EXPLORING THE ROLE OF MODERATOR EFFECTS: E-MEDICAL RECORD ADOPTION

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Abstract:

Introduction: The challenge in implementing EMR lies not only in the low level of adoption, but also in the low level of user compliance in completing data. Therefore, evaluating user behavior is an important step to maximize the potential of RME.

Objectives: This research analyzes the factors that influence EMR usage behavior at the Tampan Mental Hospital Riau Province using the Unified Theory of Acceptance and Use of Technology (UTAUT) approach.

Methods: Data was collected from 218 respondents. This research uses multiple linear regression and a moderation test with macro PROCESS V4.2 by Andrew F. Hayes.

Results: The research results show that the variables Performance Expectation (PE), Effort Expectation (EE), Social Influence (SI), have a positive effect on Behavior Intention (BI). Apart from that, Behavior Intention and Facilitating Conditions (FC) show a positive influence on Use Behavior (UB). Gender is proven to moderate the relationship between of PE to BI, as well as EE and BI, but does not moderate the relationship between SI and BI. Experience has a moderating effect on the relationship between EE and BI, but is not proven to moderate the relationship between SI and FC and BI. Meanwhile, age does not have a moderator effect UTAUT variable relationship. Likewise, voluntariness of use is not proven to moderate the relationship between IS and BI.

Conclusions: These findings indicate that the UTAUT model is relevant for understanding EMR usage behavior. Hospital management can implement effective strategies to increase system usage intentions, thereby encouraging users to complete EMR. Such as providing training or mentoring tailored to the user's gender and experience level. In addition, it is important to increase comfort in using the system by providing more technical support for users with limited experience. EMR equipment will contribute to improving the quality of health services.

Keywords: Record Electronic Medical**,** Moderator Effect**,** UTAUT

INTRODUCTION

Effective integration between healthcare systems, information technology systems and management systems embodied in the form of EMR will improve the quality of hospital services. A literature review conducted by Uslu and Stausberg (2021) uncovered clear evidence of the benefits of EMRs, which not only provide economic benefits, but also contribute to improved quality of care [1]. Despite the immense benefits of EMRs, the adoption rate of these systems in developing countries is still relatively low [2], [3]. Similarly, in developed countries, measurement results using the Electronic Medical Record Adoption Model (EMRAM) in 2014 reported that out of 5449 hospitals in America, only 3.1% had fully implemented an EMR system. While in Canada, only 0.6% of 640 hospitals

adopted EMR (at stage 6) [4]. A similar measurement was also conducted in Turkiye in 2017 and it was found that 36% of all hospitals in Turkiye had comprehensive EHR functions [5].

In Indonesia, in accordance with the Minister of Health Regulation No. 24 of 2022 concerning Medical Records, all health care facilities are required to implement EMR no later than December 31, 2023. As of January 19, 2025, out of 112,365 health facilities, 47,230 (42.03%) have been registered on the SATU SEHAT platform, Indonesia's HIE (Health Information Exchange) system [6]. Challenges in EMR implementation are not only related to the low adoption rate, but also to low user compliance in completing data. Some medical personnel find EMR systems difficult to use and intrusive, and do not guarantee patient privacy [7].

The level of user acceptance regarding EMR can be measured using one of the theoretical approaches that can describe the level of acceptance and use of a technology, namely Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is a framework developed by Venkatesh et.al., (2003) to predict technology acceptance in organizational settings [8]. This research identifies four main variables that play an important role as direct determinants of behavioral intention and use behavior that is performace expectancy, effort expectancy, social influence, facilitating condition. This model is also equipped with four moderator variables, namely: age, gender, experience, And voluntariness of use [9].

Research conducted by Putra (2023) found a relationship performance expectancy, effort expectancy, social influence, facilitating condition each partially or simultaneously influences behavioral intentions (behavioral intention) and user behavior (use behavior) in EMR adoption [3]. However, research by Yousef, et al (2021) did not find a relationship effort expectancy, social influence, facilitating condition to behavioral intention. In addition, age and experience variables were not proven to moderate this relationship [10]. Moderator effects were studied by Engin and Gürses (2019) and found that age moderating the influence of facilitating conditions on use behavior. This research also shows that experience moderates the influence of social influence on behavioral intention, and gender moderates the influence of performance expectancy and effort expectancy on behavioral intention. [11]. Study Jayaseelan et al (2020) found a direct relationship between voluntariness of use and use behavior in the context of information and communication technology in the Indian health sector [12].

OBJECTIVES

This study aims to evaluate the implementation of Electronic Medical Records (RME) in hospitals using the Unified Theory of Acceptance and Use of Technology (UTAUT) approach.

METHODS

This research used an explanatory research design and was conducted at the Tampan Mental Hospital, Riau Province. The research population consisted of 479 EMR users, with a sample of 218 respondents, which was calculated using the Slovin formula with an error limit of 5%. The sampling technique used was accidental sampling, with inclusion criteria in the form of medical and non-medical personnel who use EMR in their routine duties.

The research model based on the framework of Venkatesh et al. (2003) divided into two models, each of which was tested using multiple linear regression. The first model tests the influence of the independent variables (performance expectancy, effort expectancy, social influence) on the dependent variable (behavior intention). The second model tests the influence of independent variables (facilitating conditions and behavior intention) on the dependent variable (use behavior) and evaluates the role of moderator variables such as age, gender, work experience, and Voluntariness of Use (VoU) using a moderation test with the V4.2 process by Andrew F. Hayes, using SPSS 25 software. The classical assumption test was also carried out before regression testing.

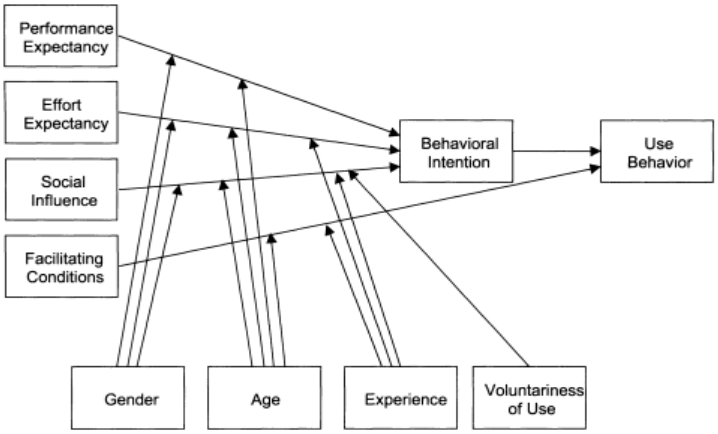


Figure 1. UTAUT model by Venkatesh et al (2003)

RESULTS

Before conducting the multiple linear regression analysis, classical assumption tests were performed to ensure the validity of the model. The results showed no violations of normality (Monte Carlo p-value=0.051), multicollinearity (VIF<3), heteroscedasticity (The residual plot showed no discernible pattern in the dispersion of residuals across predicted values), or autocorrelation with Durbin-Watson (dW) test results for Model 1 (dU = 1.79326, dW = 1.978, 4 - dU = 2.207) and Model 2 (dU = 1.783, dW = 1.861, 4 - dU = 2.217). These findings confirm that the model fulfills the required assumptions for regression analysis.

After confirming that the classical assumptions were met, multiple linear regression analysis was conducted to evaluate the relationship between the independent and dependent variables. The results are presented below.

Table 1. Multiple Linear Regression Test Results

Variable	Beta		Pvalue	
	Behavioral Intention	**Use Behavior**	**Behavioral Intention**	**Use Behavior**
Model I				
Performance Expectancy	0.507	-	0.047	-
Effort Expectancy	0.225	-	0.000	-
Social Influence	0.134	-	0.047	-
Model II				
Facilitating Condition	-	0.282	-	0.000
Behavioral Intention	-	0.449	-	0.000

Source: Processed data (2024)

On the I model performance expectancy, effort expectancy, social influence significant effect on behavioral intention ($p \leq 0.05$). Performance expectancy had the greatest influence (**β**=0.507), indicating that increasing the perception of the benefits of EMR will increase the intention to use EMR by 50.7%. Meanwhile in model II variable facilitating condition and behavioral intention significant effect on use behavior ($p \leq 0.05$). Behavioral intention has the largest influence (**β**=0.449), which means that a one unit increase in intention to use EMR will increase EMR use behavior by 44.9%.

After knowing the direct effect on multiple linear regression modeling, the researchers next looked at the moderation effect by conducting the PROCESS V4.2 moderation test by Andrew F. Hayes. There are four moderating variables, namely age (Z), gender (W), experience (V) and voluntariness of use (U). The results of the moderation test are in table 2.

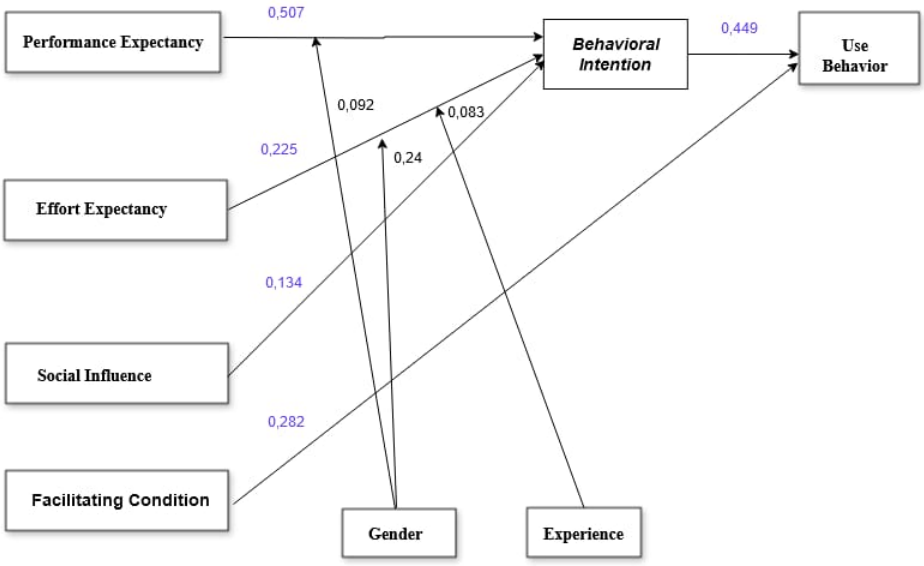
Table 2. Moderation Test Results

Variable	Coeff	p	LLC	ULCI
Performance Expectancy (X1) ⟶ Behavioral Intention				
Interaction (X1*Z)	0,092	0,038	0,005	0,178
Interaction (X1*W)	0,001	0,756	-0,005	0,007
Effort Expectancy (X2) ⟶ Behavioral Intention				
Interaksi (X2*Z)	0,240	0,006	0,071	0,410
Interaksi (X2*W)	-0,002	0,808	-0,012	0,010
Interaction (X2*V)	-0,3950	0,0007	-0,622	-0,167
Social Influence (X3) ⟶ Behavioral Intention				
Interaksi (X3*Z)	0,063	0,565	-0,151	0,277
Interaksi (X3*W)	0,005	0,436	-0,008	0,019
Interaksi (X3*V)	0,066	0,053	-0,001	0,132
Interactions (X3*U)	-0,038	0,577	-0,172	0,092
Facilitating Cindition (X4) ⟶ Use Behavior				
Interaksi (X4*Z)	0,027	0,200	-0,014	0,068
Interaksi (X4*W)	-0,002	0,683	-0,011	0,007

Source: Processed data (2024)

Gender moderates the relationship between PE and BI significantly (p=0.041; interaction coefficient= 0.092), indicating that perceptions of the benefits of EMR are influenced by differences gender. Whereas age **t**not significant as a moderator (p=0.756; interaction coefficient=0.001). In the relationship between EE and BI, no moderator effect was found gender and age. However, the value of interaction experience in the relationship between EE and BI (p=0.002 and interaction coefficient=0.083) shows a significant positive relationship. Furthermore, none of the moderator variables has been proven to have a moderating effect on the relationship between SI and BI. Age and Experience did not show a moderating effect on the relationship between FC and UB.

Based on the results of the analysis of model I and model II and the moderator effect test that has been carried out, the complete research model can be described as can be seen in Figure 2.



Source: Processed data (2024)

Figure 2. Framework of Research Results along with Coefficient Values

The variables age and voluntariness of use were removed in this model because no significant influence was found. Likewise, several paths from the moderating effects of gender and experience.

DISCUSSION

This research applies the UTAUT model to explore the factors that influence usage behavior in EMR adoption. PE variable This research includes five dimensions adapted based on factors from the Venkatesh et al., (2003) model, namely perceived usefulness, extrinsic motivation, job fit, relative advantage outcome expectations. Information regarding the positive impact of the system on performance needs to be conveyed to staff to increase their perception of the system's usefulness (perceived usefulness). [11]. Furthermore, Davis et al (1989) stated that the decision to reject or adopt a technology depends on extrinsic motivation, namely the extent to which technology is considered capable of simplifying their work (Davis et al., 1989 in Aziz, 2017). However, some users assess that the new system is not aligned with their work or does not make a significant contribution to individual performance (job fit) (Davis et al., 1989 in Aziz, 2017). supports these findings, where respondents who believe that EMR can improve productivity or performance show higher acceptance of the system (relative advantage) [14]. Most respondents (67.9%) answered negatively to the outcome expectations dimension statement, namely "If I use the EMR system, I have the opportunity to get a salary increase or promotion. This means that the majority of respondents feel there are no rewards when using the system so they do not fully intend to use EMR.

This research identifies three dimensions of EE, namely perceived ease of use, complexity and ease of use. A previous study by Tandijono (2023) showed that systems that are easy to understand and operate tend to be used more often compared to systems that are complex and complicated [15]. In the context of EMR, this ease of use has been proven to increase the efficiency of medical personnel in recording medical records, providing more effective information, as well as easy access to laboratory results and other supporting services. [16].

The staff's intention to use EMR in this research is influenced by the dimensions of subjective norms, social factors, and image which are part of the social influence (SI) variable. Subjective norms

can be seen from the perception of users who feel encouraged to use EMR when colleagues and leaders show good performance and provide recommendations for using the system [11]. However, weak social factors, such as lack of policy commitment and low motivation from the work environment, can reduce staff interest in adopting EMR optimally [16]. Bawack & Kala (2018) found that the perception of higher social status is often a motivation for doctors to use hospital information systems (HIS). This social recognition can be utilized to design effective strategies to encourage acceptance and adoption of EMR among health workers [17].

In this research, the dimensions of perceived behavioral control, facilitating conditions (FC), and compatibility were proven to have a significant effect on staff intention to use EMR. These findings indicate that the successful acceptance of EMR systems in hospitals is highly dependent on the availability of resources and knowledge that supports the use of these systems. Mentoring and training have proven effective in increasing medical personnel's acceptance of the EMR system [18]. On the other hand, if the supporting facilities are inadequate, the system implementation in the hospital is at risk of failure [15].

Age Effect as a Moderator in the UTAUT Variable Relationship

This study did not find any moderating effect of age on the UTAUT variable relationship. This is thought to be due to the distribution of respondents who are dominated by the age group under 44 years (70.6%), so that the variability of moderation effects based on age is limited. Previous studies by Yousef et al. (2021) also showed similar results, where age did not have a significant moderating effect, when the proportion of respondents aged 40-49 years was only 39.9% [10].

Many studies have not found the moderating effect of age, among 11 related studies, only four reported a significant effect of age as a moderator on use behavior [19]. Research by Park et al. (2020) also found that age was not a significant moderating factor in the use of Personal Health Record (PHR) applications among health workers [20]. The findings of Tavares J et al. (2016) which shows that age has no significant effect as a moderator in behavioral intentions [21].

According to Venkatesh et al. (2003), younger workers tend to be more affected by extrinsic rewards, such as salary increases or promotions, which can strengthen the relationship between PE and intention to use the system. The moderator effect of age on the relationship between EE and BI is explained by increasing age is often associated with difficulties in processing complex information and allocating attention to tasks at work, so it can be a barrier to the use of technology systems. Venkatesh et al. (2003) also explain the moderating effect of age on the SI to BI relationship, namely older workers often need more help and support at work, given their physical and cognitive limitations [9]. Meanwhile, the moderating effect of age on the relationship between FC and UB can be explained in Engin & Gurses (2019) research which found that the effect of support facilities is more pronounced in elderly personnel. Employees over 40 years old tend to have just started using technology in their old age, so they need special attention in providing adequate supporting conditions for the implementation of the Hospital Information System (HIS). In this context, providing training that suits individual needs and adequate technical support are important strategies to increase technology acceptance [11].

Gender Effect as a Moderator in the UTAUT Variable Relationship

This study identified the moderating effect of gender on the relationship between PE and BI. This result is in line with the findings of Hossain et al. (2019), which showed that gender moderates the relationship between PE and BI with a correlation of r = 0.76 [21]. A similar study by Engin & Gürses (2019) also found that the effect of PE on intention to use hospital information systems (HIS) was stronger in men. Therefore, a gender-based approach should not be overlooked in system implementation, as it can affect perceptions and expectations regarding performance and ease of use of technology. Developing gender-sensitive strategies in technology implementation can make a positive contribution to success [11].

In this study, gender was also shown to have a moderator effect on the relationship between EE and BI. Women generally face more challenges in adapting to technology than men, so EE becomes a more prominent factor in this group. Thus, gender moderates EE, assuming its influence is stronger in men, while expectations of the ease of use of the system are more prominent in women. Women find it difficult to adapt to technology compared to men. Thus, effort expectations will be most prominent in women [9].

However, gender was not shown to have a moderator effect on the relationship between SI and BI in this study. A literature review by Sadough et al. (2019) found that gender is one of the most frequently investigated moderating factors, although 81.8% of the studies analyzed did not show a significant effect [19]. Research by Tavares et al. (2016) also reported that gender had no significant effect on UTAUT variables [22]. In contrast, Alsahafi et al. (2020) showed that gender can moderate the effect of SI on BI, thus the need for a gender-based approach in health information system implementation strategies [23].

Experience Effect as a Moderator in the UTAUT Variable Relationship

The lack of work experience often causes various challenges in technology adoption, so EE tends to be more significant in individuals with limited experience [9]. The results of this study are consistent with the findings of Jayaseelan et al. (2020), which showed that experience moderates the effect of the variables in the UTAUT model on BI to use information technology in the health sector [12].

This result contradicts the research of Yousef et al. (Individuals with limited work experience tend to be more influenced by coworkers who have more experience in using HIS (Hospital Information System), which can shape their positive views of the technology. However, this study failed to show that experience moderates the relationship between HIS and BI [10]. In contrast, Engin and Gurses' (2019) study showed that experience has a significant moderating effect in the relationship [11]. This is also supported by Badwelan and Bahaddad (2017), who found that individuals with less than 3 years of HIS experience are more easily influenced by SIs than those who have had more than 3 years of experience [24]. Research by Jayaseelan et al. (2020) added that doctors with higher experience tend to be more active in using information and communication technology (ICT) in their daily practice [12].

Voluntariness of Use Effect as a Moderator in the UTAUT Variable Relationship

Venkatesh et al. (2003) show that individuals are more likely to comply if there are incentives or punishments related to the expected behavior. [9]. However, this study found no relationship between voluntariness of EMR use and SI, in contrast to Hossain et al. (2019), who identified that voluntariness acts as a moderator in the relationship of SI to BI [21]. The majority of respondents in this study (80.4%) stated that they use EMR voluntarily, without the need for external incentives or pressure. This finding suggests that staff at RSJT have strong intrinsic motivation to use EMR, so system implementation does not require additional coercion or rewards to encourage technology adoption [17].

CONCLUSION

By exploring the role of moderators in EMR adoption, this study underscores the complexity of user behavior and the multifaceted strategies required for successful implementation. This research confirms that the perceived usefulness of the Electronic Medical Record (RME) system is the main key in driving user intention. Therefore, hospitals need to implement training or mentoring supported by a clear reward system to increase employee motivation. A gender-based approach is also important to implement, considering the difference in focus between men who tend to see long-term benefits and women who prioritize immediate benefits for their work.

Ease of use of the system proved to be a significant factor in increasing user motivation. Hospitals should reduce operational barriers to implementing RME by providing training based on gender and experience level. Users with less experience require more intensive technical support than experienced users, who are more independent but have higher expectations of system convenience.

Social support from leaders, co-workers, and perceptions of prestige in using the system can strengthen commitment to change. This also creates a productive work culture and increases employee loyalty and satisfaction with the organization. In addition, the availability of supporting facilities, such as technological infrastructure, operational guidance, and technical assistance, is an important prerequisite to ensure effective use of the system.

LIMITATIONS

This research contributes to the literature on the application of RME with the UTAUT model, especially in the context of hospitals in developing countries. However, limitations of this study include uneven sample distribution and geographical coverage limited to one hospital. Further studies are recommended to explore a broader context with a mixed-methods approach to understand the barriers and opportunities in implementing RME in more depth.

REFERENCES

[1] A. Uslu and J. Stausberg, “Value of the Electronic Medical Record for Hospital Care: Update from the Literature,” Dec. 01, 2021, JMIR Publications Inc. doi: 10.2196/26323.

[2] A. R. Ahlan and B. I. Ahmad, “User Acceptance of Health Information Technology (HIT) in Developing Countries: A Conceptual Model,” Procedia Technology, vol. 16, pp. 1287–1296, 2014, doi: 10.1016/j.protcy.2014.10.145.

[3] R. Johnson, “Predicting Clinicians’ Intentions Towards the Electronic Health Record (EHR): an Extended UTAUT Model,” Tesis, University of Pretoria, Pretoria, 2020.

[4] J. P. Hoyt, “EMRAM is the Standard What are the Benefits?,” Istanbul, 2014.

[5] İ. Köse et al., “Basic electronic health record (EHR) adoption in **Türkiye is nearly complete but challenges persist,” BMC Health Serv Res, vol. 23, no. 1, Dec. 2023, doi: 10.1186/s12913-023-09859-w.

[6] Kementerian Kesehatan, “Monitoring Implementasi SATU SEHAT.” Accessed: Jan. 19, 2025. [Online]. Available: https://satusehat.kemkes.go.id/data/dashboard/3678097d-d11e-4b2c-8552-310d782a905b

[7] A. Alsyouf and O. Y. Abdullah, “Understanding EHRs continuance intention to use from the perspectives of UTAUT: practice environment moderating effect and top management support as predictor variables Awanis Ku Ishak,” Int. J. Electronic Healthcare, vol. 10, 2018.

[8] A. Chang, “UTAUT and UTAUT 2: A Review and Agenda for Future Research,” 2012.

[9] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, “User Acceptance of Information Technology: Toward a Unified View,” 2003.

[10] C. C. Yousef et al., “Predicting Health Care Providers’ Acceptance of a Personal Health Record Secure Messaging Feature,” Appl Clin Inform, vol. 13, no. 1, pp. 148–160, Jan. 2021, doi: 10.1055/s-0041-1742217.

[11] M. Engin and F. Gürses, “Adoption of Hospital Information Systems in Public Hospitals in Turkey: An Analysis with the Unified Theory of Acceptance and Use of Technology Model,” International Journal of Innovation and Technology Management, vol. 16, no. 6, Oct. 2019, doi: 10.1142/S0219877019500433.

[12] R. Jayaseelan, P. Koothoor, and C. Pichandy, “Index Terms ICT, E-Health, UTAUT, Health Communication, Health Management, Medical Doctors,” Medical Doctors Article in International Journal of Scientific & Technology Research, vol. 9, 2020, [Online]. Available: www.ijstr.org

[13] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," Manage Sci, vol. 35, no. 8, pp. 982–1003, Aug. 1989, doi: 10.1287/mnsc.35.8.982.

[14] D. M. Chagani, "The assessment of acceptance and identification of barriers to use of electronic medical records by doctors in emergency centres in Cape Town, South Africa," 2017. [Online]. Available: https://scholar.sun.ac.za

[15] P. L. Tandijono, "Analysis of Factors Influencing The Acceptance of Hospital Management Information System (SIMRS)," International Journal of Social Service and Research, vol. 3, no. 3, pp. 680–689, Mar. 2023, doi: 10.46799/ijssr.v3i3.243.

[16] A. Deharja, D. Y. Waskito, E. Rachmawati, and V. Vestine, "Electronic Medical Records Implementation at Soeradji Tirtonegoro Hospital, Klaten, Indonesia," Unnes Journal of Public Health, vol. 12, no. 2, pp. 104–115, 2023, doi: 10.15294/ujph.v12i2.67972.

[17] R. E. Bawack and J. R. Kala Kamdjoug, "Adequacy of UTAUT in clinician adoption of health information systems in developing countries: The case of Cameroon," Int J Med Inform, vol. 109, pp. 15–22, Jan. 2018, doi: 10.1016/j.ijmedinf.2017.10.016.

[18] A. A. Arman and S. Hartati, "Development of User Acceptance Model for Electronic Medical Record System," in 5 International Conference on Information Technology Systems and Innovation (ICITSI), IEEE, 2016, p. 115.

[19] F. Sadoughi, T. Khodaveisi, and H. Ahmadi, "The used theories for the adoption of electronic health record: a systematic literature review," Aug. 01, 2019, Springer Verlag. doi: 10.1007/s12553-018-0277-8.

[20] Park HS et al., "Factors influencing acceptance of personal health record apps for workplace health promotion: cross-sectional questionnaire study," JMIR Mhealth Uhealth, vol. 8, no. 6, 2020.

[21] A. Hossain, R. Quaresma, and H. Rahman, "Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study," Int J Inf Manage, vol. 44, pp. 76–87, Feb. 2019, doi: 10.1016/j.ijinfomgt.2018.09.016.

[22] J. Tavares, A. Goulão, and T. Oliveira, "Electronic Health Record Portals adoption: Empirical model based on UTAUT2," Inform Health Soc Care, vol. 43, no. 2, pp. 109–125, Apr. 2018, doi: 10.1080/17538157.2017.1363759.

[23] Y. A. Alsahafi, V. Gay, and A. A. Khwaji, "Factors affecting the acceptance of integrated electronic personal health records in Saudi Arabia: The impact of e-health literacy," Health Information Management Journal, vol. 51, no. 2, pp. 98–109, May 2022, doi: 10.1177/1833358320964899.

[24] A. Badwelan and A. A. Bahaddad, "Cultural Factors that Influence M-Learning for Female University Students: A Saudi Arabian Case Study," 2017

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