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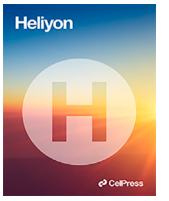

Research article

Social influence, performance expectancy, and price value as determinants of telemedicine services acceptance in Chile

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A B S T R A C T

Medicine is a discipline based on and nurtured by scientific research and technological development. The use of health services supported by information technology is increasing worldwide, and Latin America is no exception. Factors such as needing more specialists in peripheral cities, large geographic areas, and socio-cultural aspects limit the possibility of receiving timely and quality medical care services. Information Technology (IT) for health purposes, such as e-health, is a cost-effective solution for equitable access to quality healthcare services and optimization of the rising associated costs. As an e-health service, telemedicine facilitates and mediates distance communication between the patient and medical staff. Even though Latin America is at the beginning of the development of telemedicine, it would have a relevant impact, given the geographic and socioeconomic conditions of the population in this part of the world. Drawing on the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) theory, we developed a theoretical model to identify the latent factors influencing the public acceptance of telemedicine and examined their interrelationships. A survey questionnaire was designed and administered to 391 residents in Antofagasta, a mine region of Chile. After that, structural equation modeling was employed to analyze the survey data. The results reveal that the UTAUT2 factors' performance expectancy, social influence, and price value significantly impact the intention to use (R^2 = 0.693). Additionally, the model presented a good fit. This study enriches the existing theoretical research on the acceptance of telemedicine services and offers insights into understanding and managing technology in the Chilean health sector.

1. Introduction

Digitization influences many disciplines and fields, and ICTs (Information and Communications Technologies) and biomedical sciences are no exception [1]. Due to its long history and tradition, medical science has seen the emergence of multiple trends, schools, methods, etc. But, in the last half-century, computing and the speed in processing information are causing a qualitative leap in medical practice and research [2–4]. ICTs offer a scalable and multiplier infrastructure to promote continuous, intensive care and health care like never before. Digital technologies can improve access to healthcare and promote the well-being of individuals

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and entire populations [5]. The penetration of mobile communication technology and the rapid adoption of smart cellular phones ("smartphones") by large sections of the world's population has motivated a great interest in digital health and the use of advanced computing to improve health [6]. It was only a matter of time before we began to see the impact of electronic computing on medicine. In medicine, ICT initially focused on numerical calculation improvements and later on computerized patient medical records. This fact was so transformative that many authors have considered that it resulted in a before and after in clinical practice [6].

Digital medicine promises, with the help of digital technologies, to improve health by addressing global problems (e.g., diseases, diabetes, epidemics, aging, mental illness, addictions, etc.). The ITU (International Telecommunication Union) estimated that approximately 5.3 billion people – or 66 percent of the world's population used the Internet in 2022. That represents an increase of 24 percent since 2019, with 1.1 billion people estimated to have come online during that period [7]. Traditional healthcare services have evolved to online care services to patients called telemedicine [8], a beneficial service for online people. As the work of [9] describes, telemedicine can be a healthcare solution for people in countryside areas. However, this leaves 2.7 billion people offline [7,10].

People live today in a volatile, uncertain, complex, and ambiguous world [11]. The pandemic has caused radical global changes in people, government policies, and companies [12]. People's lives have radically changed, affecting education, the economy, and health. The pandemic's impact on the health sector has affected medical personnel and patients. People must take various security measures and protocols to avoid contagion by various viruses [13]. In Latin America, there are severe problems in health networks, where, as pointed out by the Red Cross [14], the continent was on the verge of a health collapse due to the coronavirus disease 2019 (COVID-19). Some units, such as the emergency unit, were saturated due to the daily number of patients. Telemedicine appears as a solution to this flow of people. This healthcare modality has been used for many years, with a greater intensity in recent months. Countries such as the United States of America and the United Kingdom have promoted and expanded this system to reduce contact between people and thus the risk of transmission of COVID-19 [15].

The current literature on the factors that influence telemedicine adoption is limited. Most studies have focused on adopting telemedicine during the COVID-19 pandemic in developed countries, and there needs to be more research on the factors that influence telemedicine acceptance. Factors such as availability, performance, cost, and people's expectations may impact the acceptability of telemedicine in developing countries differently. This study is primarily motivated by understanding the factors influencing people's willingness to use this technology and assessing its impact in developing countries with rural populations with limited healthcare access. Here, telemedicine can be a bridge. Further, telemedicine could reduce healthcare costs by allowing patients to receive healthcare services from the comfort of their homes, reducing travel and transportation costs, providing access to doctors and nurses and specialized healthcare services unavailable in rural areas, and bringing real-time access to healthcare professionals. This study addresses the research gap regarding the factors associated with telemedicine among individuals in Latin America. The Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) have been used to study telemedicine adoption. However, these models still need to be fully integrated. This study analyzed twenty-two articles published on the topic using those models to develop a more comprehensive model of telemedicine adoption (Tables 1, 2, and 3). The significant challenges in this topic include questions related to the effort technology and performance expectancy, including concerns about privacy and security and price-related issues for telemedicine services. This study could fill in the current literature on telemedicine adoption gaps by investigating the factors that influence telemedicine acceptance, presenting a more comprehensive model, and addressing the significant challenges in telemedicine adoption. This research could also provide information about the variables that significantly impact the intention to use telemedicine and the role of affordability and accessibility provided by telemedicine. By doing so, the research would shed light on the challenges faced in adopting telemedicine, enriching the existing knowledge and offering valuable insights for the healthcare industry and policymakers.

Chile is already in the technological evolution in its history compared with other countries. Considering the current technological state of Chile and other developing countries, this article looks to answer the following research questions [16,17].

RQ1 [What factors impact the acceptance and use of telemedicine?] This study aims to determine the factors that impact the acceptance and use of telemedicine in a Chilean region.

RQ2 [Can we extrapolate these results?] This study aims to extrapolate its results to other Chilean regions and developing countries worldwide. This study uses the Unified Theory of the Acceptance and Use of Technology model in its second version (UTAUT 2) to evaluate and determine factors that affect the intention to use online health systems.

The main contributions of this article are to reply to both questions and provide variables that could significantly impact the intention to use telemedicine, the accessibility of telemedicine, and the role of telemedicine affordability for users in Chile. This article is structured as follows: The first section defines a contextual framework and concepts, such as telemedicine, telemedicine in Chile, and the acceptance of technology models. The second section describes the target population distributed in the cities of the Antofagasta region. Then, we explain the sought hypotheses and the proposed model. The next section describes the methodology with the analyzed variables and experiment details. Then, the article presents the results obtained from the analyses using the statistical software Smart PLS and Statistical Package for the Social Sciences (SPSS). These analyses include evaluating the measurement model and the evaluation of the structural model. Next, there is the discussion to disclose why some variables in the model did not significantly impact the intention to use telemedicine. Finally, this research details observations and essential aspects to consider for future research related to telemedicine.

2. Background

Telemedicine has profoundly impacted the healthcare landscape, transforming how medical services are delivered and accessed, as Brown et al. [18] remark. This innovative approach to healthcare leverages technology to bridge geographical and temporal gaps, enabling patients to remotely consult with healthcare providers. The impact of telemedicine extends beyond convenience. It has significantly improved access to healthcare, particularly in underserved or rural areas. Moreover, it has proven invaluable in times of crisis, such as the COVID-19 pandemic, by reducing the risk of virus transmission in healthcare settings. An essential challenge of Telemedicine is its acceptance level in developing countries where technology and information availability are not yet fully available to everyone. The literature has analyzed the acceptance phenomenon in depth, attempting to understand the impact of a person's behavior, attitudes, and beliefs on this acceptance initially addressed in the TAM model, which subsequently led to an evolution toward the UTAUT2 model.

The following lines describe the acceptance models used in the health area and their telemedicine application.

2.1. Telemedicine

According to [19], the World Health Organization (WHO) defines telemedicine as providing health care services where distance is a critical factor and related professionals use ICTs. ICTs exchange valid information on the diagnosis, treatment, and prevention of diseases, research, evaluation, and the continuous training of its professionals—all in the interest of advancing the health of individuals and their communities.

As [20] highlighted, telemedicine uses telecommunications networks to provide health services in different medical specialties. Several countries have adopted this service and shown positive results. Telemedicine started as a tool to provide medical care in exceptional situations. It is a technology that facilitates remote mediation and communication between the patient and the medical staff for remote and online operations. It also allows for updating electronic prescriptions, communicating instructions, and directing a face-to-face consultation and interaction between professionals without needing to be physically together [21].

Since 2020, due to the COVID-19 pandemic, people's lives have changed radically, and sectors such as education, economy, and health have been evolving [22]. The pandemic's impact on the health sector has affected medical personnel and patients because they must consider various security measures and protocols to avoid contagion by this virus [13]. As stated by [23], health service users have often decided to abandon their treatments for fear of catching COVID-19, which can harm the health of many patients.

Telemedicine offers solutions for immediate access to health amid the pandemic. However, it has not yet been integrated into regular healthcare systems and requires major adaptations to existing frameworks [13]. Amid these essential changes, clinicians remain responsible for ensuring patients receive the care they need and for understanding the limitations of telemedicine visits.

2.1.1. Using telemedicine

Today, technology is constantly changing and innovating. Over half of the world's population accessed the internet in 2020, and 11% of internet users had at least one smart technology device in their homes [24]. The evolution of ICTs allows the tools intended for telemedicine to be suitable for delivering essential and quality service to the patient. In addition, it provides tools that facilitate the work of the professional who attends to them in this modality [25]. As [26–28] describe, the most developed countries worldwide, such as the United States of America (USA), have made rapid progress in online care. Since the beginning of the pandemic in 2020, the USA has already had HealthPartners, an integrated healthcare delivery and financing system in Minnesota's Twin Cities region. This system provides a coverage service to nearby hospitals and has a virtual clinic system, which operates seven days a week, twenty-four hours a day [29].

In the United States, a survey to identify the perceptions and use of telemedicine in nursing homes resulted in a high degree of confidence in implementing it to replace deficiencies in health services [30]. Just as the USA have had well-implemented and elaborated telehealth systems for a long time, other African countries have not. The pandemic predominantly affects these countries, making it even more difficult for people to stay healthy. In Africa, the use of telemedicine and technological advances is less than in other countries, meaning it is more difficult for the population to receive care. The lack of technologies forces people to expose themselves to medical attention, which generates a greater risk of contagion by COVID-19 [20].

Telemedicine plays a crucial role in many industries, like oil and gas. In this industry, it has enhanced safety, provided timely medical attention, and improved the overall well-being of the workforce in remote and challenging environments. By utilizing telemedicine, medical emergencies can be addressed quickly and effectively while enhancing productivity and sustainability. Evjemo et al. [31] documented that telemedicine was initially used mainly through telephone contact between the offshore platforms and technical support that gave instructions from land. Still, it has improved because attention is no longer based solely on instructions, but computers and electronic devices are now available for videoconferencing. In addition, [32] emphasized the importance of telemedicine in this field because it makes healthcare at sea more accessible. Another use given to telemedicine is for controlling epidemics of highly contagious diseases that are difficult to treat in the short term since they generate concern due to their high spread. Telemedicine allows for evaluating the person at risk of contagion or infection and prevents the spread of the disease [33].

The COVID-19 pandemic has affected most Latin American countries, and telemedicine in Chile has had an important role in successfully reducing the hours patients wait for their first consultation in different specialties. A study conducted in a significant Health Network in Chile showed that telemedicine initiatives applied during the COVID-19 pandemic generated a high level of satisfaction compared with the period previous to the pandemic because the patients perceived the benefits of these practices [34]. On the contrary, telemedicine in neurology is only available on specific occasions in public health establishments in the country

Table 1
List of studies using the TAM model in the health area.

Authors	Model	Sample size	Results
[44]	TAM	158 students in France	Validating the relation between variables of the TAM model except Perceived-Ease-of-Use, which does not impact the intention-to-use a telemedicine cabin.
[45]	TAM	359 subjects in Taiwan	The behavioral intention did not depend on subjective norms, attitudes, perceived behavioral control, perceived usefulness, and perceived ease of use. Moreover, perceived usefulness had independent significant associations with perceived ease of use.
[46]	TAM	30 patients in Netherland	The perceived usefulness [$F(1,27) = 3.40$, $p = 0.08$] and perceived ease of use [$F(1,27) = 5.37$, $p = 0.03$] notably changed in the EG. The CG did not richly change its perceptions. Patients within the EG became significantly more positive about the usefulness and familiarity with the Web-based telemedicine app after a brief period of use.
[47]	TAM	275 participants in Pakistan	Usage intention of telemedicine services depends on the perceived ease of use, technology anxiety, social influence, perceived ease of usefulness, trust, facility conditions, perceived risk, and resistance to technology.
[48]	TAM	336 individuals in India	Perceived ease of use is a significant determinant of one's intention to use telemedicine vis-à-vis its effect on perceived usefulness and attitude towards telemedicine use.
[49]	TAM	436 elderlies in China	The study determined that medical service satisfaction, ease of use and information quality had a significant impact on the elderly patients' acceptance of telehealth, and the acceptance had a relevant impact on the elderly patients' behavior intentions of telehealth.
[50]	TAM	200 Subjects in Brazil	The TAM model does not explain the behavioral intention of using telemedicine. One possible explication is related to the fact that the current study is based on the concept of using technology rather than a proof of the technology itself.
[51]	TAM	Sample size 10 articles met all the predefined selection criteria for data extraction and result synthesis.	The main finding of this article shows that these two models, TAM and UTAUT, are still valid and used to predict the acceptance behavior of remote care technologies by health professionals.

TAM: Technology Acceptance Model - UTAUT2: extended Unified Theory of Acceptance and Use of Technology
EG: Experimental Group - Control Group: CG

[35]. According to [36], neurology ranks 7th among the Chilean medical specialties, with most patients waiting a long time for their first medical attention.

As [37] pointed out, the shortage of professionals in the area of neurology has generated problems in the care of their patients. Due to the high demand in this area, the Talcahuano Hospital implemented a telemedicine + neurology program to reduce the waiting time. After its implementation in 2015, the program intended to help 3,084 adult patients. In short, a decreasing trend has existed in the number of patients waiting since the implementation of this program.

Ong et al. [38] analyzed the factors that affected the acceptance of telemedicine in the Philippines and found that the variables that impacted Usage Behavior (UB) the most were performance expectancy, effort expectancy, hedonic motivation, social influence, and resistance to use.

The study of [34] compares the rates of in-person and telemedicine activity for several medical specialties in 2020 and 2019. We can appreciate the reduction in in-person visits among medical disciplines other than psychiatry. The highest decrease in in-person visits occurred in pediatrics subspecialties, ophthalmology, otorhinolaryngology, and dermatology.

2.2. Acceptance models

The study of the voluntary decision made by individuals to accept and use technology has been a prominent area of research in the information technology field. Information systems researchers have been searching for models to predict technology acceptance by individuals, groups, or organizations, starting with the TAM model proposed by [39]. TAM is based on the theoretical concepts provided by the Theory of Reasoned Action (TRA) and adapted to the information technology field, proposing that using a system is a response that the user motivation can explain [40]. After TAM, various versions emerged, such as TAM 2, TAM 3, and the UTAUT models. Those theories attempted to explain how technologies get adopted [41,42]. UTAUT2 is the most used version of the latest acceptance model developed by [43], with more than eleven thousand citations in the literature.

To improve the previous UTAUT model, [43] reviewed eight predominant acceptance theories and integrated new variables to design the current version of UTAUT2. The new model recognized the existence of three main components in earlier studies on consumer adoption and use of technologies and general adoption and use of technologies. These modified some of the relationships in UTAUT and integrated new ones. As a result, they considered that adding hedonic motivation should effectively emphasize utility. Considering cost as a relevant decision-making factor in the consumer context, we should also add the variable price value. Finally, the UTAUT2 model included the variable habit because it adds to the focus on intentionality as the fundamental process and primary motivator of conduct.

Table 2
List of studies using the UTAUT model in the health area.

Reference	Model	Sample size	Results
[52]	UTAUT	391 subjects in Pakistan	Integrates UTAUT with other models. This study found variables to explain 80.4% variance in patient attitude towards the use of telemedicine health service websites.
[46]	UTAUT	25 patients in the Netherland	UTAUT constructs perceived use-fulness and facilitating conditions offer a good starting point in structuring and understanding patients perceptions of prospective telerehabilitation services. In relation to the UTAUT constructs social norm and ease of use, fewer themes arose
[53]	UTAUT	338 articles on telemedicine published in "Deutsches Ärzteblatt"	Emphasis is put on the presentation of expectations of performance and effort as well as the description and modification of framework conditions.
[54]	UTAUT	147 subjects in the Philippines	The UTAUT model, the construct of performance expectancy and facilitating conditions provide significant explanatory power on the adoption of teleneurology in a resource-limited setting.
[55]	UTAUT	116 patients in South Korea	Diabetic patients consider performance expectancy, effort expectancy and social influence to be critical factors in the acceptance of telemedicine service, as predicted by the UTAUT model.
[56]	UTAUT	248 subjects in Brazil	The results indicated that performance expectancy, and perceived security and reliability are two predictors of the behavioral intention to use telemedicine, whereas effort expectancy and social influence showed no statistical significance.
[57]	UTAUT	197 caregivers 42 patients in Malaysia	The independent predictors of acceptance of virtual consultation were possession of an electronic device capable of video-communication, living with someone, living in a care home, weekly online banking usage, and perceived familiarity with virtual platforms.

UTAUT: Unified Theory of Acceptance and Use of Technology

Table 3
List of studies using the UTAUT2 model in the health area.

Reference	Model	Sample size	Results
[58]	UTAUT2	542 Women in Bangladesh	Perceived usefulness had a significant impact on the behavioral intention for both the young aged and the elderly female. Perceived reliability and price value strongly impact on actual usage.
[59]	UTAUT2	158 students in France	Findings highlight the key role of all telemedicine cabin dimensions (accessibility, availability, and compatibility) on performance expectancy, the importance of three UTAUT2 constructs (performance expectancy, price value, and habit) and the negative impact of privacy concerns on the intention to use a telemedicine cabin.
[60]	UTAUT2	576 students in France	The 22-item French-language eHealth acceptability scale, divided into seven subscales showed good psychometric qualities.
[61]	UTAUT2	350 responses in Pakistani citizens	Performance expectancy, social influence, effort expectancy, facilitating condition, habit, hedonic motivation, price values, information quality, system quality and service quality explained 77.9% of the variance in determining user-behavior toward the adoption of telemedicine applications.
[50]	UTAUT2	200 Subjects in Brazil	The TAM model does not explain the behavioral intention of using telemedicine. One possible explication is related to the fact that the current study is based on the concept of using technology rather than a demonstration of the technology itself.
[62]	UTAUT2	456 subjects in China	The price value is the strongest pre dictor (beta = 0.30, p = 0.02), facilitating conditions (beta = 0.28, p = 0.01) and hedonic motivation (beta = 0.13, p = 0.04) also have significant effects on telemedicine acceptance.
[63]	UTAUT2	Sample size: 710 physicians in German and the USA	This study adapts the UTAUT2 model by integrating perceived security and perceived product advantage, two known barriers to successful telemedicine adoption. Significant, direct, and positive effects of performance expectancy, hedonic motivation, perceived security, and perceived product advantage on the behavioral intention to use virtual doctor appointments were found.

TAM: Technology Acceptance Model - UTAUT2: extended Unified Theory of Acceptance and Use of Technology

2.3. Acceptance models applications in e-health

TAM, UTAUT, and UTAUT2 in health have been recurrent since information technology gained space in this field. More than forty-five studies have addressed the acceptance of telemedicine by final users employing one of those models [64,65]. The results of those studies have shown that the variable performance expectancy has been significant in most studies to explain the intention to use. Tables 1, 2 and 3 summarize the main results of studies that apply acceptance models.

UTAUT2 is a better model to include as the base to study the acceptance of telemedicine because it is a more comprehensive model than UTAUT and TAM. TAM only considers two factors that influence the acceptance of technology: perceived usefulness and perceived ease of use. UTAUT2, on the other hand, considers six factors: i) Performance expectancy ii) Effort expectancy, iii) Social influence, iv) Facilitating conditions, v) Hedonic motivation, and vi) Price value. These six factors are more likely to explain the acceptance of telemedicine than just perceived usefulness and perceived ease of use. For example, social influence may be an

important factor for people considering telemedicine for the first time. They may be more likely to use telemedicine if they know their friends or family use it. Similarly, price value may be essential for people concerned about telemedicine services' cost. They may be more likely to use telemedicine if they believe that the benefits of telemedicine outweigh the costs. In addition, UTAUT2 is a more accurate predictor of technology adoption than TAM. According to a study by [63], UTAUT2 could better explain the behavioral intention and technology used in telemedicine in the USA and Germany than TAM. Another reason to use UTAUT2, according to the same authors, is because it offers a holistic and integrative focus on consumer settings. Then, UTAUT2 is better since it is a more comprehensive model, considering a wider range of factors influencing technology adoption. It is also a more accurate predictor of technology adoption than the previous version of the acceptance model.

The UTAUT2 model has derived substantial benefits from including "facilitating" and "user perception" variables, thereby bolstering its capacity to provide comprehensive insight into the factors that influence individuals' behavioral intentions concerning the adoption of telemedicine. This augmentation has distinctly surpassed the capabilities of its predecessors, elevating its efficacy in understanding the determinants of telemedicine adoption intentions. Facilitation conditions are a variable that is especially important in telemedicine, as they influence users' accessibility and willingness to use the technology. In accordance with the literature review in Tables 1, 2, and 3, the UTAUT2 model's user perception variables (performance and effort expectations, as well as social expectations) also play a key role in telemedicine acceptance since service users perceive that technology is beneficial. The UTAUT2 model's antecedent variable, "Price Value," is not commonly included in telemedicine acceptance studies since some countries provide telemedicine services through public healthcare systems and insurance. It is possible for patients' costs to vary significantly, and, in many cases, they do not pay directly for each telemedicine consultation, so "price" is less relevant in this context. However, in Chile, healthcare services are predominantly privately administered, and government-subsidized payment systems offer limited coverage for these services. Consequently, the 'Price Value' variable assumes a pronounced significance as an antecedent factor in evaluating the adoption of telemedicine within the context of nations such as Chile. When users perceive a favorable quality-price ratio in telemedicine, their inclination to intend its usage is notably heightened.

3. Hypothesis development

First, our research gives background details to define a set of research hypotheses and associated variables to give experiment result details. We selected those variables considering previous research concerning the acceptance of systems.

3.1. Performance expectancy

Performance expectancy indicates the "extent to which an individual believes that using a system will help improve their performance" [43]. The performance expectancy is considered a critical factor for patients with medical treatments in general [52], and specific diagnoses such as diabetes [55], neurology [54], and psychiatry [66], among others. This importance of the performance expectation for patients is because the telemedicine service directly relates to their health conditions [66,55]. In this regard, performance expectancy may influence behavioral intention to use telemedicine. Several previous studies based on the acceptance of telemedicine through the UTAUT model have shown that performance expectancy significantly influences the intention to use telemedicine platforms [66,52,55]. Therefore, we hypothesize that performance expectancy positively affects the intention to use telemedicine:

H1: Performance expectancy positively affects the intention to use telemedicine

3.2. Effort expectancy

[67] crafted the effort expectancy concept representing the degree of ease associated with using a system. These authors found that this new construct integrates the similarities underlying the variables Perceived ease of use, complexity, and ease of use previously used to assess IT acceptance. Earlier studies have confirmed the relationship between effort expectancy and user intention to adopt telemedicine with different degrees of significance. The work of [67] defined Effort expectancy as the degree of ease associated with using a system (p.450). This variable has been assessed in various contexts with mixed results. In e-health, most studies have been favorable toward the variable. The research study of [68] found that this variable was one of the most significant predictors of the intention to use a system in the telemedicine context. Other studies have also assessed the UTAUT model in digital Health services, providing empirical support for the impact of Effort expectancy on the adoption and usage of those services [69–72,55]. Thus, effort expectancy is hypothesized as:

H2: Effort expectancy positively affects the intention to use telemedicine

3.3. Social influence

Social influence indicates the "degree to which the patient believes that the recommendations of others are important for adopting a technology" [43]. In the context of telemedicine, it is recognized as "the extent to which the patient believes that the recommendations of others are important for adopting telemedicine health services" [52]. Among patients, social influence refers to friends,

peers, patients with similar illnesses, and medical providers such as doctors and nurses [55]. Social influence has positively impacted user behavior toward adopting telemedicine health services [66,54,52,55]. Therefore, we propose the following hypothesis:

H3: Social influence positively affects the intention to use telemedicine

3.4. Price value

The work of Venkatesh [43], in their UTAUT2 model, included the variable price value, arguing that it could affect the intention to use IT, with a positive impact if the technology has a bigger value or advantage than its associated costs. In this research, the authors conceptualized price value as "consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them (P. 161)." Additionally, those authors stressed the relevance of this variable when assessing its impact on the "use intention" in private organizations because, in those cases, the customer will bear the cost. The same authors argued that in most cases, price value might have a significant role in predicting consumer behavior associated with the acceptance of digital health services through a mobile platform. The work of [73] analyzed customers' perceptions regarding the relationship between cost and price in the marketing field, finding that those concepts are frequently associated with quality when assessing the value of a service. Moreover, [74] argued that when the price value surpasses the monetary cost, there is a higher proclivity for users to adopt the new technology. As the literature has shown, telemedicine is considered a substitute for receiving in-person health services because it avoids the need to be physically present with physicians at the moment of the service. The provision of telemedicine services has increased since the time of the pandemic in 2020. However, the role of price value in accepting telemedicine as a service has yet to be widely researched because, in many countries, public organizations provide those services without payment. Additionally, some potential users still need to be convinced about using them because of economic and personal beliefs. Dwivedi et al. [70] analyzed the acceptance of digital health services through a mobile platform, finding that price value could be an important predictor of this acceptance. Other studies in the e-health area have assessed the effect of the price value on the continuance usage of mobile telemedicine applications, noting this to be a significant relationship [75,76]. On the other hand, the study of [52] observed an impact of the price value variable on user behavior toward adopting telemedicine applications. However, in this case, it was small. Consequently, this work developed the next hypothesis:

H4: Price value positively impacts the intention to use telemedicine

3.5. Facilitating conditions

Venkatesh [43] also identified the variable facilitating conditions as a significant predictor of the acceptance of new technology. This study defined this variable as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system. (p. 453)". This variable was previously represented in three constructs: perceived behavioral control, facilitating conditions, and compatibility. The primary UTAUT model considered that the variable facilitating conditions was initially an antecedent of use behavior. The following UTAUT2 model changed this relationship since it directly affects the behavioral intention to use new technology [43]. The assessment of this impact in the e-health environment has reported significant results. Various authors have informed of a statistically significant result of the influence of facilitation conditions on the adoption of telemedicine applications [70,72,77]. Consequently, we developed the next hypothesis:

H5: Facilitating conditions positively affect the intention to use telemedicine.

In summary, this research seeks to demonstrate the following hypotheses:

(H_1) Performance expectancy positively affects the intention to use telemedicine.
(H_2) Effort expectancy positively affects the intention to use telemedicine.
(H_3) Social influence positively affects the intention to use telemedicine.
(H_4) Price value positively impacts the intention to use telemedicine.
(H_5) Facilitating conditions positively affect the intention to use telemedicine.

Based on the previous revision, a theoretical model is presented in Fig. 1 which identifies the determinants of Behavioral intention to use telemedicine and specifies their interrelationships. This article uses behavioral intention to use telemedicine as a dependent variable because this variable, as well as acceptance of telemedicine, is a measure of a person's likelihood of using telemedicine. Behavioral intention to use telemedicine is a measure of a person's intention to use telemedicine in the future. In contrast, acceptance of telemedicine is a measure of a person's current attitude toward using telemedicine. The same factors, such as performance expectancy, effort expectancy, social influence, and facilitating conditions, will probably impact these measures. This suggests that behavioral intention to use telemedicine is a valid measure of a person's likelihood of using telemedicine. The notion that behavioral intention precedes the "use behavior" goes back to the Theory of Reasoned Action [78], and various authors have supported that behavioral intention is strongly related to use behavior [79,80].

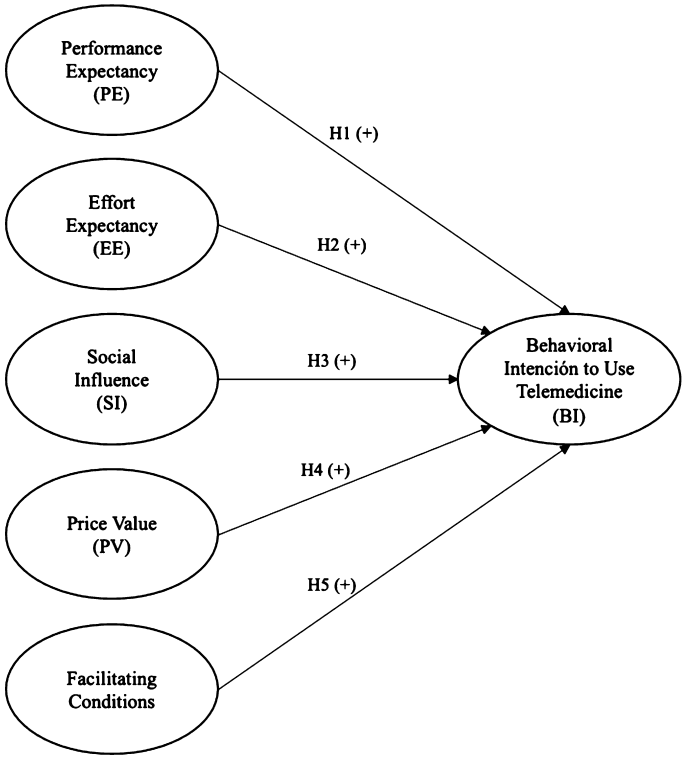

Fig. 1. Proposed model and hypothesis.

4. Methodology

4.1. Sample and pretest

The data was collected in Chile through a survey between August and November 2021. The survey was addressed to Internet users in the main cities of northern Chile. Professional surveyors performed the surveys. A pilot test was applied to 70 internet users to eliminate possible ambiguities in the questionnaire. After making minor changes to the instrument, the surveys were carried out. The exclusion of invalid surveys provided a final sample of 391 internet users. A total of 58.6% of the participants were women, and the average age of the sample was 36 years old. Among the answers, 98.72% reported having Internet access, 81.27% knew or had heard about telemedicine, and 34.78% had used a telemedicine platform. The data source is available in a GitHub repository.[1]

4.2. Measurement scales

The questionnaire that we have designed to capture data has two sections. The first block deals with demographic questions such as age, sex, and location. The second block gathers the measurement of the variables associated with the acceptance of telemedicine. These variables were taken from the existing literature and adapted to the context of telemedicine. The performance expectancy, effort expectancy, price value, and facilitating conditions were adapted from [81] work on accepting mobile applications. The purchase intention measure was adapted from the work of [82] about the acceptance of public apps. All the scales were measured with items on a 7-point Likert scale, ranging from “totally disagree” to “totally agree,” except for sociodemographic and other telemedicine-related variables.

4.3. Statistical tools

A Structural Equations Model (SEM) of structural equations, specifically Partial Least Squares (PLS), is proposed to test the reliability, validity, and hypotheses presented. Model estimation in PLS-SEM is based on a three-stage approach that belongs to the family of (alternating) least-squares algorithms. PLS-SEM allows the evaluation of causal relationships between indicators/items and the causal relationships of latent constructs [83]. PLS-SEM was selected because it has been widely used to assess the adoption of new technologies [84] and because it allows a lot of flexibility in terms of data requirements and the specification of relationships between

[1] Data Source URL https://github.com/cvidalmsu/Telemedicine.

Table 4
Reliability and validity of the constructs.

Variable	CA	CR	RA	AVE	Results	Loading
Performance Expectancy (PE)	0.885	0.920	0.907	0.741	* I find telemedicine useful when I need specialists in the health area.	0.892
					* I believe telemedicine helps me get health care more quickly.	0.851
					* I believe that telemedicine improves my well-being when I use it.	0.887
					* I can save time using telemedicine.	0.810
Effort Expectancy (EE)	0.950	0.967	0.957	0.908	* I think it will be easy for me to learn how to use telemedicine.	0.948
					* I think telemedicine is easy to use.	0.953
					* I think it's easy for me to be proficient in telemedicine.	0.959
Social Influence (SI)	0.935	0.853	0.958	0.837	* The people who are important to me think that I should use telemedicine.	0.901
					* I would recommend using telemedicine to others.	0.885
					* I hope the people who are important to me think I should use telemedicine.	0.940
					* The people who influence my behavior think I should use telemedicine.	0.932
Facilitating Conditions (FC)	0.831	0.876	0.964	0.640	* I have the necessary tools to use telemedicine.	0.748
					* I have the necessary knowledge to use telemedicine.	0.795
					* I am comfortable using telemedicine.	0.858
					* I can get help from others when I'm having trouble with telemedicine.	0.794
Price Value (PV)	0.948	0.966	0.952	0.906	* Telemedicine has a good quality/price ratio.	0.962
					* Telemedicine is reasonably priced.	0.954
					* Telemedicine offers a good service at the current price.	0.940
Behavioral Intention (BI)	0.935	0.954	0.936	0.838	* I will try to use telemedicine in the future.	0.906
					* I will use telemedicine frequently.	0.901
					* Assuming I have access to telemedicine, I would use it.	0.916
					* I plan to use telemedicine.	0.938

CA: Cronbach's Alpha - CR: Composite Reliability - RA: Rho_A - AVE: AVErage

Table 5
Discriminant validity, Fornel-Larcker criterion.

FC	PE	EE	SI	BI	PV	
FC	0.800					
PE	0.658	0.861				
EE	0.730	0.512	0.953			
SI	0.642	0.774	0.400	0.915		
BI	0.596	0.765	0.380	0.790	0.915	
PV	0.660	0.741	0.447	0.745	0.705	0.952

FC: Facilitating Conditions - PE: Performance Expectancy - EE: Effort Expectancy - SI: Social Influence
BI: Behavioral Intention - PV: Price Value

constructs and indicator variables [85]. The procedures suggested in the previous literature were used to evaluate the measurements and the structural model [86,84,87]. The data were analyzed using SmartPLS4 software [88].

5. Results

5.1. Construct validity and reliability

The reliability, convergent validity, and discriminant validity of all the multiple-item scales were evaluated to assess the measurement model. Supplementary Table 4 shows Cronbach's Alpha coefficient (CA), the composite reliability (CR), and Dijkstra-Henseler's indicator (RA: Rho_A), in addition to the loadings of each item, with which the reliability of the model was evaluated. For the proposed variables, the individual reliability of each item is ensured through loadings of more than 0.7 in their corresponding latent variable. Second, the reliability of the constructs was analyzed using Cronbach's alpha criteria (values between 0.831 and 0.950) and the composite reliability (values between 0.876 and 0.967). In all the cases, the indicators are greater than 0.7. Additionally, convergent validity is ensured by analyzing the average extracted variance. In the analysis, the values are between 0.640 and 0.908. All the indicators offer levels above the 0.5 score proposed in the literature. Discriminant validity was established according to the Fornell-Larcker criterion [86], in which the square root values of the AVE found on the diagonal are observed to be greater than the correlations between the constructs (Table 5). Similarly, the Heterotrait-Monotrait Ratio criterion [89,90] was considered, which

Table 6
Discriminant validity, Heterotrait-Monotrait Ratio (HTMT) criterion.

	PE	EE	SI	BI	PV
PE	0.688				
EE	0.857	0.578			
SI	0.634	0.832	0.420		
BI	0.584	0.821	0.402	0.843	
PV	0.661	0.791	0.468	0.788	0.746

FC: Facilitating Conditions - PE: Performance Expectancy - EE: Effort Expectancy - SI: Social Influence
BI: Behavioral Intention - PV: Price Value

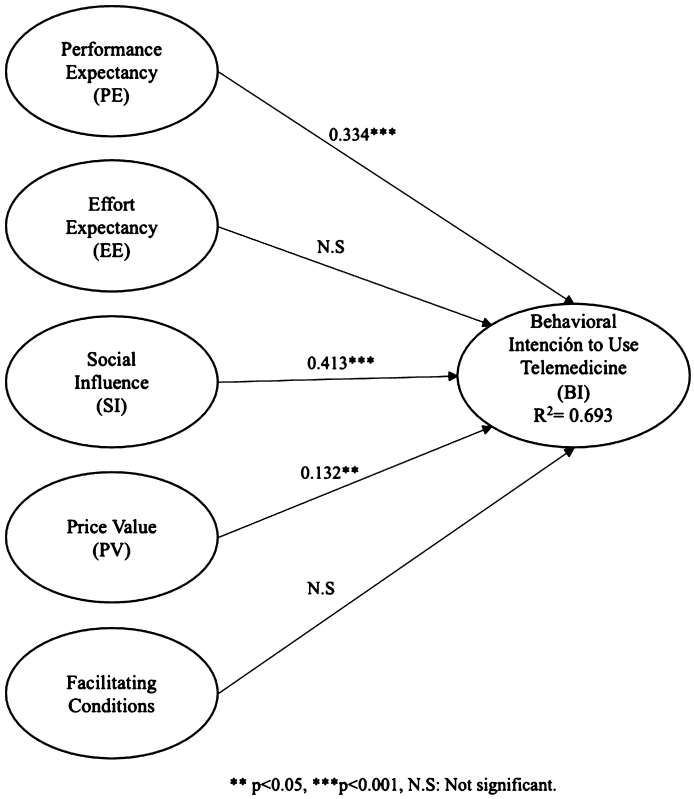

Fig. 2. Estructural model and results.

presented adequate values, lower than 0.9, in all the relationships [84]. Therefore, the results obtained reveal that there is indeed discriminant validity (Table 6).

5.2. Structural model

The evaluation of the structural model is carried out to test the proposed hypotheses. This is done through the Standardized Root Mean Residual (SRMR), the Path coefficients, and the R^2 values. The SRMR was used to measure the overall model fit. This yielded a value of 0.075, indicating a good fit for the proposed model [91]. On the other hand, path loadings and p-values were calculated to analyze the relationships described in the hypotheses, calculated with the bootstrapping technique of 5,000 subsamples. Fig. 2 shows the results of the proposed model. In addition, the R^2 values verified to evaluate the predictive capacity of the structural model are shown. Also, Table 7 shows the values of the Path coefficients and their p-values.

Table 7
Hypothesis results.

Hypothesis	Relationship	Path coefficient	p-Value	Result
H1	Performance expectancy ⟶ Behavioral intention	0.344	0.000	Supported
H2	Effort expectancy ⟶ Behavioral intention	−0.069	0.148	Unsupported
H3	Social influence ⟶ Behavioral intention	0.413	0.000	Supported
H4	Price value ⟶ Behavioral intention	0.132	0.042	Supported
H5	Facilitating conditions ⟶ Behavioral intention	0.112	0.193	Unsupported

H1: Hypothesis 1 - H2: Hypothesis 2 - H3: Hypothesis 3 - H4: Hypothesis 4 - H5: Hypothesis 5

6. Discussion

Although telemedicine could provide a wide variety of benefits for people in circumstances where they do not have medical services closely available, few studies have determined which factors impact the acceptance of this technology. This study identifies the UTAUT2 variables that could be significant in explaining the behavioral intention to use telemedicine, as explained below.

The results show that performance expectancy directly and positively affects the intention to use telemedicine services (H1). This result is consistent with previous studies in different contexts and specific medical treatments [66,54,52,55]. The importance of performance expectancy in patients can be explained because the telemedicine service directly relates to their health conditions [66,55]. The work of Rahi et al. [52] pointed out that performance expectancy has an intermediate level of importance in determining the intention of patients to adopt telemedicine services. In this study, performance expectancy is the second variable with the most significant effect on the intention to use telemedicine services, surpassed by social influence.

It was shown in the assessment of the model that effort expectancy associated with telemedicine is not significantly related to the intention to use telemedicine, then H2 is not supported. As illustrated in Fig. 2, the path coefficient (β) was -0.069, and the p-value was 0.148. These results indicate that the degree of ease associated with telemedicine does not significantly impact the intention to use telemedicine. Although most studies performed before the COVID-19 pandemic found a significant impact, [59] suggested that a possible reason for this is that currently most potential users of this technology are digital natives. This argument indicates that the effort in using such technology does not challenge the sample, and this variable seems irrelevant for this population. Similarly, the work of Serrano et al. [56] found that effort expectancy could not significantly predict this behavioral intention in adults in Brazil.

Mensah, Zeng, and Mwakapesa [92] argued for the non-significant effect that the advanced technological knowledge of citizens combined with their extensive use of it may be to blame for this because citizens are experts in using technology-related applications. Barua and Barua [93] also found that effort expectancy remains insignificant in both direct and interaction effects on behavioral intention to use m health services in a developing country. The evaluation of H3 reveals a direct and statistically significant positive influence of social influence on the intention to use telemedicine services. Consequently, this finding lends support to H3. This result is consistent with the previous literature on studies on the acceptance of telemedicine services [54,52,55]. This significant result implies that the influence of friends, peers, patients with similar illnesses, and medical personnel such as doctors or nurses are essential when determining the intention to adopt telemedicine services [55]. Contrary to the study of [52], which showed that social influence is of low importance for adopting telemedicine services, in this study, it turns out to be the strongest variable.

The variable price value is not always included in the acceptance models as a determinant of the intention to use technology. Kuttimani et al. [94] found in a meta-analysis that 79% of the studies using UTAUT2 failed to include the variable price value in the analysis, and most of them did not provide any reasons for the exclusion. In this study, we considered integrating this variable mainly because telemedicine was a paid service. The assessment of the model showed that the impact of price value on the intention to use telemedicine was significant. The path coefficient (β) was 0.132, and the p-value was 0.042, confirming (H4). This result shows that when deciding to use this service for health purposes, it is necessary to ponder the cost-benefit analysis to arrive at a fair price. These results align with previous research, which found that citizens perceived that telemedicine has higher perceived benefits than the monetary cost of using it [59,41,75,61].

The study hypothesized that facilitating conditions could positively impact the intention to use telemedicine. However, the assessment showed that this postulate was not statistically significant. Then (H5) could not be supported. In this case, the path coefficient (β) was 0.112, and the p-value was 0.193. The meaning of these results indicates that telemedicine users do not value the organizational and technical infrastructure when using telemedicine services.

Even though other studies have found this relationship statistically significant [70,72,77,46,68,54,55,52,62],this result is consistent with those obtained by Rho et al. [55] regarding diabetic patients using telemedicine and other studies after this [95,93,96–98]. These mixed results over time have depended on factors in the sample, such as country, age, and particular health service. Chan, Tang, and Teng [96] claimed that facilitating conditions may not predict intention to use online health services when respondents belong to the younger generation, particularly Generation Z, described as self-learners who can solve problems using the Internet. Also, Amin et al. [95] in Bangladesh found that the variable facilitating conditions was insignificant in predicting continuous intention to use telemedicine.

The current study's findings provide support for the impact of the user perception variables 'performance expectancy' and 'social influence' on the behavioral intention to use telemedicine, with social influence playing a pivotal role in shaping individuals' intentions to use telemedicine services within the Chilean context. This implies that the influence of social networks, peers, healthcare

providers, and influential social actors significantly affects an individual's readiness to embrace telemedicine. The opinions of referents not only help in determining the worthiness of these services but also modify their subjective evaluations regarding perceived benefits and sacrifices [43]. Performance expectancy exhibits the second-highest impact on the intention to use telemedicine services, reflecting the extent to which users anticipate that telemedicine will enhance their ability to manage their healthcare needs. This encompasses the perception of the potential benefits of telemedicine, such as improved access to healthcare, convenient consultations, time savings, and potentially better health outcomes. The third-highest impact on behavioral intention was the 'price value' variable, suggesting that customers' willingness to accept the service is determined by the perception of telemedicine's cost-effectiveness and economic viability compared to traditional in-person healthcare services. This underscores the dynamic interplay between financial considerations and the readiness to embrace innovative healthcare delivery methods.

7. Conclusions

The COVID-19 pandemic, a public health emergency of global concern, led to a rapid increase in telemedicine usage, driven by the need to limit in-person contact and reduce the risk of infection. Many doctors and patients have embraced telemedicine as a safe and convenient alternative to traditional in-person visits. People in Latin America have also increasingly turned to telemedicine platforms to meet their health needs. At the time of this research, this phenomenon has been scarcely studied in the Latin American context; therefore, there is a need to know and evaluate the characteristics of telemedicine platforms that generate acceptance and use. This study has successfully addressed this limitation by determining the factors influencing telemedicine acceptance and use in Chile.

The data for the study were obtained during the mobility restrictions brought about by the COVID-19 pandemic, proving meaningful implications for academia and the acceptance and use of telemedicine platforms. First, the results of this study show that social influence, performance expectancy, and price value, in this order, influence the intention to use telemedicine platforms. These findings provide significant insights for developing strategies to support the use of telemedicine platforms where family members, peers, and health personnel could have a critical role. They could also be helpful when designing telemedicine platform dissemination strategies. The significant impact of performance expectancy on the intention to use telemedicine shows that telemedicine platforms are directly related to a vital concern of patients' health, turning the use of these platforms into a life-death issue. Therefore, the platforms must comply with delivering information and data and providing understandable information. Another relevant finding was the significance of the price value construct when using telemedicine in a non-public setting. This result implies that the providers must focus on efficiency, monitoring the cost-benefit ratio. Finally, the effort expectancy and facilitating conditions variables did not significantly affect the Chilean population's intention to use telemedicine platforms. This result could be associated with the high level of access to devices and the internet in Chile and the fact that people generally have mastered them.

7.1. Benefits for the healthcare industry

The healthcare industry could benefit from the findings of this study because knowing the significant predictor of the intention to use it could allow the development of specific strategies to provide consultations with doctors, deliver medications, and provide other medical services. Telemedicine can provide patients access to care they might not otherwise be able to get. For example, telemedicine can provide care to patients in rural areas who do not have easy access to healthcare providers. The study also found that Price value significantly impacts the intention to use telemedicine. These two findings show that telemedicine can provide consultations with doctors without physically traveling to a doctor's office. These results can save patients time and money, free up healthcare providers to see more patients, and ensure that patients receive the best possible care. The relevance of the impact of social influence as a predictor of intention to use telemedicine means that people are more likely to adopt a technology if they see that their friends, family, or colleagues are using it. Also, this can help to create a sense of community around its use. In this case, if a person's doctor recommends telemedicine, they are more likely to be willing to try it. Additionally, social influence can help to reduce anxiety about using new technologies, especially if a person's friends have had positive experiences with telemedicine, so they are more likely to be willing to try it themselves.

7.2. Limitations and future research

The results of this research must be seen in the context of its limitations. First, the data was collected in a developing country, Chile, where the level of technological development is different from countries with higher indexes of IT development. Consequently, the results in those countries could differ. Additionally, this study considers the use of telemedicine platforms for any disease. In contrast, the results could vary for specific diseases according to some characteristics of the users, such as age or internet experience. In the future, it is necessary to generate studies that can compare or differentiate countries according to their level of access to technology. Similarly, future studies could delve into the characteristics of the acceptance of telemedicine platforms for specific diseases to see if they behave differently. Finally, it is necessary to assess if there are significant differences in the acceptance of telemedicine platforms offered by the public health network and those provided by the private network.

CRediT authorship contribution statement

Cristian Vidal-Silva: Writing – review & editing, Writing – original draft, Visualization, Supervision. **Vanessa Arriagada:** Investigation. **Moisés Flores:** Data curation. **Mónica Godoy:** Validation. **Cristopher Vargas:** Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data supplementary to this article is available in the open repository https://github.com/cvidalmsu/Telemedicine.

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