Original Article

Exploring the Impact of Telehealth Usability on Telemedicine Satisfaction: The Moderating Role of Physician-Patient Communication Skills

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Abstract

Purpose: This study aims to explore the impact of telehealth usability and physician-patient communication skills on telemedicine satisfaction, with a particular focus on the moderating role of communication skills in the telemedicine experience. The research provides insight into how these factors influence healthcare delivery in the context of virtual consultations, addressing the need for enhanced telemedicine practices, especially in the wake of the global health crisis. **Method:** A survey was conducted with 200 patient and 67 doctors and their corresponding patients across various hospitals. The survey utilized a structured questionnaire designed to measure telehealth usability, physician-patient communication skills, and telemedicine satisfaction. Data analysis was performed using SPSS, with Dyadic Data Analysis employed to examine the relationships among the variables, taking into account both doctor and patient perspectives. **Findings:** The findings reveal that telehealth usability significantly impacts telemedicine satisfaction. Furthermore, physician-patient communication skills play a critical moderating role in strengthening this relationship, highlighting the significance of both technical and interpersonal aspects of telemedicine in shaping healthcare experiences. **Originality/Implications:** This research provides valuable contributions to telemedicine literature by offering empirical evidence on the factors influencing satisfaction with virtual healthcare. The study underscores the importance of integrating user-friendly telehealth technologies with effective communication strategies to improve the overall experience for both doctors and patients. The findings suggest practical implications for healthcare providers seeking to optimize telemedicine services in the future.

Keywords: Telehealth Usability, Telemedicine's Satisfaction, Physician-patient, Communication Skills, SEM Analysis.

Introduction

Telemedicine has changed the face of the medical world with its use of online platforms to render medical consultations or other services from far-flung and inaccessible locations. In the periods of global pandemics, as in the COVID-19 health crisis, due to physical distancing measures, alternate methods of medical service delivery gained preference.[1] Telehealth services are part of the family called telemedicine and are employed when using technology to ensure video consults, remote monitoring, or effective communication between the patients and healthcare providers.[2] Usability stands at the top of successful operations for telemedicine services and determines the efficiency, effectiveness, and satisfaction derived from the platforms.[3] Telehealth usability is inherently linked to user-friendliness, accessibility, and technological reliability. These are fundamental aspects that can ensure a seamless healthcare experience.[4] Despite the fact that technology has evolved to enhance the functionality of these platforms, there are still challenges in handling various needs and expectations of patients.[5] Understanding how the usability features described above impact telemedicine satisfaction will better optimize the design and deployment of telehealth systems for long-term adoption and effectiveness.[6]

A considerable body of evidence supports the impact of telehealth usability on patient experience and satisfaction.

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Initial studies by Jain *et al.*[7] demonstrated that ease of use and system reliability are among the most significant factors affecting patient trust in telemedicine services. Kasim *et al.*[8] demonstrated that technical reliability, when combined with user-friendly navigation, greatly enhanced patient participation and adherence to medical advice during virtual consultations. In addition, McEvoy *et al.*[9] identified usability issues, including system delays and ambiguous instructions, which often led to dissatisfaction, thus reducing the chances of the patient visiting telehealth services again in the future. Other studies have been carried out from various perspectives that have emphasized demographic factors in usability perceptions.[10] For instance, Sayed *et al.*[11] revealed that patients aging is associated with difficulties in operating telehealth, directly influencing their satisfaction. Instead, younger users-especially those with greater experience of working with digital devices-show significantly more satisfaction in comparison, emphasizing that systems should cater to various users.[12] Zhang *et al.*[13] work also established the fact that feelings of frustration and trust strongly underpin telehealth usability and inform the experience more broadly. Most studies report on the positive impacts of usability but warn that unsolved usability issues can negate even the most advanced technological features and thereby negatively impact satisfaction outcomes.[3]

Despite significant research advancement, gaps remain in fully understanding the complex relationship between telehealth usability and telemedicine satisfaction.[14] For example, whereas numerous studies have explored the direct impact of usability, few have considered contextual factors like communication quality that may moderate this relationship.[15] Furthermore, most of the literature available currently tends to concentrate on technologically advanced regions, ignoring the user perspectives from developing countries, where infrastructural constraints are common.[6] Such a geographical bias reduces the generalizability of findings across the global healthcare systems.[16] Another key omission is the heterogeneity of the target population. Many studies have focused on the older adults or the technologically savvy users but have given insufficient attention to the younger or less technology literate group whose expectations and usability challenges are likely to be different.[17] Furthermore, relatively little empirical research has been conducted on how system features such as interoperability and multilingual interfaces affect satisfaction in diverse cultural settings.[18] There is also a need for longitudinal research, where continued improvement in telemedicine usability can significantly enhance telemedicine satisfaction over long periods, thereby also allowing further avenues of future investigation.[19]

This research fills those gaps by examining the relationship between telehealth usability and telemedicine satisfaction, investigating how physician-patient communication moderates this relationship. The first objective is to determine how the usability factors, including simplicity of navigation, system reliability, and accessibility, have an effect on patient satisfaction when using telemedicine platforms.[4] The second objective focuses on the moderating effect of the communication skills between physicians and patients in strengthening or weakening the usability-satisfaction link. These objectives therefore lead to two central research questions: "How does telehealth usability relate to telemedicine satisfaction?" and "How do communication skills of physicians moderate this relationship in different telehealth contexts?" With these questions, the study will focus on providing more nuanced understanding as to how usability impacts patient experience and outcomes of telemedicine. In addition, it aims to provide empirical evidence that may inform healthcare policymakers and developers in the design of more user-centered and communication-enhancing telehealth platforms. Through a comprehensive examination of usability and communication dynamics, this research hopes to fill the existing empirical gaps and offer actionable solutions for the advancement of telehealth practices across different demographic and geographical settings.

This research is important because it aims to increase the understanding of telehealth usability, which is very important for the improvement of the adoption and satisfaction of telemedicine services.[20] It offers new insights on how usability interplays with physician-patient communication, thus having a dual focus on technological and human factors.[21] The results of this study are targeted to benefit healthcare providers, platform developers, and policymakers by making suggestions on how user experience can be improved and how trust can be built as a way toward better patient outcomes.[22] As with the other works in this context, its contribution to filling the current research gaps in the empirical landscape surrounding telemedicine as a long-term solution for global healthcare challenges is important.[23] The proposed research model and hypotheses are strongly based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and Social Exchange Theory (SET). According to UTAUT, performance expectancy and effort expectancy are major determinants of technology acceptance and satisfaction.[10] Telehealth usability is therefore highly aligned with the constructs because such effective and easy-to-use systems meet the users' performance expectations while minimizing their cognitive and operation effort. The UTAUT, on the other hand, particularly highlights the enabling role of the facilitating conditions - effective communication-in augmenting the satisfaction.[24] Addition of physician-patient communication, therefore, adds up as the perfect fit to this model and receives ample support based on the evidence emanating from previously conducted research studies.[25] Social Exchange Theory (SET) provides even more theoretical foundation by pointing to the mutual aspect of patient-provider interaction in telemedicine.[26] Effective physician-patient communication engenders a feeling of trust and emotional fulfillment that compensates for technical limitations in the usability of telehealth.[27] Interplay between the human and technological factors creates holistic healthcare experience and leads to high

patient satisfaction, as proposed by Lee *et al*.[28]. This paper integrates the aforementioned theoretical perspectives for the purpose of providing an elaborate explanation of how telehealth usability and communication dynamics shape telemedicine satisfaction. The results are anticipated to validate the theoretical constructs and provide actionable insights for improving telemedicine systems.

Literature Review

Telehealth systems have become the transformative tools of modern health care, with technology bridging gaps in accessibility, efficiency, and convenience.[29] Usability, an important dimension of telehealth, is described as the extent to which users can easily navigate a system in order to achieve their goals with ease, effectiveness, and user-friendliness.[20] Scholars have placed emphasis on usability because it is the direct outcome that affects patients' and healthcare providers' use of telemedicine platforms.[30] Intuitive design, system reliability, ease of navigation, and timely support services are some of the factors that contribute significantly to user satisfaction.[3] A user-friendly interface ensures that the different users, irrespective of their level of technological competency, can access health care without any unnecessary complications and thereby increase their trust and confidence in the technology.[31] Additional studies show that usability barriers, such as poor internet connectivity, technical failure, and interoperability issues of the system, must also be addressed to enhance positive experience and wider acceptance of telehealth solutions.[27] Therefore, the findings indicate that usability is not only a technical criterion but also lays the foundation for other elements in determining overall satisfaction with telemedicine services.[32]

The role of telehealth usability transcends its technical features to also include psychological and social user experiences.[5] Studies have shown that platforms that meet the specific needs of diverse populations, such as older adults and chronic patients, tend to have a higher level of satisfaction.[12] Some of the features that are vital in ensuring the efficiency of interactions between patients and providers include real-time consultations, simplified appointment scheduling, and integrated communication systems.[21] The mechanisms of privacy and security, including encrypted communication channels and robust data protection protocols, enhance the feeling of safety and satisfaction among patients.[33] For providers, high usability systems help them manage workflows more effectively and minimize cognitive load to ensure the best possible care is delivered.[27] Further outcomes related to usability and satisfaction have been adherence to medical recommendations, health improvements, and retention of patients in telemedicine programs in the long run.[34] Hence, usability appears to be a multidimensional construct with profound links to quality and satisfaction gained from telemedicine services.[13]

Telehealth Usability and Telemedicine's Satisfaction

Usability has been a fundamental principle in assessing the effectiveness of telehealth systems.[1] Several studies have proven that usability is a factor of utmost importance to improve user satisfaction in various health care settings.[7] For example, Little *et al*.[14] stated that the intuitive navigation of information, transparency of information, and responsiveness in telehealth greatly enhance patient participation, ensuring an enjoyable experience. Gilmore *et al*.[31] opined that user-friendliness, accessibility and system reliability will directly affect the satisfaction and convenience dimensions of patients directly. Such evidences suggest the fact that, technical errors alongside complex interfaces impact the effective delivery of communication negatively and thereby influence patient satisfaction wherein user-oriented interfaces ease the communication problems.[35] Similarly, recent studies by Santos *et al*.[16] have found that telehealth systems designed to meet the diverse needs of different demographics, such as older adults and technologically inexperienced users, increase comfort and satisfaction. Some studies have also documented a significant link between system usability and outcomes, including trust in telemedicine platforms, adherence to health advice, and repeat usage.[19] In fact, according to Pereira *et al*.[23], the more intuitive and accessible the interface, the higher the chances that patients will meaningfully engage with services offered, thus raising overall satisfaction. It suggests that, for the provider, good usability increases smooth workflow practices, reduces work challenges, and improves the healthcare service quality itself, according to McEvoy *et al*.[9]. But what also research highlighted is that usability works not independently. Factors, such as training, digital literacies, and infrastructural provisions are what transform usability into satisfaction.[2] Thus, the empirical evidence generally converges on the notion that usability stands out as a key influencer of satisfaction with telemedicine systems.

Building on past empirical research, the relationship between telehealth usability and telemedicine satisfaction may be conceptualized through the interplay of technical performance and user experience.[20] A well-designed telehealth platform ensures that information flows in a seamless way, communication is uninterrupted, and proper support mechanisms are accessible to patients, fulfilling core patient needs.[4] Usability embodies multiple ingredients such as device compatibility, data security, and easy navigation, all of which contribute toward a positive telemedicine experience.[3] For example, some systems which possess efficient scheduling, fast solving of issues, and appropriate instructional instruction continually receive high rating from the patient.[6] Second, usability engenders trust with regard to technology which happens to be the most salient mediator toward a satisfactory solution; according.[20] From a theoretical point of view, the TAM asserts that perceived ease of use and perceived usefulness are directly related to satisfaction with digital tools, such as telehealth systems.[7] The enhancement of usability falls in line with these constructs, making telemedicine more accessible and easier to use for both patients and providers. Overcoming usability-related issues helps overcome technological anxiety and lack

of confidence, thus enhancing satisfaction levels.[9] These insights provide strong empirical support for hypothesizing that telehealth usability significantly and positively influences telemedicine satisfaction.

H1: Telehealth usability significantly influences the telemedicine's satisfaction.

Physician-Patient Communication Skills, Telehealth Usability and Telemedicine Satisfaction

Physician-patient communication has been identified for a long time as a vital component of successful healthcare delivery.[15] The ability of a healthcare provider to listen, empathize, and clearly articulate medical advice directly affects the patient's level of satisfaction with the treatment prescribed.[21] According to Das *et al.*[6], effective communication between patients and physicians fosters trust and creates a sense of partnership, which is an important part of a fulfilling healthcare experience. Communication becomes more vital in the telehealth scenario, considering that both the provider and the patient are physically distant.[36] Eustache *et al.*[22] also have observed that the way the virtual communication is clear, soft, and on time impacts directly the perception of patients towards the quality of care. Moreover, structured and empathetic communication fills the gaps left by technological limitations and ensures that the patient is heard and supported.[37] There are various empirical studies that emphasize the moderating effect of communication skills in several technology-mediated healthcare processes.[28] For example, Mohd Salim *et al.*[25] highlighted that the effectiveness of telehealth services highly depends on the provider's ability to show empathy and engage with the concerns raised by the patients during consultation. Similar findings were made by Morgan *et al.*[26], who said that the physician-patient interactions acted as the "human touch" in telemedicine, alleviating possible dissatisfactions resulting from technological glitches or usability limitations. Such findings show that even the most technically adept telehealth systems might not work out if communication is suboptimal.

The importance of communication justifies, both theoretically and empirically, its moderating role in the usability-satisfaction relationship.[24] Even though telehealth usability provides the foundation for a positive experience, the provider's communication skills may either enhance or diminish this impact.[38] For example, a well-designed telehealth platform may facilitate easy scheduling and high-quality video calls, but poor communication during the consultation may undo satisfaction.[23] In contrast, when the communication of providers is outstanding, it makes patients feel even more positive towards the platform in the presence of slight usability flaws. According to San and Arranz[39], "communication serves as a supplementary variable, assisting the patient in deciphering and utilizing the technological functions of telehealth systems effectively". This moderating effect can be also viewed by applying Social Exchange Theory that asserts the reciprocal nature of interactions between the patients and the provider.[17] Proper communication satisfies not only the emotional and information needs of the patients but also enhances their trust in the service delivery technology.[35] Therefore, communication between physicians and patients enhances the usability-satisfaction relationship as communication offers a more holistic and supportive healthcare experience.[40] This situation makes communication skills the most crucial variable in ensuring that the usability can be totally utilized; thus, further strengthens the case for moderating the role of communication skills.[15]

H2: Physician-patient communication skills significantly moderates the relationship of telehealth usability and the telemedicine's satisfaction.

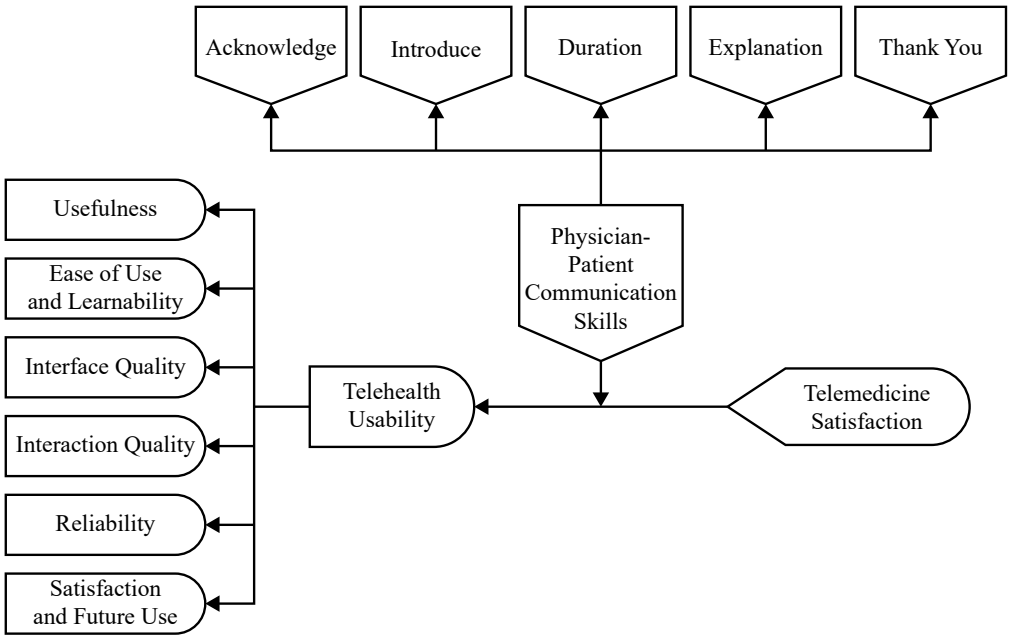

Figure 1: Theoretical Model.

Theory to Explain the Relationships and Model

The Unified Theory of Acceptance and Use of Technology (UTAUT) offers a comprehensive framework to explain the relationships and model proposed (Figure 1) in this research. UTAUT suggests that performance expectancy, effort expectancy, and facilitating conditions are the factors that influence users' acceptance and satisfaction with technological tools.[17] Telehealth usability closely relates with the constructs given as it translates the effort expectancy and facilitating conditions for successful adaptation. Furthermore, communication between the physicians and patients ensures performance expectancy via direct influence in quality perceived results from healthcare experiences for the patients. The theorized moderating factor in communication competence also finds bases under Social Exchange Theory, pointing to trust and reciprocity forming the basis for successful interpersonal interchange.[33] Good communication increases trust and reduces the negative effects of technological challenges, hence creating a comprehensive and fulfilling telemedicine experience. Such theories combined into a strong conceptual lens from which to understand how usability and communication dynamically interact to affect satisfaction with telemedicine.

Methodology

Research Design

The study adapted the quantitative research approach to determine the relationships between telehealth usability, physician-patient communication skills, and telemedicine satisfaction. It covered several hospitals in an effort to provide diverse and representative findings, thus enhancing generalizability. Focusing on doctors and patients actively involved in telemedicine services, the study helps to gain empirical insights into technological and interpersonal determinants shaping the satisfaction of virtual care.

Sampling and Participants

The target population included active users who formed part of the sampling frame: both medical doctors and patients. Purposive sampling to select doctors and patients who had past experience in telehealth, with their corresponding patients chosen based on use of the services. This final sample had a balanced representation from different hospital settings: 67 doctors and their 200 corresponding patients. This sample size was considered adequate for Dyadic Data Analysis, and it was hoped that this would result in robust and statistically significant findings.

Data Collection Procedure

Data were collected through a structured questionnaire that measured the usability of telehealth, physician-patient communication skills, and telemedicine satisfaction. Questionnaires were sent via email and handed over to both doctors and patients during visits to their respective hospitals. Each questionnaire included a cover letter stating the purpose of the study and promising confidentiality. Adequate time was given to respondents to fill the survey, and reminders were also sent to enhance the response rate. For the analysis of the data, SPSS was used, and Dyadic Data Analysis was applied to understand the relationship between the variables from the view of doctors and patients.

Instrumentation

The scales (Table 1) in measuring the variables of interest have been adopted from previously validated research works.

Table 1: Instrumentations.

Constructs	Items No	Source
Telehealth usability	21	Parmanto *et al.*[41]
Telemedicine's satisfaction	15	Yip *et al.*[30]
Physician-patient communication skills	20	Bar-Ad *et al.*[18]

The adopted scales were anchored to a five-point Likert scale ranging from "1 = Strongly Disagree" to "5 = Strongly Agree," making sure that each variable is scaled consistently and in a way of minimizing response bias.

Analytical Approach

The data of both doctors and patients were coded and analyzed in SPSS to use Dyadic Data Analysis that would be aimed at investigating telehealth usability-physician-patient communication skills-telemedicine satisfaction relationships. This method facilitated the assessment of how the perspective interaction between a doctor and his patient would impact telemedicine satisfaction. Specifically, this explored the moderating role of physician-patient communication skills in the relationship between usability of telehealth and satisfaction, considering that the data were both individual and dyadic. Results were interpreted to determine significant patterns and relationships, providing a complete understanding of the factors influencing virtual care satisfaction.

Results

Table 2 is a presentation of the descriptive statistics for the most important variables: telehealth usability, telemedicine satisfaction, and physician-patient communication skills. The sample size for telehealth usability and telemedicine satisfaction is 200, and the sample size for physician-patient communication skills is 67. For telehealth usability, the mean score is 4.072 with a standard deviation of 0.612, which means that respondents generally rated the usability of telehealth platforms positively, with relatively low variability. A satisfaction level in telemedicine is generally higher, and the mean obtained is 4.358. The standard deviation is 0.718; this suggests the respondents are basically satisfied with telemedicine services; however, satisfaction ratings do contain moderate variability. Physician-patient communication skills rated a mean score of 4.189 while having a standard deviation of 0.528, showing communication skills as mostly positive.

Table 2: Descriptive Statistics of Key Variables.

	N	Mini	Maxi	Mean	Std. Deviation
Telehealth usability	200	1	5	4.072	0.612
Telemedicine's satisfaction	200	1	5	4.358	0.718
Physician-patient communication skills	67	1	5	4.189	0.528

Table 3 depicts the correlation coefficients between the three main variables: telehealth usability (TU), telemedicine satisfaction (TS), and physician-patient communication skills (PPCS). High, positive correlations exist for all the variable pairs. Telehealth usability is significantly positively correlated with the satisfaction of telemedicine with a correlation coefficient of $r = 0.834$, $p < 0.01$, which suggests the higher usability is associated with greater satisfaction. Physician-patient communication skills are very highly correlated positively with both telehealth usability $r = 0.763$, $p < 0.01$ and telemedicine satisfaction $r = 0.833$, $p < 0.01$: again emphasizing how good communication leads to effective, usable telehealth and greater patient satisfaction. All correlations are significant at the 0.01 level (1-tailed).

Table 3: Correlations Between Variables.

	TU	TS	PPCS
Telehealth usability	1		
Telemedicine's satisfaction	.834**	1	
Physician-patient communication skills	.763**	.833**	1

** Correlation is significant at the 0.01 level (1-tailed).

Table 4 depicts the Cronbach's alpha value for the three primary variables. Cronbach's alpha is an indicator of internal consistency. When it approaches values close to 1.0, the instrument shows good reliability. The high score for usability in telehealth has a score of 0.941 with an excellent level of internal consistency in the application of the 21 items in this variable. Telemedicine satisfaction has a similarly high reliability score of 0.922 for its 15 items, which means that the scale used to measure satisfaction is also highly consistent. Physician-patient communication skills have a slightly lower but still strong Cronbach's alpha of 0.887 for the 20 items, which indicates good reliability in measuring communication skills.

Table 4: Reliability Analysis (Cronbach's Alpha).

Variable	Cronbach's Alpha	Number of Items
Telehealth usability	0.941	21
Telemedicine's satisfaction	0.922	15
Physician-patient communication skills	0.887	20

Table 5 reports the ICC for telemedicine satisfaction, measuring the percentage of total variance in satisfaction that can be explained by differences between doctors and patient. The ICC of 0.27 means that 27% of the variation in satisfaction is due to between-doctor differences and patient differences, while 73% of the variation in satisfaction is explained by within-doctor variation (residual variance). This implies that although physician-level factors contribute to satisfaction, there are other factors, probably at the patient level, that also influence satisfaction.

Table 5: ICC for Satisfaction and Doctor-Level Variance.

Model	Intercept Variance	Residual Variance	ICC
Telemedicine's satisfaction	1.50	4.00	0.27

Table 6 presents the fixed effects analysis. The estimates for model effects, standard errors, t-values, and p-values are as follows: Intercept=2.34, $p < 0.001$. This result means that the average value of telemedicine satisfaction begins at 2.34 before accounting for the independent variables. High telehealth usability indeed has a huge positive effect on telemedicine satisfaction ($\beta = 0.45$, $p < 0.001$) and indicates the higher usability contributes to higher satisfaction. Physician-patient communication skills also have significant positive effects in the model $\beta = 0.30$, $p = 0.013$, which may indicate that improvement in communication does improve satisfaction levels. The interaction term between telehealth usability and physician-patient communication skills is positive at 0.20, meaning that the effect of usability on satisfaction is enhanced by better communication skills.

Table 7 shows that the random effects analysis report. This is to a best-fit, thus determining variance related to doctor-level differences and residual, or error variance. For random intercept, the variance related to doctor level is 0.85 (Standard error = 0.22), and the Z-value is 3.86 ($p < 0.001$). This signifies that there is significant variability

in satisfaction between different doctors. The residual (error) variance is 1.50 with a standard error of 0.13, Z-value = 11.54, and $p < 0.001$. This shows significant unexplained variation at the individual level that can be explained due to patient-specific factors. This outcome thus stresses the need for both doctor-level and patient-level factors to explain telemedicine satisfaction.

Table 6: Model Summary (Fixed Effects).

Effect	Estimates (β)	Standard Error	t-value	p-value
Intercept	2.34	0.56	4.18	0.000
Telehealth usability	0.45	0.10	4.50	0.000
Physician-patient communication skills	0.30	0.12	2.50	0.013
Telehealth usability × Physician-patient communication skills	0.20	0.08	2.53	0.014

Table 7: Covariance Parameter Estimates.

Effect	Variance	Standard Error	Z-value	p-value
Doctor_ID (Random Intercept)	0.85	0.22	3.86	0.0001
Residual (Error Variance)	1.50	0.13	11.54	0.0000

Discussion

With telemedicine emerging as a core element of modern health care, the scope of ensuring patient satisfaction through novel technological solutions is also increasing and challenging. In this study, two important dimensions that shape the satisfaction of telemedicine were investigated: the usability of telehealth and the physician-patient communication skills. Together, these aspects determine the quality and effectiveness of virtual healthcare interactions. The results of the study confirm the crucial role of usability in determining patient experiences through telemedicine and, at the same time, establish the mediation effects that effective communication exerts over satisfaction outcomes. With telehealth slated to bridge the gap in healthcare accessibility, the results of this study provide much-needed insights for healthcare professionals, policymakers, and technology developers as they strive to optimize virtual care systems.

These findings agreed with the already published literature in suggesting that the usability of telehealth has an immense impact on telemedicine satisfaction while adding subtlety. Indeed, platform ease-of-use, accessibility, and reliability for the patient's decision about telemedicine has already been studied and reported upon by Legaspi *et al.*[3]. This study extends these findings by illustrating the multidimensional facets of usability-the intuitiveness of interfaces, the error-free execution of systems, and device interoperability-as elements that directly define patient experiences. Respondents said that the two most important aspects to build trust are technological fluency and easy navigation, as frustrations often occur within virtual care settings.

Further, this study elaborates on the idea that the usability of platforms contributes not only to technical satisfaction but also emotional well-being as the patient feels empowered and confident when using tools that accommodate their needs. As indicated by Olivos *et al.*[42], the results strongly resonate with those who indicated an increase in a sense of control and agency from the patient end in the event there is a show of usability in the priorities for design on platforms. Underlining an urgent need for telehealth providers to engage into iterative design with consideration of diverse demographics of patients regarding age, educational levels, and familiarity with technology. The combined findings underline the importance of usability for patient satisfaction with telemedicine and thus become actionable directions toward improvements in design and functionality for the platforms.

Verification of the second hypothesis introduces significant human-centered subtleties into the argument regarding the role of physician-patient communication as a moderator between telehealth usability and telemedicine satisfaction. Communication, filling in where technology leaves off in patient trust, becomes all the more important as in the absence of touch, so it is with telehealth. These were consistent with Mohd Salim *et al.*[25] who found that interpersonal aspects of virtual consultations had a great influence on overall patient satisfaction. Communication provides clearness, compassion, and personalized care with sometimes frustrations due to minor technical failures or usability issues.

This study further identifies the key moderating factors, which are active listening, empathetic dialogue, and clear instructions as being specific aspects of communication. The patients who said they felt heard and respected were willing to forgive technical imperfections in the system; this suggests that effective communication compensates for usability flaws. This resonates with SET, as the physician's empathetic response maintains a reciprocal relationship wherein the patient is valued, even in a technologically mediated interaction. This moderating role of communication further shows how it can act as a strategic tool in usability disparities, especially for patients who have limited digital literacy or challenges in accessibility.

Combining the results of both hypotheses, the findings of the present study show an interdependent role of technology and communication in patient satisfaction with telehealth. However, whereas technology provides the core for functional interaction, communication transcends this

basis to a general patient experience. The fact that both technology and human interaction are relevant implies that telemedicine developers as well as health care providers have to be convergent. This translates to the designing of user-friendly platforms and training physicians on cultivating stronger virtual communication skills. Findings, therefore, specifically indicate how usability and communication interplay in determining satisfaction, hence presenting an interdisciplinary framework that integrates the technological and human-centric approach to healthcare.

In conclusion, the findings of this study reveal how the usability of telehealth and physician-patient communication contribute to the satisfaction of telemedicine. Both are vital to a seamless and empathetic virtual healthcare experience. Whereas usability gives the technical platform, communication adds the human touch in matters of trust and relationships. Therefore, this research will affirm the hypotheses while filling the gaps that literature still lacks as well as provide actionable strategies toward improving telehealth systems. These insights will prove invaluable in steering the development of systems as telemedicine continues to evolve, in a balance of technological excellence with human connection toward meaningful and satisfying healthcare interactions with patients across the globe.

Conclusion

This study demonstrates that physician-patient communication skills and the usability of telehealth can form critical ingredients for building satisfaction among patients. While focusing on integrating both the technological and interpersonal elements, it brings to the light that, despite functionality as a foundation pillar, it is actually good communication that has a great hand in improving experiences. It enhances the demand to equilibrate between digitalization and human-based processes, as the study outlines one example for long-lasting telemedicine activities. This research not only verifies the existence of previous theoretical frameworks but also presents a subtle aspect by exploring the interaction between usability and communication in healthcare technology. This research will, therefore, offer actionable insights into optimizing telemedicine services so that they are user needs-driven without sacrificing the quality of care. Emphasizing the complementary roles of technical systems and human skills, the findings thus provide a basis for future innovations in telehealth that are both efficient and empathetic. As telemedicine continues to evolve, this research provides a foundation for creating more equitable and satisfying healthcare experiences, bridging gaps between patients and providers in a digital-first healthcare landscape.

Implications of the Study

The paper presents rich theoretical contributions as it enhances the scope of telemedicine based on the frameworks of usability and communication. In the sense that empirically the pivotal role of telehealth usability is shown to affect the level of satisfaction towards telemedicine, this study simply restates earlier theories on the acceptance of technology and user satisfaction. This work is integrated in principles from the standpoint of technology usability and the interpersonal communication theory: Technical functionality without human elements like effective communication will not suffice. Findings indicate a synergistic relationship between technological affordances and interpersonal interactions, which further extends the theoretical boundaries of UTAUT in emphasizing the moderating role of physician-patient communication skills. This integrated perspective opens avenues for combining technology-focused and interactional approaches to better understand satisfaction in virtual care models.

Additionally, the role of communication skill as a significant moderator enriches the growing human factors literature base in digital health. The conceptualization of the communication construct can be operationalized as a means to understand with nuance the mitigation of issues caused by these digital platforms that interpersonal engagement often entails. This further extends the theories of trust and satisfaction of e-health services by demonstrating that improved communication is not only satisfied but also enhanced the users' trust and care quality perception. Further, the study expands the theoretical service interaction quality discussion by placing it in the telemedicine context, which also puts emphasis on the criticality of interactive skills in digital health systems.

The results of this study have serious practical implications for telemedicine service providers, policymakers, and practitioners in digital health systems. In the first place, the findings that the effect of telehealth usability on patient satisfaction is apparent demonstrate a significant investment need in user-centric designs for the systems. The development of intuitive interfaces, easy navigation, and reliability for the user must be an objective for the telemedicine platform. The usability of the system could be tested by service providers periodically and the users' feedback gathered in order to continue improving the usability of the system. The users may experience various technical issues which the systems would be designed to overcome, considering the varied user capabilities and technical skills, which would then enhance access and usage of telemedicine services.

In addition, the moderating role of physician-patient communication skills, demonstrated here, underlines the necessity for training healthcare professionals in digital communication. Telemedicine practitioners must be adept at interpreting patient needs and compensating for the potential lack of face-to-face interaction. Tailored training programs focusing on digital empathy, active listening, and the use of visual aids in virtual consultations are therefore needed. Institutions can take standardized frameworks for assessing and enhancing communication skills in telemedicine settings. Additionally, policymakers can establish certifications for telemedicine communication excellence to improve patient care standards across providers, increase satisfaction, and instill trust in remote healthcare services.

Limitations and Future Research Directions

Despite the contributions of this research, there are limitations that open new avenues for future exploration. The first limitation is that the study relies on quantitative methods to understand nuanced patient experiences. Future research could use mixed-method approaches or in-depth qualitative studies to capture a richer understanding of how usability and communication influence satisfaction from a patient's perspective. A particular cultural and geographical setting was the context of this research, which limits the generalization of findings to other populations. Future studies may consider cross-cultural comparisons or test the model proposed in different systems of telemedicine to enhance its universal applicability.

In addition, this study focuses on satisfaction as the only outcome variable and ignores other possible outcomes, such as patient adherence, health outcomes, or loyalty to telemedicine platforms. Future studies could expand the scope by investigating other dependent variables, such as the effect of usability and communication on trust, behavioral intention, or retention rates in telemedicine. Another promising direction might be longitudinal designs to examine sustained influences of such factors over time, thus unveiling their long-term effects in virtual care environments. Addressing these limitations will contribute toward a more holistic understanding of the adoption and effectiveness of telemedicine.

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Appendix 1

Telehealth Usability

Usefulness

1. Telehealth improves my access to healthcare services
2. Telehealth saves me time traveling to a hospital or specialist clinic
3. Telehealth provides for my healthcare needs

Ease of Use and Learnability

1. It was simple to use this system
2. It was easy to learn to use the system
3. I believe I could become productive quickly using this system

Interface Quality

1. The way I interact with this system is pleasant
2. I like using the system
3. The system is simple and easy to understand
4. This system is able to do everything I would want it to be able to do

Interaction Quality

1. I could easily talk to the clinician using the telehealth system
2. I could hear the clinician clearly using the telehealth system
3. I felt I was able to express myself effectively
4. Using the telehealth system, I could see the clinician as well as if we met in person

Reliability

1. I think the visits provided over the telehealth system are the same as in-person visits
2. Whenever I made a mistake using the system, I could recover easily and quickly
3. The system gave error messages that clearly told me how to fix problems

Satisfaction and Future Use

1. I feel comfortable communicating with the clinician using the telehealth system
2. Telehealth is an acceptable way to receive healthcare services
3. I would use telehealth services again
4. Overall, I am satisfied with this telehealth system

Telemedicine's Satisfaction

1. I can easily talk to my health-care provider
2. I can hear my health-care provider clearly
3. My health-care provider is able to understand my health-care condition
4. I can see my health-care provider as if we met in person
5. I do not need assistance while using the system
6. I feel comfortable communicating with my health-care provider
7. I think the health-care provided via telemedicine is consistent
8. I obtain better access to health-care services by use of telemedicine
9. Telemedicine saves me time travelling to hospital or a specialist clinic
10. I do receive adequate attention
11. Telemedicine provides for my health-care need
12. I meet with my health-care provider more frequently via telemedicinea
13. I find telemedicine an acceptable way to receive health-care services
14. I will use telemedicine services again
15. Overall, I am satisfied with the quality of service being provided via telemedicine

Physician-patient Communication Skills

Acknowledge

1. I knock and wait for a reply before entering the patient room
2. I acknowledge everyone in the room upon entry
3. I address the patient by his/her name
4. I sit down (or am at eye-level) when speaking with the patient

Introduce

1. I introduce myself by name to the patient
2. I mention my years of experience or specialty
3. I clarify/inform the patient of my specific role in his/her care
4. I smile and display good eye contact

Duration

1. If I am performing a bedside procedure, I am there for the entire duration of the procedure
2. I ask the patient, "What questions do you have for me?"

Explanation

1. I use clear and understandable language (no medical jargon)
2. I discuss and thoroughly explain all pertinent diagnoses/treatment plans with the patient
3. I discuss and thoroughly explain all available treatment options (e.g. surgery, medicines) and adjunctive therapies (e.g. nutrition, physical therapy)
4. I give a time expectation of how long a test or procedure will take, and when the patient should expect the results
5. I request the patient's permission prior to performing a test/procedure

Thank you

1. I graciously end the interview (e.g. thank the patient for his/her time), rather than saying goodbye or leaving
2. When discussing multidisciplinary care with the patient, I praise the care provided by other teams (e.g. surgery, medicine)
3. I thank the patient for choosing our hospital
4. I acknowledge everyone in the room prior to leaving
5. I leave contact information for the patient (e.g. my card, hospital contact number)