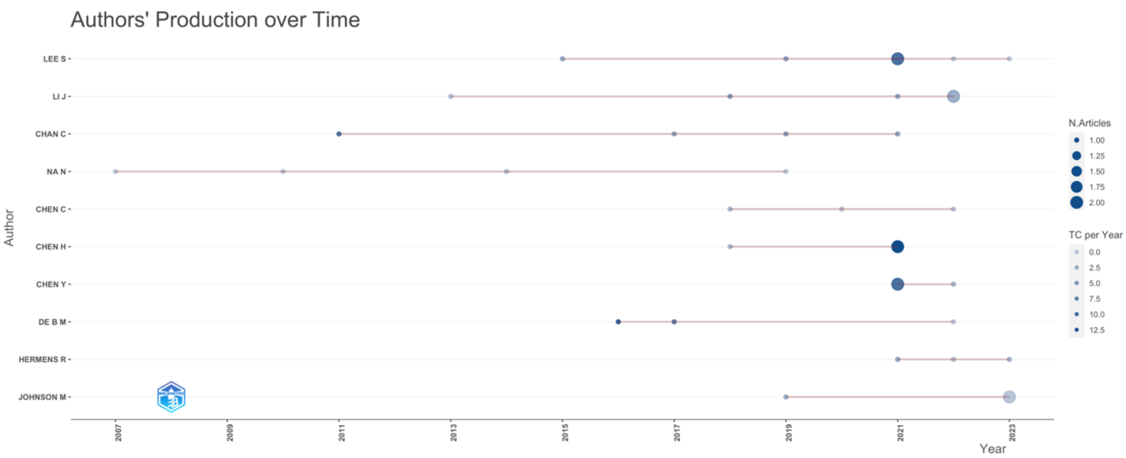
Figure 12 - Most relevant authors



source: data extracted from Biblioshiny (2023)

In Figure 13 shows that some of the most relevant authors keep their production along the years (LI J, CHAN C, NA N, CHEN C, CHEN H and CHEN Y) and there are not many new authors in the list. This implies that this research is concentrated on some authors clusters, but all of them are regularly published.

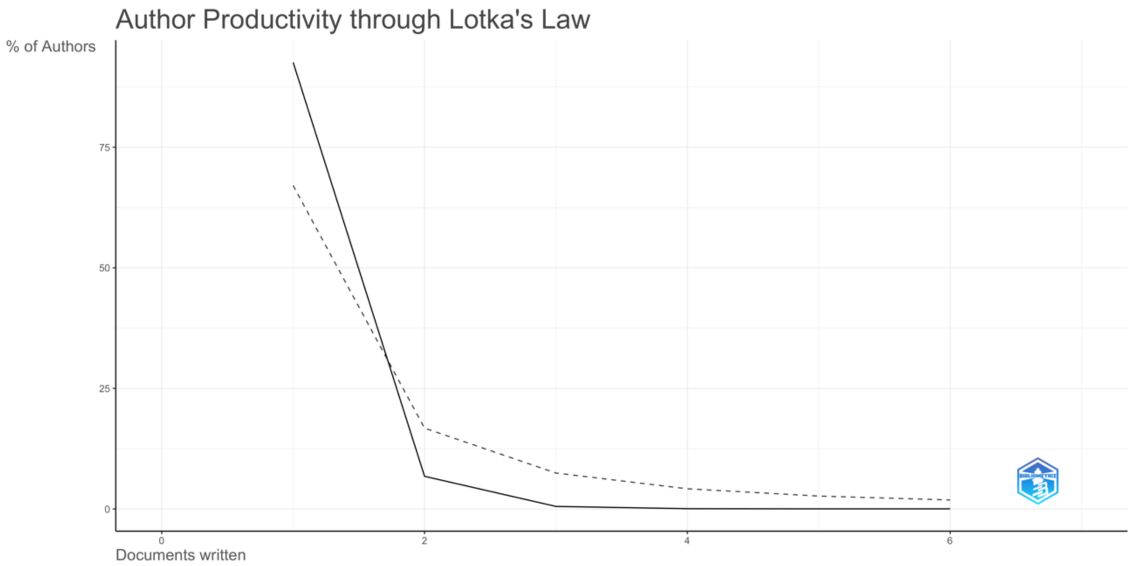
Figure 13 - Authors production over time



source: data extracted from Biblioshiny (2023)

The Lotka Law (focus on authors) was created in 1926, also known as the Inverse Square Law, due to its premise: the number of authors who have published exactly (n) papers is inversely proportional to (n^2). According to Maltrás Barba (2003), there is a rule that for every 100 authors with only one paper, there will be 25 authors with 2 papers, 11 authors with 3 papers, and so on. The Lotka Law is also seen as a function of productivity probability. The more you publish, the easier it seems to publish a new paper, and researchers who publish more interesting results gain more recognition and access to resources to improve their research (MALTRAS BARBA, 2003). Therefore, the Lotka Law presented in Figure 14 measures the productivity of authors according to a size-frequency distribution model of the various authors in a set of documents (Teixeira et al., 2013).

Figure 14 - Authors productivity according to Lotka’s Law

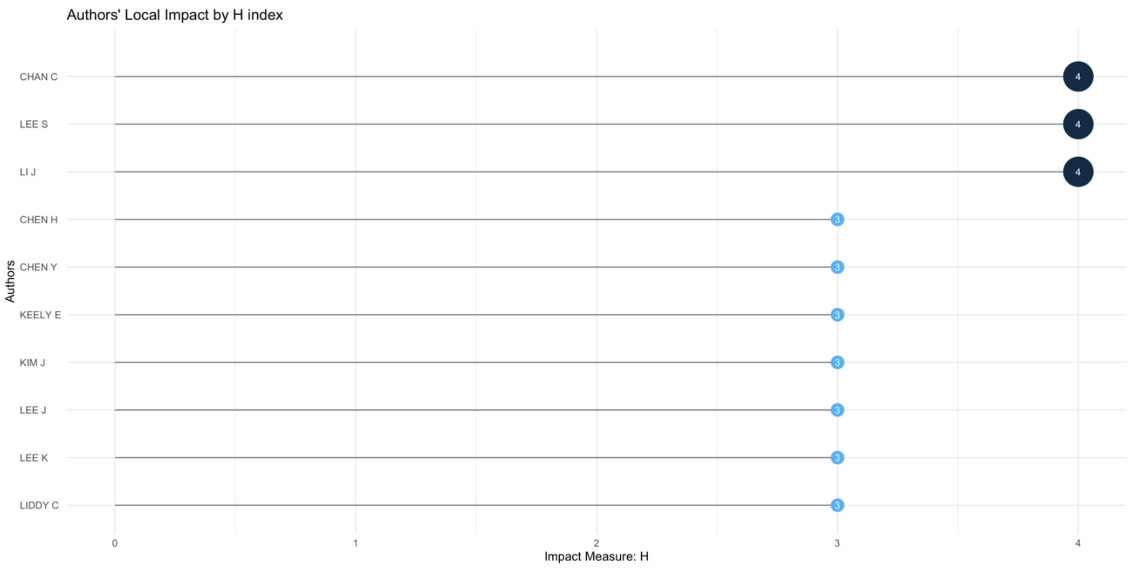


source: data extracted from Biblioshiny (2023)

The H-Index is an indicator that assesses the impact of authors based on the number of articles they have published and the number of citations those articles have received. The higher the H-Index, the greater the author’s impact.

In Figure 15**Erro! Fonte de referência não encontrada.**, the top 10 authors with the highest impact, as measured by the H-Index, are highlighted. Professor Chan C has the highest H-Index, with 17 articles that have received at least 17 citations.

Figure 15 - Authors H-Index impact levels



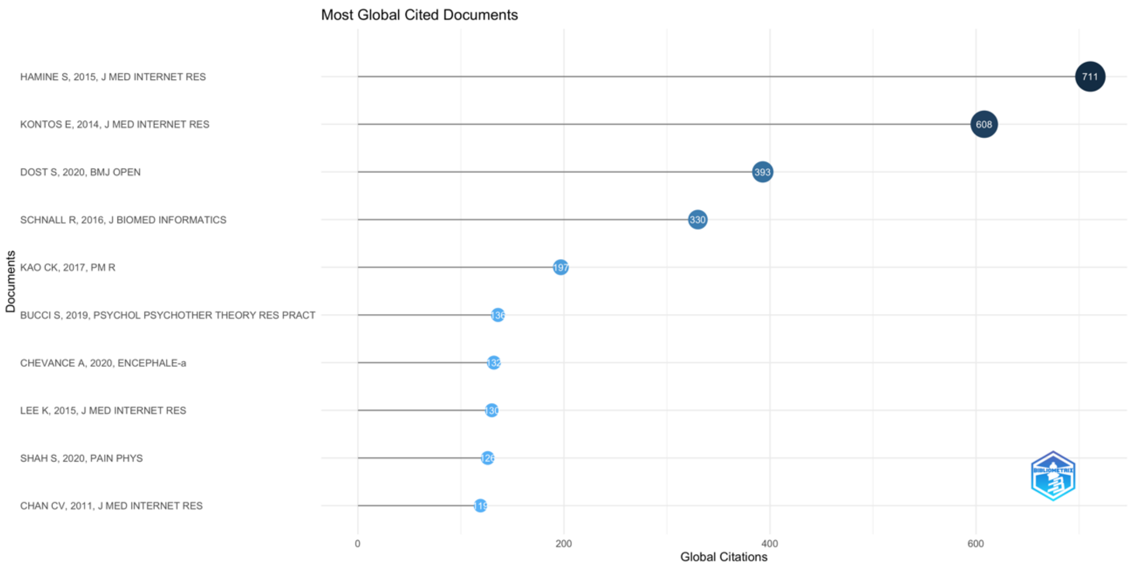
source: data extracted from Biblioshiny (2023)

2.3. Document Analysis

When examining the most frequently cited documents worldwide, it becomes evident that the author Hamine (2015) leads with 711 citations, followed by Kontos (2014) with 608 citations, and Dost (2020) with 393 citations. The list of the top 10 most cited documents globally is presented in Figure 16 and described in detail in the subsequent binding matrix shown in Chart 1. Furthermore, it is noteworthy that the journal "Journal of Medical Internet Research" appears four times in this list.

In 2023, JMIR received a Journal Impact Factor of 7.4 (5-Year Journal Impact Factor: 7.6) according to the latest release of the Journal Citation Reports™ from Clarivate, 2023. JMIR continues to be a Q1 journal in the categories of 'Medical Informatics' (ranked 5/31) and 'Health Care Sciences and Services' (ranked 3/105) (Source: Journal Citation Reports from Clarivate, 2023).

Figure 16 - Most cited documents



source: data extracted from Biblioshiny (2023)

Chart 1 - Matrix presenting the top 10 most cited papers

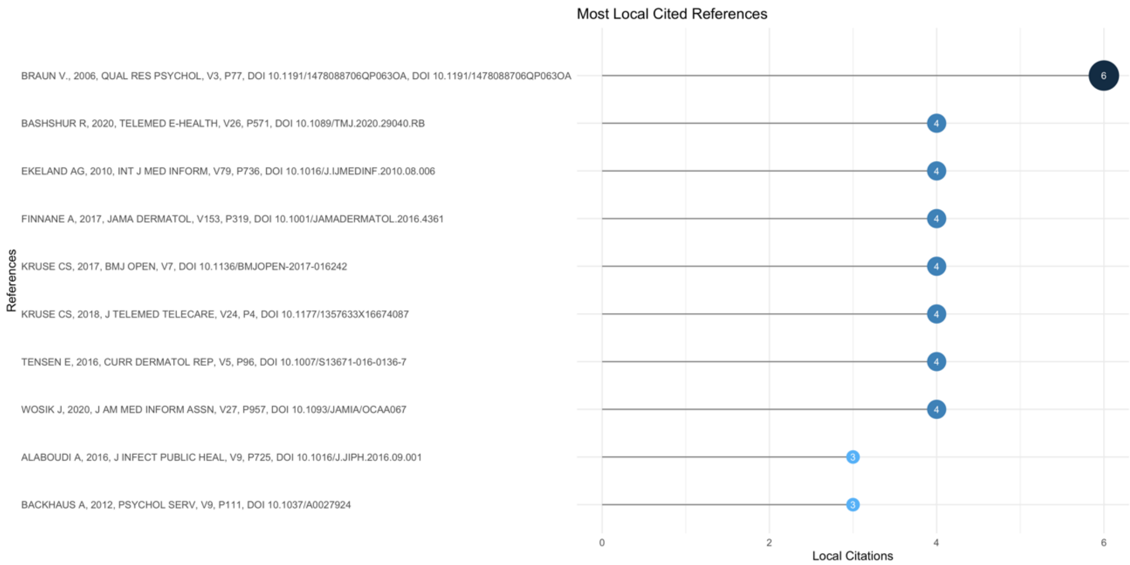
Order	Paper	Journal	Author/Year	Main Findings
1	Impact of mHealth Chronic Disease Management on Treatment Adherence and Patient Outcomes: A Systematic Review	Journal of Medical Internet Research	(Hamine et al., 2015)	There is potential for **mHealth tools** to better facilitate adherence to chronic disease management, but the evidence supporting its current effectiveness is mixed.
2	Predictors of eHealth Usage: Insights on The Digital Divide From the Health Information National Trends Survey 2012	Journal of Medical Internet Research	(Kontos et al., 2014)	This study illustrates that lower SES, older, and male online US adults were less likely to engage in a number of **eHealth** activities compared to their counterparts.
3	Perceptions of medical students towards online teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students	BMJ Open	(Dost et al., 2020)	Online teaching has enabled the continuation of medical education during these unprecedented times. Moving forward from this pandemic, in order to maximise the benefits of both face-to-face and online teaching and to improve the efficacy of medical education in the future, we suggest medical schools resort to teaching formats such as team-based/problem-based learning
4	A user-centered model for designing consumer mobile health (mHealth) applications (apps)	Biomed Informatics	(Schnall et al., 2016)	Results from this work provide detailed descriptions of the user-centered design and system development and have heuristic value for those venturing into the area of technology-based intervention work. Findings from this study support the use of the

Order	Paper	Journal	Author/Year	Main Findings
				ISR framework as a guide for **future mHealth app development**.
5	Consumer Mobile Health Apps: Current State, Barriers, and Future Directions	PM&R	(Kao & Liebovitz, 2017)	Over 165,000 mobile health apps are available, primarily for patients, with top categories being wellness and disease management. These apps have untapped potential but face barriers, such as regulatory oversight and privacy concerns. Future directions include improving data integration, **interoperable platforms**, and increased app prescription by healthcare providers.
6	The digital revolution and its impact on mental health care	Psychology and Psychothererapy Theory Research	(Bucci et al., 2019)	People with mental health problems around the world have limited, if any, chance of accessing psychological help at all. **Digital platforms** allow people to self-monitor and self-manage in a way that face-to-face/paper-based methods of assessment have up until now not allowed.
7	Ensuring mental health care during the SARS-CoV-2 epidemic in France: A narrative review	ENCEPHALE-a	(Chevance et al., 2020)	French mental healthcare is now facing a great and urgent need for reorganization and must also prepare in the coming days and weeks to face an epidemic of emotional disorders due to the confinement of the general population.
8	Consumer Use of "Dr Google": A Survey on Health Information-Seeking Behaviors and Navigational Needs	Journal of Medical Internet Research	(Lee et al., 2015)	Approximately half of the population of consumers of **Web-based health information** with chronic health conditions would benefit from support in finding health information on the Internet. Despite the popularity of the Internet as a source of health information, further work is recommended to maximize its potential as a tool to assist self-management in consumers with chronic health conditions.
9	The Technological Impact of COVID-19 on the Future of Education and Health Care Delivery.	Pain Phys	(Shah et al., 2020)	Many of the technological changes imposed so abruptly on the health-care system by the COVID-19 pandemic may be positive and it may be beneficial that some of these transitions be preserved or modified as we move forward. Clinicians must be objective in assessing these changes and retaining those changes that clearly improve health-care education and patient care as we enter the COVID era.
10	A Framework for Characterizing eHealth Literacy Demands and Barriers	Journal of Medical Internet Research	(Chan & Kaufman, 2011)	The framework and analytic approach can be a potentially powerful generative research platform to inform development of rigorous eHealth examination and design instruments, such as to assess eHealth competence, to design and evaluate consumer eHealth tools, and to develop an eHealth curriculum.

source: data extracted from Biblioshiny (2023)

Following a similar reasoning, we observe that of the most cited documents in the world, Figure 17 presents the 10 most cited references in these documents. Braun in 2006 (n=6 citations), Bashshur in 2020 (n=4 citations), Ekeland in 2010 (n=4 citations), among others, stand out. These works cited in were the most cited, however, it is not possible to infer that they were the most important.

Figure 17 - Most cited references



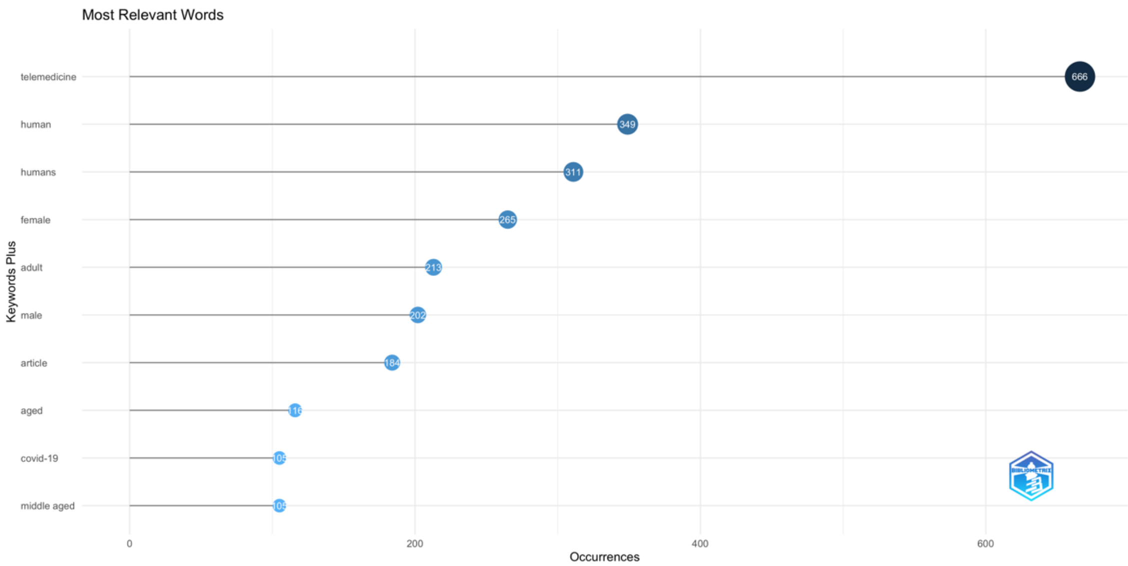
source: data extracted from Biblioshiny (2023)

2.4. Thematic Analysis

In this step, a coding process of the relevant literature was carried out based on the search criteria. Initially, the analysis of the data codes, it is emphasized that care was taken and the semantic contexts were treated with care, considering the relationship between significants and their denotative and connotative representations, in accordance with the terminology, to present their true meanings.

Zipf's Law, or the Law of Least Effort, which measures the frequency of word occurrence in several texts, ordering a list of terms on a particular subject (Teixeira et al., 2013). Next, the visualization of the most used keywords by each author and the main references used in their publications are presented in Figure 18 with the most frequent relevant words.

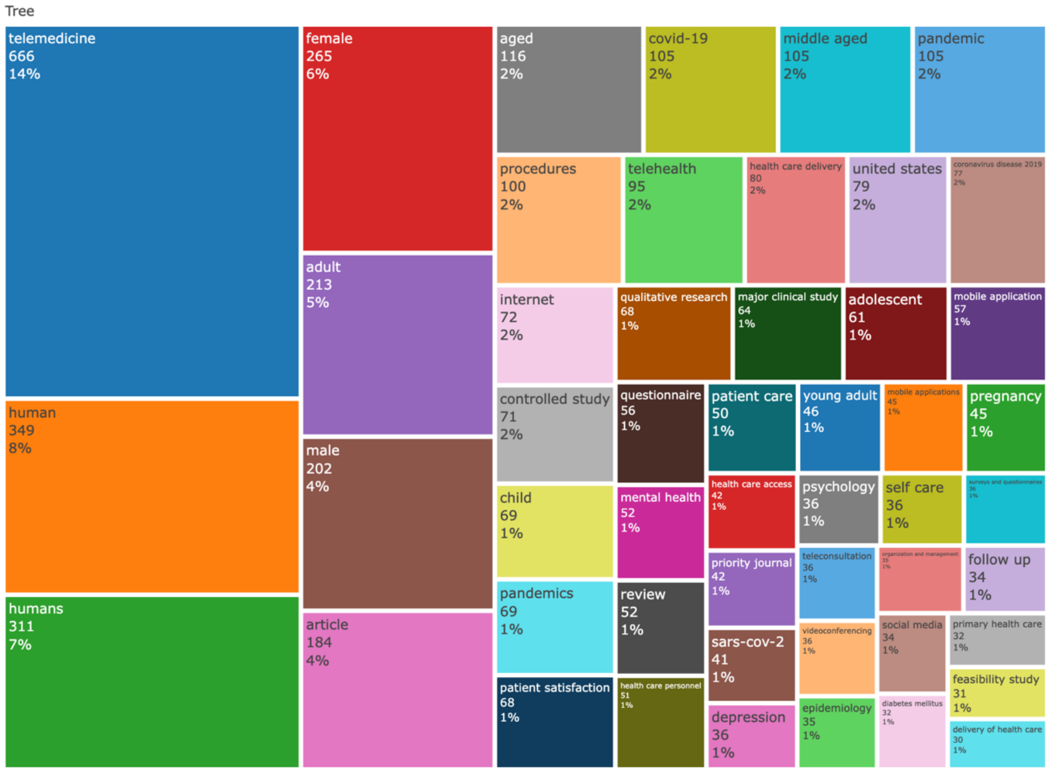
Figure 18 - Most relevant words by frequency



source: data extracted from Biblioshiny (2023)

In the following, Figure 19 shows a tree map that shows the data organized in hierarchical dimensions that uses proportional rectangles to carry numerical values (score per occurrence) for each branch.

Figure 19 - Treemap with the main keywords

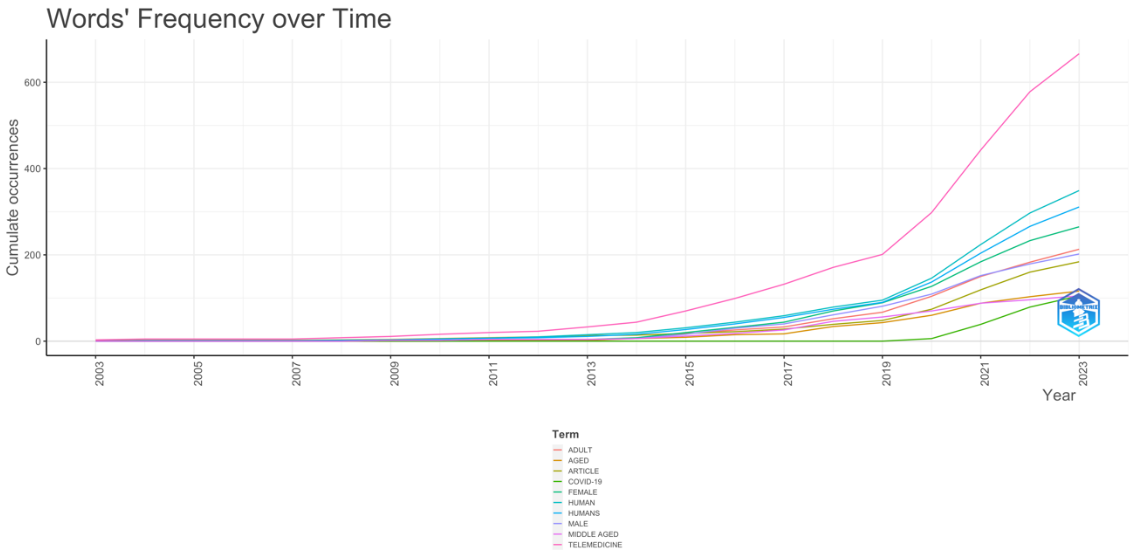


source: data extracted from Biblioshiny (2023)

The area of each rectangle in the tree map represents the frequency of the word associated with that rectangle. The larger the area of the word, the higher the score it obtained within the analysis in relation to the number of occurrences of it. When the area of the word is smaller, the word had less score within the amount of keywords found in the collection of documents. In fact, this tree map opens up a little more the amount of words already mentioned in **Erro! Fonte de referência não encontrada.** previously presented. Therefore, they are complementary observations that were made.

Figure 20 shows the cumulative occurrence of associated terms over time among the keywords presented in the articles. Surprisingly one of the key terms shown was "COVID-19" (n=105), referring to the global pandemic, concentrated between 2020 and 2023. This shows the quick impact in research and publications related to teleconsultation, and telemedicine in general, that the pandemic did. Another interesting finding is that "middle aged" (n=105) is one of the top 10 most frequent terms, shows a recent increase, indicating that this specific age group is being more researched over time. Older people are usually associated with lower technology aptitude (Batsis et al., 2019; Lam et al., 2020).

Figure 20 - Words frequency over time

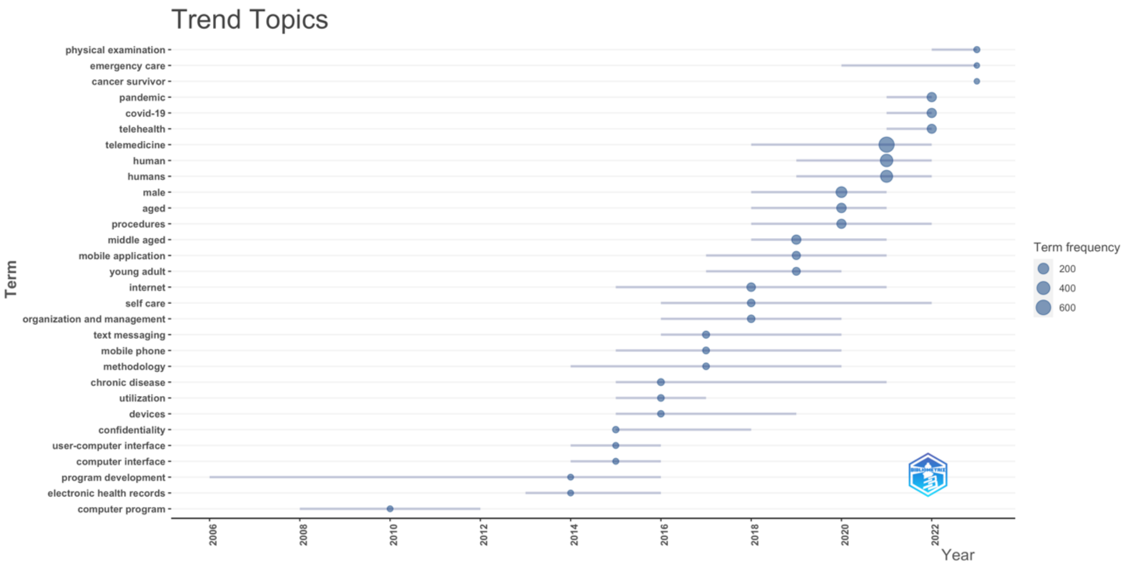


source: data extracted from Biblioshiny (2023)

Regarding the subject frequency changes and evolutions over time, the trending topics presented on Figure 21 brings more insight about the possible paths the research on this matter is being conducted. Physical examination (n=8) for instance, is a very new topic. Physical examination is absent in telecardiology consultations. In televascular consultations the professionals try to compensate for the lack of physical proximity by getting involved in a form of collaboration that constitutes a novel environment for all (Pappas & Seale, 2010).

The lower quarter of the trending topics, shows a diminishing interest in the most technical aspects of the solution like “user-computer interface” (n=7), “computer interface” (n=7), “program development” (n=5) and “computer program” (n=6), indicating that the supporting technology has reached a level that value can be obtained in a more consistent way (Baker & Stanley, 2018).

Figure 21 - Trending topics over time

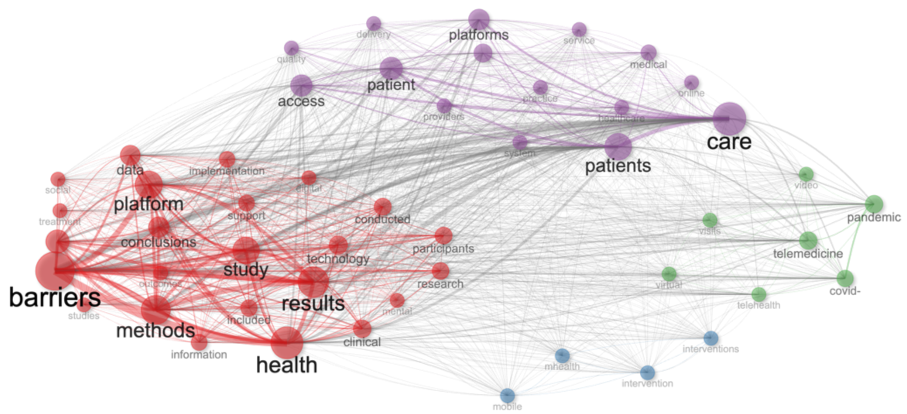


source: data extracted from Biblioshiny (2023)

Figure 22 represents the keyword co-occurrence network defined by the researcher, in which four clusters were identified. The graph was created based on the following plot options: normalization by Association (vertex similarities are normalized using association strength), using n=50 (the top 50 cited references), vertex size is proportional to their degree, and all other arguments assumed default values.

Each of the four clusters formed could help identify thematic and/or practical relationships within the research conducted (Aria & Cuccurullo, 2017).

Figure 22 - Co-ocurrency network



source: data extracted from Biblioshiny (2023)

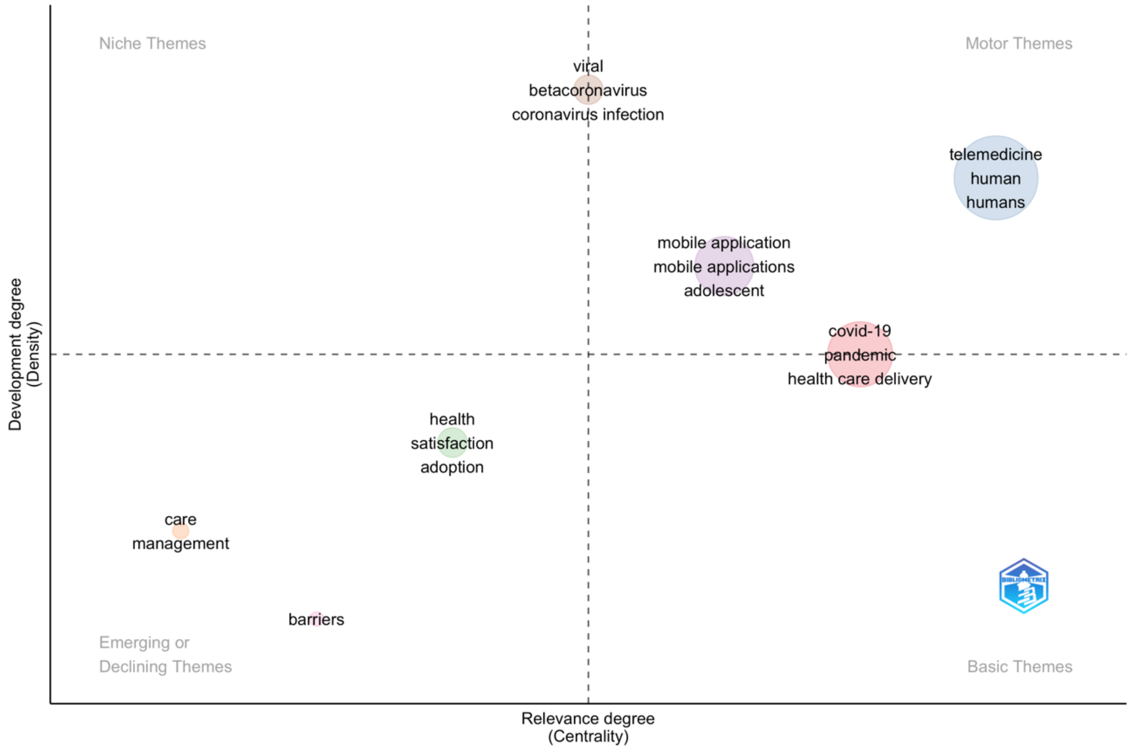
The nodes clusters identified focused on the barrier's aspects, platforms and care, pandemics and COVID-19 related publications and a less representative intervention and mobile/mHealth.

Searching for a perception of thematic evolution. One analytical possibility is through the thematic map, where the centrality and density are verified, which can be used to classify the themes and map them in a two-dimensional plane. The themes are analyzed according to the quadrant in which they are inserted. The quadrants are defined as follows:

a) Upper right quadrant: Driver themes are those that are central and dense. This are the most important themes in a field.
b) Lower right quadrant: Basic themes are those that are central but not dense. This are important concepts that are related to other themes.
c) Lower left quadrant: Emerging or declining themes are those that are not central but are dense. This are new or declining themes that are becoming more or less important.
d) Upper left quadrant: Very specialized/niche themes are those that are neither central nor dense. This are specialized topics that are of interest to a small group of people.

In the case of the thematic map presented below in Figure 23, it is possible to observe an overview of the search system in the databases with themes related to dimensional classification (Aria & Cuccurullo, 2017).

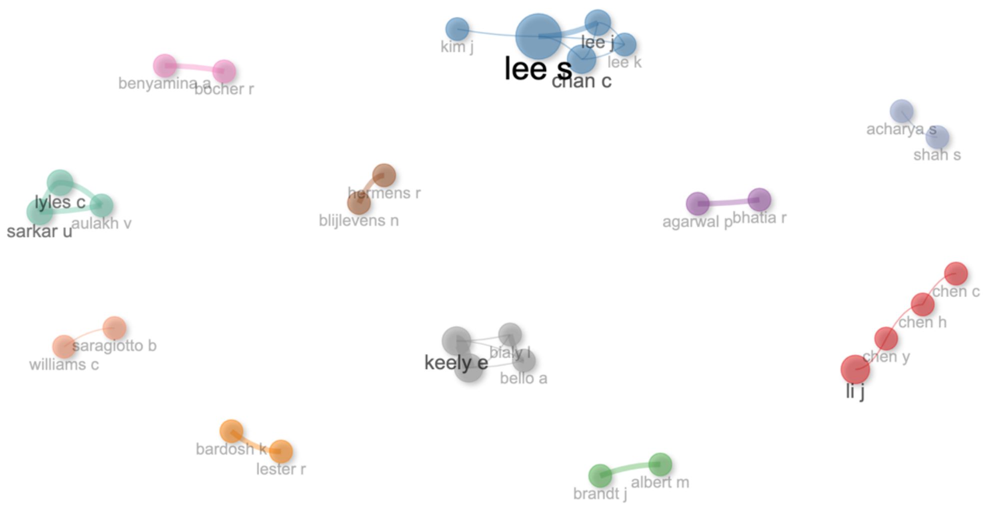
Figure 23 - Thematic Map



source: data extracted from Biblioshiny (2023)

By analyzing the co-citation networks, it was identified how the literature connects prolific articles, with 11 main clusters (or 11 groups of researchers) being identified, as shown in Figure 24. Collaboration networks aim to demonstrate the interaction of how authors, affiliations/institutions, and countries relate to others in a specific research field, making it possible to reveal the authors, institutions, and countries analyzed in the corpus of the topic discussed. In conclusion, it is possible to affirm that there are few consolidated research groups on the topic under study and that there are opportunities for publications and to strengthen the growth of research in this area.

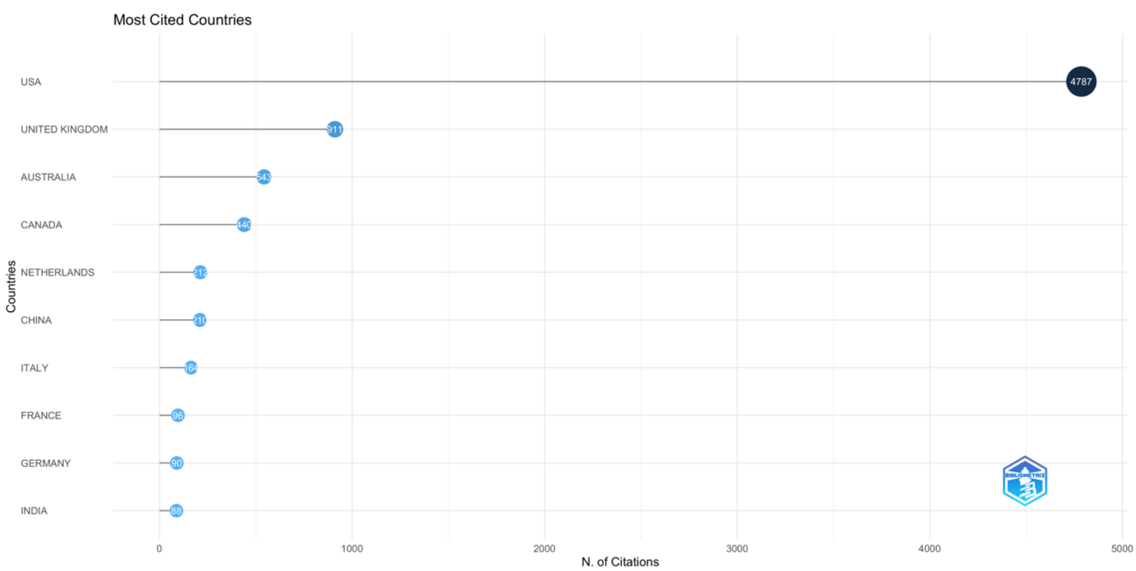
Figure 24 - Author's collaboration network clusters



source: data extracted from Biblioshiny (2023)

Regarding the country of origin of the research, when we examine the citations as shown in Figure 25, we can see that USA leads with 4,787 citations, followed by the United Kingdom (n=911) and Australia (n=543). Brazil appears only in 12th place with 60 citations, making it the highest-ranked South American country.

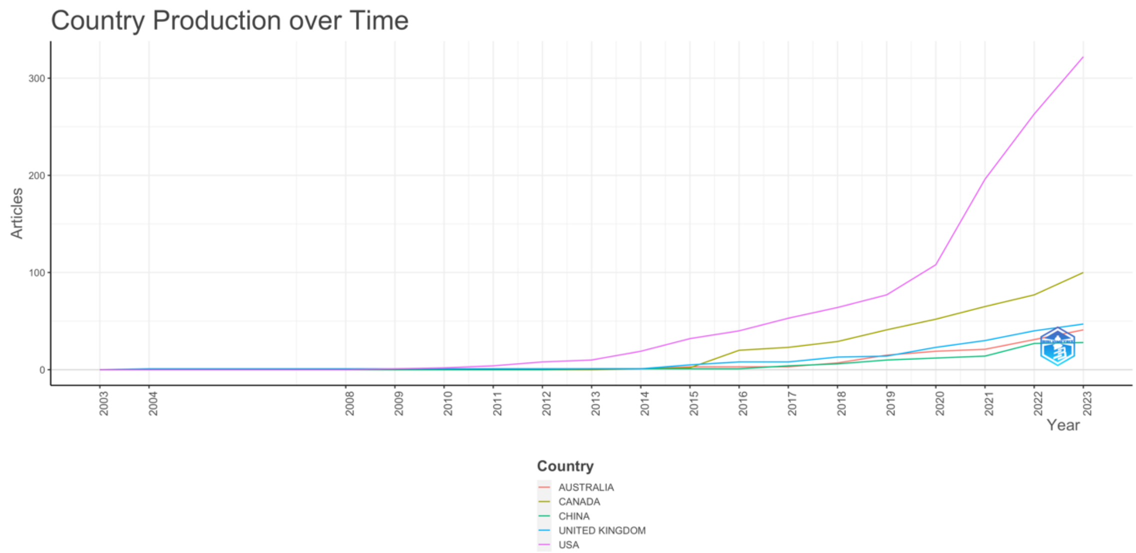
Figure 25 - Countries classified by citations



source: data extracted from Biblioshiny (2023)

Complementing the last analysis, Figure 26 shows that it is possible to verify that although the UK is in 2nd place in citation quantity over time, Canada (n=77) has recently taken the 2nd place making the UK (n=40) drop to 3rd place.

Figure 26 - Country production over time



source: data extracted from Biblioshiny (2023)

3. Literature Review

A literature review is a critical and comprehensive examination of scholarly works, research studies, and academic publications relevant to a specific research topic or area of inquiry (Rowley & Slack, 2004). It serves as an essential component of the research process, as it provides a structured framework for understanding the existing body of knowledge and identifying gaps, trends, and inconsistencies in the current literature. It can be defined as a systematic, objective, and unbiased survey of the relevant literature on a particular subject.

The importance of a literature review in research cannot be overstated, as it offers a solid foundation for developing research questions, hypotheses, and research designs. As Hart (1998) highlights, a literature review is a key element in framing the research problem, determining the scope of the study, and formulating research objectives. It also aids in identifying the theoretical and empirical underpinnings of the research, allowing researchers to build on existing knowledge and contribute to the academic discourse. In essence, a literature review serves as a crucial step in the research process, helping researchers situate their work within the broader academic landscape and providing the necessary intellectual context to advance the study's objectives. The conventional method for database search involved utilizing keywords and citation links as primary mechanisms to identify pertinent research papers for the study.

Recently Connected Papers as a literature mapping tool has been invented by three Israeli researchers Alex Tarnavsky, Eitan Eddie Smolyansky and Itay Knaan Harpaz which was made freely available to the public in June 2020 (Kaur et al., 2022).

Connected Papers is an innovative and visually driven tool designed to assist researchers and applied scientists in the discovery and exploration of research papers within their respective fields. While it can be used to locate "Prior" and "Derivative works," such as seminal works and survey or review papers, its user interface is relatively simple, offering limited options. Unlike conventional tools, Connected Papers constructs its visual graphs based on the source paper, but these graphs are distinct from traditional citation maps; they rely on a similarity metric to establish the strongest connections. This unique approach allows it to uncover related papers that may remain elusive through standard keyword or citation searches.

Connected Papers employs its algorithms to analyze around 50,000 research papers, selecting a curated selection of the most highly cited papers for users to explore. These papers are not only relevant to the source paper but also possess the strongest connections with it. Each research paper is represented as a circle, with similar papers grouped together in proximity and connected by robust lines, presenting a more intuitive and visually engaging way for researchers to navigate the literature landscape.

The tool further enhances its visual representation by placing less similar papers in their respective clusters, which are located at a greater distance from the central source paper. Moreover, it employs the size of circles to denote the citation frequency, with more frequently cited papers appearing as larger circles. Additionally, it uses varying shades of color to distinguish more recent papers, with these papers typically presented in a darker hue. These visual cues contribute to a richer and more nuanced exploration of the research landscape, allowing users to readily identify important and current contributions within their field.

To advance the literature review, key papers identified in the Bibliometric Study were chosen to be the reference for each topic of the literature review. They were submitted to the Connected Papers tool to the connection graph to be drawn.

The prior works list was analyzed to identify the seminal papers used to support the theory and findings produced on the key articles and the derivative works were used to understand where the proposed concepts were advanced in terms of the research to make sure that the gaps described in the objectives were relevant and could be further explained.

3.1. Business Models

According to Osterwalder & Pigneur (2012), several management researchers have investigated the notion of "business model". Most of the research in this area focuses on economics, finance, firm performance, and innovation processes. Chesbrough & Rosenbloom (2002) and Chesbrough (2010), for example, investigate the relationship between innovation and business models. They view business models as a mediating construct between technology and economic value and assess how innovative business models result in business success.

Another chain of thought examines the fit between a firm's business model and its product market strategy and analyze the impact of product market strategy and business model choices on a firm's performance. Johnson et al. (2008) explore how innovative business models can reshape industries and drive growth, how many companies find business-model innovation difficult, and how managers can design or renovate their business models.

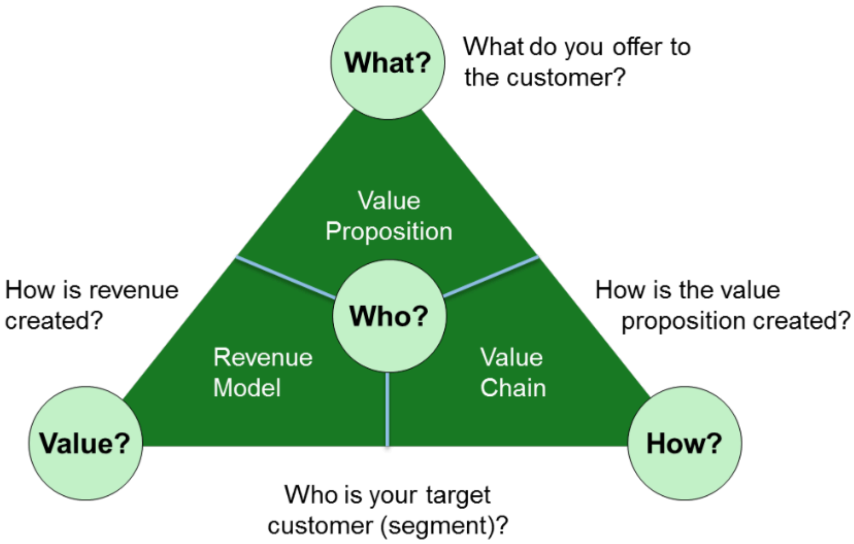
Teece (2010) overviews state-of-the-art research on business models in strategic management. This article analyzes the significance of business models and explores their connections with business strategy, innovation management, and economic theory. Given the importance of business design. Business models are mentioned frequently in the strategy literature but are rarely analyzed and poorly understood, with too little attention given to their design. He explicitly recognizes that increased understanding of the essence of business models should help the understanding of a variety of subjects including market behavior, competition, innovation, strategy, and competitive advantage.

3.1.1. Business Models Classification

Several ways to classify and organize business models have been proposed. One successful approach has been made by Oliver Gassman and team with the St. Gallen Business Model Navigator (Gassmann et al., 2014).

This approach defines four key questions when analyzing a business model and created the magic triangle to illustrate it (Figure 27):

Figure 27 - St. Gallen Business Model Definition - Magic Triangle



source: (Gassmann et al., 2014)

By answering the four associated questions and explicating (1) the target customer, (2) the value proposition towards the customer, (3) the value chain behind the creation of this value, and (4) the revenue model that captures the value, the business model of a company becomes tangible and a common ground for its re-thinking is achieved. A central virtue of the business model is that it allows for a holistic picture of the business by combining factors located inside and outside the firm.

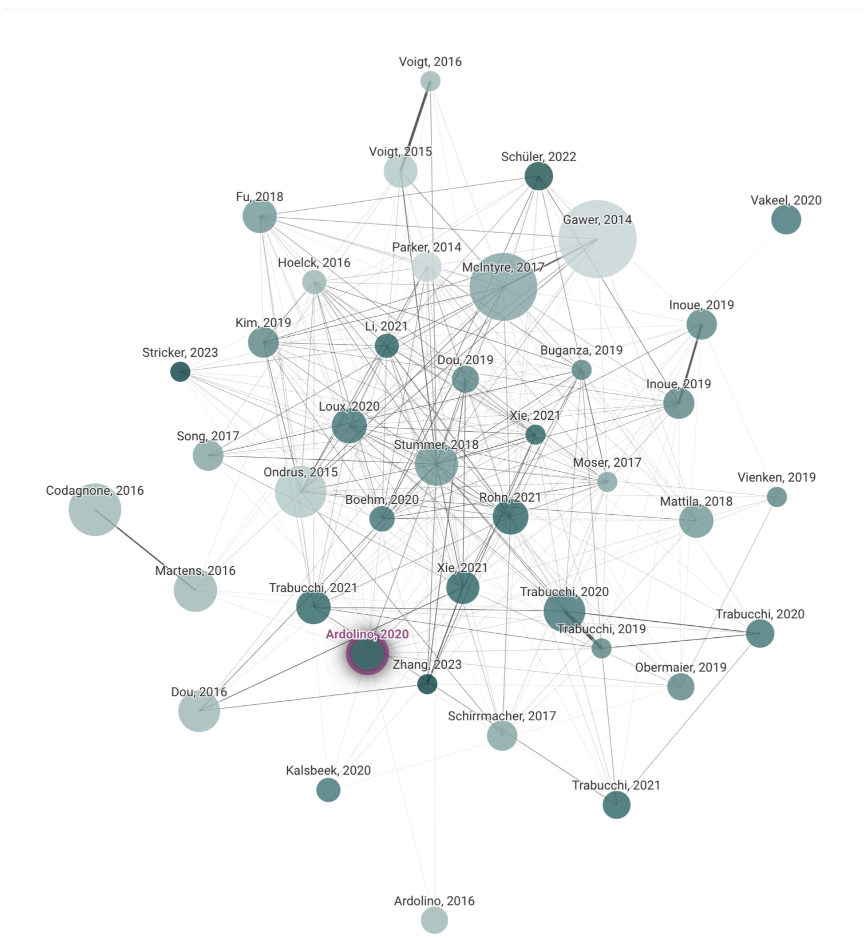
The recombination approach used by St. Gallen model is usefull when generating and innovating in the business model design. They have proposed 55 key business models using this method and the Multilateral Business Model is one of them. It is called two-sided market and has the following definition:

A two-sided market facilitates interactions between multiple interdependent groups of customers. The value of the platform increases as more groups or as more individual members of each group are using it. The two sides usually come from disparate groups, e.g., businesses and private interest groups (Gassmann et al., 2014).

3.1.2. Multilateral Business Models

In order to better understand and describe the Multilateral Business Model, or Platform Model, the paper "A Business Model Framework to Characterize Digital Multisided Platforms", published by Ardolino et al. (2020) was submitted to the Connected Papers tool resulting in the graph presented in Figure 28.

Figure 28 - Connected papers to Business Model Framework to Characterize Digital Multisided Platforms



Source: connected papers

The ten prior works identified in the graph are presented on the Table 4 classified by the number of citations on each paper, denoting its historical importance and impact. When analyzing each paper individually, some key findings can be identified.

Table 4 - Prior works to Business Model Framework to Characterize Digital Multisided Platforms

Title	Author, Year	Citations
Network Externalities, Competition, and Compatibility	(Katz & Shapiro, 1985)	6478
Platform competition in two sided markets	(J. Rochet & Triole, 2003)	4376
Competition in Two-Sided Markets	(M. Armstrong, 2005)	2979
Two-sided markets: a progress report	(J. Rochet & Tirole, 2006)	2626
Chicken & Egg: Competition Among Intermediation Service Providers	(Caillaud & Jullien, 2003)	1738
Strategies for Two Sided Markets	(T. R. Eisenmann et al., 2006)	1501
Two-Sided Network Effects: A Theory of Information Product Design	(Parker & Alstyne, 2010)	1466
The Economics of Two-Sided Markets	(Rysman, 2009)	1115
Multi-Sided Platforms	(Hagiu & Wright, 2015)	800
Some Empirical Aspects of Multi-sided Platform Industries	(Evans, 2003)	534

Source: Connected Papers

Katz & Shapiro (1985) showed that network externalities can lead to a natural monopoly in two-sided markets. This is because the platform with the most users on one side will be the most attractive to users on the other side. Another study surveyed the literature on competition in two-sided markets. It identified a number of key factors that influence competition in these markets, including network externalities, economies of scale, switching costs, and product differentiation (M. Armstrong, 2005).

The researchers Rochet and Tirole had two papers in the list. One that analyzed platform competition in a setting with two platforms and two sides. They showed that the outcome of competition depends on the relative importance of network externalities and economies of scale (J.-C. Rochet & Tirole, 2003). The other one provided a comprehensive overview of the economics of two-sided markets. They discussed a wide range of topics, including network externalities, platform competition, and pricing strategies (J. Rochet & Tirole, 2006).

Caillaud & Jullien (2003) studied the competition among intermediation service providers (ISPs) in a two-sided market. They showed that ISPs may be reluctant to invest in new products and services if they are concerned about the possibility of being locked out of the market by a dominant competitor. While T. Eisenmann et al. (2006) identified a number of strategies that platform providers can use to be successful in two-sided markets. These strategies include subsidizing one side to attract users on the other side, bundling products and services, and offering exclusive features to one side.

Parker & Alstyne (2010) developed a theory of information product design that takes into account two-sided network effects. They showed that platform providers should design their products to maximize the value of the platform for both sides of the market. Just before that, Rysman (2009) provided an overview of the economics of two-sided markets. He discussed a number of topics, including network externalities, platform competition, and pricing strategies.

One of the earlier papers have surveyed the empirical literature on multi-sided platform industries. He found that multi-sided platform industries are often characterized by high concentration and high margins (Evans, 2003). The last paper showed that multi-sided platforms face a number of unique challenges, such as the need to coordinate the interests of multiple sides (Hagiu & Wright, 2015).

From reading the papers and analyzing its relations, the combined outtakes from the papers could be summarized as the following statements:

a) Network externalities are a key driver of competition in two-sided markets. When the value of a platform increases for one side as the number of users on the other side increases, this creates a positive feedback loop that can lead to a winner-take-all market structure (Katz & Shapiro, 1985; J. Rochet & Triole, 2003; Rysman, 2009).
b) Platform competition can be complex, with multiple platforms competing for users on both sides. This can lead to a variety of strategic behaviors, such as subsidizing one side to attract users on the other side, or bundling products and services to make it more difficult for users to switch platforms (M. Armstrong, 2005; Hagiu & Wright, 2015; J.-C. Rochet & Tirole, 2003).
c) Two-sided markets are often characterized by chicken-and-egg problems. This is where the value of the platform for one side depends on the number of users on the other side,

but neither side wants to be the first to enter the market. This can lead to market failures, where platforms fail to emerge even though there is potential demand for them (Caillaud & Jullien, 2003; Evans, 2003; Parker & Alstyne, 2014).

d) Platform providers need to carefully design their strategies to attract and retain users on both sides of the market. This may involve subsidizing one side, bundling products and services, or offering exclusive features to one side (T. Eisenmann et al., 2006; Hagiu & Wright, 2015; J. Rochet & Tirole, 2006).

e) Platform providers can also use data and analytics to better understand their users and their needs. This information can be used to develop more effective marketing strategies and to improve the platform's design and features (Caillaud & Jullien, 2003; Evans, 2003; Parker & Alstyne, 2010).

From the derivative works found on Table 5 analysis there was no direct use of the Model Framework on a healthcare setting, indicating that this topic can be further explored in combination with other sources. To update the views on the Digital Platform Framework (Ardolino et al., 2016) an analysis of these papers were performed.

Table 5 - Derivative works to Business Model Framework to Characterize Digital Multisided Platforms

Title	Author	Citations
Openness in platform ecosystems: Innovation strategies for complementary products	(Cenamor & Frishammar, 2021)	46
Complementor competitive advantage: A framework for strategic decisions	(Cenamor, 2021)	35
A journey towards a digital platform business model: A case study in a global tech-company	(Şimşek et al., 2021)	26
Bilateral value-added services and pricing strategies of the third-party platform considering the cross-network externality	(X. Zhang et al., 2021)11/10/23 3:20:00 PM	14
Research on the Mechanism of Sustainable Business Model Innovation Driven by Digital Platform Ecosystems	(Li et al., 2023)	2
From Specialization to platformization: Business Model Evolution in the Case of Servicenow	(Schaffer et al., 2021)	1
The hope of exponential growth – Systems mapping perspective on birth of platform business	(Pussinen et al., 2023)	1
The digital entrepreneurial ecosystem in the European Union: evidence from the digital platform economy index	(Wibisono, 2023)	1
Significance of face-to-face service quality in last mile delivery for e-commerce platforms	(Inoue & Hashimoto, 2023)	0
Systematizing the lexicon of platforms in information systems: a data-driven study	(Bartelheimer et al., 2022)	0

Source: Connected Papers

Cenamor (2021) developed a framework for strategic decision-making in platform ecosystems. The framework takes into account a number of factors, including complementor competitive advantage, platform openness, and the competitive landscape. On later research, he found that openness is a key factor in the innovation of complementary products in platform ecosystems. They developed a framework for assessing the openness of platform ecosystems and for identifying strategies that platform providers can use to increase openness (Cenamor & Frishammar, 2021).

Still on the model creation, Li et al. (2023) developed a model of sustainable business model innovation driven by digital platform ecosystems. They showed that businesses need to be able to adapt to changing market conditions and to develop new ways to create value for their customers to remain competitive.

Some of the studies focused on case studies. Şimşek et al. (2021) presented a case study of a global tech company that transitioned to a digital platform business model. They identified a number of challenges that the company faced during the transition, such as changing the mindset of employees and developing new partnerships. Another study focused on the business model evolution of ServiceNow from a specialization strategy to a platform strategy. They found that ServiceNow was able to achieve exponential growth by opening up its platform to complementors (Schaffer et al., 2021). Wibisono (2023) examined the digital entrepreneurial ecosystem in the European Union using the digital platform economy index. He found that the digital entrepreneurial ecosystem is growing rapidly in the European Union, and that this growth is supported by a number of factors, including government support, venture capital funding, and a strong entrepreneurial culture.

With a focus on expanding the knowledge on specific topics of Digital Platforms, one paper used a systems mapping perspective to analyze the birth of platform businesses. They identified a number of factors that contribute to the emergence of platform businesses, such as the availability of data, the development of new technologies, and the changing needs of users (Pussinen et al., 2023). Another paper analyzed the pricing strategies of third-party platforms that offer bilateral value-added services. They showed that platforms can generate more revenue by offering cross-network externalities (X. Zhang et al., 2021).

The key combined outtakes from derivative works on (Ardolino et al., 2020) are as follows:

a) Openness is a key factor in the success of platform ecosystems. Open platforms allow complementors to develop innovative products and services that extend the functionality of the platform. This can lead to increased value for users and increased revenue for the platform provider (Cenamor, 2021; Cenamor & Frishammar, 2021; Li et al., 2023).
b) Complementor competitive advantage is another important factor in the success of platform ecosystems. Complementors that have a competitive advantage in terms of

innovation, quality, or cost can attract more users to the platform. This can benefit both the complementor and the platform provider (Cenamor & Frishammar, 2021; Li et al., 2023; X. Zhang et al., 2021).

c) Third-party platforms can offer bilateral value-added services, such as cross-network externalities, to generate revenue. This can benefit both the platform and its users (Pussinen et al., 2023; X. Zhang et al., 2021).

d) Sustainable business model innovation driven by digital platform ecosystems is essential for businesses to remain competitive in the digital age. This requires businesses to be able to adapt to changing market conditions and to develop new ways to create value for their customers (Li et al., 2023).

e) The hope of exponential growth is one of the key motivators behind the creation of digital platforms. Platforms have the potential to reach a large number of users and to generate significant revenue (Schaffer et al., 2021; Şimşek et al., 2021; Wibisono, 2023).

The original model proposed six dimensions to better characterize a Digital Platform – Value Proposition, Platform Sides, Platform Revenue Model, Platform Control, Platform Competition and Platform Architecture (Ardolino et al., 2020).

Considering that these dimensions were key elements to define a Digital Platform, and after matching those with greater importance to Teleconsultation Platforms, the following concepts were chosen to be further explained. Key practical examples were selected from the Teleconsultation Platforms list on Table 1.

3.1.2.1. Value Proposition

The value proposition of a platform refers to the unique benefits and value that the platform offers to its users or participants. It is the reason why users choose to engage with the platform and what sets it apart from competitors (Ardolino et al., 2020). The value proposition articulates the value that users can expect to receive from using the platform and addresses their needs, challenges, or desires (Ondrus et al., 2015).

In the context of a teleconsultation platform, the value proposition revolves around the convenience, accessibility, and quality of healthcare services provided remotely. The platform offers benefits such as:

a) Convenience: Teleconsultation platforms allow patients to access healthcare services from the comfort of their own homes, eliminating the need for travel and reducing waiting times. This convenience is particularly valuable for individuals with mobility limitations, those in remote areas, or those seeking specialized medical expertise (Bakshi & Tandon, 2022; Mensah, 2022; Pappas & Seale, 2010).

b) Accessibility: Teleconsultation platforms can improve access to healthcare, especially for individuals in underserved or rural areas with limited access to healthcare facilities. It enables patients to connect with healthcare providers regardless of geographical barriers, increasing access to medical expertise and reducing healthcare disparities (Regragui et al., 2023).

c) Quality of Care: Teleconsultation platforms can provide access to a wide range of healthcare professionals, including specialists, without the need for referrals or long waiting times. This allows patients to receive timely medical advice, diagnosis, and treatment, potentially improving health outcomes (Jannati et al., 2021).

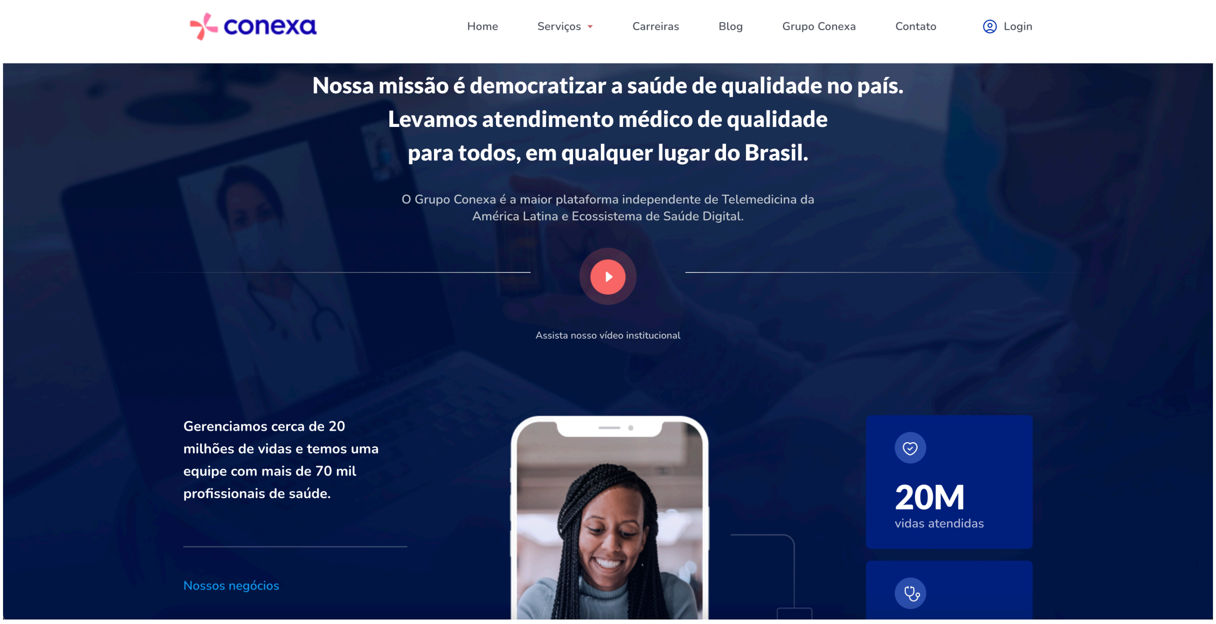
d) Continuity of Care: Teleconsultation platforms enable seamless continuity of care, allowing patients to consult with their regular healthcare providers remotely. This is particularly valuable for individuals with chronic conditions or those requiring ongoing medical supervision (Ouimet et al., 2020).

Defining the value proposition of a teleconsultation platform can present challenges. It requires a deep understanding of the needs and preferences of both healthcare providers and patients. The platform operator must identify the unique value that the platform offers and effectively communicate it to both sides of the platform. Balancing the interests and expectations of different stakeholders and ensuring that the value proposition remains relevant and compelling in a rapidly evolving healthcare landscape can be challenging.

Additionally, regulatory and legal considerations, such as data privacy and security, can impact the design and communication of the value proposition. Compliance with regulations while still delivering a compelling value proposition requires careful navigation and adherence to relevant guidelines (Bricarello & Poltronieri, 2021).

To illustrate this concept, the teleconsultation platform Conexa Saúde (Figure 29) was chosen to display the characteristics of its Value Proposition to the market.

Figure 29 - Conexa Saúde platform website



Source: company website

Conexa Saúde is a Brazilian teleconsultation platform that connects patients with doctors for video consultations. The company also offers a variety of other services, such as electronic prescriptions and medical records. It was founded in 2017 by a group of doctors who wanted to create a platform that would make it easier for patients to access healthcare, regardless of their location (*Conexa Saúde*, 2023).

The platform is used by both patients and doctors. Patients can use the platform to schedule video consultations with doctors, access their electronic medical records, and receive prescriptions. Doctors can use the platform to manage their appointments, view patient records, and send prescriptions.

Conexa Saúde's value proposition is to provide high-quality, accessible, and affordable healthcare to patients in Brazil. The company's teleconsultation platform makes it easy for patients to connect with doctors from anywhere in the country, without having to travel long distances or wait for appointments (*Conexa Saúde*, 2023).

The company also offers a variety of other services, such as electronic prescriptions and medical records, to make the healthcare experience more convenient and efficient for patients.

The following are some of the key benefits of Conexa Saúde's value proposition:

a) Convenience: Patients can access healthcare from anywhere in Brazil, without having to travel long distances or wait for appointments.
b) Accessibility: The company has a network of over 25,000 doctors who use the platform to provide telemedicine services. This means that patients can have access to a wide range of medical specialties and expertise.
c) Affordability: Its telemedicine services are typically more affordable than traditional healthcare services. This is because the company does not have the same overhead costs as traditional healthcare providers.
d) Quality: The doctors are highly qualified and experienced. The company also has a rigorous quality control process in place to ensure that patients receive the highest quality of care.

3.1.2.2. Platform Sides

The importance of platform sides lies in their interdependence and the value they bring to the platform ecosystem. The presence of multiple sides enables positive network effects, where the growth and participation of one side attract and benefit the other side, creating a virtuous cycle. For example, as more healthcare providers join the teleconsultation platform, it becomes more attractive for patients seeking medical advice, and vice versa (Ardolino et al., 2016; Rysman, 2009).

The interaction between platform sides is crucial for the success and sustainability of the platform. The platform operator must carefully manage and balance the needs and interests of both sides to create a thriving ecosystem. For instance, the platform needs to ensure an adequate supply of healthcare providers to meet patient demand, while also ensuring a sufficient patient base to attract and retain healthcare providers (Ardolino et al., 2020; Trabucchi & Buganza, 2021).

In a multisided platform, the interaction between sides can take various forms. For example, patients may search for and select healthcare providers based on their expertise, availability, or ratings. Healthcare providers, on the other hand, may use the platform to schedule and conduct teleconsultations with patients, leveraging the platform's communication and video conferencing capabilities (Martinelli & Bastianelli, 2022; Trabucchi & Buganza, 2021).

The platform operator plays a crucial role in facilitating and coordinating the interactions between platform sides. They establish the rules, policies, and technical infrastructure that enable seamless communication and transactions between healthcare providers and patients. The platform operator may also implement mechanisms to ensure quality control, trust, and safety for both sides.

Understanding the dynamics and needs of each platform side is essential for designing effective strategies and features that enhance the user experience and drive platform growth. By catering to the needs of both healthcare providers and patients, a teleconsultation platform can create a robust and sustainable ecosystem that delivers value to all participants (Bokolo, 2021; Martinelli & Bastianelli, 2022).

The following list presents a general overview of what a teleconsultation platform typically involves (Ardolino et al., 2020):

a) Platform Operator or Provider: This is the entity that creates, maintains, and operates the multi-sided platform. The platform operator's role is to facilitate interactions and transactions between the different sides. They set the rules, establish pricing, and maintain the technology infrastructure.

b) Users or Patients: These are individuals or entities who use the platform's services or products. They might be seeking a particular service, product, or information. In some cases, users might also contribute content or data to the platform.

c) Producers, Suppliers, Doctors etc.: These are individuals, businesses, or entities that provide the goods, services, or content offered on the platform. They might be selling products, offering services, or creating content to attract users.

d) Advertisers: Some multi-sided platforms include advertisers who pay to promote their products or services to users on the platform. These ads can be a source of revenue for the platform operator.

e) Developers: In technology platforms, developers might be considered a side that creates applications or extensions for the platform, adding to its functionality. They often do this to reach users or provide additional services.

f) Regulators or Government Agencies: In regulated industries, government agencies may play a role in overseeing and ensuring compliance with laws and regulations.

g) Data Providers: In platforms that rely on data, data providers supply valuable information or datasets to enhance the platform's value.

h) Payment Processors: For platforms that involve financial transactions, payment processors facilitate payments between users, producers, and the platform.

i) Community Managers or Moderators: Some platforms have community managers or moderators who help maintain a safe and welcoming environment, enforce rules, and manage interactions among users.

j) Collaborative Partners: These are external businesses or organizations that collaborate with the platform to provide additional services or features. Collaborative partners can enhance the platform's value proposition.

The exact number of sides and their roles can vary widely based on the specific platform and industry. Multi-sided platforms are known for their ability to connect multiple groups, each with its unique role, creating value through network effects.

An example is N2B Figure 30, a teleconsultation platform focused on a niche market. It specializes in nutrition, having tailored solutions to business and gyms.

Figure 30 - N2B Teleconsultation platform website

Source: company website

There are four sides to the platforms, the traditional one Patient and Nutritionist and also Company and Gym, that benefits from externalities from the first two sides.
According to Saude Business (2020) the tool is optimized to promote the benefits and preventive aspects of proper nutrition.

Originating from the insurance market, entrepreneurs Cesar Terrin and Luísa Cusnir decided to establish a company that would address a "real market pain." After delving into the root of the issue, they realized that many diseases could be prevented through proper nutrition. This led to the inception of n2b, a startup that connects nutrition professionals with individuals seeking to improve their dietary habits through technology (Saude Business, 2020).

The name n2b, which stands for "Nutrition to Business," has been in the market since May 2016 and has served over 400,000 people, creating new B2B opportunities for its partners. With an impressive client portfolio, including companies like Smartfit, Tecfit, VR Benefícios, Siemens, among others, the startup's aim is to deliver structured, personalized, and engaging nutrition to its consumers (*N2B*, 2023).

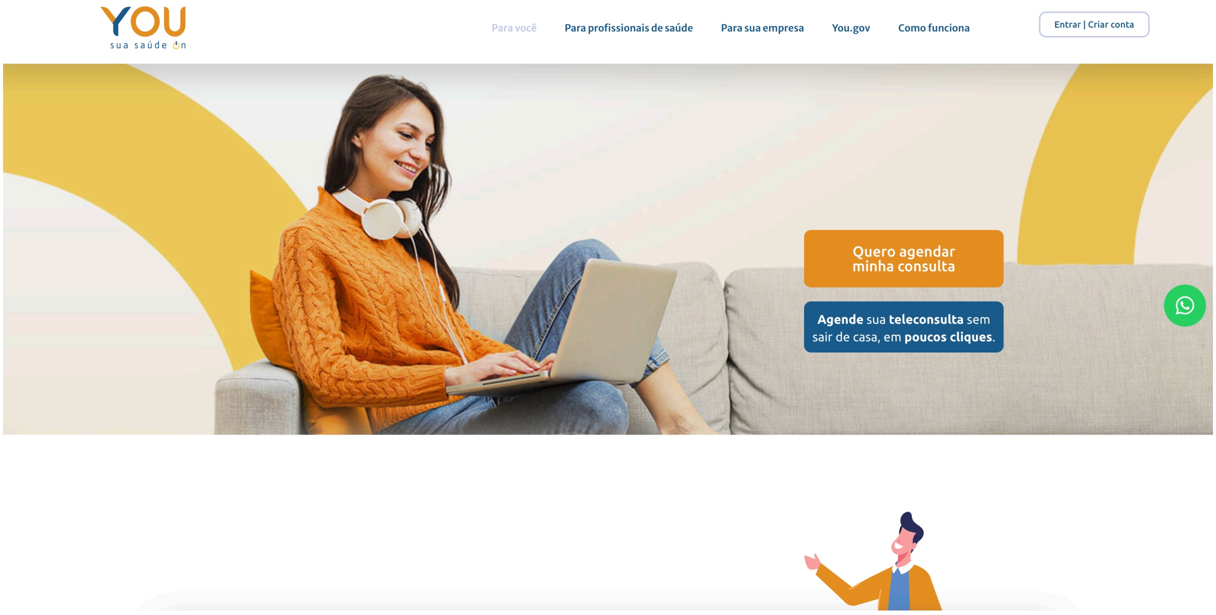
In early 2020, the company's founders saw an opportunity to expedite their roadmap and introduced an additional service through teleconsultation. "Until then, the n2b team conducted on-site consultations, primarily focused on B2B, aimed at performing bioimpedance measurements and tracking body progress. However, with the coronavirus pandemic, the CFN (Federal Council of Nutritionists) authorized teleconsultations.

Combining technology with human interaction, the platform offers not only consultations but also a meal assessment diary, an expert chat feature, personalized menus, and a product scanner. The tool incorporates a reader for the nutritional information of processed foods, allowing the nutritionists to evaluate the recommended products. "This was our way of assisting people during this period of physical distancing," emphasizes the startup's CEO.

Another platform that has diversity in its sides is You Teleconsulta. It presents as specializing in the Health 4.0 system, providing a safe and efficient environment through online consultations, ensuring a 100% satisfactory experience (*You Teleconsulta*, 2023).

With the platform's support system, it is possible to request physical exams, access the patient's medical record, and prescribe remote prescriptions and certificates, which makes the healthcare professional's approach more accurate, improving the precision of diagnosis and therapy (Figure 31).

Figure 31 - You Teleconsulta Platform Website

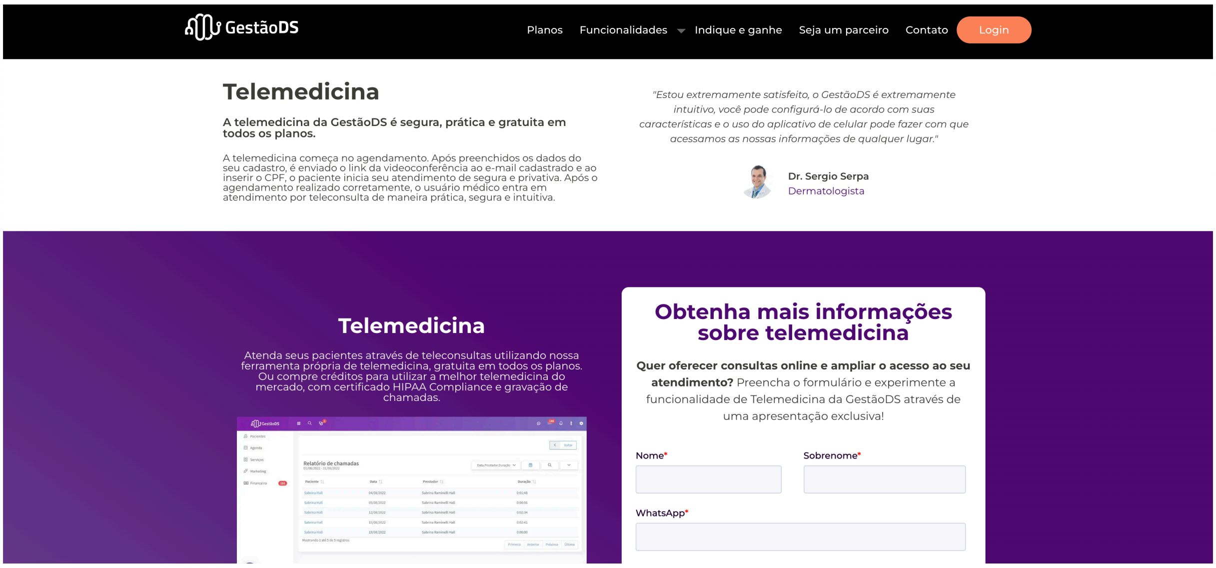


Source: company website

The sides present on this platform are the patient at one side and a range of healthcare specialties, each having its own price point and conditions to be used. They offer Psychologist, Psychiatrist, General Practitioner, Nurse and Nutritionist as well (Serra, 2022).

Another company, Gestão DS, enables the sides to benefit from indicating other parties do the platform (Figure 32). The platform has been experiencing exponential growth in the last three years with solutions that assist the medical profession in the challenge of retaining patients, increasing efficiency, and growing their practices. Since its establishment in 2015, the company has averaged a 95% annual growth rate and has increased its revenue tenfold (Yoshida, 2022).

Figure 32 - GestãoDS platform website



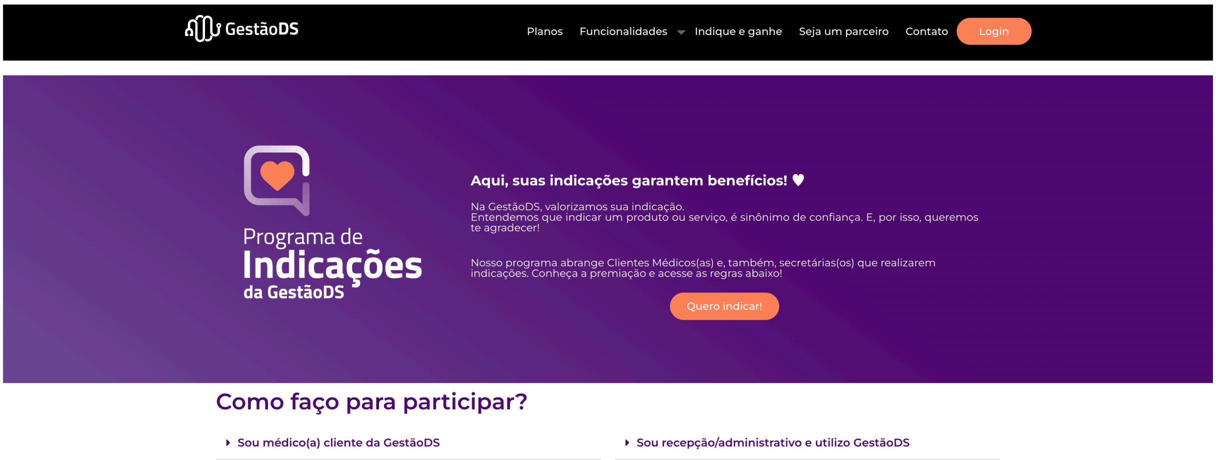
Source: company website

With offices in Santa Maria and Porto Alegre and a presence throughout Brazil, the startup originated in the Pulsar incubator at the Federal University of Santa Maria (UFSM), founded by friends André Baptista, Felipe Ravanello, and Marcelo Limana, with the subsequent addition of plastic surgeon David Sena (Yoshida, 2022). Today, GestãoDS serves over 50 medical specialties, ranging from plastic surgery clinics to dermatologist offices, gynecologists, obstetricians, and ophthalmologists, with a focus on the customer journey and intelligent medical office management.

With over 6 million registered patients and more than 16 million appointments conducted, the company, which was selected for the Scale-Up Endeavor program last year, an acceleration program for the fastest-growing companies in Brazil, emphasizes user-friendly interactions between medical offices and patients.

The company also offers bonuses for indications to the platform, as part of its fidelity program (Figure 33).

Figure 33 - GestãoDS fidelity program



Source: company website

The specific roles and the number of sides involved in a teleconsultation platform will depend on the nature and purpose of the platform and the niche industry it operates in. It is an extension of the Value Proposition since it's closely related to the public each platform will cater to.

3.1.2.3. Platform Revenue Model

Platform Revenue Model in the context of a teleconsultation platform refers to the strategies and mechanisms employed by the platform operator to generate revenue from the services provided on the platform (Andersson Schwarz, 2017; Ardolino et al., 2020; Voigt & Hinz, 2015).

The revenue model concerns how economic flows are defined in the platform. It involves the choice on how the charges are made.

One option is to charge affiliation fees. These fees are paid by the users to the platform manager, to join the platform. They can be paid one time, to be a part of the ecosystem or monthly, like a subscription. Affiliation fees give you the right to choose a service and use the platform. The use of the service is most likely to be paid by use (Ardolino et al., 2020; Ondrus et al., 2015).

Another aspect is the interaction fees. Interaction fees are paid by the users to the platform manager whenever an interaction is carried out by the platform users. If a teleconsultation is being made, an interaction fee can be requested. Some platforms charge a interaction fee to update a prescription (Morsch, 2023).

How the financial flows between sides works in the platform is a key aspect of both the Revenue Model and Platform Control. A financial flow between sides may be present between users of two different sides and it is generally related to a transaction payment for the exchange of a product or a service. Having control if the payment is made directly to the person delivering the service or if the platform works as a payment processor and/or escrow is a decision that impacts the overall structure of the business.

Other aspects like the payment of referral fees to the users. Referral fees represent economic flows that are given to a specific user of a side as a reward for its specific actions, like a patient recommending the platform for another patient using his "code". Or a doctor inviting a fellow physician to be a part of the platform.

The combination of the aspects of the revenue model dictates how the platform does its business. To better visualize those arrangements, the following list was compiled:

a) Subscription-based model: The platform charges a recurring fee from healthcare providers or patients for accessing and using the teleconsultation services. This model can offer different subscription tiers with varying levels of features and benefits.

b) Transaction-based model: The platform charges a fee or commission for each teleconsultation session conducted through the platform. The fee can be a percentage of the consultation fee or a fixed amount per session.

c) Advertising-based model: The platform generates revenue by displaying targeted advertisements to users during their interactions with the platform. Advertisers pay the platform for the opportunity to reach the platform's user base.

d) Commission-based model: The platform takes a percentage of the payment made by patients to healthcare providers for teleconsultation services facilitated through the platform. This model is commonly used in platforms that connect patients with healthcare professionals.

e) Value-added services model: The platform offers additional services or features that users can opt for at an additional cost. These services can include premium support, access to specialized healthcare professionals, or extended consultation time.

f) Data monetization model: The platform collects and analyzes user data to generate insights and valuable information. The platform can then sell this data to third parties, such as researchers, pharmaceutical companies, or healthcare organizations, for research or marketing purposes.

g) Partnership and collaboration model: The platform forms partnerships or collaborations with healthcare institutions, insurance providers, or other stakeholders in the healthcare ecosystem. These partnerships can involve revenue-sharing agreements or referral fees for patient referrals.

It is important for teleconsultation platforms to carefully consider their revenue models to ensure sustainability and profitability while providing value to users. The choice of revenue model can depend on factors such as the target market, competition, regulatory environment, and the platform's unique value proposition.

The revenue model of a platform is of significant importance as it determines how the platform generates revenue and sustains its operations. The revenue model directly impacts the platform's profitability, growth potential, and ability to attract investors. However, implementing and optimizing a revenue model can present various challenges.

One challenge is selecting the most suitable revenue model for the platform. Different revenue models, such as subscription-based, transaction-based, or advertising-based, have their own advantages and limitations. The platform operator needs to carefully analyze the target market, user preferences, and competitive landscape to determine the revenue model that aligns with the platform's value proposition and user needs (Ardolino et al., 2020; Voigt & Hinz, 2015).

Another challenge is ensuring the scalability and sustainability of the revenue model. As the platform grows and attracts more users, the revenue model should be able to accommodate increased demand and generate sufficient revenue to cover operational costs and investments.

Scaling the revenue model may require adjustments, such as introducing tiered pricing, expanding into new markets, or diversifying revenue streams (Kim & Yoo, 2019; Olsen et al., 2021).

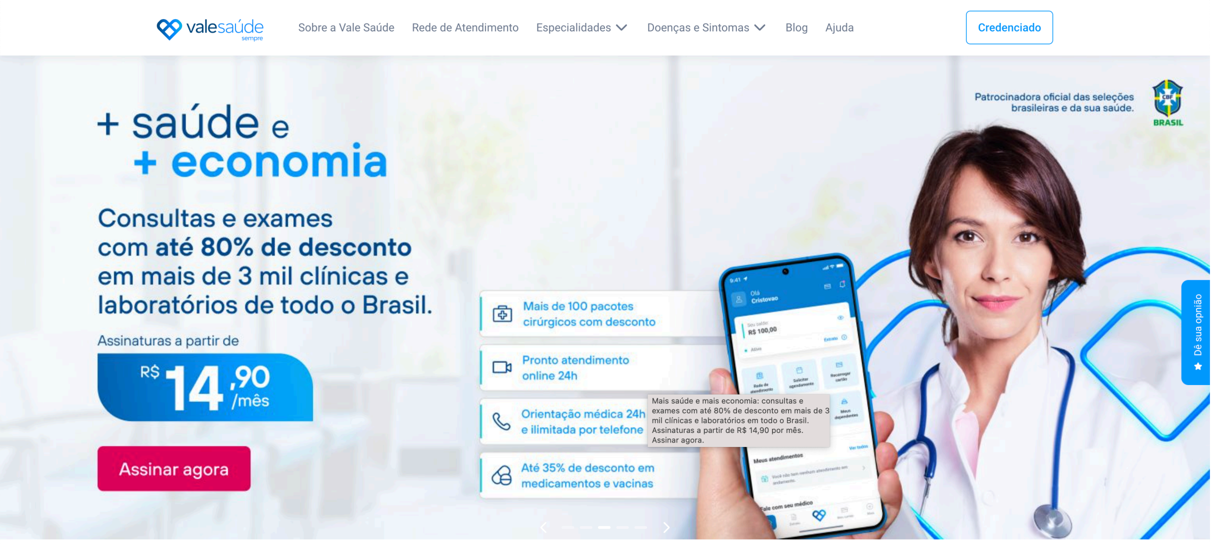
Maintaining a balance between generating revenue and providing value to users is another challenge. Platforms need to strike a balance between monetization efforts and user experience. Overemphasis on revenue generation at the expense of user satisfaction can lead to user churn and negative reputation. Therefore, platforms must continuously assess and refine their revenue model to ensure it aligns with user expectations and provides a compelling value proposition (Baker & Stanley, 2018; Cook & Bakker, 2019).

Regulatory and legal considerations can also pose challenges to the revenue model of a platform. Compliance with data privacy regulations, intellectual property rights, and consumer protection laws can impact revenue generation strategies. Platforms need to navigate these legal complexities and ensure their revenue model adheres to relevant regulations (Codagnone & Martens, 2016; Martens, 2016; Xie & Huang, 2021).

Furthermore, platforms may face challenges related to competition and market dynamics. As the platform ecosystem evolves, new entrants and disruptive technologies can impact the viability of existing revenue models. Platforms need to stay agile and adapt their revenue models to remain competitive and capture value in a rapidly changing market (Andersson Schwarz, 2017).

The company Vale Saúde (*Vale Saúde*, 2023), opted for a two-tier subscription type of service, having very low-priced options (Figure 34).

Figure 34 - ValeSaúde platform website



Source: platform website

Vale Saúde was founded in 2011 by Eduardo Brigagão, an executive with extensive experience in the financial market and previous roles at banks and credit card companies, including Credicard, of which he was president.

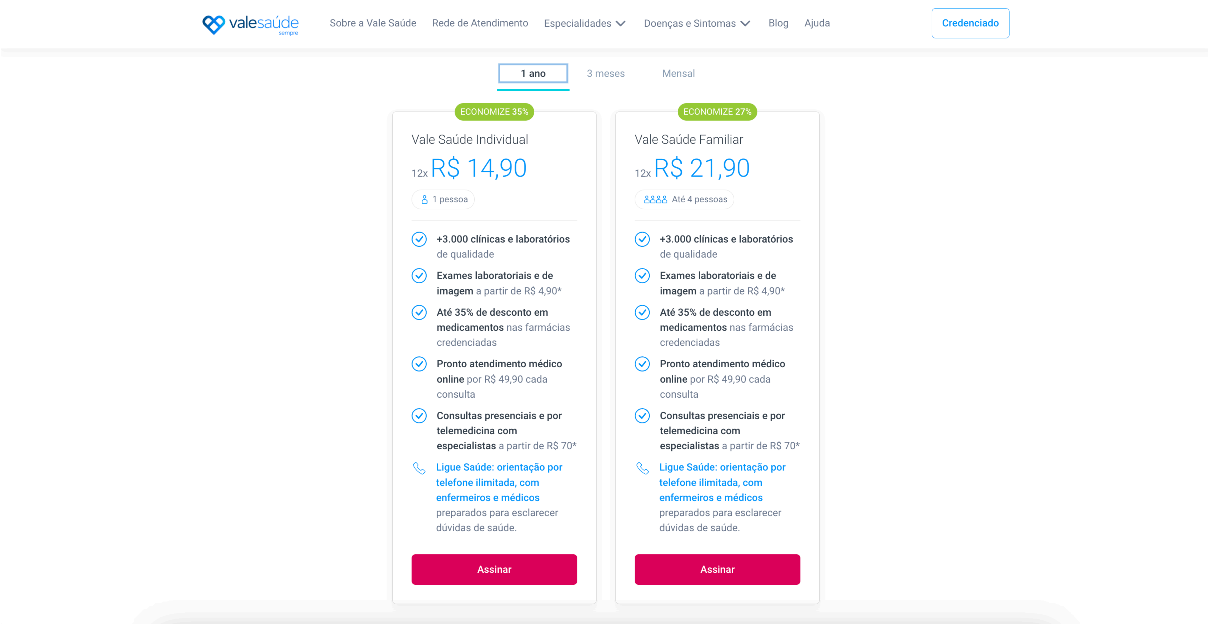
The company was created with the goal of providing an affordable healthcare plan for people who do not have access to a traditional plan. Vale Saúde's plan is a prepaid plan, allowing users to have teleconsultations, tests, and medical procedures by paying a fixed monthly fee.

Vale Saúde began its operations in 2012, with a network of accredited clinics and laboratories in São Paulo. The company quickly expanded its operations to other cities in Brazil and now has a network of over 10,000 accredited providers across the country.

In 2022, Vale Saúde was acquired by Vivo, one of the largest telecommunications companies in Brazil. Vivo's acquisition of Vale Saúde is part of the company's strategy to expand its presence in the healthcare market.

The current offerings cover an Individual and a Family plan (Figure 35). They have the same benefits and only differ on the amount of people cover between them. It is charged monthly and can be billed monthly, every three months and yearly. The longer the plan, the larger the discount offered.

Figure 35 - ValeSaúde Platform Revenue Model

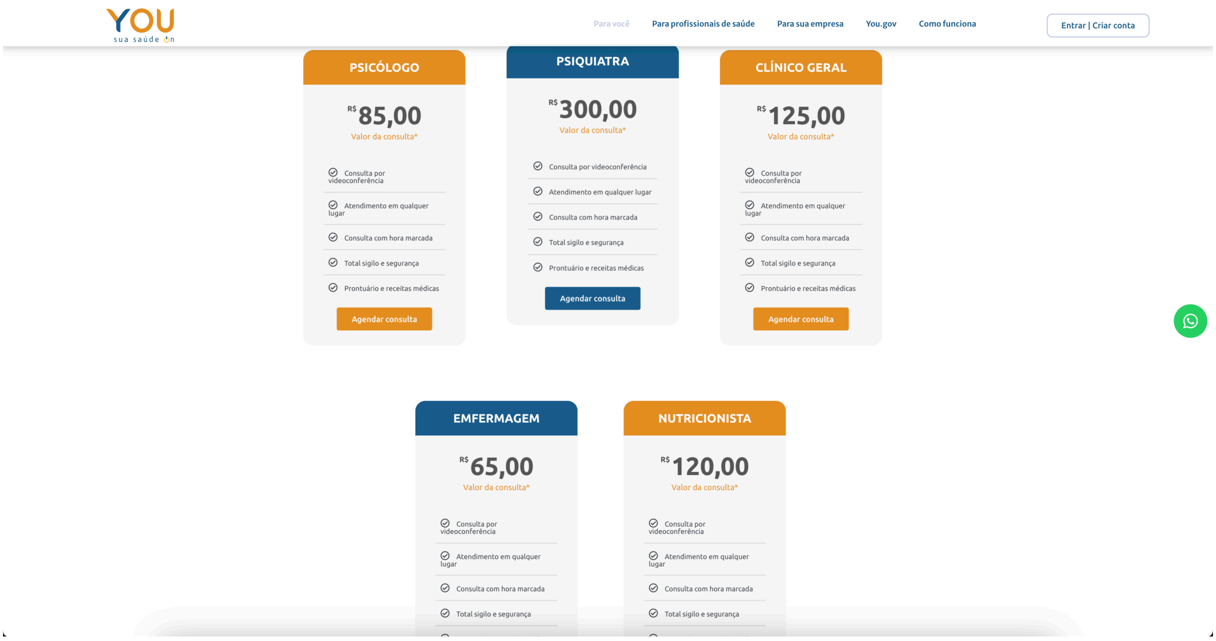


Source: platform website

Vale Saúde is a service offered to the same customers having the possibility to be billed in the montly phone and data bill.

The platform mentioned on the Platform Sides, You Teleconsulta, is also a valid example for options in the revenue model as shown on Figure 36, displaying the cost of a single teleconsultation. When analyzed further, a remark was found indicating that the actual price may vary according to the professional who will perform the teleconsult.

Figure 36 - You Teleconsulta payment plans



Source: company website

A new platform available on Brazilian Market is the startup Dandelin (Figure 37) has a different arrangement of revenue model. The app allows for elective consultations at monthly fees not exceeding R$ 100 is being adopted as an alternative for those who have lost their health insurance due to the economic crisis or are waiting for months in line for medical care in the public health system (SUS) (Burratini, 2023).

Figure 37 - Dandelin platform website

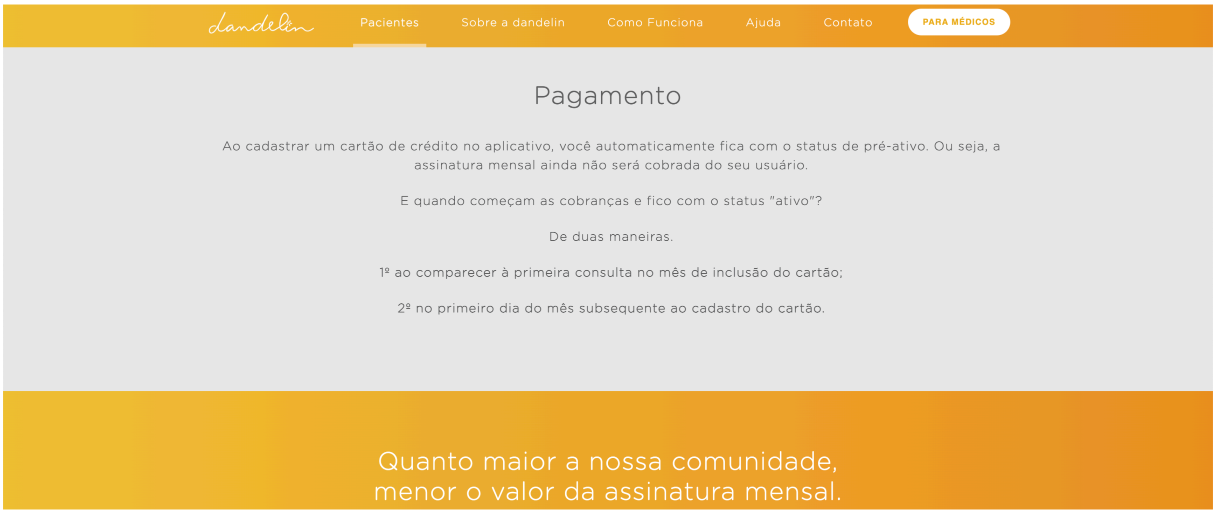
Source: company website

The user starts participating in the cost-sharing after scheduling their appointment and providing a valid payment method. The billing is done at the end of each month. No specialist is authorized to collect any amount from the patient.

The Dandelin platform uses shared economy principles (Figure 38), enabling patients to pay less while providing better compensation to doctors. The monthly fee is based on actual usage, considering the number of consultations multiplied by the consultation fee divided among the community members. Currently, there are 3,000 registered patient-type users.

Burratini (2023) states that through the platform, doctors can receive up to 50% more per consultation than what health insurance companies pay.

Figure 38 - Dandelin platform payment information



Source: company website

The revenue model of a platform is crucial for its sustainability and success. However, implementing and optimizing a revenue model can present challenges related to model selection, scalability, user value, regulatory compliance, and market dynamics. Platforms must carefully navigate these challenges to develop a revenue model that supports their growth and profitability while providing value to users.

3.1.2.4. Platform Control

Platform control in the context of teleconsultation platforms refers to the management and regulation of these platforms to ensure their effective and secure operation. It involves establishing legislation, privacy policies, feedback from all sides, terms of use, and technological requirements for teleconsultation platforms (Villarreal-Zegarra et al., 2022; J. Zhang et al., 2023). The control of these platforms is crucial for their successful implementation and adoption, especially in emergency situations such as the COVID-19 pandemic. However, the adoption of telemedicine and eHealth platforms in emergency situations is still limited worldwide (Anthony Jnr, 2021).

The use of teleconsultation has increased significantly during this time, with studies reporting an 80% increase in teleconsultations in 2020 (Alhajri et al., 2021). Governments have also played a role in facilitating teleconsultations by providing telemedicine platforms and offering free teleconsultations (Mélo et al., 2021).

Some of the key features in Platform Control are:

a) User verification and authentication: The platform may require users to verify their identities and credentials before accessing or providing teleconsultation services. This helps ensure that only qualified healthcare professionals and authorized patients can participate in consultations (Layfield et al., 2020).

b) Privacy and data security measures: The platform should implement robust security measures to protect the privacy and confidentiality of patient information. This may include encryption of data, secure storage, and adherence to relevant data protection regulations (Smith et al., 2020).

c) Quality assurance and standards: The platform operator may establish guidelines and standards for teleconsultation practices to ensure the delivery of high-quality healthcare services. This can include guidelines for conducting virtual consultations, maintaining professional ethics, and providing appropriate documentation (Ouimet et al., 2020).

d) Monitoring and moderation: The platform may employ monitoring mechanisms to detect and prevent fraudulent or inappropriate activities. This can involve automated systems or human moderators who review consultations and user interactions to ensure compliance with platform policies (Mohammed et al., 2021).

e) Feedback and rating systems: The platform may incorporate feedback and rating mechanisms to allow patients to provide reviews and ratings for healthcare providers. This helps maintain accountability and transparency, enabling patients to make informed decisions when choosing a healthcare professional (Ardolino et al., 2020; Xing et al., 2020).

f) Technical support and troubleshooting: The platform should provide technical support to users, ensuring that they can access and use the platform effectively. This can include assistance with video conferencing tools, troubleshooting connectivity issues, and providing user guides (Ardolino et al., 2020; Regragui et al., 2023).

g) Governance and dispute resolution: The platform operator may establish mechanisms for resolving disputes between users or addressing any issues that arise during teleconsultations. This can involve establishing clear procedures for reporting complaints and resolving conflicts (Ardolino et al., 2020; Bricarello & Poltronieri, 2021).

One example of a government run teleconsultation platform is eSaudeSp, from São Paulo Government (Figure 39).

Figure 39 - eSaudeSP Platform Website

Source: company website

eSaúdeSP is a teleconsultation platform offered by the Municipal Health Secretariat of São Paulo, Brazil. The platform allows patients to schedule video consultations with doctors, access their electronic medical records, and receive prescriptions. eSaúdeSP is a free service for all residents of São Paulo.

To use eSaúdeSP, patients must create an account on the platform’s website. Once they have created an account, patients can schedule video consultations with doctors from a variety of specialties, including general medicine, pediatrics, gynecology, and urology. Patients can also access their electronic medical records on eSaúdeSP, and they can receive prescriptions from doctors through the platform.

Some of the key features of eSaúdeSP are:

a) Video consultations: Patients can schedule video consultations with doctors from a variety of specialties.
b) Electronic medical records: Patients can access their electronic medical records on eSaúdeSP.
c) Prescriptions: Patients can receive prescriptions from doctors through eSaúdeSP.
d) Convenience: Patients can see a doctor without having to leave their homes.
e) Accessibility: eSaúdeSP is free for all residents of São Paulo.

The eSaúdeSP platform has a high degree of platform control (*Plataforma da Saúde Paulistana*, 2023), for example, the eSaúdeSP platform sets the rules for how doctors and patients can interact with each other on the platform. The platform also controls the flow of information by determining which doctors and patients can access certain features of the platform.

This high degree of platform control allows the eSaúdeSP platform to ensure that its services are delivered in a consistent and high-quality manner. It also allows the platform to protect the privacy and security of its users.

Here are some specific examples of how eSaúdeSP uses its platform control:

a) The platform requires all doctors to be licensed and certified by the Brazilian Medical Council.
b) The platform sets standards for the quality of care that doctors must provide.
c) The platform monitors patient satisfaction and takes action against doctors who receive negative feedback.
d) The platform encrypts all patient data to protect its privacy and security.

This allows the platform to ensure that its services are delivered in a consistent and high-quality manner, and to protect the privacy and security of its users.

In addition to the above, eSaúdeSP' is integrated with the Brazilian public healthcare system, which gives it access to a large pool of patients and the platform is supported by the São Paulo municipal government, which gives it financial and political resources.

Another example of Platform Control in action can be seen on Figure 40, on platform Morsch Telemedicina. Telemedicine Morsch was founded in 2001 as Clínica Morsch providing cardiology services for the entire Alto Uruguai Gaúcho region with a variety of graphical exams (Morsch, 2023).

The telemedicine services began in 2005 to assist in the healthcare of neighboring municipalities. With rapid growth, it was recommended to other locations and needed to expand.

As it evolved, we became a complete Telemedicine Platform, integrating tools such as:

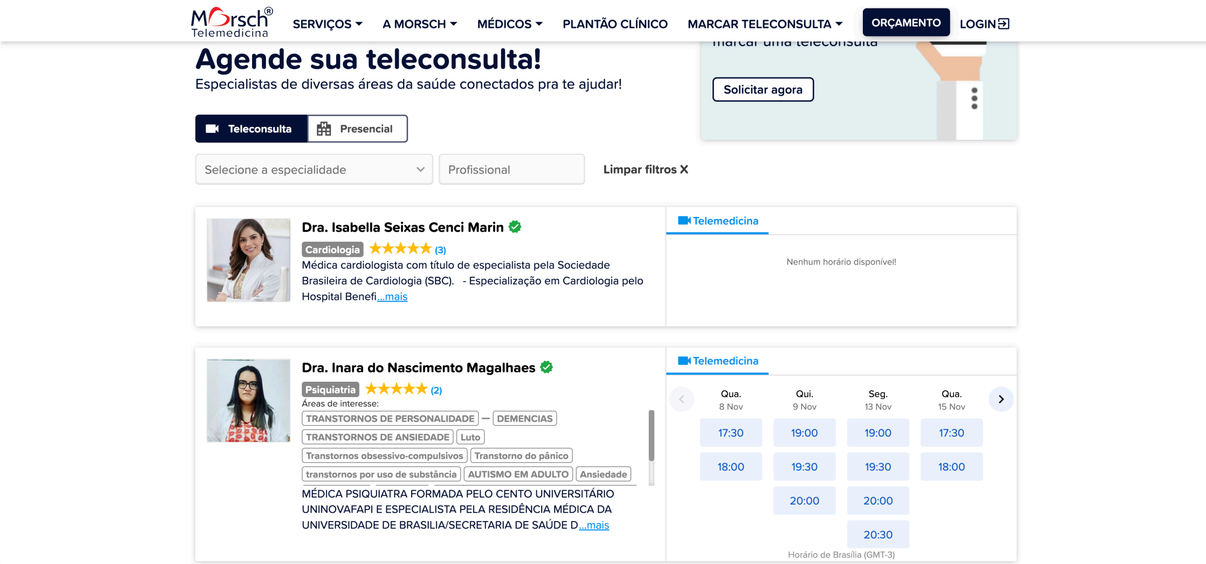
a) Telediagnosis and remote reporting.
b) Cloud-based electronic patient records (EHR).
c) Teleconsultation with telemonitoring.

Figure 40 - Morsch Telemedicina platform website

Source: company website

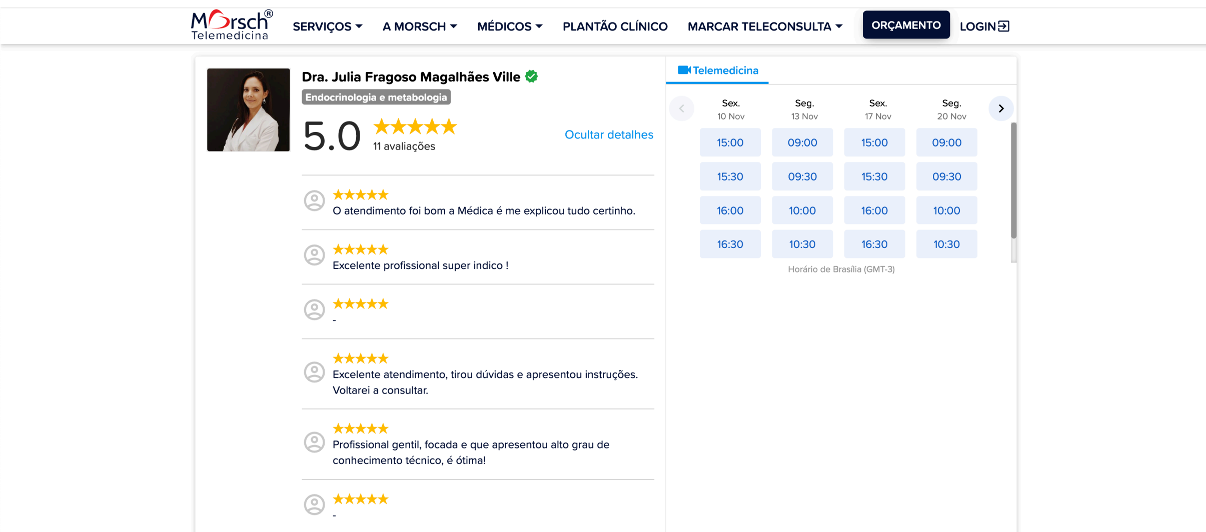
The platform currently has implemented a rating system that enables a patient to give a score to each teleconsultation session so it can become visible to other patients. The system is "star based" and has 1 to 5 stars available to rate, 5 being the highest (Figure 41). The patients can also give written feedback after each session (Figure 42). The feedback is also exhibited when booking a session.

Figure 41 - Morsch Telemedicina platform rating system



Source: company website

Figure 42 - Morsch Telemedicina platform written feedbacks



Source: company website

Alongside the mean score for each doctor, the number of evaluations is also shown. The patients whose evaluation is presented is kept anonymous, not exposing in case of a bad feedback (Morsch, 2023).

Thus platform control in the context of a teleconsultation platform refers to the mechanisms and strategies employed by the platform operator to govern and regulate the interactions and activities taking place on the platform. It involves establishing rules, policies, and technical features that shape the behavior of users and ensure the smooth functioning of the platform (Ardolino et al., 2020; X. Zhang et al., 2021).

3.1.2.5. Platform Architecture

Platform architecture refers to the internal structure and organization of components and interfaces within a platform (Voss & Hsuan, 2009). It defines how different elements of the platform are designed and connected to enable the platform's functionality and capabilities. The architecture of a platform plays a crucial role in determining its flexibility, scalability, and ability to support various services and applications.

For example, in the context of digital platforms, such as e-commerce platforms like Amazon or ride-sharing platforms like Uber, the platform architecture encompasses the underlying technology infrastructure, databases, APIs (Application Programming Interfaces), and user interfaces that enable the platform's operations. It includes the design and arrangement of these components to facilitate seamless interactions between users, service providers, and the platform itself.

The platform architecture also influences the platform's ability to support customization and innovation. A modular platform architecture, for instance, allows for the integration of third-party applications and services, enabling complementors to contribute to the platform's functionality and expand its offerings (van der Geest & van Angeren, 2023). This architectural approach promotes generativity, where the platform becomes a foundation for the development of new services and applications by external contributors.

Ardolino et al. (2020) further conceptualize platform architecture as it refers to the infrastructural organization of a digital platform, including its technological aspects and interfaces with users. It encompasses the design and structure of the platform that enables interactions and transactions among different groups of users. Some of the characteristics considered are for platform architecture are:

a) User Registration: This characteristic determines whether users need to register to access or interact with the platform. Some platforms require mandatory registration, while others allow users to access without registration.

b) Boundaries between Sides: This characteristic refers to the distinction or lack thereof between different sides or groups of users on the platform. In some platforms, there may be separate access channels for each side, while in others, there may be a single channel for all users.

c) Versioning and Update: This characteristic examines how platform updates are arranged and how versioning is organized. It looks at how the platform manager handles updates and whether there are different versions of the platform.

d) Platform Access: This characteristic explores the different ways users can access and interact with other users on the platform. It considers the various access methods available to users.

e) Openness: This characteristic relates to the level of openness of the platform. It examines whether users have the freedom to access and modify the platform's source code and data, enabling co-innovation.

To illustrate this concept, the teleconsultation platform ProDoctor (Figure 43) was chosen given the importance it gives to Platform Architecture.

Figure 43 - ProDoctor platform website

Source: company website

ProDoctor Telemedicine was founded in 2011 by Jomar Nascimento. Nascimento was inspired to start the company after seeing the lack of access to healthcare in rural and underserved areas of Brazil. He believed that telemedicine could be a way to bridge this gap and provide everyone with access to quality healthcare, regardless of their location.

Nascimento began developing the ProDoctor Telemedicine platform in 2011, and the platform was launched in 2012. The platform was initially used by a small number of doctors and patients, but it quickly gained popularity. Today, ProDoctor Telemedicine is one of the leading telemedicine providers in Brazil, with millions of patients and thousands of doctors using the platform.

ProDoctor Telemedicine has played a significant role in improving access to healthcare in Brazil. The company's platform has made it possible for patients in rural and underserved areas to access quality healthcare, without having to travel long distances. ProDoctor Telemedicine has also helped to reduce the burden on doctors, by making it easier for them to provide care to patients in remote areas.

Considering the relevance of the platforms, some of the key figures (Andrade, 2022):

a) In 2023, ProDoctor Telemedicine conducted over 10 million telemedicine consultations.
b) ProDoctor Telemedicine's platform is used by over 30,000 doctors in Brazil.
c) ProDoctor Telemedicine is available in over 90% of Brazilian municipalities.
d) ProDoctor Telemedicine has been used to provide healthcare to patients in over 5,000 rural communities in Brazil.

ProDoctor Telemedicine is committed to making healthcare accessible to everyone, regardless of their location or socioeconomic status. The company's telemedicine platform provides patients with convenient access to quality healthcare, while also helping doctors to provide more efficient and effective care.

Figure 44 - ProDoctor AWS Case

Source: company website

Recently the company has published its success case with Amazon Web Services (Figure 44) regarding its Platform Architecture (Andrade, 2022).

The case discusses how a small business customer was able to pivot to telemedicine in 90 days using AWS services. The blog post focuses on the security and architecture aspects of the ProDoctor telemedicine platform.

On the security side, ProDoctor, used a variety of AWS services to secure their telemedicine platform, including (Santos & Nascimento, 2022):

- AWS Identity and Access Management (IAM): IAM was used to manage user permissions and access to the platform.
- AWS Key Management Service (KMS): KMS was used to encrypt sensitive data, such as patient records and telemedicine consultations.
- AWS CloudTrail: CloudTrail was used to audit all activity on the platform.
- AWS GuardDuty: GuardDuty was used to monitor for malicious activity on the platform.

On the architecture front, ProDoctor used the following AWS services to build their telemedicine platform (Santos & Nascimento, 2022):

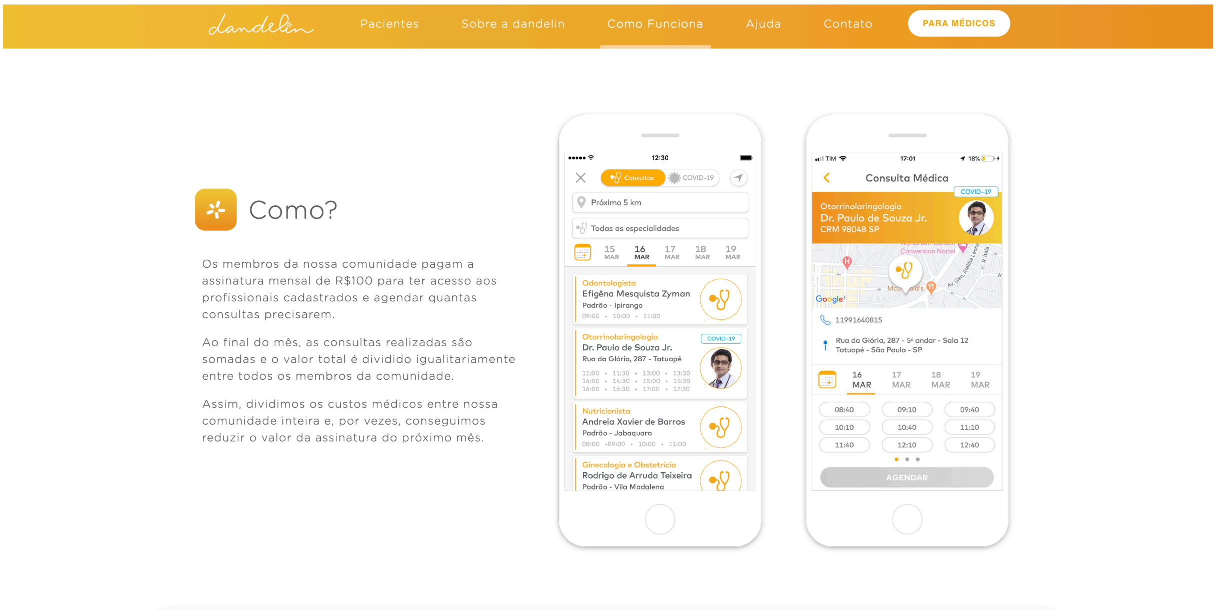
- Amazon Elastic Compute Cloud (EC2): EC2 was used to host the platform's web servers and application servers.
- Amazon Relational Database Service (RDS): RDS was used to store the platform's patient records and other data.
- Amazon Simple Storage Service (S3): S3 was used to store the platform's telemedicine consultations and other files.
- Amazon Elastic Load Balancing (ELB): ELB was used to distribute traffic across the platform's web servers.
- Amazon CloudFront: CloudFront was used to deliver the platform's content to users with low latency and high availability.

ProDoctor also used several other AWS services to enhance the functionality and security of their telemedicine platform. For example, the customer used Amazon Simple Notification Service (SNS) to send notifications to users about their appointments and test results. The customer also used Amazon Cognito to manage user authentication and authorization.

By using AWS services, ProDoctor was able to build a secure and reliable telemedicine platform in just 90 days. The company was also able to scale their platform to meet the needs of their growing user base, showing the importance and relevance of Platform Architecture to the company.

The startup teleconsultation platform Dandelin choose a different route for its architecture. The platform is only accessible by mobile apps, both available in Apple and Google app stores (Figure 45).

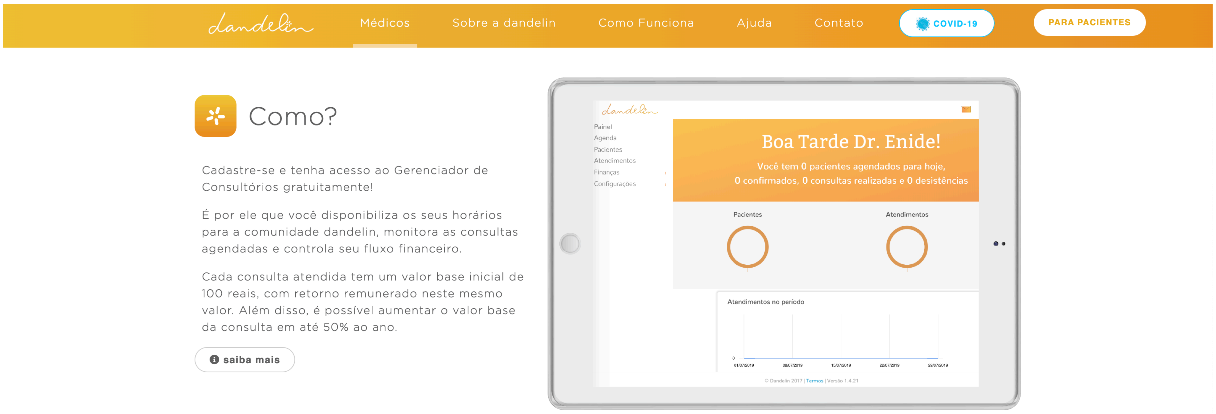
Figure 45 - Dandelion platform patient mobile app



Source: company website

For the patient facing app, only mobile phones are available. The full selection of platform functionalities can be accessed by the interface. On the other side of the platform, the 60 specialties of doctors enrolled on the platform can only access it using an iPad or similar tablet (Figure 46).

Figure 46 - Dandelin platform doctor app



Source: company website

Having the apps available on the main app stores ensures a broader reach for its userbase. The ability to automatically updates the platform app without user interaction is a bonus bringing more security and privacy for its users.

In summary, platform architecture refers to the internal structure and organization of components and interfaces within a platform. It determines the platform's functionality, scalability, and ability to support various services.

3.2. Healthcare Barriers

Healthcare barriers refer to obstacles or challenges that hinder individuals from accessing or receiving adequate healthcare services. These barriers can be categorized into various factors, including financial, geographical, cultural, and organizational barriers.

Financial barriers are often a significant challenge for individuals seeking healthcare. Lack of insurance coverage or high out-of-pocket costs can prevent people from accessing necessary medical care (Allen et al., 2017). In low- and middle-income countries, the competitive dynamics between private and public healthcare systems can lead to resource disparities, with public sector facilities being stripped of resources given to the private sector as subsidies (Basu et al., 2012).

Geographical barriers can limit access to healthcare services, particularly in rural or remote areas. Limited availability of healthcare facilities and long travel distances can make it difficult for individuals to access care (Brighton et al., 2013). Inadequate transportation infrastructure and lack of public transportation options further exacerbate this barrier (Bush et al., 2017).

Cultural and language barriers can also impede healthcare access. Language barriers can hinder effective communication between healthcare providers and patients, leading to misunderstandings and inadequate care (Brennan et al., 2022). Cultural beliefs and practices may influence individuals' perceptions of healthcare and their willingness to seek medical attention (Brighton et al., 2013).

Organizational barriers within healthcare systems can create challenges for patients. These barriers include long wait times for appointments or procedures, limited availability of healthcare providers, and complex referral processes (Devictor et al., 2023). In addition, deprioritization of medical care and judgment by clinicians can discourage individuals from seeking healthcare (Troberg et al., 2022).

Furthermore, the COVID-19 pandemic has highlighted additional barriers to healthcare access. These include disruptions in healthcare services, fear of infection, and overwhelmed healthcare systems (Bharsakade et al., 2021).

Perceived risk is a significant barrier to the adoption of telemedicine in healthcare. Healthcare professionals have expressed concerns about the implementation and management of telemedicine, particularly during the COVID-19 pandemic (Jiménez-Rodríguez et al., 2020).

Uncertainty about insurance coverage and reimbursement policies has historically been a major barrier to adoption, especially among physicians in private practice. Technological issues, such as a lack of technical skills among staff, have also been identified as barriers to telemedicine adoption (Dubin et al., 2020). Inadequate internet connectivity and unstable electricity supply have been reported as major barriers to user adoption of telemedicine in certain regions, such as Sub-Saharan Africa.

Additionally, healthcare professionals and medical students have highlighted barriers such as lacking financial incentives and resources, interoperability challenges, and concerns about confidentiality and privacy regulations. Lack of organizational effectiveness, health staff motivation, patient satisfaction, and trustworthiness have been identified as barriers to telemedicine adoption in rural Bangladesh (Zobair et al., 2019). Socioeconomic status can also influence the perceived risks of telemedicine services, which may impact adoption rates.

Addressing healthcare barriers requires a multifaceted approach. Strategies may include improving insurance coverage and reducing out-of-pocket costs, increasing the availability of healthcare facilities in underserved areas, providing language interpretation services, and promoting cultural competency among healthcare providers. Additionally, implementing telehealth and eHealth solutions can help overcome geographical barriers and improve access to care.

After exploring the results on the Bibliographic Review, the following paper was considered for the literature review dure to its fit to the needs of this research. The paper "Understanding barriers of telemedicine adoption: A study in North India" by researchers Sonika Bakshi and Urvashi Tandom from Chitkara University, Patiala, Punjab, India.

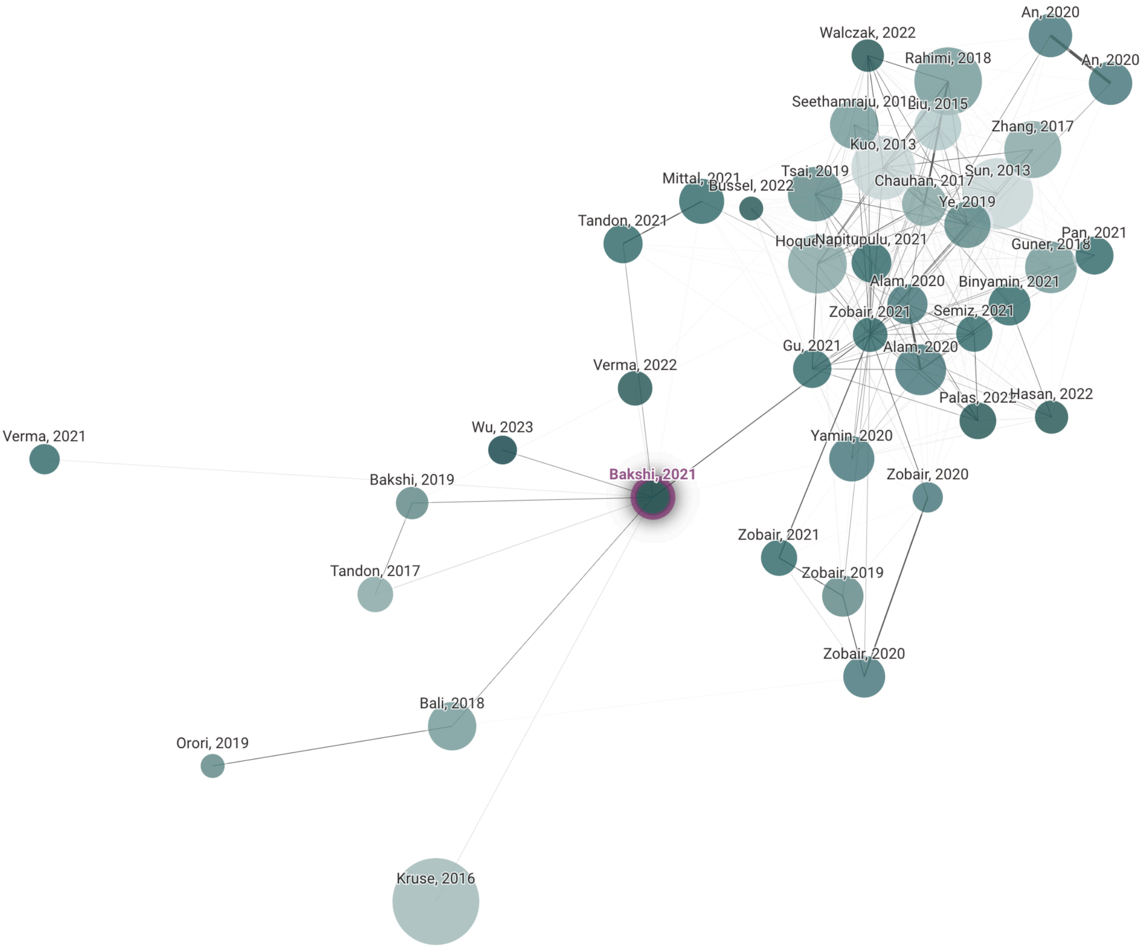
This study develops a theoretical framework that highlights facets of perceived risk and their relationship with behavioral intention. It states that the higher the risk perceived by doctors, the more prospects that they will not adopt telemedicine. Therefore, addressing these risks will help overcome apprehensions about telemedicine (Bakshi & Tandon, 2022). The data were collected through field as well as an online survey.

The perceived risks identified in the study were Financial Risk, Time Risk, Social Risk, Technology Risk and Security and Privacy Risk. They all focus on the behavioral intention to use the teleconsultation solution.

The article also provided the validated scales used on the PLS-SEM model presented and they were later incorporated in the model proposed in this research.

The article was submitted to the Connected Papers tool resulting in the graph presented in Figure 47.

Figure 47 - Connected papers to Understanding barriers of telemedicine adoption: A study in North India



Source: connected papers

The ten prior works identified in the graph are presented on the Table 6 classified by the number of citations on each paper, denoting its historical importance.

Table 6 - Prior works to Understanding barriers of telemedicine adoption: A study in North India

Title	Author, Year	Citations
Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology	(F. D. Davis, 1989)	49073
User Acceptance of Information Technology: Toward a Unified View	(Venkatesh et al., 2003a)	30862
User Acceptance of Computer Technology: A Comparison of Two Theoretical Models	(F. D. Davis et al., 1989)	23278
A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies	(Venkatesh & Davis, 2000)	17645
Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology	(Venkatesh et al., 2012)	8567
Technology Acceptance Model 3 and a Research Agenda on Interventions	(Venkatesh & Bala, 2008)	5499
Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology	(Hu et al., 1999)	2036
The Technology Acceptance Model: Its past and its future in health care	(Holden & Karsh, 2010)	1858
Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model	(Hoque & Sorwar, 2017)	584
Using a modified technology acceptance model in hospitals	(Aggelidis & Chatzoglou, 2009)	491

Source: connected papers

From the prior works a clear focus on methods was found. They cover Technology Acceptance Model (TAM) and its extensions. A brief description of each paper, in chronologic order, is presented to better explain the methodologic grounding of (Bakshi & Tandon, 2022):

a) Davis, (1989) developed the original TAM, which was based on the theory of reasoned action. The TAM proposed that perceived usefulness and perceived ease of use are two key factors that influence user acceptance of information technology.

b) Hu et al. (1999) used the TAM to study physician acceptance of telemedicine technology. They found that perceived usefulness and perceived ease of use were significant predictors of physician acceptance of telemedicine technology.
c) Venkatesh and Davis (2000) conducted four longitudinal field studies to test the TAM. They found that perceived usefulness and perceived ease of use were significant predictors of user acceptance in all four studies.
d) Venkatesh et al. (2003a) proposed the UTAUT, which is an extension of the TAM that incorporates additional factors such as social influence and performance expectancy. The UTAUT has been shown to be a more comprehensive and predictive model of user acceptance than the original TAM.
e) Venkatesh and Bala (2008) proposed a research agenda on interventions that can be used to improve user acceptance of information technology. They identified a number of interventions that can be effective, such as training programs, social support, and system customization.
f) Aggelidis & Chatzoglou (2009) used a modified TAM to study user acceptance of information technology in hospitals. They found that perceived usefulness, perceived ease of use, and job relevance were significant predictors of user acceptance of information technology in hospitals.
g) Holden & Karsh (2010) reviewed the literature on the TAM in healthcare. They concluded that the TAM is a robust and predictive model of user acceptance in healthcare, but that extensions to the TAM may be needed to account for additional factors that may influence user acceptance in certain contexts.
h) Venkatesh et al. (2012) proposed an extension of the UTAUT to account for the unique factors that influence consumer acceptance and use of information technology. They found that factors such as hedonic motivation and habit play an important role in consumer acceptance of information technology.
i) Hoque & Sorwar (2017) extended the UTAUT to study the factors that influence the adoption of mHealth by the elderly. They found that factors such as trust, perceived risk, and security concerns play an important role in the adoption of mHealth by the elderly.

The following short outtakes could be taken from the combined analysis of the prior papers on Table 6:

a) Perceived usefulness and perceived ease of use are the two key factors that influence user acceptance of information technology. Perceived usefulness is the extent to which a user believes that using a particular technology will improve their performance or productivity. Perceived ease of use is the extent to which a user believes that using a particular technology will be effortless (Aggelidis & Chatzoglou, 2009; F. D. Davis, 1989; Venkatesh & Davis, 2000).
b) The TAM has been shown to be a robust and predictive model of user acceptance in a wide range of contexts, including healthcare, education, and business. However, extensions to the TAM have been proposed to account for additional factors that may influence user acceptance in certain contexts. For example, the Unified Theory of Acceptance and Use of Technology (UTAUT) incorporates additional factors such as social influence and performance expectancy (Hoque & Sorwar, 2017; Venkatesh et al., 2003a, 2012).
c) Interventions that can improve perceived usefulness, perceived ease of use, or other factors that influence user acceptance can lead to increased adoption and use of information technology. For example, training programs can help users to learn how to use a new technology effectively, and social support from colleagues or managers can encourage users to adopt a new technology (Aggelidis & Chatzoglou, 2009; Hoque & Sorwar, 2017; Hu et al., 1999; Venkatesh & Davis, 2000).

When analyzing the derivative works presented on Table 7, classified by the number of citations on each paper, some key insights were gathered.

Table 7 - Derivative works to Understanding barriers of telemedicine adoption: A study in North India

Title	Author, Year	Citations
Technology Acceptance in Healthcare: A Systematic Review	(AlQudah et al., 2021)	36
Assessing individual behavior towards adoption of telemedicine application during COVID-19 pandemic: evidence from emerging market	(Rahi, 2021)	17
Factors influencing the acceptance of telemedicine in the Philippines	(Ong et al., 2022)	13
A Technology Acceptance Model for Deploying Masks to Combat the COVID-19 Pandemic in Taiwan (My Health Bank): Web-Based Cross-sectional Survey Study	(W.-H. Tsai et al., 2021)	12
Understanding the Drivers of Ghanaian Citizens' Adoption Intentions of Mobile Health Services	(Mensah, 2022)	3
Technology-enabled cure and care: An application of innovation resistance theory to telemedicine apps in an emerging market context	(Kautish et al., 2023)	2
Understanding medical service quality, system quality and information quality of Tele-Health for sustainable development in the Indian context	(Rana et al., 2023)	1
What Drives People's Behavioral Intention Toward Telemedicine? An Emerging Economy Perspective	(Hossain et al., 2023)	0
Trust transfer effects and associated risks in telemedicine adoption	(Kuen et al., 2023)	0
Getting Connected to M-Health Technologies through a Meta-Analysis	(Calegari et al., 2023)	0

Source: connected papers

Studies conducted a systematic review of the literature on technology acceptance in healthcare. They found that perceived usefulness and perceived ease of use are the two key factors that influence technology acceptance in healthcare. However, they also found that other factors such as attitude towards technology, social influence, and performance expectancy play an important role (AlQudah et al., 2021).

Rahi (2021) studied individual behavior towards adoption of telemedicine applications during the COVID-19 pandemic in an emerging market. He found that perceived usefulness and perceived ease of use were the two most important factors influencing telemedicine adoption. However, he also found that social influence and performance expectancy played a significant role. With similar results, Ong et al. (2022) examined the factors influencing the acceptance of telemedicine in the Philippines. They found that perceived usefulness, perceived ease of use, attitude towards technology, social influence, and performance expectancy all had a significant impact on telemedicine acceptance.

Kautish et al. (2023) applied innovation resistance theory to telemedicine apps in an emerging market context. They found that perceived risk, perceived compatibility, and perceived complexity were all significant predictors of innovation resistance. With a similar finding, Kuen et al. (2023) studied the trust transfer effects and associated risks in telemedicine adoption. They found that trust in the telemedicine provider, trust in the referral source, and trust in the technology all had a significant impact on telemedicine adoption. However, they also found that perceived risk was a significant barrier to telemedicine adoption.

Other paper studied medical service quality, system quality, and information quality of tele-health for sustainable development in the Indian context. They found that all three dimensions of quality had a significant impact on patient satisfaction and tele-health adoption (Rana et al., 2023). Calegari et al. (2023) conducted a meta-analysis to identify the factors that influence people to get connected to m-health technologies. They found that perceived usefulness, perceived ease of use, social influence, and performance expectancy all had a significant impact on m-health adoption.

Lastly, Mensah (2022) studied the factors influencing Ghanaian citizens' adoption intentions of mobile health services. He found that perceived usefulness, perceived ease of use, trust, and cost were all significant predictors of adoption intentions.

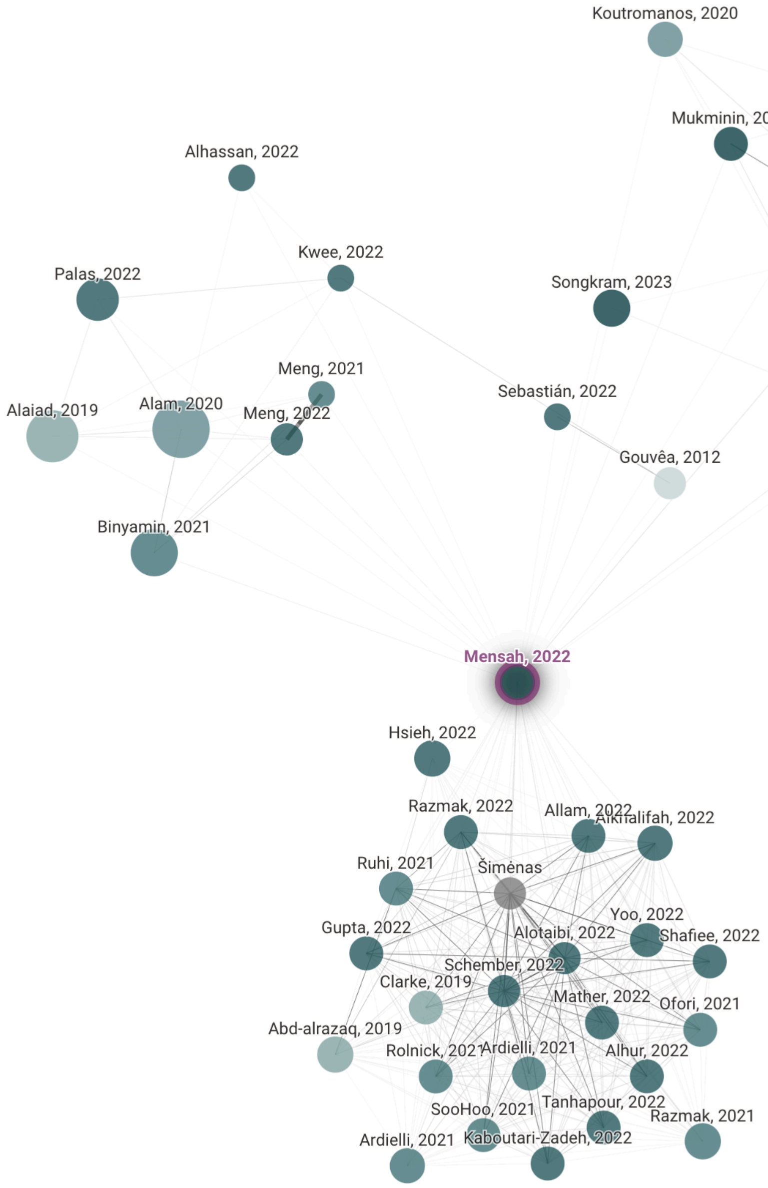
Overall, the combined outtakes from these papers suggest that telemedicine adoption is a complex process that is influenced by a variety of factors. These factors include perceived usefulness, perceived ease of use, attitude towards technology, social influence, performance expectancy, trust, cost, risk, compatibility, complexity, medical service quality, system quality, information quality, and hedonic motivation. The following key takeaways are:

a) Technology acceptance in healthcare is a complex process that is influenced by a variety of factors, including perceived usefulness, perceived ease of use, attitude towards technology, social influence, and performance expectancy.
b) The COVID-19 pandemic has accelerated the adoption of telemedicine in many parts of the world, but there are still a number of barriers that need to be addressed in order to ensure the widespread and sustainable adoption of telemedicine.
c) Factors such as lack of awareness, lack of access to technology, and concerns about privacy and security are all significant barriers to telemedicine adoption.
d) It is important to develop and implement interventions that can address these barriers and promote the adoption of telemedicine. This may involve providing training and education programs to raise awareness of telemedicine and its benefits, improving access to technology, and addressing concerns about privacy and security.

The paper "Understanding the Drivers of Ghanaian Citizens' Adoption Intentions of Mobile Health Services" by Isaac Kofi Mensah, found as a derivative paper from the last research, is also relevant to the present research. It explores the factors influencing the adoption of mobile health services, a specific and mobile implementation of Teleconsultation Platforms. After reading t, it was selected for further inspection.

The paper was then submitted to the Connected Papers tool resulting in the graph presented in Figure 48.

Figure 48 - Connected Papers to Understand the Drivers of Ghanaian Citizens' Adoption Intentions of Mobile Health Services



Source: connected papers

The study utilizes the Technology Acceptance Model (TAM) as the theoretical framework and employs structural equation modeling for data analysis. The findings reveal that perceived usefulness and ease of use significantly predict the behavioral intention to use and recommend mobile health services. Additionally, perceived risk negatively impacts the intention to use and recommend adoption.

Digital self-efficacy is found to be a significant determinant of behavioral intention, intention to recommend, perceived usefulness, and perceived ease of use. Other factors of communication also have a positive impact on the intention to use and recommend mobile health services. However, the intention to use does not significantly influence the recommendation intention.

It emphasizes that teleconsultation platforms and applications can contribute to the improvement of healthcare delivery. The study's use of the TAM framework is justified by its parsimony, robustness, and previous applications in information system research. The TAM has been widely recognized as the most influential theory in this field, making it suitable for examining the adoption of mobile health services.

The research methodology involved the development of a questionnaire based on a literature review and previous studies. The questionnaire consisted of two parts: basic demographic information and variables related to perceived usefulness, perceived ease of use, behavioral intention to use, intention to recommend, perceived risk, mobile self-efficacy, and word-of-mouth. The data were collected using a five-point Likert scale. The scales validated were adapted to be used in this research.

The ten prior works to this paper, identified in the Figure 48 are presented on Table 8 classified by the number of citations on each paper, denoting its historical importance.

Table 8 - Prior works to Understand the Drivers of Ghanaian Citzens' Adoption Intentions of Mobile Health Services

Title	Author, Year	Citations
Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology	(F. D. Davis, 1989)	49073
Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research	(Fishbein & Ajzen, 1977)	37083
User Acceptance of Information Technology: Toward a Unified View	(Venkatesh et al., 2003b)	30439
Evaluating Structural Equation Models with Unobservable Variables and Measurement Error	(Fornell & Larcker, 1981)	24023
User Acceptance of Computer Technology: A Comparison of Two Theoretical Models	(F. D. Davis et al., 1989)	22857
A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies	(Venkatesh & Davis, 2000)	17560
Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology	(Venkatesh et al., 2012)	8663
Theory of Planned Behavior	(Heller et al., 2015)	6454
Extrinsic and Intrinsic Motivation to Use Computers in the Workplace1	(F. D. Davis et al., 1992)	4947
Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model	(Hoque & Sorwar, 2017)	595

Source: Connected Papers

The prior works, as expected, shared a lot in common with Table 6, so to add on the last conclusions, some constructs and concepts were detailed in order to be futher used in this research.

Perceived usefulness and perceived ease of use are the two key factors that influence user acceptance of information technology. Perceived usefulness is the extent to which a user believes that using a particular technology will improve their performance or productivity.

Perceived ease of use is the extent to which a user believes that using a particular technology will be effortless.

User acceptance of information technology is a complex process that is also influenced by other factors such as attitude towards technology, social influence, and performance expectancy. Attitude towards technology is a person's overall evaluation of the technology. Social influence is the degree to which a person is influenced by other people's opinions and actions. Performance expectancy is the person's belief that using the technology will lead to a desired outcome.

It is important to develop and implement interventions that can improve perceived usefulness, perceived ease of use, attitude towards technology, social influence, and performance expectancy in order to promote the adoption of information technology. A teleconsultation platform falls in this category.

When analyzing the derivative works presented on Table 9, classified by the number of citations on each paper, some key insights were gathered. Since the paper is recent, published in 2022, only five key derivative works were found.

Table 9 - Derivative works to Understand the Drivers of Ghanaian Citzens' Adoption Intentions of Mobile Health

Title	Author, Year	Citations
The Use of a Technology Acceptance Model (TAM) to Predict Patients' Usage of a Personal Health Record System: The Role of Security, Privacy, and Usability	(Alsyouf et al., 2023)	19
Adoption of mobile health services using the unified theory of acceptance and use of technology model: Self-efficacy and privacy concerns	(Y. Liu et al., 2022)	4
Satisfaction with and Continuous Usage Intention towards Mobile Health Services: Translating Users' Feedback into Measurement	(Fu et al., 2023)	1
Increasing mobile health application usage among Generation Z members: evidence from the UTAUT model	(Aydin, 2023)	0
The mobile augmented reality acceptance model for teachers and future teachers	(George et al., 2023)	0

Source: Connected Papers

A brief description of the papers is presented as follows:

a) Alsyouf et al. (2023) used the Technology Acceptance Model (TAM) to predict patients' usage of a personal health record (PHR) system. They found that perceived usefulness, perceived ease of use, security, and privacy were all significant predictors of PHR system usage.
b) Y. Liu et al. (2022) used the Unified Theory of Acceptance and Use of Technology (UTAUT) model to study the adoption of mobile health services. They found that perceived usefulness, perceived ease of use, performance expectancy, self-efficacy, and privacy concerns were all significant predictors of mHealth service adoption.
c) Fu et al. (2023) developed a measurement scale to assess satisfaction with and continuous usage intention towards mHealth services. They found that satisfaction with mHealth services was a key driver of continuous usage.

d) Aydin (2023) used the UTAUT model to study the factors that influence mobile health application usage among Generation Z members. They found that perceived usefulness, perceived ease of use, performance expectancy, social influence, and hedonic motivation were all significant predictors of mHealth application usage.
e) George et al. (2023) developed a mobile augmented reality acceptance model for teachers and future teachers. They found that perceived usefulness, perceived ease of use, performance expectancy, and attitude towards technology were all significant predictors of mobile augmented reality acceptance.

Considering the evaluation of both papers (Bakshi & Tandon, 2022; Mensah, 2022) and their respective connected papers, the perceived risks were analyzed in search of a more structured definition resulting in the following classification.

3.2.1. Financial Risk

Financial risk for patients in the context of telemedicine refers to the potential monetary burden or out-of-pocket expenses associated with utilizing telemedicine services. It encompasses the costs that patients may incur for accessing telemedicine consultations, including consultation fees, technology requirements, and potential limitations in insurance coverage or reimbursement policies (Ardolino et al., 2020; Bakshi & Tandon, 2022; Mensah, 2022).

The main challenges faced by patients in terms of financial risk in telemedicine include:

a) Cost of Telemedicine Services: Patients may face financial barriers in accessing telemedicine services due to consultation fees or subscription costs associated with the telemedicine platform. These costs can vary depending on the healthcare provider, the type of consultation, and the specific telemedicine platform being used (Uscher-Pines et al., 2022).

b) Insurance Coverage and Reimbursement: The extent of insurance coverage and reimbursement for telemedicine services can vary depending on the insurance provider and the specific policies in place. Patients may face challenges in understanding their insurance coverage for telemedicine and may need to navigate complex reimbursement processes (Alhassan & Adam, 2022; Allen et al., 2017; Stricker et al., 2023; Uscher-Pines et al., 2022).

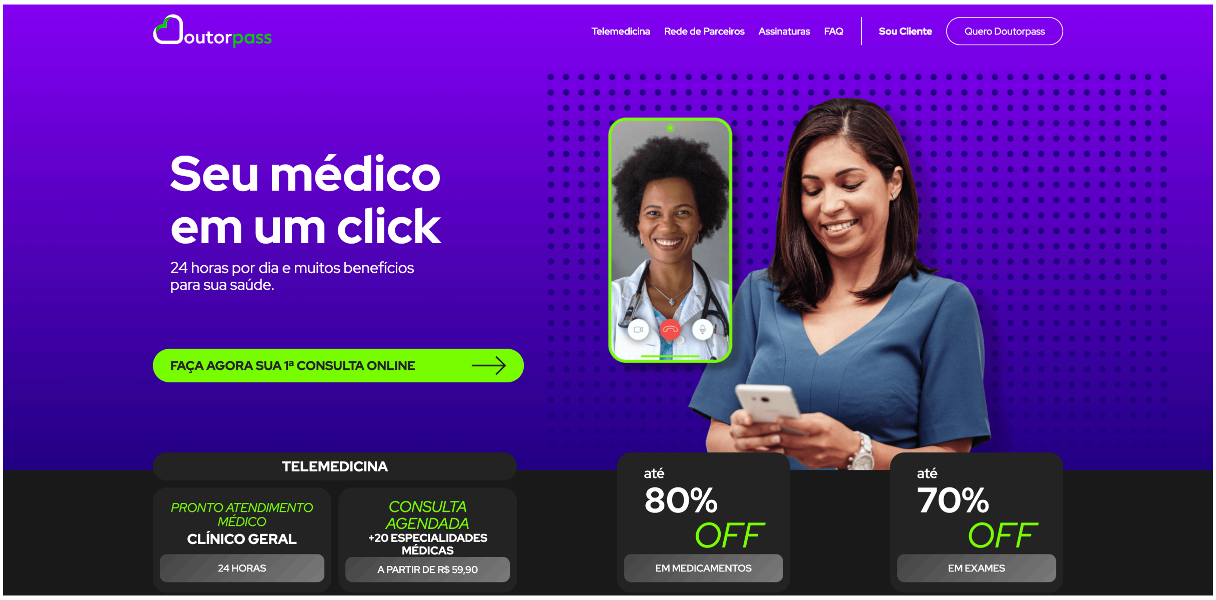
c) Technology Requirements: Patients may need to invest in specific technology devices or internet connectivity to access telemedicine services. The cost of acquiring or upgrading technology devices, such as smartphones or computers, and ensuring reliable internet access can pose financial challenges for some patients (Mensah, 2022; Ong et al., 2022).

d) Affordability and Accessibility: Financial constraints can limit the ability of some patients, particularly those from low-income or underserved populations, to access telemedicine services. The cost of telemedicine consultations may be prohibitive for individuals with limited financial resources, potentially exacerbating healthcare disparities (Mensah, 2022; Uscher-Pines et al., 2022).

e) Lack of Awareness and Education: Limited awareness and understanding of telemedicine services among patients can hinder their adoption and utilization. Patients may be unaware of the potential cost savings or benefits of telemedicine, leading to hesitancy in seeking telemedicine consultations (Bakshi et al., 2019; Bakshi & Tandon, 2022).

This risk can be tied to the platform Revenue Model as well. The choice of supporting paid medcare plans is part of the model. From the platforms available on Table 1, Doutor Pass offers a paid subscription model but fully private health plan refundable (Figure 49).

Figure 49 - Doutor Pass platform website



Source: company website

By enabling patients to charge their private health plan with teleconsultation sessions. Even though telemedicine services are often reimbursed at lower rates than traditional in-person healthcare services, once the platform reach a minimum level of patients, the business is sustainable.

Doutor Pass also offers benefits like discounts on medications and exams outside the teleconsultation platform.

The platform GestãoDS offers the teleconsultation module free of charge (Figure 50) for the physicians that choose to use its platform. The choice of charging (or not) is up to the doctor, helping lower the financial risk for the patient in the use of the service.

Figure 50 - GestãoDS platform free teleconsultation

Source: company website

Addressing financial risk for patients in telemedicine requires efforts to ensure affordability, transparency, and equitable access to telemedicine services. This can include initiatives such as promoting insurance coverage and reimbursement for telemedicine, implementing pricing structures that consider patient affordability, and providing education and resources to help patients navigate the financial aspects of telemedicine.

3.2.2. Time Risk

Time risk, in the context of telemedicine from the patient's perspective, refers to the potential loss of time associated with learning and using telemedicine technology and the challenges related to internet connectivity and infrastructure. It encompasses the delays, inefficiencies, and frustrations that patients may experience due to technological limitations and inadequate access to reliable internet connections (Kuen et al., 2023; Mensah, 2022).

Although telemedicine does offer patients the potential to save waiting and travel time (Almathami et al., 2020), time risk, which refers to a perceived potential loss of time associated with telemedicine (Bakshi & Tandon, 2022; Zobair et al., 2019), may be experienced.

The main challenges related to time risk in telemedicine for patients include:

a) Learning and Familiarity: Patients may need time to become familiar with the telemedicine platform, including understanding how to navigate the system, schedule appointments, and use the necessary communication tools. The learning curve associated with using new technology can result in initial time investment and potential delays in accessing healthcare services (Zobair et al., 2019, 2020).

b) Internet Connectivity: Inadequate internet infrastructure and unreliable internet connections can lead to time wastage and frustration for patients. Poor internet connectivity in rural or remote areas, as well as in developing economies, can hinder the smooth functioning of telemedicine consultations and cause disruptions or delays in accessing healthcare services (Alhassan & Adam, 2022; Almathami et al., 2020).

c) Technical Issues: Patients may encounter technical issues during telemedicine consultations, such as audio or video quality problems, connectivity interruptions, or difficulties in sharing medical records or images. These technical challenges can result in time-consuming troubleshooting or the need for additional appointments, leading to potential time inefficiencies (Kuen et al., 2023).

d) Appointment Availability and Scheduling: The availability of telemedicine appointments may vary, and patients may need to wait for a suitable time slot or face scheduling challenges due to limited healthcare provider availability. This can result in delays in receiving timely healthcare services and potential time conflicts for patients (Kuen et al., 2023).

Addressing time risk in telemedicine requires efforts to improve internet infrastructure, enhance connectivity, and provide user-friendly platforms that minimize the learning curve for patients. Ensuring reliable and stable internet connections, offering technical support, and streamlining appointment scheduling processes can help mitigate time-related challenges and enhance the patient experience in telemedicine.

3.2.3. Technology Risk

Technology risk in the context of teleconsultation platforms refers to the potential challenges and uncertainties associated with the use of technology in delivering remote healthcare services.

It encompasses the risks of technology failure, data breaches, privacy concerns, and the overall reliability and security of the telemedicine platform (Mensah, 2022; Wu & Ho, 2023).

Understanding and managing technology risk is crucial for the successful implementation and adoption of telemedicine. It involves assessing and mitigating potential risks to ensure the safety, privacy, and effectiveness of telemedicine services. Some of the challenges in defining technology risk in telemedicine include:

a) Technology Reliability: Telemedicine relies heavily on technology infrastructure, such as internet connectivity, video conferencing platforms, and electronic health record systems. Any technical issues or failures can disrupt the delivery of healthcare services and impact patient care. Ensuring the reliability and stability of the technology infrastructure is essential to mitigate this risk (AlQudah et al., 2021; Alsyouf et al., 2023).

b) User Acceptance and Technical Competence: The successful adoption of telemedicine relies on the acceptance and technical competence of both healthcare providers and patients. Resistance to change, lack of familiarity with technology, or inadequate training can hinder the effective use of telemedicine platforms. Addressing these challenges through training, education, and user-friendly interfaces is crucial (Bhattacherjee & Hikmet, 2008; Ouimet et al., 2020).

c) Regulatory and Legal Compliance: Telemedicine is subject to various regulatory and legal requirements, including licensing, privacy laws, and reimbursement policies. Complying with these regulations and ensuring that the telemedicine platform meets the necessary standards can be complex and challenging (Bakshi et al., 2019; Bakshi & Tandon, 2022; Codagnone & Martens, 2016).

d) Connectivity and Access: Telemedicine relies on stable internet connectivity and access to technology devices. However, disparities in internet access, particularly in rural or underserved areas, can limit the reach and effectiveness of telemedicine services. Ensuring equitable access to telemedicine and addressing connectivity challenges are important considerations.

One of the teleconsultation platforms listed on Table 1, Conexa Saúde (Figure 51), list on its website key information regarding its compliance with local laws.

Figure 51 - Conexa Saúde platform website

Source: company website

The company ensures compliance with Ministério da Saúde regulation Portaria (467/20), that allows teleconsultation in exceptional conditions. Furthermore, according to Resolution CFM No. 1,643/2002, it is determined that patient information can only be shared with another healthcare professional with the prior permission of the patient. This should be done through the patient's free and informed consent and under security regulations capable of ensuring the confidentiality, availability, and integrity of the information (*Conexa Saúde*, 2023).

Addressing technology risk requires a comprehensive risk management approach, including risk assessment, mitigation strategies, and ongoing monitoring and evaluation. Collaboration between healthcare providers, technology experts, and policymakers is essential to identify and address technology risks effectively (Paul et al., 1999).

3.2.4. Security and Privacy Risk

Security and privacy risks in telemedicine refer to the potential vulnerabilities and threats to the confidentiality, integrity, and availability of patient information and the privacy of healthcare interactions. These risks can arise from various factors, including technological vulnerabilities, inadequate security measures, unauthorized access, data breaches, and non-compliance with privacy regulations (Bakshi & Tandon, 2022; Dubin et al., 2020; Mensah, 2022).

The main challenges faced by telemedicine platforms in addressing security and privacy risks include:

a) Data Security: Telemedicine platforms handle sensitive patient information, including medical records, personal health information, and communication data. Ensuring the secure transmission, storage, and access control of this data is crucial to protect patient privacy and prevent unauthorized access or data breaches.

b) Authentication and Identity Verification: Verifying the identity of both healthcare providers and patients is essential to ensure that only authorized individuals can access and use the telemedicine platform. Implementing robust authentication mechanisms, such as two-factor authentication, can help mitigate the risk of unauthorized access.

c) Encryption and Secure Communication: Telemedicine platforms should employ encryption protocols to secure the transmission of patient data and communications between healthcare providers and patients. This helps protect against interception and unauthorized access to sensitive information.

d) Compliance with Privacy Regulations: Telemedicine platforms must comply with relevant privacy regulations, such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States or the General Data Protection Regulation (GDPR) in the European Union. Ensuring compliance with these regulations requires implementing appropriate privacy policies, data protection measures, and consent mechanisms.

e) User Awareness and Training: Healthcare providers and patients need to be educated and trained on best practices for maintaining security and privacy during telemedicine interactions. This includes awareness of phishing attacks, secure use of communication tools, and safeguarding personal devices and access credentials.

f) Technical Infrastructure and System Vulnerabilities: Telemedicine platforms should regularly assess and address vulnerabilities in their technical infrastructure, including software and hardware components. Regular security audits, penetration testing, and software updates are essential to mitigate the risk of system vulnerabilities being exploited.

g) Third-Party Service Providers: Telemedicine platforms often rely on third-party service providers for hosting, data storage, or communication tools. Ensuring that these providers have robust security measures and adhere to privacy regulations is crucial to maintain the overall security and privacy of the telemedicine platform.

Telemedicine involves the transmission and storage of sensitive patient information. The risk of data breaches, unauthorized access, or data loss is a significant concern. Implementing robust security measures, encryption protocols, and compliance with data protection regulations are essential to safeguard patient data and maintain privacy (Alsyouf et al., 2023; Bokolo, 2021; Y. Liu et al., 2022).

Teleconsultation providers can mitigate technology risks by implementing a number of security measures, such as:

a) Encrypting all data in transit and at rest: This will protect patient data from unauthorized access, even if it is intercepted.

b) Using strong authentication and authorization mechanisms: This will help to ensure that only authorized users can access telemedicine systems.

c) Implementing a layered security approach: This involves implementing multiple security measures, such as firewalls, intrusion detection systems, and access control lists, to protect telemedicine systems from attack.

d) Keeping software up to date: This will help to patch any known security vulnerabilities.

e) Educating patients and clinicians about cybersecurity best practices: This will help to raise awareness of cybersecurity risks and encourage users to take steps to protect themselves.

f) Using reliable and secure communication networks: This will help to ensure that telemedicine services are available and performant.

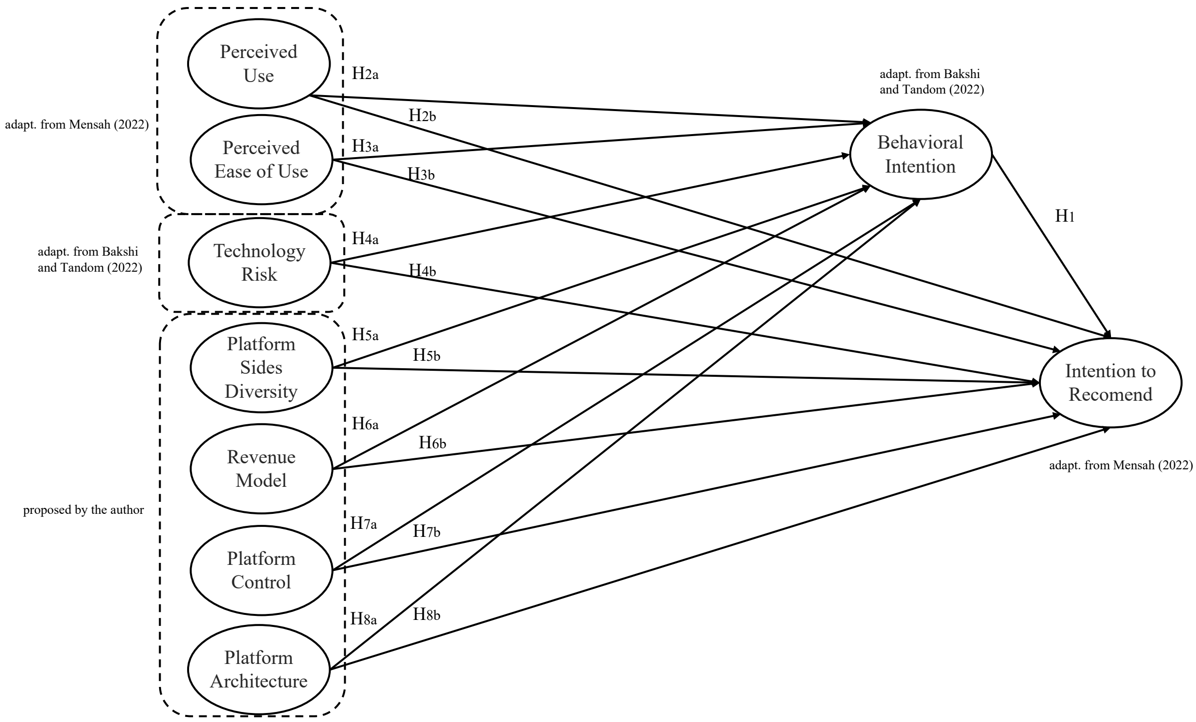
g) Designing telemedicine systems to be interoperable: This will make it easier to integrate telemedicine systems with other healthcare systems, such as EHRs and billing systems.

Addressing security and privacy risks in telemedicine requires a comprehensive approach that includes technical measures, policy frameworks, and user education. By implementing appropriate security controls and privacy safeguards, telemedicine platforms can enhance patient trust, protect sensitive information, and ensure the confidentiality and integrity of healthcare interactions (Ardolino et al., 2020; Chan & Kaufman, 2011; Macis et al., 2020).

4. Theorical Model and Hypothesis

This section presents the proposed theoretical model Figure 52, which was developed based on the theory described in the literature review and further developed based on the formulation of research hypotheses listed in their respective constructs. To seek answers to this research, we developed a structural model containing the constructs that we adapted for this context. The seminal references followed the corresponding scales.

Figure 52 - Theoretical Model



Source: the author

4.1. Perceived Usefullness (PU)

Perceived usefulness refers to the extent to which individuals believe that using a particular technology or service will bring them advantages or benefits. In the context of teleconsultation platforms, perceived usefulness is the perception that using a digital teleconsultation platform for initial and subsequent health assessments will enhance access to quality healthcare and improve one's way of life and work performance.

Teleconsultation platforms that create a welcoming environment for consumers to enhance their access to high-quality healthcare will inherently foster positive perceptions of the utility of such services. In essence, when users believe that the services are beneficial, improve their lifestyle and work performance, and contribute to their overall well-being, they are more likely to advocate for their use among others. These favorable opinions about the usefulness of teleconsultation platforms may also translate into a corresponding effect on individuals' intentions to adopt these services.

Previous studies have demonstrated that perceived usefulness is positively related to intention to use teleconsultation platforms (Mensah, 2022; Zhao et al., 2018).

H2a: Perceived Usefulness positively influences the patient Behavior Intention
H2b: Perceived Usefulness positively influences the patient Intention to Recommend

4.2. Perceived Ease of Use (PEOU)

Perceived ease of use refers to the extent to which individuals believe that using a particular technology or service will be effortless and free from challenges or difficulties. In the context of teleconsultation platforms, perceived ease of use is the perception that using a digital platform for healthcare purposes will be convenient, user-friendly, and require minimal effort (F. D. Davis, 1989). It is positively related to the intention to use mobile health services.

Perceived ease of use within the realm of teleconsultation platforms pertains to the extent to which individuals believe that utilizing the platform for accessing healthcare will be devoid of challenges or complications. When patients experience unobstructed access to healthcare services through user-friendly systems that offer a hassle-free environment, they are more inclined to embrace this technology. Factors contributing to ease of use, such as faster download times, user-friendly document uploading and downloading, customizable interfaces, technical efficiency, intuitive design and easy site navigation, can significantly enhance the perceived ease of adopting such services. The comfort and convenience resulting from this perceived ease of use can notably influence patients' intentions to engage with teleconsultation platforms (Bakshi & Tandon, 2022; Mensah, 2022).

H3a: Perceived Ease of Use positively influences the patient Behavior Intention
H3b: Perceived Ease of Use positively influences the patient Intention to Recommend

4.3. Technology Risk (TER)

Among the considered risks, Technology risk is a significant barrier to the adoption of teleconsultations platforms (Bakshi et al., 2019; Bakshi & Tandon, 2022). It refers to the fear and uncertainty associated with the use of technology in healthcare delivery. This suggests that healthcare professionals may be hesitant to embrace telemedicine due to concerns about the reliability, functionality, and usability of the technology involved.

One of the reasons for technology risk in telemedicine adoption is the poor understanding of technology and its application in healthcare delivery. Physicians, especially older ones (Kaissar et al., 2023), may lack the necessary knowledge and skills to effectively use computers and modern gadgets, which can create apprehensions about telemedicine (Mensah, 2022). This highlights the importance of providing adequate training programs to healthcare professionals to alleviate their concerns and increase their confidence in using telemedicine technology.

Another aspect of technology risk in teleconsultations adoption by patients is the inherent barriers and limitations of the technology itself. Issues such as unreliable internet connectivity and low internet speed can hinder the smooth functioning of teleconsultation applications (Bokolo, 2021). Additionally, the need for cybersecurity measures to protect sensitive patient information adds another layer of complexity to the technology. These technological challenges can create doubts and reservations among healthcare professionals, making them reluctant to fully embrace this service.

To overcome technology risk in telemedicine adoption, it is crucial to address these concerns and provide healthcare professionals with the necessary support and resources. This includes offering comprehensive training programs to enhance their technological skills and knowledge. Moreover, efforts should be made to improve internet connectivity and ensure consistent and reliable internet bandwidth for telemedicine applications.

By addressing these technological barriers and providing healthcare professionals and patients with the tools and support they need, the adoption of telemedicine can be facilitated, leading to positive influence both Behavior Intention and Intention to Recommend teleconsultation platforms (Bakshi & Tandon, 2022).

H_{4a}: Technology Risk positively influences the patient Behavior Intention
H_{4b}: Technology Risk positively influences the patient Intention to Recommend

4.4. Platform Sides Diversity (LP)

The Platform Sides Diversity construct refers to the different groups of users that interact and participate in a digital multisided platform. These platform sides are essential components of the MSP business model and play a crucial role in facilitating interactions and transactions (Ardolino et al., 2016, 2020). At least two different sides must be present so that the Platform can create value.

The platform sides are characterized by interdependent relationships due to the presence of indirect and bilateral positive network effects. This means that the value and benefits derived from the platform increase as more users from different sides join and interact with each other.

For the teleconsultation context this sides involves (Verma, 2022) medical doctors, nurses, psychologists, physical therapists, dentists and other healthcare specialties besides the patient. This construct focuses on the platform sides diversity on the patient perspective.

Three aspects of Platform Sides Diversity were considered:

a) Sides: Specify the number of participants and their respective roles within the MSP. It's important to note that not all the roles mentioned will necessarily be assumed, as this depends on both the platform's functions and the specific industry it serves. (T. Eisenmann et al., 2006; Y. Wang et al., 2014).

b) Segmentation: The platform may create a segmentation of different types of users within each side. The segmentation can include benefits like additional functions and services available for the patients (Gazé & Vaubourg, 2011).

c) Direct Externalities: Considers the presence of mechanisms that make more valuable the joining of a potential user in one side based on the number of patients or physicians already present in the same side (Sriram et al., 2015).

Having more diversity in the presented aspects can lead to a better relation of the patient with the platform, increasing both its intention to use and recommend.

H_{5a}: Diversity of Platform Sides positively influences the patient Behavior Intention
H_{5b}: Diversity of Platform Sides positively influences the patient Intention to Recommend

4.5. Revenue Model (MR)

In the context of a teleconsultation platform, a revenue model refers to the strategy and structure through which the platform generates revenue from its various sides or user groups. It outlines how the platform monetizes its services and interactions between different sides of the platform. (Ardolino et al., 2020)

Revenue models in teleconsultation platforms can be complex and varied, depending on the specific platform and industry. Some common revenue models include (J. Rochet & Tirole, 2006; J.-C. Rochet & Tirole, 2003):

Affiliation fees: Patients and other types of participants pay a fee to join the platform and access its services, much like a subscription like Netflix charges its users.

Interaction fees: Both parties can be charged a fee for each interaction, transaction or consult they make on the platform.

Financial flows between sides: The platform facilitates financial transactions between users of different sides and may charge a fee for these transactions. The payment processor is optionally included in most platforms and payment can be made directly to the other party without direct participation of the platform.

It is posited that the specific revenue model characteristics chosen by the platform can influence both the patient behavior intention and intention to recommend and it may vary by platform niche of focus (Z. Wang et al., 2023).

H_{6a}: Revenue Model positively influences the patient Behavior Intention
H_{6b}: Revenue Model positively influences the patient Intention to Recommend

4.6. Platform Control (PC)

Platform control is the ability of a platform owner to influence the behavior of users on the platform. This can be done through a variety of mechanisms, such as setting prices, designing the user interface, and collecting data (Ardolino et al., 2020).

In a multisided teleconsultation platform, platform control is important because it allows the platform administrator to balance the needs of the different user groups on the platform, namely patients, doctors, and other healthcare providers (Martinelli & Bastianelli, 2022).

The constructs of Platform Control and Behavior Intention are positively related. Platform control, which involves the management and regulation of teleconsultation platforms, can influence individuals' perceived behavioral control. Perceived behavioral control refers to an individual's belief in their ability to perform a behavior.

When individuals perceive that the teleconsultation platform is well-controlled and secure, they are more likely to have a higher sense of control over their behavior, leading to a greater intention to engage in teleconsultation. This positive relationship between platform control and behavior intention can be supported by studies using the Theories of Reasoned Action (TRA) and Planned Behavior (TPB) (Hagger et al., 2002).

Similarly, there is a positive relationship between Platform Control and Intention to Recommend. When individuals perceive that a teleconsultation platform is well-controlled, reliable, and efficient, they are more likely to have a positive attitude towards the platform. This positive attitude, in turn, influences their intention to recommend the platform to others (Ma et al., 2022).

The perception of platform control plays a crucial role in shaping individuals' attitudes towards the platform, as it instills trust and confidence in its functionality and security. Therefore, individuals who perceive high levels of platform control are more likely to have a positive attitude towards the platform and a greater intention to recommend it to others.

H_{7a}: Platform Control Model positively influences the patient Behavior Intention
H_{7b}: Platform Control Model positively influences the patient Intention to Recommend

4.7. Platform Architecture (PA)

Platform architecture in the context of teleconsultation platforms refers to the underlying structure and design of the platform that enables the delivery of teleconsultation services. It encompasses the technological infrastructure, software systems, and communication protocols that facilitate the interaction between healthcare providers and patients remotely (Ardolino et al., 2020).

Platform architecture can also involve different types of teleconsultation, such as asynchronous and synchronous teleconsultation (J. Zhang et al., 2023). Asynchronous teleconsultation involves monitoring and delivering feedback through text messaging, email, or web-based platforms. Synchronous teleconsultation, on the other hand, involves real-time video and audio interactions between healthcare providers and patients. This requires videoconferencing equipment and real-time communication tools.

The design of a teleconsultation platform should also consider usability and interoperability (Macis et al., 2020). Usability assessment is important to ensure that the platform is user-friendly and accessible to different users, including the elderly. Interoperability allows the platform to integrate with heterogeneous information technology systems, enabling seamless data exchange and communication between different healthcare providers and systems.

C.-H. Tsai (2014) posited that the elements on the platform architecture can have significant explanatory power in predicting continuance intentions, covering Behavior Intention and Intention to recommend.

H_{8a}: Platform Architecture positively influences the patient Behavior Intention
H_{8b}: Platform Architecture positively influences the patient Intention to Recommend

4.8. Behavioral Intention (BII)

Behavioral Intention (BI) can be defined as "the degree to which a person has consciously planned to either perform or abstain from a specific future behavior" (Bakshi & Tandon, 2022).

Numerous studies related to health behavior share the belief that an individual’s intention to engage in a particular behavior is the single best predictor of that individual’s behavior. An individual's BI to use new technology plays a pivotal role in determining their actual usage of that technology. This is supported by (C.-F. Liu, 2011), who reaffirmed the direct relationship between the intention to use and the actual usage of a system.

The strong interconnection between BI and actual usage behavior highlights BI as a predictor of the actual usage of technology in the healthcare sector (Bhattacherjee & Hikmet, 2008). Therefore, Behavioral Intention has been incorporated and validated as a dependent variable in this study.

It's proposed that behavior intention, given the right conditions, can influence the patient intention to recommend the teleconsultation platform to another patient.

H1: Behavioral Intention positively influences the patient Intention to Recommend

4.9. Intention to Recommend (ITRC)

The construct Intention to Recommend a teleconsultation platform refers to an individual's inclination or willingness to suggest or endorse the use of a specific platform services to others for caring for their health. It reflects the individual's belief that the use of digital platform is beneficial and valuable enough to be recommended to friends, family, or acquaintances. It is a measure of the individual's intention to promote the adoption of mobile health services among others (Mensah, 2022).

Octavius & Antonio (2021) explores the factors influencing patients' intention to recommend telemedicine services. The study defines intention to recommend as the willingness of patients to recommend teleconsultation services to others based on their satisfaction and perceived benefits. It identifies factors presented in this model, such as perceived usefulness, perceived ease of use, and others as predictors of intention to recommend.

Another study found that continuance usage of the teleconsultation platforms significantly influences intention to recommend (Hartono et al., 2021). This means that individuals are more likely to recommend the application if they have used it multiple times. The intention to recommend is an important outcome as it reflects the satisfaction and positive experiences of users, which can contribute to the diffusion and adoption of the technology.

In the context of the present research, intention to recommend a teleconsultation platform is considered a dependent variable.

5. Research Design and Execution

This section outlines the methodological procedures employed in this study. It will begin by discussing data collection and the obtained sample, followed by the development of the research instrument. The third subsection addresses common method bias, non-response bias, and collinearity, while the fourth subsection will present the two stages of research analysis.

5.1. Scale Creation and Validation

This section presents the study design, containing the development of the scale, the research subject, its instruments, procedures and data treatment and the proposed models.

The proposed protocol has been meticulously developed to delineate a systematic approach for the creation of a measurement scale for digital platform characteristics. This protocol is inherently incremental, drawing upon a foundation of knowledge gleaned from a critical analysis of the principal studies in this domain. Each stage involved in crafting this measurement scale is comprehensively expounded upon in the subsequent sections.

The development of these measurement scales entails the construction of a robust instrument and the alignment of qualitative concepts with quantitative metrics. In essence, it involves the assignment of numerical values to entities in accordance with a predetermined set of rules, thereby imbuing structure and rigor into the examination of the phenomenon (Pooja & Sagar, 2014). In accordance with these precepts, a protocol for the formulation of measurement scales emerges as a meticulously organized series of steps. It leverages selected techniques to ensure the creation of a valid measurement scale (Rossiter, 2002).

The proposition of any scale entails the fundamental task of defining its constructs. Without an accurate delineation of what is to be measured, the resulting measurements would inevitably lack precision. In this context, a construct serves as a conceptual term used to theoretically describe a phenomenon of interest (Edwards & Bagozzi, 2000).

To lay the groundwork for this process, a comprehensive review of the available literature within scientific databases was meticulously undertaken. This comprehensive exploration provided invaluable insights into the subject matter from the perspective of scientific research and enabled the identification of the most suitable models for evaluating the proposed dimensions. As a result, the constructs in this study were grounded in the Business Model Framework to Characterize Digital Multisided Platforms, as posited by Ardolino et al. (2020). Four distinct constructs from the model were strategically employed to assess the proposed dimensions, encompassing Platform Sides, Revenue Model, Platform Control and Platform Architecture.

The development of items for this new scale drew its inspiration from the model proposed by Ardolino et al., resulting in an initial pool of 67 items allocated across the four predefined analytical dimensions. The process placed significant emphasis on semantic alignment with the constructs as a fundamental criterion, ensuring a reflective relationship that would facilitate accurate scale measurement (Jarvis et al., 2003).

Upon reaching a preliminary scale version, the necessity of face validation became evident, as per DeVellis (2003).This validation process was fortified through expert assessments conducted by judges, in line with (Malhotra et al., 2014).

As recommended by Hardesty & Bearden (2004), this stage aimed to gauge the consensus among a panel of specialist judges regarding the scaling efficacy for each construct, while also assessing the clarity and appropriateness of the scale's items for measurement. Furthermore, this phase sought to ascertain the judges' capability to calculate the scale's reliability in the subsequent stage, as advised by (Gountas et al., 2012).

The employment of a two-phase approach in the refinement process, as outlined in studies such as Gountas et al. (2012), is advocated for its complementary nature. The first phase, face validation, provides the advantage of yielding an instrument more likely to receive approval through subsequent statistical testing.

The face validation process commenced by inviting specialist judges to complete questionnaires sent via email. To enhance objectivity, judges were provided with three distinct forms: Positive Motivation Face Validity, Neutral Motivation Face Validity, and Negative Motivation Face

Validity. These forms contained item-construction associations presented in random order, and judges were instructed to assign scores to indicate the extent of the relationship between each item and its respective construct (DeVellis, 2003; Hardesty & Bearden, 2004).

The assessment of the ability to link variables with constructs was quantified, and scores equal to or exceeding 0.65 were deemed acceptable in terms of convergent agreement, as per Stratman and Roth (2002), or exceeding 0.80 in accordance with the guidelines of Hair et al. (2006).

This phase, as delineated by DeVellis (2003) and Bright et al. (2012), aims to assess, within a panel of specialists, whether the items within the scale are suitable for effectively measuring a construct. Following the establishment of face validation through protocol development, the scale's purification process commences by evaluating the model's reliability through electronic questionnaire administration to a sample of respondents. In the context of this study, Structural Equation Modeling (SEM) was employed to aid this phase.

To form the panel of judges, 30 professionals with a background in academic and scientific production were conveniently invited, with the objective of selecting individuals who matched the study's desired profile, specifically researchers and/or professionals with direct involvement in healthcare and/or digital platforms. All professionals contacted agreed to participate; however, six of them did not return to the study or submit their responses.

The 24 respondents were intimately divided in two groups: 16 of them had a healthcare background and 8 of them with business background. The healthcare professionals were medical doctors, dentists, psychologists, physical therapists and nutritionists. About 75% of the healthcare professionals had Masters or Phd titles and were researchers as well as clinical practitioners. Except for the dentist, all of them had performed a teleconsult at least once in the last semester with 50% of them performing it at least once a week.

Regarding business background professionals, 50% of them are also entrepreneurs and are each a founder of its own teleconsultation startup. All of them also have an academic career in parallel with the business initiative. Importantly, all judges were established researchers, known for their contributions in the form of publications at conferences and in prominent scientific journals within the field, or they were affiliated with teleconsultation or digital platforms study groups.

Once the research instrument was finalized, it was disseminated to the 24 experts for an in-depth content analysis of its constituent items. These experts were tasked with evaluating various aspects, including the format, readability, item comprehensibility, and conceptual relevance concerning teleconsultation digital platforms content.

Invitations were extended to the judges via email, which outlined the research's title, objectives, and the procedure for evaluating the instrument. The judges were requested to return their assessments within a fifteen-day timeframe. Ultimately, the reports were received within the stipulated deadline. The responses were collected in the online survey platform Survio.com. The Figure 53 shows a screen capture of the tool used.

Figure 53 - Face validity instrument

Source: surve.io website

In summary, the experts concurred that the proposed instrument effectively encompassed teleconsultation platforms characteristics, with the items comprehensively addressing the facets associated with the proposed constructs. This review process led to several improvements, including refining item wording for enhanced clarity, identifying and removing less relevant items. The Table shows the quantity of assertive initially proposed and how many of those passe the 0.8 consensus proposed by Hair et al. (2006).

Table 10 - Face validity results

Construct	**Initial Qty**	**Qty > 0.8**	**Aproval %**
Platform Sides	19	11	57,89%
Revenue Model	17	13	76,47%
Platform Control	16	10	62,50%
Platform Architecture	15	10	66,67%
Total	67	44	65,67%

Source: the author

The final scale is composed by four constructs with ten to thirteen assertive affirmation each. Those constructs are in line with the theory presented on the Literature Review and are suitable to be used on a survey to enable the creation of a PLS-SEM model.

5.2. Instrument Development

To understand the variables that influence the behavior intention to use a teleconsultation platform and, consequently, the intention to recommend a teleconsultation platform to a greater or lesser degree, the theoretical relationships described earlier were utilized. Accordingly, a questionnaire was developed with statements from a specific scale created and validated for this research as well as various scales, adapted for the study.

Appendix A presents the constructs, corresponding statements, and the references used for the scale (Ardolino et al., 2020; Bakshi & Tandon, 2022; Mensah, 2022).

The research includes a sociodemographic section on the respondent's profile and psychometric scales from the proposed model. The model was constructed with 47 questions anchored on a Likert-type scale with five points (1- "Strongly Disagree," 2- "Disagree," 3- "Neutral," 4- "Agree," and 5- "Strongly Agree").

However, during the model adjustment phase, 25 items were excluded, totaling 22 statements. Using Structural Equation Modeling (SEM) with Partial Least Squares (PLS), we conducted multivariate analysis to estimate latent variables.

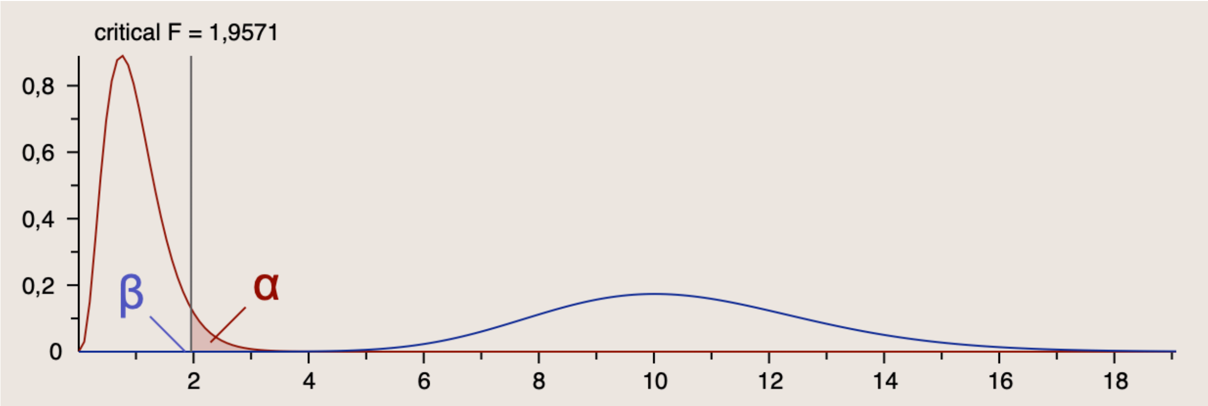
5.3. Data Collection and Sampling

This study employed a quantitative approach, gathering data through a convenience sampling method (Malhotra & Menezes, 2019) from individuals reachable by the researcher. Data collection was facilitated through an online survey questionnaire published on the QuestionPro research platform, which was shared within the respondents. It is worth noting that all respondents were required to be over 18 years of age and, upon starting the questionnaire, had to agree to the terms outlined in its introduction, indicating their awareness of the study's potential risks and benefits.

In this study, G*power software 3.1.9.7 was used to calculate the number of questionnaires needed to validate the test (Faul et al., 2007), aiming to maintain at least 80% of the explanatory power to ensure the validity of the model. In the "a priori" test, the effect size was 0.15, the test power was 0.80, $p<0.05$, and 5 predictors, which resulted in an f^2 of 2.32 with a sample of at least 109 respondents (Figure 54).

Of the participants, 516 completed the survey, and after data purification, using the Mahalanobis Distance (D^2) criterion to identify outliers (n=13), 503 respondents remained. Therefore, for the "post hoc" test, a sample of 503 individuals was considered, with an effect size of 0.15, $p<0.05$, and 8 predictors. The result was an f^2 of 1.95 and the sample power (1-β err prob) of 99.99% **Erro! Fonte de referência não encontrada.**. For this study, a pre-test (J. Hair et al., 2016) with 20 individuals (included in the total sample) was conducted to verify the understanding of the research instrument. After the pre-test, it was not necessary to make adjustments to the research instrument.

Figure 54 - G*Power post hoc graph



Source: the author

Finally, as no data were missing, there was no need to use an imputation method. IBM SPSS and R Studio were used for data analysis.

5.4. Common Method Bias, Nonresponse Bias, Collinearity and Normality

Since the data are primary, it was necessary to ensure that no systematic bias influenced the collected information. The common method variance was verified by applying Harman's single-factor test (Podsakoff & Organ, 1986) to the 22 items. The variance extracted from the first component was 22.84% Table 11, below the minimum of 50%, which validates the test. In addition, the analysis of the non-respondent bias was also carried out, which sought to compare two subsamples in a t-test to verify if there would be a difference between the means, which was not found, so it was possible to execute the research with the total sample (J. S. Armstrong & Overton, 1977). By performing these tests, it was found that both the common method bias and the non-respondent bias do not represent a problem for the continuation of the research.

Table 11 - Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,026	22,847	22,847	5,026	22,847	22,847
2	1,387	6,306	29,153			
3	1,316	5,984	35,137			
4	1,147	5,212	40,349			
5	1,067	4,851	45,200			
6	,998	4,535	49,735			
7	,933	4,243	53,978			
8	,873	3,966	57,944			
9	,843	3,834	61,778			
10	,824	3,747	65,525			
11	,799	3,630	69,155			
12	,763	3,466	72,621			
13	,738	3,356	75,977			
14	,697	3,169	79,146			
15	,662	3,007	82,153			
16	,635	2,886	85,039			
17	,608	2,763	87,802			
18	,602	2,735	90,537			
19	,571	2,594	93,131			
20	,556	2,527	95,658			
21	,501	2,277	97,935			
22	,454	2,065	100,000			

Source: the author

In addition, when analyzing the collinearity, it was identified that all the Variance Inflation Factors (VIFs) of the constructs were below 3.3 (Kock, 2015) (PU=1,140, PEOU=1,278, TER=1,123, LP=1,100,MR=1,077,BII=1,193,ITRC=1,143), indicating that there is no multicollinearity between the constructs.

Therefore, it can be considered that the regression coefficients are well estimated and adequate for the model. The skewness (β= 10.659; z= 893.649; p<0.001) and kurtosis (β= 79.950; z= 16.933; p<0.001) verified the normality of the data by the multivariate Mardia test on Table 12.

These tests for the indicators were highly significant with $p<0.001$, indicating non-normality, which was expected and necessary to limit the use of statistical analysis techniques characteristic of the normal distribution of data.

The skewness and kurtosis calculations were made using the online tool WebPower – Statistical power analysis online (Z. Zhang, 2018) from data generated using R-Studio.

Table 12 - Constructs Normality Analysis

Construct	Skewness	Standard Error of Skewness	Skewnes p-value	Kurtosis	Standard Error of Kurtosis	Kurtosis p-value
PU	-1,517	0,109	-13,928	3,290	0,217	15,138
PEOU	-1,385	0,109	-12,718	2,575	0,217	11,848
TER	-0,847	0,109	-7,779	0,579	0,217	2,666
LP	-1,373	0,109	-12,606	2,404	0,217	11,058
MR	-0,962	0,109	-8,832	0,631	0,217	2,902
BII	-0,912	0,109	-8,371	0,728	0,217	3,350
ITRC	-0,895	0,109	-8,218	0,772	0,217	3,552

Source: the author

5.5. The Choice of Methods

According to Romani et al. (2023), PLS-SEM is the most suitable analysis method for four main reasons: first, to maximize the variance of endogenous variables explained by exogenous variables. Second, it does not require normality for data distribution to be met, which is ideal in applied social sciences that tend to have distortions due to asymmetry and/or kurtosis. Third, it is ideal for estimating new and complex models. Finally, it is preferred for interaction tests since it does not inflate the measurement error.

Complementing PLS-SEM, NCA was also found suitable for this research. The main reasons to choose to use the necessary condition analysis (NCA) method can be consolidated in (Dul, 2019):

a) Identifying Critical Factors: NCA helps identify necessary conditions that are critical for achieving a desired outcome. Traditional analytical tools like regression analysis may identify factors that contribute to the outcome on average, but NCA focuses on identifying the specific conditions that must be present for the outcome to occur. This can provide valuable insights into the key determinants that need to be addressed or improved upon.

b) Complement to Traditional Approaches: NCA is not meant to replace traditional analytical approaches like regression analysis or structural equation modeling. Instead, it complements these approaches by providing a different perspective on causality. While traditional approaches focus on identifying factors that have large effects on the outcome, NCA focuses on necessary but not sufficient conditions that act as constraints or bottlenecks. By combining both approaches, researchers can gain a more comprehensive understanding of the underlying mechanisms.

c) Uncovering Hidden Insights: NCA can reveal insights that may not be discovered using traditional approaches. It can identify critical determinants that may not show large effects in traditional analyses but are necessary for achieving the desired outcome. By focusing on these critical determinants, researchers can gain a deeper understanding of the factors that truly drive the outcome.

d) Practical Implications: NCA can have practical implications for organizations. By identifying necessary conditions, organizations can prioritize their efforts and resources towards addressing these critical factors. This can lead to more targeted interventions and strategies for improving performance or achieving desired outcomes.

NCA offers a unique approach to analyzing necessary conditions in organizational research. It provides a different perspective on causality and can uncover critical determinants that may not be identified using traditional approaches. NCA focuses on single determinants and their combinations, allowing researchers to identify necessary conditions that act as constraints or bottlenecks for achieving desired outcomes (Dul et al., 2020, 2021).

Overall, according to Richter et al. (2020), the use of PLS-SEM and NCA together enables researchers to identify the must-have factors required for an outcome in accordance with the necessity logic. At the same time, this approach shows the should-have factors following the additive sufficiency logic. The combination of both logics enables researchers to support their theoretical considerations and offers new avenues to test theoretical alternatives for established models.

5.6. Research Analysis Stages

This section presents the stages of analysis in this research, with the first stage being Structural Equation Modeling measurement, and the second stage involving NCA – Necessary Condition Analysis.

5.6.1. Stage 1: SEM – Structural Equation Modeling

To analyze the proposed model, a Partial Least Squares Structural Equation Modeling (PLS-SEM) approach was chosen using R-Studio software. This approach was identified as the most suitable for the study due to its capability to estimate complex models with numerous constructs and items (J. Hair et al., 2016).

The analysis began with an evaluation of the factor cross loadings of variables, excluding those with loadings below 0.5 to adjust the model (Ringle et al., 2014). Cross loadings above 0.5 are recommended as they indicate that the construct explains more than 50% of the indicator's variance, providing acceptable item reliability. All the means, SDs, loadings and VIFs are available on Appendix B.

Subsequently, the reliability of internal consistency was assessed, where higher values of Composite Reliability (CR) typically indicate higher reliability. It is recommended that the CR values are greater than 0.7, indicating high internal consistency of the scales used (J. F. Hair et al., 2021).

Next, we proceeded to assess correlations, convergent validity, and discriminant validity. Convergent validity evaluates the degree to which a construct converges in explaining the variance of its items. This was determined by examining the Average Variance Extracted (AVE) from all items within each construct. Values exceeding 0.5 were deemed acceptable, signifying that the construct accounted for a minimum of 50% of the variance within its items.

For discriminant validity, which assesses how distinct a construct is from others in the structural model, it was required that the AVEs of the constructs be equal to or greater than the correlations between the constructs (Fornell & Larcker, 1981).

To evaluate the structural model, we assessed the coefficients of determination (R^2) and the effect size (f^2). The f^2 is employed to estimate the effect size in correlated samples (repeated measures, longitudinal data, and clustered data) for two continuous variables, indicating the extent to which each construct is useful in fitting the model. Suggested benchmarks for f^2 are values greater than 0.02, 0.15, and 0.35, signifying small, medium, and large effect sizes, respectively (Cohen, 1988). We also examined Q^2, representing the model's prediction quality, with the criterion being values greater than zero. Finally, we assessed the model's goodness-of-fit (GoF) as a score for the quality of the adjusted model, with a threshold of above 0.36 to be deemed appropriate (J. Hair et al., 2016).

To confirm the hypotheses within the proposed theoretical model, we tested the significance (p-value) of the indicated relationships using the resampling technique, specifically bootstrapping.

5.6.2. Stage 2: NCA - Necessary Condition Analysis

Dul (2016) introduced the NCA – Necessary Condition Analysis method, which offers a systematic approach to identifying necessary conditions within datasets. Unlike the examination of relationships between independent and dependent variables, the NCA method highlights regions in variable scatter plots that can define a necessary condition (Contreras et al., 2022).

In NCA, there are different types of necessary conditions that can be identified. Here are the three proposed types with descriptions:

a) Dichotomous Necessary Condition: This type of necessary condition involves two possible values, either present or absent. It is represented using a contingency matrix or a binary variable. The presence of the necessary condition is required for the desired outcome to occur, while its absence guarantees failure.

b) Discrete Necessary Condition: In this type, both the necessary condition and the outcome can have more than two values. For example, they can be categorized as low, medium, or high. The empty area in the upper left corner of a scatterplot or contingency matrix indicates the presence of a necessary condition.

c) Continuous Necessary Condition: This type encompasses a range of values for both the necessary condition and the outcome. It allows for a more nuanced analysis of the relationship between the condition and the outcome. The ceiling line in a scatterplot or a regression line in a continuous necessary condition analysis can help identify the minimum level of the necessary condition required for different levels of the outcome.

These different types of necessary conditions allow researchers to analyze the presence and impact of specific conditions on achieving a desired outcome.

In this study, the NCA method was applied to the theoretical model of teleconsultation platforms concerning the dependent variables Behavior Intention (BII) and Intention to Recommend (ITRC).

In the context of NCA, a scatterplot is used to explore the relationship between a potential necessary condition (X) and an outcome (Y). If there is a potential necessary condition, the scatterplot may reveal the presence of an empty zone in the upper left corner. This empty zone indicates that the desired outcome cannot be achieved without a certain level of the necessary condition. Researchers can then draw a ceiling line to separate the empty zone from the zone with observations, further highlighting the potential necessary condition (Dul, 2016).

The bottleneck table is a table that shows the minimum level of a necessary condition required for different desired levels of an outcome. It helps identify the weakest link or constraint (bottleneck) in achieving a desired outcome. The table typically includes the necessary condition (X), the desired outcome (Y), and the minimum level of X needed to achieve each desired level of Y. By examining the bottleneck table, researchers can determine the specific levels of the necessary condition that are critical for achieving different levels of the outcome (Dul, 2019; Dul et al., 2020).

6. Results

This section encompasses both descriptive and estimative analyses of the structural model concerning the latent variables and their implications for the study's outcomes.

6.1. Characterization of the respondents

The participants' demographic characteristics are presented here to provide context regarding the socio-economic profile of the study's respondents. Table 13 demonstrate comprehensive data on gender, age group, educational attainment, marital status, dependents, work status and frequency of teleconsultations in the last six months. There is a similar representation between Genders in the 503 respondents having slightly more males then females.

Table 13 - Characterization of the Respondents

Charact	Type	N	Freq (%)
Gender	Male	265	52,7
	Female	238	47,3
	Total	503	100
Age Group	From 18 to 24	262	52,10
	From 25 to 34	156	31,00
	From 35 to 44	42	8,30
	From 45 to 54	32	6,40
	From 55 to 64	10	2,00
	Above 64	1	0,20
	Total	503	100
Education	High school (incomplete)	10	2,00
	High school (complete)	44	8,70
	Undergrad (incomplete)	179	35,60
	Undergrad (complete)	233	46,30
	Graduate (incomplete)	15	3,00
	Graduate (complete)	22	4,40
	Total	503	100
Marital Status	Single	336	66,80
	Married	119	23,70

	Stable Union	29	5,80
	Widowed / Divorced	14	2,80
	Other	5	1,00
	Total	503	100
Dependents	Yes	112	22,30
	No	391	77,70
	Total	503	100
Private Medcare	Yes	356	70,80
	No	147	29,20
	Total	503	100
Works Status	Full time work	240	47,70
	Part time work	131	26,00
	Self employed	59	11,70
	Unemployed	73	14,50
	Total	503	100
Telesconsults in the last six months	Once	304	60,40
	Twice	101	20,10
	Three times	47	9,30
	More than three times	51	10,10
	Total	503	100

Source: the author

It was observed that for both groups, male (50,60%) and female (53,80%), the age is concentrated between 18 and 24 years. Regarding education, most men are recent graduate (49,10%), and the majority of women are algo recent graduates but to a lesser degree (43.3%). In terms of medcare and marital status, regardless of gender, the concentration of responses aligns with what was encompassed by the majority of the total sample. Considering work status, there was a higher concentration of men with full time jobs (49,1%) than women (46,2%) but women were more self-employed (13.9%) than men (9.8%).

In a similar way, it can be observed that the Perceived Usefulness (PU) ($t_{(501)}$=2,448; p=0,015) presented mean difference in the females group ($\overline{X}_{fem} = 4{,}3221; \overline{S}_{fem} = 0{,}64002$). This difference in perception can be partly explained by (Pribeanu et al., 2017) where it was found that in a social technology context, females have a higher perceived usefulness than males.

Evaluating the Technology Risk (TER) ($t_{(501)}$=2,504; p=0,013), it presented mean difference in the females group ($\bar{X}_{fem} = 3{,}9639; \bar{S}_{fem} = 0{,}8139$). This can indicate that females have a higher technology risk perception than males. One research found moderating effects of gender, indicating that gender plays a significant role in the adoption of advanced technologies in healthcare (Shahbaz et al., 2020), therefore it must be highlighted the importance of considering gender-specific differences in understanding and addressing risk perceptions in healthcare and telemedicine.

When evaluating Platform Sides Diversity (LP) ($t_{(501)}$=3,966; p<0,001), it was found that it presented mean difference in the females group ($\bar{X}_{fem} = 4{,}2549; \bar{S}_{fem} = 0{,}6890$). This is an interesting finding. While (Dongre et al., 2021) found no significant difference between gender and the attitude of healthcare professionals towards telemedicine. This suggests that while gender differences in risk perception may exist, they may not uniformly impact all aspects of telemedicine adoption.

In a similar way, it can be observed that the Behavior Intention (BII) ($t_{(501)}$=2,057; p=0,040) presented mean difference with those who have dependents ($\bar{X}_{dep} = 4{,}011; \bar{S}_{dep} = 0{,}7851$). The study by Luo et al. (2021) indicates that women used more telemedicine services in general than men, suggesting a potential preference for telemedicine among females. Furthermore, the study by Benis et al. (2021) reports that most participants utilizing telemedicine were women, indicating a potential gender difference in the utilization of telemedicine.

In a similar way, it can be observed that the Intention to Recommend (ITRC) ($t_{(501)}$=2,188; p=0,029) presented mean difference in the females group ($\bar{X}_{fem} = 3{,}886; \bar{S}_{fem} = 0{,}8729$). A study by Chou et al. (2018) indicated that female patients show a higher level of satisfaction toward the services of gender-friendly healthcare centers, which may extend to a higher intention to recommend telemedicine services that cater to their needs and preferences. Another study by (Malhotra et al., 2020) found that 60% of the study population were female, indicating a significant representation of females in the assessment of knowledge, perception, and willingness to use telemedicine

All the other constructs PEOU, MR, BII presented similar means when analyzed by gender.

Finally, having paid private medcare has no direct impact in any of the constructs of the model. The behavior of medcare holders do not affect teleconsultation behavior, intention to recommend and all the other constructs of the model.

6.2. Stage 1: SEM – Structural Equation Modeling

After the initial round of analysis, results from the factor loadings of variables indicated that it was necessary to exclude certain variables (all factors below 0.7) in order to fine-tune the model (Ringle et al., 2014). Subsequently, convergent validity and discriminant validity, involving the correlation between the constructs in the theoretical model, were verified. The measurement model analysis should precede the examination of relationships between constructs or latent variables. Following this, the measurement model was examined, involving various statistical indicators such as Composite Reliability (CR), Average Variance Extracted (AVE), coefficients of determination (R^2), effect size (f^2), and goodness-of-fit (GoF) (J. Hair et al., 2016), as presented in the Table 14 below:

Table 14 - Evaluation of convergent validity and GoF values of the model

Construct	CR (>0,7)	AVE (>0,5)	f^2	R^2
PU	0.763	0.518	0.029	
PEOU	0.806	0.510	0.025	
TER	0.750	0.502	0.000	
LP	0.717	0.500	0.019	
MR	0.720	0.501	0.006	
BII	0.784	0.549	0.102	0.267
ITRC	0.755	0.510	0.000	0.358

Source: the author

As shown in Table 14, the Composite Reliability (CR) values range from 0.717 to 0.784, which demonstrates satisfactory results (Hair et al., 2009). For this model, the Average Variance Extracted (AVE) values range from 0.500 to 0.549, and all latent variables exhibit AVE values greater than 50%, indicating the presence of convergent validity.

Table 15 - Discriminant validity assessment: Fornell-Larcker criterion

Construct	PU	PEOU	TER	LP	MR	BII	ITRC
PU	0.720						
PEOU	0.471	0.714					
TER	0.288	0.270	0.708				
LP	0.428	0.334	0.270	0.679			
MR	0.325	0.361	0.281	0.358	0.682		
BII	0.405	0.369	0.271	0.387	0.322	0.741	
ITRC	0.441	0.411	0.212	0.392	0.322	0.495	0.714

Source: the author

The discriminant validity of the items reflects the correlation between the factors. It is observed that the AVEs were greater than or equal to the correlations between the constructs, as shown in Table 15, meeting Fornell & Larcker (1981) definitive criterion, with all the factor loadings of each indicator having values above 0.5. Therefore, it was not necessary to exclude variables to adjust the model.

Based on the R^2 values, it is observed that the model has precision and predictive relevance in all constructs. The f^2 is used to estimate the effect size in correlated samples (repeated measures, longitudinal data, and grouped data) for two continuous variables, assessing how useful each construct is in adjusting the model. In this research, it is observed that the constructs were considered to have medium and large effects (J. Hair et al., 2016). All these structural model evaluation indicators are presented in Table 15.

Another measure evaluated is GoF - Goodness of Fit of the Model (Tenenhaus et al., 2005) refers to how well a statistical model fits the observed data. It is a measure of how closely the predicted values from the model match the actual values in the data. In the context of PLS path modeling, the goodness of fit (GoF) index is a measure that assesses the overall validity of the model. It is calculated as the geometric mean of the average communality and the average R-squared values. The GoF index provides a global validation of the PLS model, indicating how well the model explains the relationships between the latent variables and the observed variables (Henseler & Sarstedt, 2013).

The criteria of GoF to determine whether GoF values are no fit, small, medium or large to be considered as global valid PLS model as defined by Wetzels & Odekerken (2009) are presented on Table 16:

Table 16 - GoF Criteria

GoF Criteria	Fit
Less than 0.1	No Fit
Between 0.1 to 0.25	Small
Between 0.25 to 0.36	Medium
Greater than 0.36	Large

Source: adapted from (Wetzels & Odekerken, 2009)

The GoF value found was 0.4003 (40.03%), which is considered large enough for the validity of the model in partial least squares. To test the significance of the indicated relationships, the resampling or bootstrapping technique was employed Table 17.

Table 17 - Hypothesis confirmation

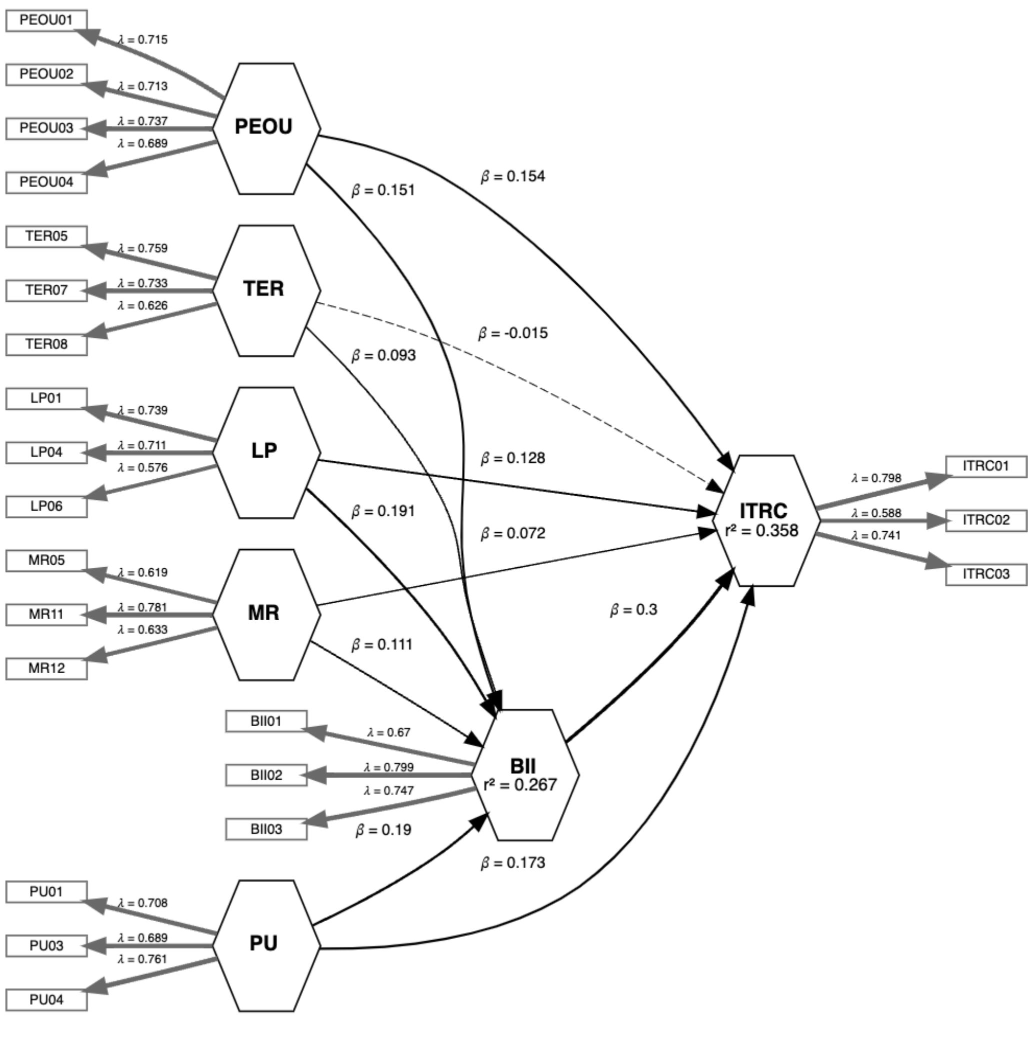
H#	Direct Relations	β	Bootstrapping (n=503)	Standard Deviation	t-Test	p-value
H1 (+)	BII→ITRC	0.300	0.297	0.048	6,228	0,000
H2a (+)	PU→BII	0.190	0.193	0.054	3,521	0,000
H2b (+)	PU→ITRC	0.173	0.174	0.045	3,851	0,000
H3a (+)	PEOU→BII	0.151	0.149	0.049	3,073	0,002
H3b (+)	PEOU→ITRC	0.154	0.155	0.043	3,573	0,000
H4a (+)	TER→BII	0.093	0.098	0.048	1,980	0,048
H4b (+)	TER→ITRC	-0.015	-0.017	0.038	-0,404	0,686 (Rejected)
H5a (+)	LP→BII	0.191	0.190	0.049	3,911	0,000
H5b (+)	LP→ITRC	0.128	0.132	0.048	2,691	0,007
H6a (+)	MR→BII	0.111	0.117	0.042	2,616	0,009
H6b (+)	MR→ITRC	0.072	0.072	0.047	1,533	0,126 (Rejected)
M#	**Indirect Relations (Mediation)**					
M1	PU→BII→ITRC	0.057	0.055	0.018	3.191	0.002 (Partial)
M2	PEOU→BII→ ITRC	0.045	0.045	0.017	2.608	0.009 (Partial)
M3	TER→BII→ITRC	0.028	0.029	0.015	1.905	0.057 (Complete)

M4	LP→BII→ITRC	0.057	0.057		0.017	3.366	0.001 (Partial)
M5	MR→BII→ITRC	0.033	0.033		0.015	2.238	0.009 (Partial)

Source: the author

As shown in Table 17, all the hypothesis, except for two, H4b and H6b, all the direct and indirect paths in the research model were positive and statistically significant. As a result, the proposed model supported the hypotheses, as presented in Figure 55.

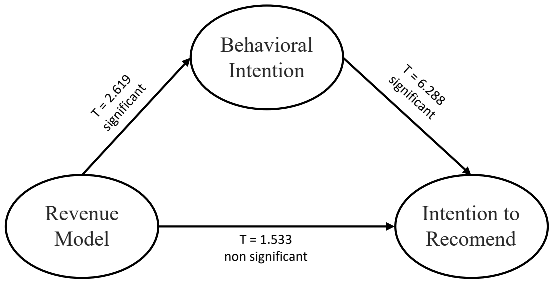
Figure 55 - Results analysis of the SEM PLS Model



Source: the author

On the other hand, one complete mediation was observed in the model TER→BII→ITRC, showing key research finding, detailed on Figure 56.

Figure 56 - Demonstration of complete mediation TER→BII→ITRC



Source: the author

6.3. Stage 2: NCA – Necessary Condition Analysis

To perform the NCA, the files from SPSS containing the means of each construct's observations were imported in R-Studio. A separate file was created for each dependent variable, BII and ITRC.

The scatterplots presented in Figure 57 (BII) and Figure 58 (ITRC) represents the proposed relationships for each pair of constructs, having the dependent variable fixed.

Figure 57 - NCA Plot of Behavior Intention (BII)

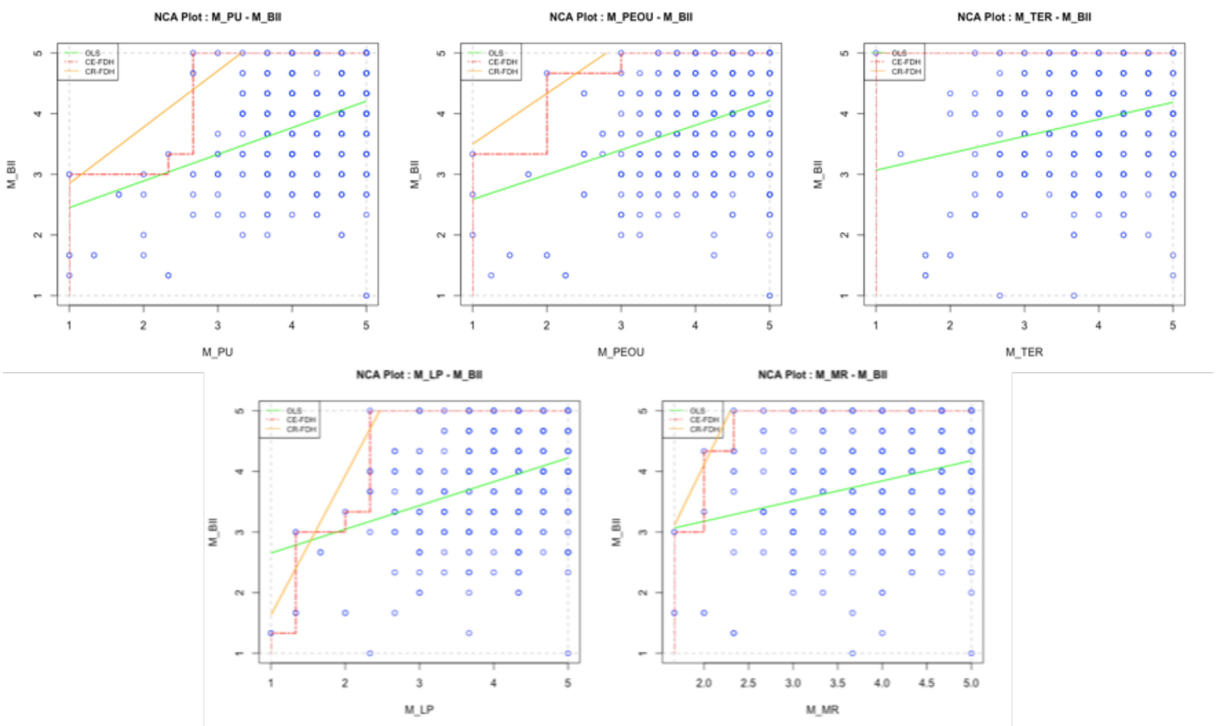
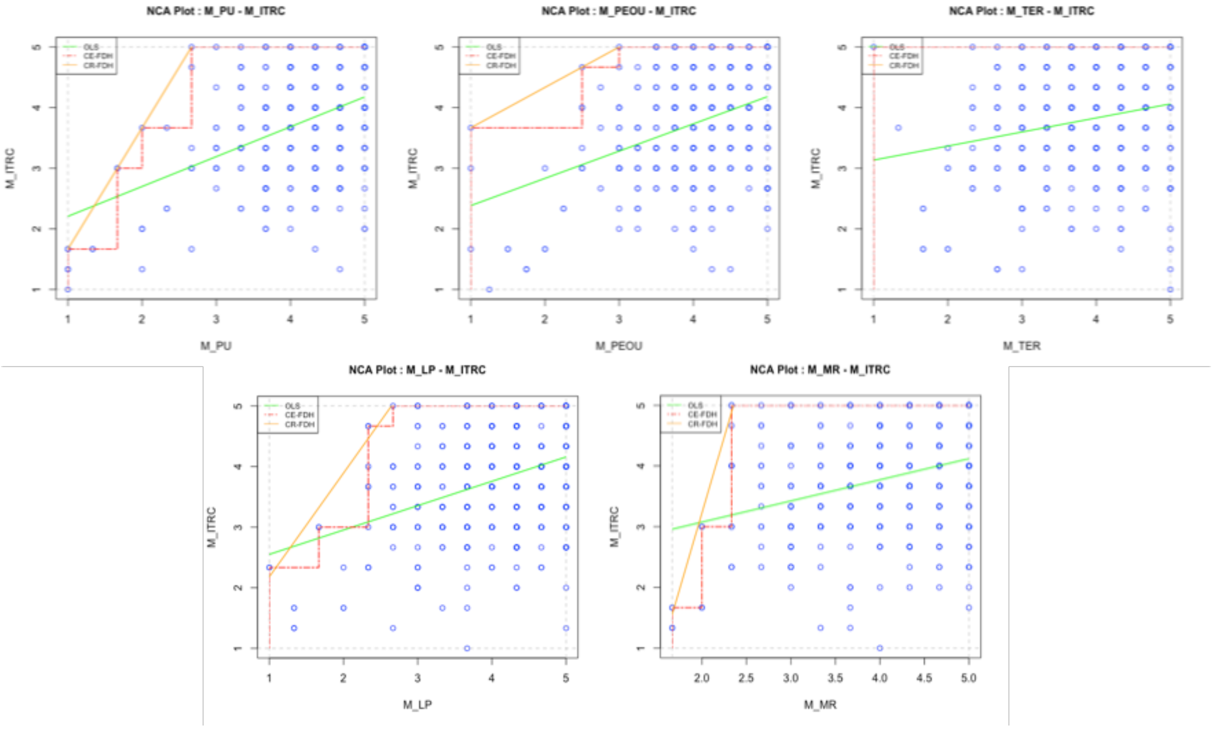


Figure 58 - NCA Plot for Intention to Recommend (ITRC)



Source: the author

Table 18 presents the bottleneck tables demonstrating that 70% (Dul et al., 2021) for a level of 70 of Behavior Intention (BII), Perceived Ease of Use must be at least 9.0, Perceived Usefulness bust me at least 25.6 while Platform Sides and Revenue Model must be at least 23.6 and 6.9 respectively. If a case (behavior intention) has a level of a condition that is lower than the threshold value, this patient cannot achieve the corresponding level of Perceived Ease of Use. The condition is a bottleneck. For the highest level of Behavior Intention, the required threshold levels of Perceived Usefulness are 57.9, for Perceived Ease of Use is 45.0 and for Platform Sides and Revenue Model are 36.6 and 18.9 respectively.

Table 18 - Bottleneck table and NCA effect sizes for BII

Bottleneck QL	PU	PEOU	TER	LP	MR
0	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN
20	NN	NN	NN	1.8	NN
30	NN	NN	NN	6.2	NN
40	NN	NN	NN	10.5	NN
50	4.1	NN	NN	14.9	NN
60	14.8	NN	NN	19.2	2.9
70	25.6	9.0	NN	23.6	6.9
80	36.4	21.0	NN	27.9	10.9
90	47.1	33.0	NN	32.2	14.9
100	57.9	45.0	NN	36.6	18.9
NCA effect sizes (accuracy and fit are 100%)					
Construct	BII CD-FDH				Slope
PU	0.201				0.929
PEOU	0.125				0.833
TER	0.000				-
LP	0.194				2.300
MR	0.067				3.000

Source: the author

Table 19 (BII) presents the bottleneck tables demonstrating that 70% (Dul et al., 2021) for a level of 70 of Intention to Recommend, Perceived Ease of Use must be at least 5.0, Perceived usefulness bust me at least 26.7 while Platform Sides and Revenue Model must be at least 23.6 and 13.5 respectively. If a case (intention to recommend) has a level of a condition that is lower than the threshold value, this patient cannot achieve the corresponding level of Perceived Ease of Use. The condition is a bottleneck. For the highest level of Behavior Intention, the required threshold levels of Perceived Usefulness are 50.0, for Perceived Ease of Use is 41.7 and for Platform Sides and Revenue Model are 41.2 and 20.7 respectively.

Table 19 - Bottleneck table and NCA effect sizes for ITRC

Bottleneck QL	PU	PEOU	TER	LP	MR
0	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN
20	1.7	NN	NN	NN	1.5
30	6.7	NN	NN	0.3	3.9
40	11.7	NN	NN	6.1	6.3
50	16.7	NN	NN	12.0	8.7
60	21.7	NN	NN	17.8	11.1
70	26.7	5.0	NN	23.6	13.5
80	31.7	20.0	NN	29.5	15.9
90	36.7	35.0	NN	35.3	18.3
100	41.7	50.0	NN	41.2	20.7
NCA effect sizes (accuracy and fit are 100%)					
Construct	ITRC CD-FDH				Slope
PU	0.236				2.000
PEOU	0.135				0.667
TER	0.000				-
LP	0.201				1.712
MR	0.133				5.000

Source: the author

Since the ceiling envelopment-free disposal hull (CE-FDH) ceiling line accuracy is inherently 100% (Dul, 2016, 2019), a separate column was not included for this measure. The NCA results, as shown in Table 18 and Table 19, specify whether the independent variables are necessary conditions when assessing the effect size ($d \geq 0.1$) and significance ($p < 0.05$) for both variables, with the exception of Technology Risk (TER), reach the necessary conditions.

7. Discussion of the results

This section encompasses both descriptive and estimative analyses of the structural model concerning the latent variables and their implications for the study's outcomes.

The hypothesis H1 (BII→ITRC; β=0.300) was supported demonstrating that there is a relationship between the intention to use and the intention to recommend the teleconsultation platform. This relationship involves the way people perceive and evaluate teleconsultation services and how these perceptions can influence their decision to use or recommend these services (Mensah, 2022). In the case of intention, the influence can be given by various factors such as convenience, accessibility, quality of service, positive experience, confidence in technology, and the need to resolve patient health (Bakshi & Tandon, 2022). In addition, the recommendation of teleconsultation occurs when the individual has had a positive experience with teleconsultation or believes that the service can be beneficial to the person receiving the recommendation. Among all hypothesis, H_1 (BII→ITRC; β=0.300) was the strongest found in the model.

The hypothesis H2a (PU→BII; β=0.190) was supported, showing that Perceived Usefulness is positively related to the Behavior Intention of the patient to use a teleconsultation platform. The hypothesis H2b (PU→ITRC; β=0.173) was also supported demonstrating the positive relation with Intention to Recommend confirming earlier observations (Aggelidis & Chatzoglou, 2009; Holden & Karsh, 2010; Hu et al., 1999; Mensah, 2022). This is because if a patient believes that a telemedicine platform will be useful to them, they are more likely to be willing to use it and if a patient has a positive experience with a telemedicine platform, they are more likely to recommend it to others.

The hypothesis H3a (PEOU→BII; β=0.151) and H3b (PEOU→ITRC; β=0.154) were supported was supported, indicating that the Perceived Ease of Use is related to both Behavior Intention and Intention to Recommend. It is also supported by the theory (Aggelidis & Chatzoglou, 2009; Bakshi & Tandon, 2022; Hu et al., 1999; Mensah, 2022). Some of the key elements that help on this aspect are the design the user interface to be intuitive and easy to learn, the provision of clear and concise documentation and tutorials, the availability of technical support to help users troubleshoot any problems and ensuring that the platform is tested to identify and fix any usability issues.

The hypothesis H4a (TER→BII; β=0.098) was supported even though the hypothesis H4b (TER→ITRC; β=-0.017) was rejected. After analyzing the model further, the complete mediation M3 (TER→BII→ITRC; β=0.028) was identified. According to Stone-Romero and Rosopa (2010) complete mediation occurs when an independent variable (X) influences a dependent variable (Y) through a mediating variable (M), and the effect of X on Y is completely eliminated when M is controlled for. In other words, the mediating variable fully accounts for the relationship between the independent and dependent variables.

It this case, although there was no relation between the Technology Risks that a patient must evaluate so that he feels comfortable to recommend the platform, once his experience was taken into account, his Behavior Intention, the relation was supported. The literature has grounds for this mediation to happen based on selected studies (Ahadzadeh et al., 2021; Jiang & Lau, 2023; Rho et al., 2014). Their finding identifies that in order to control the perceived technology risk, its necessary to reduce the complexity of the platform, making it easier for patients to use the platform without any technical expertise, improve the security of the platform by implementing strong security measures to protect patient data and offering incentives for patients to recommend the platform like giving patients discounts or other rewards for recommending the platform to their friends and family.

On the original study from where the Technology Risk construct was adapted from, the technology risk was the least significantly related to behavioral intention to adopt telemedicine (β=0.12, p=0.017) (Bakshi & Tandon, 2022).

Both hypotheses related to the Platform Sides H5a (LP→BII; β=0.190) and H5b (LP→ITRC; β=0.132) were supported. This support indicates a relation between the Platform Sides, measured in the study as the diversity of the participants present, in this case doctors, nutritionists, psychologists, physical therapists, among others as positive. The literature supports the

Even though the hypothesis H6a (MR→BII; β=0.111) was supported, the hypothesis H6b (MR→ITRC; β=0.072) was rejected. It shows a relation between the behavior intention of the patient according to characteristics of the Revenue Model but no relation with the intention to recommend. This issue was partly identified in the literature, partly due to poor communication between patient and provider, resulting in misinformation about the model (Wang et al., 2023) and the traditional taboo to talk about finances (Liu et al., 2022; Zhou et al., 2020), specially when dealing with large expenditures (Williams et al., 2002).

8. Final Considerations

In this chapter the pivotal conclusions and ultimate considerations of this research are made, connecting them to the initial research question and the primary objectives outlined at the first chapter of this document. We also assess the limitations of the research, offer recommendations for future studies, and bring this investigation to a close with a discussion on its implications and contributions.

Based on the comprehensive analysis of the relevant references, the research concludes that the adoption and acceptance of teleconsultation platforms are influenced by various factors, including perceived usefulness, perceived ease of use, technology risk, platforms sides diversity and platform revenue model. The study found that perceived usefulness and ease of use are critical determinants of technology acceptance in healthcare, while technology risk, particularly among healthcare professionals, can hinder the adoption of telemedicine. Additionally, the research revealed that addressing technology risk through adequate training programs for healthcare professionals is essential for overcoming apprehensions about telemedicine.

Furthermore, the study identified the significance of network effects and multisided business models in teleconsultation platforms, emphasizing the interdependence between different user groups and the potential for market failures when platforms fail to emerge despite potential demand. The research also highlighted the importance of addressing the diversity of sides present in the platform, as well as the revenue model within such healthcare systems, to ensure equitable access to teleconsultation services.

Moreover, the findings underscored the critical role of necessary condition analysis (NCA) in identifying specific conditions that are essential for achieving desired outcomes in teleconsultation services. NCA provides a unique perspective on causality and can uncover critical determinants that may not be identified using traditional approaches, thereby offering valuable insights for platform operators and policymakers. It’s a new method for business research (Contreras et al., 2022; Dul, 2019). When used in combination, PLS-SEM and NCA offer a broader and more accurate understanding of phenomena, enabling the assessment of necessary logic and the identification of must-have factors required for outcomes.

The research can be partially or entirely replicated, and the study can be adapted to different contexts. Primarily, the results obtained confirmed that the proposed model demonstrated consistency, with appropriate adjustments, making it suitable for replication in future research.

In conclusion, the research contributes to a deeper understanding of the factors influencing the adoption of teleconsultation platforms, the challenges associated with technology risk, and the mechanisms for addressing barriers to access. The study provides valuable implications for platform operators, healthcare professionals, and policymakers to enhance the effectiveness and acceptance of teleconsultation services, ultimately contributing to the advancement of healthcare delivery.

8.1. Theorical Implications

The theoretical implications of the research are multifaceted and contribute to the understanding of various theoretical constructs. Firstly, the study provides insights into the dynamics of two-sided markets and the strategies required to attract and retain users on both sides of the teleconsultation platform. This aligns with the theoretical framework of multisided business models, network externalities, and competition in two-sided markets. The research underscores the importance of carefully designing strategies to cater to the needs of different user groups, such as patients, doctors, hospitals, insurers, and pharmaceutical companies, within the teleconsultation platform.

Moreover, the study delves into the theoretical underpinnings of technology risk, particularly in the context of teleconsultation platforms, highlighting the barriers and limitations of technology adoption by patients. It contributes to the theoretical discourse on perceived risks and their influence on user attitudes and willingness to adopt telemedicine services. Additionally, the research addresses the theoretical dimensions of security and privacy risks in telemedicine, emphasizing the significance of implementing robust security measures and compliance with data protection regulations.

Furthermore, the theoretical implications extend to the domain of user acceptance and intention to recommend teleconsultation platforms. The study aligns with theoretical models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), shedding light on factors such as perceived usefulness, perceived ease of use, and social influence. It also contributes to the theoretical understanding of continuance usage and its influence on intention to recommend the teleconsultation application.

In conclusion, the research offers theoretical contributions to the understanding of multisided business models, network externalities, technology risk, perceived risks, security and privacy, user acceptance models, and continuance usage in the context of teleconsultation platforms. These theoretical implications provide a foundation for further theoretical development and empirical research in the field of telemedicine and healthcare technology.

8.2. Practical Implications

Based on the analysis of the relevant references, the research has several practical implications. Firstly, the study underscores the importance of addressing technology risk in teleconsultation platforms, which requires a comprehensive risk management approach involving risk assessment, mitigation strategies, and ongoing monitoring and evaluation. Collaboration between healthcare providers, technology experts, and policymakers is essential to identify and address technology risks effectively. Additionally, the research highlights the significance of understanding the dynamics and needs of each platform side for designing effective strategies and features that enhance the user experience and drive platform growth. By catering to the needs of both healthcare providers and patients, a teleconsultation platform can create a robust and sustainable ecosystem that delivers value to all participants.

Moreover, the findings emphasize the critical role of perceived usefulness and perceived ease of use in driving user acceptance of telemedicine technology. Platform providers can use data and analytics to better understand their users and their needs, which can be used to develop more effective marketing strategies and improve the platform's design and features. Furthermore, the research sheds light on the challenges related to time risk in telemedicine for patients, such as learning and familiarity with the telemedicine platform, which may result in initial time investment and potential delays in accessing healthcare services.

The study also highlights the practical implications of addressing organizational barriers within healthcare systems, such as long wait times for appointments or procedures, limited availability of healthcare providers, and complex referral processes. Overcoming these barriers is crucial for enhancing patient access to healthcare services and improving overall healthcare delivery.

Overall, the research provides valuable insights for platform providers, healthcare professionals, and policymakers to address the practical challenges and opportunities associated with teleconsultation platforms, ultimately contributing to the advancement of healthcare delivery and accessibility.

8.3. Study limitations and recommendation to future studies

The study limitations identified in the research encompass the following key areas:

a) Financial Barriers: The cost of telemedicine services, including consultation fees and subscription costs, may pose financial challenges for patients, potentially limiting their access to teleconsultation platforms. Additionally, the extent of insurance coverage and reimbursement for telemedicine services varies, impacting the affordability and accessibility of these services for different patient populations.

b) Communication Challenges: Poor communication between patients and providers, particularly regarding the revenue model and financial aspects, may lead to misinformation and traditional taboos surrounding discussions about finances, potentially influencing patient behavior and intention to recommend teleconsultation platforms.

c) Platform Architecture and Control: The study's focus on platform architecture, platform control, and platform sides diversity may present challenges in terms of operational implementation and practical implications for teleconsultation platforms and should be further analyzed.

These limitations underscore the complexities and multifaceted nature of teleconsultation platforms, emphasizing the need for further research and practical considerations to address financial, communication, technological, and user-related challenges in the implementation and utilization of telemedicine services.

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Appendix A - Scales description

Construct	Item	Assertive	Reference
Perceived Usefulness (PU)	PU01	Considero que a plataforma de teleconsulta será útil em minha vida diária	Adapted from Mensah (2022)
	PU02 (*)	Acredito que o uso da plataforma de teleconsulta aumenta minhas chances de alcançar coisas importantes para mim	
	PU03	Acho que o uso da plataforma de teleconsulta aumenta minha eficácia em monitorar minha saúde	
	PU04	Acredito que o uso da plataforma de teleconsulta aumenta meu desempenho em monitorar minha saúde	
Perceived Ease of Use (PEOU)	PEOU01	Aprender a usar a plataforma de teleconsulta é fácil para mim	Adapted from Mensah (2022)
	PEOU02	Minha interação com a plataforma de teleconsulta é clara e compreensível	
	PEOU03	Eu acho a plataforma de teleconsulta fácil de usar	
	PEOU04	É fácil aprender a usar a plataforma de teleconsulta	
Technology Risk (TER)	TER01 (*)	Plataformas de teleconsulta podem ter informações incompletas	Adapt from Bakshi and Tandon (2022)
	TER02 (*)	As informações disponíveis em uma plataforma de teleconsulta podem ser insuficientes	
	TER03 (*)	Um diagnóstico sem exame físico pode ser incerto	
	TER04 (*)	A comunicação assíncrona (sem ser ao vivo) com o profissional de saúde pode atrapalhar	
	TER05	A qualidade da consulta (audio e video) depende do equipamento utilizado (celular, tablet, computador)	
	TER06 (*)	Existe falta de treinamento adequados para uso de plataformas de teleconsulta	
	TER07	O profissional de saúde pode não ter os conhecimentos necessários para utilizar uma plataforma de teleconsulta	
	TER08	O paciente pode não ter os conhecimentos necessários para utilizar uma plataforma de teleconsulta	
	TER09 (*)	O profissional de saúde pode não ter as habilidades de comunicação necessárias para utilizar uma plataforma de teleconsulta	

Platform Sides Diversity (LP)	LP01	Prefiro uma plataforma de teleconsulta que possua diversos tipos de participantes (ex. médico, psicólogo, fisioterapeuta, etc.)	Proposed by the author
	LP02 (*)	Prefiro uma plataforma de teleconsulta que se especialize em um tipo de tratamento (ex. dermatologia, psicologia, endocrinologia, etc.)	
	LP03 (*)	Prefiro uma plataforma de teleconsulta que inclua serviços de oferta de produtos (ex. drogarias, farmácia de manipulação, etc.)	
	LP04	Prefiro uma plataforma de teleconsulta que tenha funcionalidades acessíveis gratuitamente	
	LP05 (*)	Pagaria apenas uma taxa inicial para usar a plataforma (ao invés de uma assinatura)	
	LP06	Pagaria uma taxa adicional para ter mais privilégios de uso na plataforma, como utilização de especialidades específicas (beleza, cosméticas, etc)	
	LP07 (*)	Pagaria uma taxa adicional para ter preferência na utilização dos serviços, como acesso antecipado à agenda	
	LP08 (*)	Pagaria uma taxa adicional para ter acesso a mais prestadores de serviço (similar as categorias de um plano de saúde)	
	LP09 (*)	Prefiro uma plataforma de teleconsulta que utilizam incentivos para indicação de novos usuários	
	LP10 (*)	Prefiro uma plataforma que pague os incentivos em maior quantidade para o usuário indicado	
	LP11 (*)	Prefiro uma plataforma de teleconsulta com mais usuários do tipo paciente	
Revenue Model (MR)	MR01 (*)	Prefiro uma plataforma de teleconsulta em que eu pague uma taxa de inscrição (similar a academia)	Proposed by the author
	MR02 (*)	Prefiro pagar uma assinatura para usar a plataforma de teleconsulta (como no Netflix)	
	MR03 (*)	Prefiro uma plataforma de teleconsulta onde os prestadores de serviço (ex. médico, psicólogo, fisioterapeuta, etc.) paguem para participar	
	MR04 (*)	Prefiro uma plataforma de teleconsulta com assinatura somente se existissem benefícios adicionais	

	MR05	Prefiro uma plataforma de teleconsulta onde eu pague apenas pelo uso de cada serviço (consulta, sessão ou atendimento)	
	MR06 (*)	Prefiro uma plataforma de teleconsulta onde os preços dos serviços sejam tabelados	
	MR07 (*)	Prefiro uma plataforma de teleconsulta onde os prestadores de serviço devem definam seu preço	
	MR08 (*)	Prefiro uma plataforma de teleconsulta onde eu pague antecipadamente, apenas se tivesse algum benefício (desconto, mais opções de agenda, etc)	
	MR09 (*)	Prefiro uma plataforma de teleconsulta onde eu pague por um pacote de serviços (ex. sessões de terapia), apenas se tivesse algum benefício (desconto, mais opções de agenda, etc)	
	MR10 (*)	Prefiro uma plataforma de teleconsulta onde o pagamento seja negociado com o prestador	
	MR11	Prefiro uma plataforma de teleconsulta os serviços sejam pagos diretamente na plataforma	
	MR12	Eu acredito que pagar bonus de indicação pode ser uma boa estratégia para se obter mais usuários e prestadores de serviço	
	MR13 (*)	Os prestadores de serviço devem receber uma recompensa (dinheiro ou crédito) pela indicação de pacientes para a plataforma de teleconsulta	
Platform Control (PC)	PC01 (*)	Prefiro uma plataforma de teleconsulta em que os usuários tenham sua identidade verificada antes de usar a plataforma	Proposed by the author
	PC02 (*)	Prefiro uma plataforma de teleconsulta onde os prestadores de serviço tenham sua identidade verificada antes de usar a plataforma	
	PC03 (*)	Prefiro uma plataforma de teleconsulta onde as credenciais dos prestadores de serviço (ex. CRM, CRF, especializações, etc.) sejam validadas antes de usarem a plataforma	
	PC04 (*)	Prefiro uma plataforma de teleconsulta que ofereça acesso anônimo, em que eu não preciso me cadastrar e fornecer meus dados para acessar	

	PC05 (*)	Aceito compartilhar meus dados para melhoria do serviço	
	PC06 (*)	Aceito compartilhar meus dados com os prestadores de serviço para realização do serviço	
	PC07 (*)	Prefiro uma plataforma de teleconsulta que permita que o usuário avalie o prestador de serviço após cada interação	
	PC08 (*)	Prefiro uma plataforma de teleconsulta que as avaliações do prestador sejam públicas para todos os usuários	
	PC09 (*)	Prefiro uma plataforma de teleconsulta que permita que o prestador de serviço avalie o usuário após cada interação	
	PC10 (*)	Prefiro uma plataforma de teleconsulta em que as avaliações do usuário sejam públicas para todos os prestadores de serviço	
Platform Architecture (AP)	AP01 (*)	Prefiro uma plataforma de teleconsulta em que o processo de registro sejá rápido e fácil	Proposed by the author
	AP02 (*)	Prefiro uma plataforma de teleconsulta que sejam atualizadsa automaticamente	
	AP03 (*)	Prefiro uma plataforma de teleconsulta que me permitam escolher quando atualizar o aplicativo	
	AP04 (*)	Prefiro uma plataforma de teleconsulta que tenham atualizações gratuítas	
	AP05 (*)	Prefiro uma plataforma de teleconsulta que esteja disponível em ambiente web	
	AP06 (*)	Prefiro uma plataforma de teleconsulta que esteja disponível em um celular/tablet com Android	
	AP07 (*)	Prefiro uma plataforma de teleconsulta que esteja disponível em um celular/tablet com iOS/iPhone	
	AP08 (*)	Prefiro uma plataforma de teleconsulta que permita a conexão de outros aplicativos, como Apple Health, MyFitnessPal e outros	
	AP09 (*)	Prefiro uma plataforma de teleconsulta que que tenha APIs publicadas para conectividade, para permitir exportar os dados ou conectar em outras plataformas como Plano de Saúde	
	AP10 (*)	Prefiro uma plataforma de teleconsulta que permita o compartilhamento de dados com outros aplicativos	
Behavior Intention (BII)	BII01	Pretendo continuar usando plataformas de teleconsulta no futuro	Adapt from Bakshi and Tandon (2022)

	BII02	Sempre tentarei usar plataformas de teleconsulta quando necessário	
	BII03	Planejo continuar usando plataforma de teleconsulta com frequência	
Intention to Recomend (ITRC)	ITRC01	Acho sensato sugerir aos meus familiares e amigos que usem a plataforma de teleconsulta para cuidar da sua saúde.	Adapted from Mensah (2022)
	ITRC02	Acredito que, com base na minha interação positiva com a plataforma de teleconsulta, recomendarei seu uso a outras pessoas para cuidar da sua saúde.	
	ITRC03	Acredito que sempre recomendarei o uso do sistema de plataforma de teleconsulta para cuidar da saúde das pessoas.	

Nota: (*) Itens excluídos na fase de ajuste do modelo

Appendix B - Main descriptive items

Construct	Item	MEAN	SD	Cross Loadings	VIF
Perceived Usefulness (PU)	PU01	4.183	1.080	0.708	1,15
	PU02 (*)	*	*	*	*
	PU03	4.288	1.019	0.689	1,12
	PU04	4.239	1.009	0.761	1,15
Perceived Ease of Use (PEOU)	PEOU01	4.177	1.087	0.715	1,31
	PEOU02	4.101	1.025	0.713	1,30
	PEOU03	4.276	0.970	0.737	1,26
	PEOU04	4.052	1.061	0.689	1,24
Technology Risk (TER)	TER01 (*)	*	*	*	*
	TER02 (*)	*	*	*	*
	TER03 (*)	*	*	*	*
	TER04 (*)	*	*	*	*
	TER05	4.103	1.011	0.759	1,12
	TER06 (*)	*	*	*	*
	TER07	3.579	1.144	0.733	1,16
	TER08	3.936	1.122	0.626	1,09
	TER09 (*)	*	*	*	*
Platform Sides Diversity (LP)	LP01	4.117	1.283	0.739	1,14
	LP02 (*)	*	*	*	*
	LP03 (*)	*	*	*	*
	LP04	4.427	0.909	0.711	1,14
	LP05 (*)	*	*	*	*
	LP06	3.779	1.359	0.576	1,02
	LP07 (*)	*	*	*	*
	LP08 (*)	*	*	*	*
	LP09 (*)	*	*	*	*
	LP10 (*)	*	*	*	*
	LP11 (*)	*	*	*	*
Revenue Model (MR)	MR01 (*)	*	*	*	*
	MR02 (*)	*	*	*	*

	MR03 (*)	*	*	*	*
	MR04 (*)	*	*	*	*
	MR05	4.105	1.162	0.619	1,07
	MR06 (*)	*	*	*	*
	MR07 (*)	*	*	*	*
	MR08 (*)	*	*	*	*
	MR09 (*)	*	*	*	*
	MR10 (*)	*	*	*	*
	MR11	4.211	1.041	0.781	1,10
	MR12	3.934	1.168	0.633	1,06
	MR13 (*)	*	*	*	*
Behavior Intention (BII)	BII01	3.879	1.076	0.670	1,15
	BII02	3.907	1.108	0.799	1,23
	BII03	3.831	1.128	0.747	1,20
Intention to Recomend (ITRC)	ITRC01	3.968	1.080	0.798	1,20
	ITRC02	3.706	1.317	0.588	1,09
	ITRC03	3.726	1.162	0.741	1,14

Nota: (*) Itens excluídos na fase de ajuste do modelo