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Research Article

Telemedicine System Acceptance by Physicians: The Role of Task-Technology Fit and Convenience Value

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Abstract: This study explored physicians' acceptance of telemedicine by examining satisfaction with the use of telemedicine platforms for serving patient care. A model was developed, integrating the expectation-confirmation model (ECM) and task-technology fit (TTF) to investigate factors influencing physicians' satisfaction with the use of telemedicine application platforms. Five hypotheses were developed to evaluate the effects of perceived usefulness, TTF, and convenience value on physician satisfaction. Data were collected from 62 anonymous physicians through electronic surveys conducted between October and December 2023. The responses were analyzed using partial least squares structural equation modeling (PLS-SEM). The results showed that perceived usefulness and TTF are among the key determinants of physicians' satisfaction in using telemedicine platforms. Meanwhile, convenience value did not significantly impact physicians' satisfaction.

Keywords: Expectation-confirmation model; Physicians; Satisfaction; Task-technology fit; Telemedicine

1. Introduction

Information technology is crucial in advancing healthcare by enhancing the delivery of medical services and products. Among the various innovations, telemedicine is a key technological solution for improving access to healthcare. It includes the use of communication technology to deliver medical services remotely (Andrianto and Athira, 2022). These services are conducted in various ways, such as through text messages, videos, telephone conversations, websites, applications, robots, and virtual reality approaches (Stoltzfus et al., 2023). The concept enables health service providers, specifically physicians, to work remotely (Al-Meslamani et al., 2022; Gabrielsson-Järhult et al., 2021), communicate, diagnose, provide treatment, and discuss with other professionals (Alvarado, 2021).

In Indonesia, telemedicine is a promising solution to bridge the healthcare access gap, specifically in rural areas (Anggraini, 2023; Kemenkes, 2022). The uneven distribution of healthcare professionals, who are predominantly located in urban areas (Zhang et al., 2020), elevates the challenges posed by inadequate infrastructure. According to the Ministry of Health Indonesia, in 2020 only 57.6% of the country's physicians (123,691 individuals) practiced in the Java region (Annur, 2022). The number of physicians per capita only reached 4:10,000, falling below the WHO standard of 10:10,000 (Kemenkes, 2021). In this situation, telemedicine holds considerable potential to improve healthcare accessibility by offering cost-effective and efficient medical services in areas with limited or no physician availability.

Telemedicine can enhance the capacity of physicians in several ways. Firstly, it facilitates the rendering of service to more patients by eliminating the need for in-person visits for routine

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checkups or follow-ups (Haleem et al., 2021). This can improve efficiency and potentially increase income for physicians. Secondly, telemedicine fosters collaboration by enabling online interactions with colleagues. This expands professional networks and facilitates knowledge sharing, which leads to better patient care. Additionally, telemedicine offers efficiency and improves patient care, minimizes time spent on medical assessments, reduces crowding in waiting rooms, and facilitates more effective communication during consultations (Haleem et al., 2021).

Despite the benefits offered by telemedicine, several limitations need to be considered. The transition to telemedicine can present challenges for physicians. Some may struggle with new workflows, unfamiliar software, and alternative methods of delivering care, specifically those having limited prior experience (Lee et al., 2021; Malouff et al., 2021). Limited consultation time in telemedicine can disrupt the flow of care, potentially preventing physicians from delivering optimal care and leading to patient dissatisfaction. Alongside various problems associated with using telemedicine, specifically for physicians as health service providers, there are concerns that technology may influence satisfaction.

As essential stakeholders, physicians play a crucial role within the telemedicine system. Empirical studies on physicians' satisfaction with telemedicine are relatively limited. Umeh et al. (2022), Choi et al. (2022), and Damico et al. (2022) explored satisfaction with telemedicine. However, the studies did not identify specific factors influencing physician satisfaction. Given the various challenges associated with the use of telemedicine for physicians as healthcare providers, there are concerns about its impact on satisfaction.

Several methodologies can be adopted to evaluate user satisfaction with applications. Among the methods, the expectation-confirmation model (ECM) is particularly suitable for evaluating post-use satisfaction, as it directly confirms whether the users' (physicians, in this study) experiences are in line with their expectations before using an application (Jumaan et al., 2020). To provide a more comprehensive assessment, the ECM can be integrated with the Task-Technology Fit (TTF) model. This combined approach allows for an evaluation of whether the features of telemedicine platforms effectively support the specific task physicians are required to perform.

The model is based on the premise that the performance of technology is determined by the fit of task requirements and technology features required (Ouyang et al., 2017). In the context of telemedicine usage, a better fit between technology and task environment is expected to enhance satisfaction with platform use (Althumairi et al., 2022).

Building on the expectation-confirmation theory (ECT) of Lu et al. (2022), Bhattacherjee (2001) identified that in the context of telemedicine usage, convenience value (CV) is an important factor influencing the satisfaction of physicians. Based on this insight, the present study considered physicians' perceptions of convenience in using telemedicine systems to be a critical factor warranting investigation. Therefore, the study question "*How does task-technology fit and perceived convenience in the context of telemedicine use by physicians affect physicians' satisfaction?*" was formulated

To answer the question, a conceptual model and hypotheses were developed, as presented in Section 2. The model was tested using a survey method, with the data collection method described in Section 3. Sections 4 and 5 present the measurement and structural model evaluation. Finally, an analysis of the results is presented in Section 6.

2. Model Development

According to Oghuma et al. (2016), satisfaction is defined as a user's affective attitude toward a particular application as a result of direct interaction with the application. In the context of mobile health, Lu et al. (2022) described satisfaction as the extent to which users are content with their experience, comprising aspects such as information quality, service quality, and system management. In this study, it refers specifically to the level to which physicians feel content with using telemedicine in clinical practice. This type of satisfaction is cumulative, reflecting an overall assessment developed over time rather than a response to a single encounter (Wahjudi et al., 2018).

To analyze physicians' satisfaction, a study model was developed by integrating the ECM and TTF. ECM was derived from ECT, introduced by Bhattacherjee (2001). It is mostly used in marketing to assess consumer satisfaction and behavior after purchase. As outlined by ECT, the model explains a series of stages leading to repeat purchases or continued service usage. First, consumers form pre-purchase expectations about the performance of the product or service. Subsequently, the experience was compared to the initial expectations. This comparison directly determines the level of satisfaction (Oghuma et al., 2016). Building on this framework, Lu et al. (2022) identified three key variables that influence satisfaction, including perceived usefulness (PU), health stress (HS), and convenience value (CV). However, HS was excluded, as the study focused on public health awareness to access services during the COVID-19 pandemic.

PU explains the capability of a system to enhance individual performance (Ardi et al., 2024; Lu et al., 2022). In this study, PU represents the degree to which physicians believe telemedicine can improve performance in medical practice. Meanwhile, CV relates to how users perceive the ease and time saved in achieving goals. This comprises factors such as the accessibility of services (Lee et al., 2017) and the ability to manage appointments and health maintenance effortlessly (Lu et al., 2022). In this study, CV was adopted to assess the reassurance and convenience physicians experience using telemedicine, referring to technology's ability to support user tasks anytime and anywhere. This includes factors such as flexibility, time and location efficiency for consultations, as well as ease of interaction with patients and colleagues.

The TTF model addresses the practical aspects of technology usability by considering both user perceptions and the compatibility between task and technology features (Khan et al., 2018; Ouyang et al., 2017). This model adopts a work-oriented perspective, allowing the evaluation of how well technology correlates with users' work and tasks. By using the TTF model, the extent to which technology is appropriate and supportive of its users' work can be assessed, thereby determining the optimal contribution to workflow. In this study, the TTF model was used to assess the suitability of telemedicine technology for physicians by analyzing the relationship between technology (in this case, telemedicine) with the specific medical needs and tasks physicians encounter in clinical practice. The conceptual study model construct is presented in Figure 1.

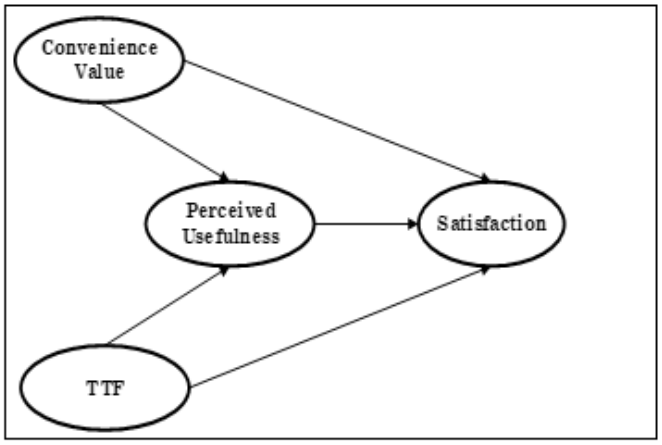

Figure 1 Conceptual research model

2.1. The impact of convenience value and TTF on perceived usefulness

Studies have established a positive impact of CV on perceived usefulness. For instance, Lu et al. (2022) showed that the convenience of mobile health simplifies access to health information, removes time and location constraints, and significantly contributes to users' perception of its usefulness. Wu and Chen (2017) stated that the TTF variable had a positive effect on perceived usefulness in the context of massive open online courses (MOOCs). Similarly, Rahi et al. (2020) reported a positive effect of TTF on perceived usefulness in the context of Internet banking. Based

on this insight, the following hypotheses aim to analyze the relationship between CV, and TTF with perceived usefulness:

H1. Convenience value positively affects perceived usefulness

H2. TTF positively affects perceived usefulness

2.2. The impact of convenience value, task technology fit, and perceived usefulness on satisfaction

Several studies support the positive effect of these variables on user satisfaction. Lu et al. (2022) showed that the CV of mobile health directly contributes to user satisfaction with technology. Similarly, Cruz-Jesus et al. (2023) stated that when technology corresponds effectively with user tasks, as defined by TTF, a high level of satisfaction is reported. Furthermore, ECT suggests a positive influence of perceived usefulness on satisfaction (Lu et al., 2022). Dhiman and Jamwal (2022) observed that users who perceive a system as improving performance experience also show increased satisfaction. Li et al. (2022) confirmed the positive influence of perceived usefulness on satisfaction with online learning. Based on this argument, the following hypotheses aim to analyze the impact of these variables on physicians' satisfaction:

H3. CV positively affects satisfaction

H4. PU value positively affects satisfaction

H5. TTF value positively affects satisfaction

3. Data Collection Methods

This study relied on primary data collected from a sample of physicians population. As participation was not feasible for all physicians, a non-probability method, specifically purposive sampling, was adopted. This method was chosen because the study required participants with specific criteria, including practicing physicians with experience using telemedicine applications for online consultations. The minimum sample size was determined by the largest number of paths leading to the dependent variable, in this case, three hypothesized relationships. Following the guidelines provided by Hair et al. (2014), with a significance level of 5% and a minimum R^2 of 0.25, a sample size of at least 59 participants was considered sufficient.

To evaluate the hypothesis and examine the interactions between variables, data were collected through an online questionnaire survey conducted from October to December 2023. Assessment of the questionnaire was conducted using a five-point Likert scale with 1 is strongly disagree to 5 is strongly agree (Salma et al., 2024). Data were analyzed using the structural equation modeling (SEM) approach supported by the Partial Least Squares-Structural Equation Modeling (PLS-SEM) software. This multivariate analysis technique includes two stages, namely (1) measurement model (outer model) evaluation, to assess the relationships between latent constructs and their observable indicators and (2) structural model (inner model) evaluation to examine the relationships among the latent constructs (Suzianti et al., 2024).

The analysis was based on 62 completed questionnaires. Table 1 describes the demographic profile of the sample. Most respondents were under the age of 40 (67%), resided in urban areas, and possessed diverse years of practice. The majority worked in primary care settings, frequently used the Halodoc for Doctor app, and reported different durations of app usage.

4. Measurement Model Validation

This study used three key measurement model criteria, namely internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2014). Convergent validity assesses the extent to which indicators within the same construct measure the same underlying concept. It is evaluated through outer loading values and average variance extracted (AVE) (Nugroho et al.,, 2022). While Hair et al. (2014) suggest an outer loading value above 0.708 for a strong correlation between each indicator and the underlying construct, Romadlon et al. (2022) argue that loadings between 0.5 and 0.6 are acceptable, provided the AVE exceeds 0.5 for adequate convergent validity. Evaluation of all indicators showed that the measurement model met the internal consistency criteria, as presented in Table 2.

Table 1 Demographic profile and research criteria of study participants

Characteristic	Number	Percentage
Gender		
Female	42	68%
Male	20	32%
Age Range		
≤ 40	40	67%
41-60	18	30%
> 60	2	3%
Telemedicine App		
Halodoc for Doctor	26	37%
Alomedika	19	27%
Clinic or hospital telemedicine	13	18%
Others	13	18%
Years in Practice		
< 10	32	52%
10-20	14	23%
> 20	16	26%
Specialty		
Primary care	42	68%
Specialty care	16	26%
Others	4	6%
Total accumulated usage		
< 6 months	18	29%
6 months–2 years	24	39%
>2 years	20	32%

Internal consistency reliability measures the coherence and reliability of indicators within a single construct. This study used composite reliability (CR) as the criterion. Ning et al. (2023) and Hair et al. (2014) suggest that CR values ranging from 0.7 to 0.9 show satisfactory reliability. As shown in Table 2 and Figure 2, all constructs had CR values exceeding 0.7, supporting the internal consistency of the measurement model. The values were greater than 0.9 for all constructs, showing the high reliability (Puspasari et al., 2023) of the measurement instruments.

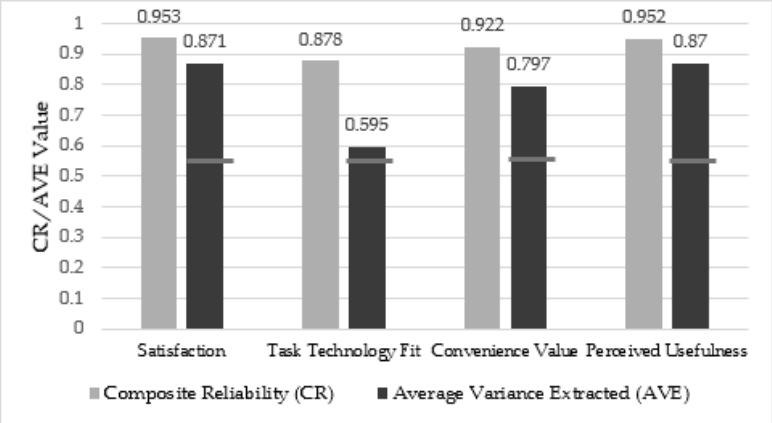

Figure 2 Composite reliability (CR) and average variance extracted (AVE) for each construct

Discriminant validity ensures that different constructs in the model are distinct and capture unique phenomena (Hair et al., 2014). This study used two criteria, namely cross-loadings and the Fornell-Larcker criterion. Cross-loadings reflect the strength of an indicator's association with unintended constructs. Ideally, indicators should load more strongly onto their intended construct than others (Hair et al., 2014). As shown in Table 3, all loading values of each latent variable are higher than other

constructs. This implies that every latent variable is unique and conceptually different from the others, supporting the measurement model's validity.

Table 2 Measurement scale and study results

Construct	Outer Loading	CR	AVE
Satisfaction (Lu et al., 2022)		0.953	0.871
I am satisfied with my experience using telemedicine	0.943		
My experience using telemedicine is exactly what I need	0.931		
Overall, I am satisfied with the telemedicine services that I use	0.927		
Task-technology fit (El-Masri et al., 2022; Indonesia, 2020)		0.878	0.595
Telemedicine is equipped with features that support anamnesis.	0.768		
Telemedicine is equipped with features that support physical examinations through audiovisual	0.569		
Telemedicine is equipped with features that support diagnoses, education, and recommendations for patients	0.73		
The telemedicine application I use is well-suited to support my tasks	0.889		
The telemedicine application is enough to support all my medical consultation tasks	0.86		
Convenience Value (Lu et al., 2022; Lee et al., 2017)		0.922	0.797
Telemedicine helps me provide health services anywhere and at any time	0.874		
By using telemedicine it is easier for me to manage my time, compared to consulting at a practice or hospital	0.907		
Using telemedicine makes my life easier	0.897		
Perceived usefulness (Dhiman and Jamwal, 2022)		0.952	0.870
Telemedicine improves my work performance in managing many tasks	0.918		
I find telemedicine useful in supporting my work	0.947		
Telemedicine increases the effectiveness of carrying out my duties	0.933		

Table 3 Cross-loading criterion for discriminant validity assessment

Item	Satisfaction	Task-Technology Fit	Convenience Value	Perceived Usefulness
SAT1	0.943	0.759	0.677	0.745
SAT2	0.93	0.628	0.63	0.709
SAT3	0.927	0.641	0.627	0.656
TTF1	0.527	0.768	0.411	0.459
TTF2	0.312	0.569	0.106	0.158
TTF3	0.547	0.73	0.604	0.61
TTF4	0.68	0.889	0.48	0.598
TTF5	0.644	0.86	0.407	0.482
CV1	0.629	0.516	0.874	0.772
CV2	0.667	0.556	0.907	0.738
CV3	0.554	0.421	0.897	0.765
PU1	0.668	0.569	0.8	0.918
PU2	0.752	0.602	0.794	0.947
PU3	0.692	0.613	0.782	0.933

The Fornell-Larcker criterion compares the AVE of each construct with the squared correlations between constructs. When the AVE of a construct is greater than the squared correlations with all other constructs, it suggests good discriminant validity (Hair et al., 2014). As shown in Table 4, the AVE square root value of each construct on the diagonal elements had a higher value than the correlation between constructs on the non-diagonal elements in the same column. Therefore, the construct shared more variance with its own indicators. This result supported the Fornell-Lercker criterion and further strengthened the conclusion of good discriminant validity.

Table 4 Fornell-larcker criterion for discriminant validity assessment

Variables	Satisfaction	Convenience Value	Perceived Usefulness	Task-Technology Fit
Satisfaction	0.933			
Convenience Value	0.692	0.893		
Perceived Usefulness	0.756	0.849	0.933	
Task-Technology Fit	0.728	0.559	0.638	0.772

5. Structural Model Evaluation

Multicollinearity testing is conducted to detect high correlations between two or more independent variables in a regression model. This is measured by the variance inflation factor (VIF), where a value greater than 5 typically shows high multicollinearity. The highest VIF value observed was 4.161 (perceived usefulness), which is below the commonly used threshold of 5. Therefore, multicollinearity did not appear to be a significant concern in this study. Significance testing was conducted using a bootstrapping procedure with a 95% confidence interval and a significance level of 0.05 to generate p values as presented in Table 5.

Table 5 Structural model results and hypothesis testing

Hypothesis	Path Coefficient	T Statistics	P Values	Results
Convenience Value -> Perceived Usefulness	0.716	8.512	<0.001	Supported
Task-Technology Fit -> Perceived Usefulness	0.237	2.618	0.009	Supported
Convenience Value -> Satisfaction	0.154	1.088	0.277	Not Supported
Perceived Usefulness -> Satisfaction	0.363	2.034	0.042	Supported
Task Technology Fit -> Satisfaction	0.41	3.625	<0.001	Supported

The coefficient of determination test measured how much variation in the dependent variable can be explained by the independent variable(s). Henseler (2009) described R^2 values of 0.67, 0.33, and 0.19 as substantial, moderate, and weak. Furthermore, Table 6 shows the R^2 value for the endogenous variable. The values for satisfaction and perceived usefulness are considered substantial, showing a high ability to explain the variation of the associated independent variables. This model's standardized root mean square residual value (SRMR) was 0.090. Based on the guidelines by (Schermelleh-engel and Moosbrugger, 2003), this value reflects an acceptable model fit.

Table 6 Summary of coefficient determination (R^2) values

Endogenous Variable	R Square	R Square Adjusted	Result
Satisfaction	0.679	0.663	Substantial
Perceived Usefulness	0.76	0.752	Substantial

6. Results and Discussions

The results of this study showed that perceived usefulness and TTF have significant positive effects on physicians' satisfaction with telemedicine, while convenience value does not have a significant impact. This suggested that satisfaction is associated with the perceived enhancement of performance (perceived usefulness) and/or the suitability of telemedicine features to professional tasks (TTF). These results are in line with prior studies such as the study by Cruz-Jesus et al. (2023), which showed a positive impact of TTF on user satisfaction. The study by Dhiman and Jamwal (2022) and Li et al. (2022) supports the expectation confirmation theory, signifying that users who perceive a system as enhancing performance tend to report higher satisfaction levels.

This study showed that physicians' perceptions of convenience in telemedicine usage are not necessarily translated into increased satisfaction. Based on observation, physicians do not primarily derive satisfaction from the convenience and time-saving features of telemedicine. These results

contrast with the results of Lu et al. (2022), who observed a direct relationship between convenience and user satisfaction in mobile health applications. This discrepancy might be due to the different perspectives and contexts. Lu et al. (2022) focused on mobile health usage from the patient's perspective during the COVID-19 pandemic, while the current study focused on the physician's perspective and was not specifically related to the pandemic. This difference in focus could lead to different perceptions regarding convenience. Other factors, such as the quality of telemedicine systems (Althumairi et al., 2022), security and privacy issues, hospital management support (Kissi et al., 2020), and self-efficacy (Rikhy et al., 2022), maybe more influential in shaping physicians' satisfaction with telemedicine.

Considering the significant influence of TTF and perceived usefulness on physician satisfaction, telemedicine app developers in Indonesia should prioritize features that directly address the unique needs and workflow of physicians while delivering medical services to patients. Adherence to existing government regulations (Kemenkes, 2019) for telemedicine administration is crucial. By ensuring features that directly support physicians' tasks during online consultation, developers can contribute to improved performance and enhanced satisfaction. This will positively impact the access to and the quality of healthcare services provided.

In this study, both TTF and convenience value have a positive impact on perceived usefulness, which reflects physicians' perceived performance improvement. Specifically, TTF ensures that telemedicine functionalities correlate seamlessly with medical duties. Meanwhile, convenience value stems from the time and location flexibility that facilitates easy communication with patients and colleagues. Both factors contribute to the perception of improved performance of physicians by the use of telemedicine systems.

Regarding the data collection conducted for this study, only 62 participants met the criteria, while more were expected. The participating physicians were those who met specific criteria, including the use of telemedicine technology. In addition to not meeting the criteria, some physicians did not participate in the survey because of refusal to adopt telemedicine technology. To obtain more comprehensive data and draw stronger conclusions, future studies should consider adopting a more inclusive sampling method that captures participants who are less inclined toward technology but use it out of necessity. Additionally, since this study used a non-probability sampling method, it could not guarantee a representative sample of the population. The participating physicians may not reflect the diversity of the entire population.

7. Conclusions and Future Direction

In conclusion, telemedicine offered a valuable medium for healthcare delivery but did not replace traditional face-to-face consultations. To optimize effectiveness, telemedicine development should prioritize the needs of both physicians and patients. This study contributed to the objective by integrating the ECM and TTF concepts. The results showed that physicians' satisfaction with telemedicine is significantly influenced by two key factors. These included perceived improvement in performance and the suitability of features to tasks. In this study, CV did not significantly impact satisfaction despite being valuable.

The limitations of this study include the adoption of a broad category of telemedicine applications without focusing on a specific type. As a result, was not possible to suggest specific concrete improvements tailored to a particular platform. Future studies could address this by examining individual telemedicine systems to determine whether similar insights exist and to propose more targeted system enhancements.

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Author Contributions

All authors contributed to the study's model development and design. Data collection is mostly done by Fadhilah Dian Utami. Data analysis and draft preparation was done by Rajesri Govindaraju and Fadhilah Dian Utami.

Conflict of Interest

Both authors have no conflicts of interest related to this study.

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