



The Acceptance and Use of Electronic Medical Records in Developing Countries within the Unified Theory of Acceptance and Use of Technology Framework

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Abstract

Edited by: Ana Vucurevic
Citation: Faida EW, Supriyanto S, Haksama S, Markam H, Ali A. The Acceptance and Use of Electronic Medical Records in Developing Countries within the Unified Theory of Acceptance and Use of Technology Framework. Open Access Maced J Med Sci. 2022 Mar 09; 10(E):326-336. <https://doi.org/10.3889/oamjms.2022.8409>
Keywords: Acceptance; Usage; Electronic medical record; Unified theory of acceptance and use of technology
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Received: 16-Jan-2022
Revised: 05-Feb-2022
Accepted: 04-Mar-2022
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Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist
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BACKGROUND: The Indonesian Ministry of Health requires hospitals to record and report all activities in the Hospital Management Information System (SIMRS). However, the disruptive use of software, hardware, and Brainware has reduced its effective management and usability, which has become a separate workload. Electronic Medical Record (EMR) is one of the important implementations of SIMRS because it relates to the ability to identify information, results, history taking, examinations, and records of all patients. Furthermore, it has become a current global trend for most hospitals and has also been used as a substitute for paper medical records.

AIM: This study aims to collect and identify the user characteristic, technology used, and other variables influencing the acceptance and use of information and technology systems based on the unified theory of acceptance and use of technology (UTAUT) model.

METHOD: Secondary data were obtained from scientifically published journals online in the form of original articles that are accessed in full text with the help of search engines such as Springer link, Proquest, PubMed, and Prospero.

RESULT: It was found that the most dominant technology system in hospitals outside the use of HIS, Electronic Health Record (EHR), physician assistants, E-Prescribing, Telemedicine, extended producer responsibility, and Technology solution for tuberculosis was EMR. It had the largest influence variable in several studies based on the UTAUT model. The most dominant characteristics of users were women between the ages of 20 and 30 years with 0 and 5 years working experience, and also 60% were nurses. The result also showed that 17 other variables had influenced the use of information and technology systems in the UTAUT model.

Conclusion: Literature study provides evidence that acceptance and use of health information technology systems, especially RME in hospitals influenced by the main variable UTAUT. Variables related to technical aspects, behavior, and user characteristics as new endogenous and new exogenous mechanisms. Management of health service providers in increasing acceptance and use of EMR needs to pay attention to the availability of infrastructure, user factors are also an important concern in helping to deal with problems in developing countries.

Introduction

The Sustainable Development Goals (SDGs) are a worldwide concept that intends to provide a healthy life and improve people's well-being. They are part of the 2030 Agenda [1]. Moreover, based on the Regulation from the Ministry of Health in Indonesia Number 21 of 2020 concerning the Strategic Plan for 2020–2024, the health information system is directed to strengthening services that are faster, valid, and involve sharing resources [2]. The improvement that is expected to answer the needs of Indonesian Strategic Plan is in using an integrated electronic-based standard health system. Furthermore, the Indonesian strategical development includes the expansion of the online referral systems, coverage, and the development of types of telemedicine services, such as the integration of private health facilities, and the digitalization of medical records [3].

The rapid development of infrastructure and innovation of information technology systems have made health services shift from conventional to electronic-based [4], [5]. Consequently, Electronic Medical Records (EMR) has increased in various countries in the world, especially in Indonesia [3]. The needs of the migration from conventional information management to electronic-based are because it has high advantage and provides benefits in improving the quality of health services. A number of factors, including not only infrastructure but also the key subject of human resources (HR), influences the acceptability, and usage of EMR. These factors exist because there are still many doubts about using this system, especially on the aspects of security and confidentiality [6].

Therefore, the needs of well-planned implementation in developing countries are extremely required due to poor EMR, in which that these countries are unable to provide the desired features

and functions [7]. Furthermore, ineffective EMR may result in inadequate behavior on clinical performance, negative reactions by users, disruption to workflow, neglect of further implementation, and ultimately reject the initiative's implementation [8]. In other word, it is important to learn how the system works for hospitals to become more productive, effective, and accurate. This study aimed to review the experience of using the most widely used technology in hospitals based on the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical framework, the dominant characteristics of users, and variables influencing their success in receiving and using EMR.

EMR is widely accepted in hospitals and clinics, and this is due to the continuous use of information and technology. The recent development has led to effective communication among physicians. The use of EMR is seen as a viable way to improve the quality of healthcare [9]. This is because of the competence of the system to handle large amounts of information and data in the health sector, thereby supporting various clinical, organizational, and health-care management needs [10].

The EMR system integrates clinical data, patient records, decision support application programs, and transaction processing within the hospital [9]. Furthermore, based on a physician's point of view, it creates a better way of collecting, storing, retrieving, and analyzing medical information. This information is then used to find the best treatment and to provide decent care for patients [6]. Based on schematic linkages and interdisciplinary understanding, the application of EMR has been used to provide an effective and efficient way of managing patients, doctors, and clinics.

Out of 2650 hospitals in Indonesia, about 19% did not have SIMRS in 2019, and in 2020 it fell to 11% [12]. The data from hospitals with SIMRS at the front and back offices also decreased from 52% in 2019 to 35% in 2020. However, there are 3% of hospitals in Indonesia have not practiced SIMRS in 2019 and 2020 [12]. Furthermore, about 30% of hospitals are yet to report their use classification since 2020 [12].

One of the main reasons for using SIMRS services is that medical records are carried out completely, quickly, and precisely [12]. However, the problems that occurred in the General Hospital of Doctors Soetomo Surabaya as both a referral hospital for the province of East Java and an educational center showed that the data on filling in EMR completeness in outpatients was < 27% based on preliminary studies.

The EMR implementations of the SIMRS were directly related to sources of information about identity, history taking, examination, and records of all activities of health services for patients [2]. Therefore, hospitals are obliged to maintain medical record by succeeding the Indonesian State Regulation Number 44 of 2009 concerning Hospitals. Furthermore, the Indonesian Ministry of Health Regulation Number 269 of 2008

concerning Medical Records in article two states that (1) medical records need to be made in full and clear writing or electronically and (2) the administration of medical records using electronic information and technology should also be regulated which allows health-care facilities to make EMR [2]. Therefore, it is necessary to ensure the effective implementation of the EMR system [11]. Technological administrators and doctors also need to periodically review its usage and obtain information about developing it [11]. Furthermore, by analyzing this new technology, the implementation of the EMR system would be improved.

This study aims to collect and identify user characteristics, technology systems, and other variables that influence the use of technology-based on the UTAUT framework. However, there were few studies relating to the use of EMR, especially in developing countries due to the context of infrastructure and HR capabilities. This study was conducted based on the health information system considering the importance of EMR. It is expected to provide various advantages for the health care industry [13]. Furthermore, adoption by physicians is critical to the successful implementation of any HIS project [14]. EMR offers many potential advantages over traditional paper-based records and is the first step toward improving the quality of health care. Therefore, this literature review is expected to increase the overall application of EMR from various factors to achieve optimal, quality, fast and precise health service productivity, which in the future affects the health of individuals, families, and residents of a country.

Methods

This study was aimed to review the Population, Exposure/Event, Outcome, Study Design (PEOS) framework and questions as a reference in identifying key concepts that match the objectives and review questions. Furthermore, it was also used in developing appropriate search terms and determine the inclusion and exclusion criteria [15] Table 1.

Table 1: Framework PEOS (Population, Exposure, Outcome, and Study Design)

No	PEOS	Research Question
1	Population	Physician in health care/hospital, health workers in health care/hospital, doctor in healthcare/hospital, clinical staff working
2	Exposure	Health information management, electronic medical record, electric medical record, electronic health record
3	Outcome	Behavioral intention, use behavior
4	Study Design	An observational study (not intervention), cross sectional study, qualitative descriptive

The main type of reference was secondary data which were obtained from the previous research journals based on the theme. The selection criteria were also based on the type of original articles collected from Springer link, Proquest, and PubMed that are accessed in full text to obtain relevant results from 2012 to 2021. The usage of systematic review method is in line with the PRISMA protocol (Figure 1) [16], and only papers

with English publications were reviewed. The search technique involved practitioners that were medical record experts and health academics. Furthermore, the method also reviews the usage of keywords such as use behavior, computerized medical record system, physician, health information system, health personnel, and hospital. The combination of keywords was performed by mesh term in PubMed search with variations (((("Behavior, Addictive"[Mesh]) AND "Medical Records Systems, Computerized"[Mesh]) AND "Physicians"[Mesh]) AND "Health Information Systems"[Mesh]) AND "Health Personnel"[Mesh]) AND "Hospitals"[Mesh].

Inclusion criteria

The following criteria were included in the study:

1. Articles using data analysis and presentation with quantitative statistical tests
2. Articles with the theoretical framework of the UTAUT
3. Articles involving users and implementation of the use of information and technology systems in health services or hospitals

Exclusion criteria

The following criteria were excluded from the study:

1. Articles using qualitative data analysis and presentation with a literature review
2. Not full-text article
3. Articles involving users and implementation of the use of information and technology systems are not in health services or hospitals.

Handling the risk of bias (quality)

The assessment of articles was completed in accordance with the objectives and keywords used. Furthermore, the quality assessment started from the abstract and full-text review including the Introduction, Method, Results, Analysis, Conclusion, Discussion component. The PEOS Framework such as Population, Exposure, Outcome, and Study Design was used to define the problem statement and determine the inclusion and exclusion criteria in the search for journals such as using the PRISMA checklist. The final selection of studies, and any discrepancies or problems in the assessment, was resolved by discussion between the two independent reviewers that conducted the assessment.

Data synthesis

This research was carried out using data that have categories with the same characteristics according to the specific objectives of this study. The

results were presented by grouping the same category on user characteristics, technology systems used, and other variables based on the UTAUT framework.

Out of 637 articles that were obtained from different search engines, only 20 were relevant to the keywords and met the inclusion criteria.

Results

Table 2 shows the search results for articles that passed the exclusion and eligibility criteria.

Table 2 shows that the 20 selected articles were able to provide useful information, and each of the UTAUT models developed had several variables that influence the acceptance and use of information technology systems. The variables of Performance Expectation, Effort Expectation, Social Influence, Facilitating Condition, Behavioral Intention had the strongest influence on the acceptance and use of EMR in health-care facilities. Furthermore, Table 3 shows other important variables besides the original ones in the UTAUT theory model that also influence the acceptance and use of EMR in hospitals.

From the table above, the behavior of using information technology systems in health-care facilities or in hospitals was influenced by 17 variables other than Performance Expectation, Effort Expectation, Social Influence, Facilitating Condition, and Facilitating Condition. The finding is in line with the several articles that were used as references in this study. Variables that have been proven to influence the behavior of using technology in hospitals may be used to find new models in developing the UTAUT theory. Furthermore, variables added to Performance and Effort Expectation, Social Influence, and Facilitating Condition need to be studied in-depth to understand the relationship they have with technology, especially when the study is devoted to the use of EMR in hospitals.

The characteristics of HR that most dominantly influence behavior on the acceptance and use of information technology systems in hospitals are shown in Table 4.

Table 4 shows that the characteristics of HR in using information and technology systems in hospitals were dominated by female users, between the ages of 20 and 30 years, with 0 and 5 years working experience in the nursing profession. Furthermore, the table below shows the 20 selected articles that were able to provide useful information.

Table 5 shows the use of EMR in the [18]; [19]; [20]; [21]; [24], Health Information System (HIS) [25]; [28]; [36], Picture Archiving and Communication Systems (PACS), E-Prescribing, Telemedicine, Electronic Patient Record, and Technological Solutions for Tuberculosis Treatment Monitoring in the [22], [23], [26], [27], [34].

Table 2: Identification of Selected Articles That Have an Influence on the UTAUT Model

Author, Year, Country	Title	Design	Objective
Chen-Chung Ma, Kuang-Ming Kuo & Judith W. Alexander, 2016, Taiwan [17]	A survey based study of factors that motivated nurses to protect the privacy of Electronic Medical Records (EMR).	Using cross-sectional study and questionnaires to collect data from nurses in a large tertiary care military hospital in Taiwan. Analysis by SEM.	To investigate factors that motivate nurses to protect privacy in electronic medical records, based on the Decomposed Theory of Planned Behavior
Jorge Tavares, Tiago Oliveira, 2016, Portugal [18]	Electronic Health Record Patient Portal Adoption by Health Care Consumers: An Acceptance Model and Survey.	Using a survey, the sample consisted of 360 respondents and was analyzed by PLS	To understand the factors that drive individuals to adopt EHR portals
P. Venugopal, S. Aswini Priya, V. K. Manupati, M. L. R. Varela, J. Machado, G.D. Putnik, 2018, India [19]	An Analysis of the Impact of UTAUT Predictors on the Intention and usage of Electronic Health Records and Telemedicine from the Perspective of Clinical Staffs	Using structured questionnaire administered to 770 clinical staff on the usage of telemedicine and electronic health records in hospitals. Regression analysis using AMOS 20.	To determine the impact of performance expectancy, effort expectancy and social influence on behavioral intention as well as the impact of facilitating conditions on technical/clinical staff's perspective.
Teresa ML Chiu, Benny PS Ku, 2015, Hongkong [20]	Moderating Effects of Voluntariness on the Actual Use of Electronic Health Records for Allied Health Professionals	Using a survey to 135 physiotherapists worked in eight hospitals that participated in the trial and implementation of the AHPN.	To examine the moderating effect of voluntariness on the actual use of an electronic health record (EHR) designed for use by allied health professionals in Hong Kong
Norm Archer, Mihail Cocosila, 2011, Canada [21]	A Comparison of Physician Pre-Adoption and Adoption Views on Electronic Health Records in Canadian Medical Practices	Using a cross-sectional survey. The data were collected both from physicians using EHRs and analyzed with structural equation modeling (SEM) techniques.	To propose a theoretical model comprising behavioral factors either favoring or against EHR adoption and use in Canadian medical practices, from the physicians' point of view
Ransome Epie Bawack, Jean Robert Kala Kamdjoug, 2018, Africa [36]	Adequacy of UTAUT in clinician adoption of health information systems in developing countries: The case of Cameroon	Using questionnaire distributed to clinicians in 4 out of 7 major public hospitals in Cameroon, and analyzing by SEM	To investigate the adequacy of UTAUT1 in determining factors that influence the adoption of HIS by clinicians in developing countries, based on the case of Cameroon
Mohammadhiwa Abdekhoda, Kawa Mirza Salih, 2017, Iran [22]	Determinant Factors in Applying Picture Archiving and Communication Systems (PACS) in Healthcare	Using a cross-sectional study in which 190 physicians worked in a teaching hospital affiliated with Tehran University of Medical Sciences.	To identify determinant factors that affect the adoption of PACS by physicians
Natalia Wrzosek, Agnieszka Zimmermann, Łukasz Balwicki, 2020, Poland [23]	Doctors' Perceptions of E-Prescribing upon Its Mandatory Adoption in Poland, Using the Unified Theory of Acceptance and Use of Technology Method.	Using questionnaire completed by 144 family doctors in Poland during the technology implementation phase and the initial period of obligatory e-prescribing	To identify the factors that impact doctors' acceptance levels for the new technology.
Odai Enaizan, Bilal Eneizan, Mohammad Almaaitah, 2020, Malaysia [6]	Effects of privacy and security on the acceptance and usage of EMR: The mediating role of trust on the basis of multiple perspectives.	Using 375 usable questionnaires and an analysis SEM and test the fit of the mode	To propose a new model testing the individual, security, and privacy factors affecting EMR acceptance and the role of trust as a mediator.
Janis Luyten, Wim Marneffe, 2021, Belgia [24]	Examining the acceptance of an integrated Electronic Health Records system: Insights from a repeated cross-sectional design	Using a survey 304 responses and analyzing by (PLS-SEM)	To differentiate between the enablers and barriers of EHR acceptance prior to EHR implementation and those that arise over time by testing a theoretical model specifically tailored to the EHR context.
Roxana Sharifian, Fatemeh Askarian, Mohtaram Nematollahi, Payam Farhadi, 2014, Iran [25]	Factors influencing nurses' acceptance of hospital information systems in Iran: application of the Unified Theory of Acceptance and Use of Technology	Using a cross-sectional survey of nurses (n=303) and examined using the LISREL path confirmatory modeling	To investigate the factors affecting hospital information systems nurse-user acceptance of HISs, based on the Unified Theory of Acceptance and Use of Technology (UTAUT), in the Shiraz University of Medical Sciences teaching hospitals
Kirubel Biruk Shiferaw, Shegaw Anagaw Mengiste, Monika Knudsen Gullstett, Atinkut Alamirrew Zeleke, 2021, Ethiopia [26]	Healthcare providers' acceptance of telemedicine and preference of modalities during COVID-19 pandemics in a low-resource setting: An extended UTAUT model.)	Using a multi-centric online survey with survey 423 responses and analyzing using SEM SPSS AMOS version 23	To assess health-care providers acceptance and preferred modality of telemedicine and factors among health professionals working in Ethiopia.
Éric Maillet, Luc Mathieub, Claude Scotte, 2015, Canada [27]	Modeling factors for the acceptance, actual use, and satisfaction of nurses using an Electronic Patient Record in acute care settings: an extension of the UTAUT.	Using a multicenter cross-sectional, randomized stratified sampling 616 nurses and SEM Technique	To explain the acceptance and actual use of an EPR and nurses' satisfaction by testing a theoretical model adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT)
Zhou Lulin, Joseph Owusu-Marfo, Henry Asante Antwi, Xinglong Xu, 2020, Ghana [28]	The Contributing Factors to Nurses' Behavioral Intention to Use Hospital Information Technologies in Ghana	Using descriptive non-experimental. analyzed via the SmartPLS Structural Equation Modeling path analysis	To explore the factors that affect Ghanaian nurses' acceptance of HIT
Kirubel Biruk Shiferaw, Eden Abetu Mehari, 2019, Ethiopia [29]	Modeling predictors of acceptance and use of electronic medical record system in a resource limited setting: Using modified UTAUT model	Using multi-centric online survey and evaluation by Structural Equation Modeling (SEM) using SPSS Amos version 23.	To assess healthcare providers' acceptance and preferred modality of telemedicine and factors thereof among health professionals working in Ethiopia
Lu Lin Zhou, Joseph Owusu-Marfo, 2019, Ghana [30]	Assessment of the social influence and facilitating conditions that support nurses' adoption of hospital electronic information management systems (HEIMS) in Ghana using (UTAUT) model	Applying a non-experimental survey design, using an electronic platform questionnaire on smartphones to collect data on 660 nurses, and statistically using AMOS, SEM version 22.0	To assess the "Social Influence" (SI) and "Facilitating Conditions" (FC) that support Nurses' Acceptance of HEIMS in Ghana using the "Unified Theory of Acceptance and Use of Technology" (UTAUT) model.
Seok Kim, Kee-Hyuck Lee, Hee Hwang and Sooyoung Yoo, 2016, Seoul [31]	Analysis of the factors influencing healthcare professionals' adoption of the mobile electronic medical record (EMR) using the unified theory of acceptance and use of technology (UTAUT) in a tertiary hospital.	Surveying 942 healthcare professionals, and using Structural Equation Modeling (SEM) analysis.	To confirm the factors that influence users' intentions to utilize a mobile electronic health records (EMR) system using both a questionnaire survey and a log file analysis that represented the real use of the system. SAS 9.0 and AMOS 21.
Odai Enaizan, A. A. Zaidan, N. H. M Alwi, B. B. Zaidan, 2020, Malaysia [32]	Electronic medical record systems: decision support examination framework for individual, security, and privacy concerns using multi-perspective analysis	Using integrated technique for order of preference by similarity (TOPSIS) and analytic hierarchy process (AHP). K-means clustering. 100 questionnaires.	To investigate how individual, security and privacy determinants influence EMR acceptance and use
Mohammedjud Hassen Ahmed, Adina Demissie Bogale, Binyam Tilahun, 2020, Ethiopia [33]	Using electronic medical record and its predictors among health care providers at referral hospitals, north-West Ethiopia, 2019: using unified theory of acceptance and use technology 2 (UTAUT2) model.	Using a cross-sectional explanatory study, the sample size of 423, SPSS version 20 and AMOS version 23, and SEM analysis.	To assess health care provider's intention to use and its predictors towards Electronic Medical Record systems at three referral hospitals in the north-west, Ethiopia, 2019.
Ravi Seethamraju, Krishna Sundar Diatha, Shashank Garg, 2017, India [34]	Intention to Use a Mobile-Based Information Technology Solution for Tuberculosis Treatment Monitoring – Applying a UTAUT Model.	Using a survey to 129 participants and using PLS-SEM analysis.	To investigate the factors influencing the acceptance and use of a mobile-based IT solution for TB treatment monitoring.

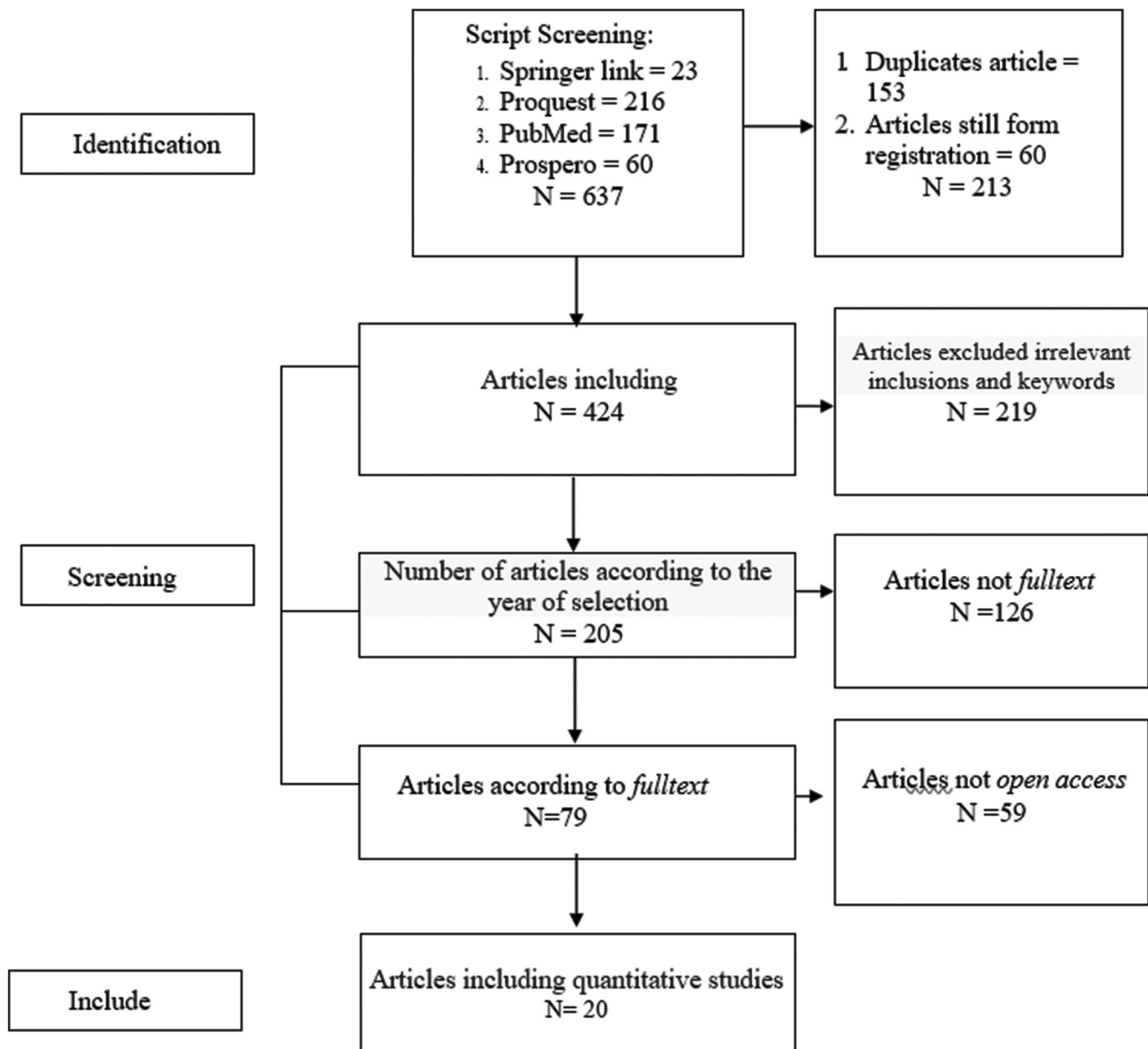


Figure 1: Based on PRISMA guideline [16] Out of 637 articles that were obtained from different search engines, only 20 were relevant to the keywords and met the inclusion criteria

Table 3: Other variables influencing acceptance and use of information technology systems [17], [27]

No	Independent Variable	References
1	Compatibility	[17]; [27]
2	Self-efficacy	[17]; [29]; [27]
3	Perceived Behavioral Control	[17]
4	Habit	[18]
5	Self-perception	[18]
6	Security	[6]
7	Privacy	[6]
8	Individual	[6]
9	Trust	[6]
10	Training	[24]
11	Administration	[24]
12	Attitude	[24]; [26]; [28]; [31]
13	Use behavior	[30]
14	Computer literacy	[20]; [33]
15	Job	[21]
16	Necessity for system	[21]
17	Communication Quality	[24]

Table 4: Characteristics of dominant human resources influencing the use of information technology systems [17], [27], [30]

No	Human Resource Characteristics	Frequency	Percentage	References
1 Gender				
	- Female	8	62%	[17]; [14]; [22]; [24]; [27]; [30]; [31]; [33]
	- Male	5	38%	[19]; [21]; [26]; [34]; [35]
	Total	13	100%	
2 Age				
	- 20–30 years	9	62%	[19]; [14]; [24]; [26]; [28]; [30]; [31]; [33]; [35]
	- 31–40 years	3	31%	[22]; [23]; [34]
	- 42–50 years	1	7%	[17];
	Total	13	100%	
3 Working period				
	- 0–5 years	9	80%	[19]; [14]; [22]; [26]; [28]; [30]; [31]; [33]; [35]
	- 6 years	1	10%	[4]
	- 10 years	1	10%	[24]
	Total	11	100%	
4 Profession				
	- Doctor	4	40%	[14]; [26]; [31]; [34]
	- Nurse	5	60%	[24]; [28]; [30]; [33]; [35]
	Total	9	100%	

The finding found in Table 5 shows that the largest use of technology from 20 journals were influenced by the variables of Performance Expectation, Effort

Expectation, Social Influence, Facilitating Condition, and Behavioral Intention in the use of EMR. Furthermore, six journals were the most dominant compared to other technologies, which indicates that the use of EMR in hospitals to conduct further studies requires the variables of Performance and Effort Expectation, Social Influence, Facilitating Condition, and Behavioral Intention in determining the level of success in its use behavior. **Table 5: Information technology systems used in hospitals [12], [22], [25]**

No	Technology in Hospital	Reference	Number of article
1	Electronic Medical Records (EMR)	[6]; [17]; [31]; [32]; [33]; [35]	6 articles
2	Health Information System (HIS)	[25]; [28];	3 articles
3	Electronic Health Record (EHR)	[19]; [18]; [20]; [21]; [24]	5 articles
4	Picture Archiving and Communication Systems (PACS)	[22]	1 article
5	E-Prescribing	[23]	1 article
6	Telemedicine	[26]	1 article
7	Electronic Patient Record	[27]	1 article
8	Information Technology Solution for Tuberculosis Treatment Monitoring	[34]	1 article

Discussion

Effect of performance and effort expectation, social influence, facilitating condition, and behavioral intention to use behavior

Based on the results from the study of Venkatesh *et al.* [37], independent variables consisting of Performance and Effort Expectation, Social Influence, and Facilitating Condition were able to influence use behavior through behavioral intention with the results from 20 journals that had been collected. However, it was found that the independent variables had a wider influence on use behavior and behavioral intention due to the fact that several moderating and mediating variables also had an effect.

Out of the 20 journals, 11 or 55% stated that the UTAUT theory describes a significant influence on behavioral intention and use of technology in hospitals. The study conducted by Shiferaw and Mehari states that 40.2–58.5% of the variance that is in line with the intentions of using the EMR system may help in determining the factors associated with its acceptance and use which shows that 40–58.5% of the variables consisting of Performance and Effort Expectation, Social Influence, Facilitating Condition, self-efficacy and attitude toward variables in this model explained the relationship factors in the use of EMR in hospitals. Furthermore, 40% and 58.5% explained the model to behavioral intention and actual use.

There were differences with the study of Maillet *et al.* [27] whereby the Performance and Effort Expectation, Social Influence, and Facilitating Condition are not independent but mediating variables that are influenced by other variables of self-efficacy and compatibility [18], which affected the actual use of extended producer responsibility (EPR) technology and nurses' satisfaction by 33.6%.

According to Wrzosek *et al.* [18], the model explained 49.7% of the variance in behavioral intention and 26.8% in use behavior which means that there is 49.7% probability to arrive at the intention to use the EHR and 26.8% in understanding its behavior. Furthermore, this shows that the model was able to explain more on the intention alone, while in reality, the system usage was still lacking. In general, the results of three journal articles [18]; [27]; [35] showed that [32] the UTAUT model backbone was able to explain the effect of using technology systems in hospitals by approximately below 60%. However, in other study, the model showed an effect above 50% to 83%, namely, 83% on EMR [33], 51.7% on HIS [30], 60.7% on HIT [28], 72.8% on HIS [25], 80% on EHR [24], 66.8% on EHR [21], and 82% on EMR [17]. The finding in the previously stated journals is in line with theory that the model in UTAUT theory was able to explain 77% of the variance on behavioral intention and 52% on use behavior [38].

Other variables influencing the acceptance and use of information and technology systems

The UTAUT model aims to explain user intentions and behavior in using information systems. The key constructs consist of performance and effort expectancies, social influence, and facilitating conditions [37]. The first three factors are direct determinants of intention and use behavior, while that of concluding gender, age, experience, and voluntary use were presented as moderators.

The UTAUT model was developed by referring the finding from various researches and also by comparing from the constructs of eight models that were to explain the behavior of using information systems. The systems are, namely, the Theory of Reasoned Action, Technology Acceptance Model (TAM), Motivational Model, Theory of Planned Behavior (TPB), Combined TPB/TAM or CTPB/TAM, Model of Personal Computer Use), Diffusion of Innovations Theory (DIT), and Social Cognitive Psychology/Cognitive Theory (SCT) [39]; [40]; [41].

According to the developments in recent studies, the influence may be obtained in determining other factors outside the four main constructs, which includes Performance and Effort Expectations, Social Influence, and Facilitating Conditions as well as moderating variables such as age, gender, years of service, and volunteering to use behavior through behavioral intention [42]. Use behavior is defined as the actual use of a technology [30], [42], and the indicator used to measure it is the intensity usage which describes how often users have access to information technology [37].

The method of adding new variables is grouped into extension types, namely, (1) new exogenous, (2) endogenous, (3) moderating, and (4) outcome mechanisms. Moreover, the reviewed journals

indicate that the addition of a new variable to the new exogenous mechanism has an effect on performance and effort expectancies [42]. The variable self-efficacy refers to the knowledge and skills of individuals in using computers effectively tasks. Furthermore, it has contributed to the new exogenous mechanism, which only affects the effort expectancy [17], [27], [29].

Compatibility is the extent to which an innovation is perceived as consistent with the values, needs, and experiences of potential adopters. The following quotes were used as indicators, namely, 1) "using the system is compatible with all aspects of my work," 2) "I think that using the system fits well with the way I like to work," and 3) "using the system fits into my style of work" [37] (Jogiyanto, 2008).

Perceived Behavior Control (PBC) is closely related to supporting and inhibiting factors in a person's behavior. It is one of the factors that influences an individual's intention to determine attitude and is a variable in the TPB by Ajzen [43]. The previous studies have showed that PBC as a new endogenous mechanism is influenced by self-efficacy and facilitating conditions that affect Behavioral Intention with indicators that the respondent has the knowledge and resources to protect the privacy of EMR [17].

Habit is defined as the extent to which people tend to showcase their behavior automatically when learning [18]. As a new exogenous mechanism, it directly and indirectly influences the behavioral intention to use the EHR portal. Self-perception, which is also referred to as self-efficacy, is the ability of an individual to do something single-handedly. It is one of the indicators of perceived behavioral control in the facilitating condition variable in the theory of UTAUT [37], [43]. Self-perception is a new exogenous mechanism that has a direct influence on the behavioral intention in using the EHR portal [18].

Privacy or confidentiality and security are the protection of information from parties that do not have the right to access the information. Medical records containing medical history need to be confidential because they belong solely to the patient, while the document belongs to the doctor, dentist, or health service facility [44]. According to Sabarguna (2008), computer security, especially in the health sector, includes aspects of privacy or confidentiality, integrity, authentication, availability, access control, and non-repudiation. Medical records that are implemented electronically in hospitals need to be kept safe and confidential. The idea of the implementation of EMR is supported by previous studies where privacy, security, and individual characteristics as new exogenous mechanisms or as independent variables directly influence the behavioral intention to use EMR [6]. However, privacy and security both positively influence the behavioral intention to use EMR. Furthermore, the trust variable as a new endogenous mechanism that explains the privacy, security, and individual characteristics has an effect on behavioral intention to use EMR.

EMR development depends on HR, users, and policymakers. It is an automated system consisting of a laboratory that enables doctors to document when a patient visits the hospital (WHO, 2006). Although it is a good system, it is not complete and does not mean anything without the support of good HR. These resources are based on their knowledge, skills, willingness, and behavior in which is influenced by the education that is taken both formally and non-formally, and an example is training. The previous studies have shown that training as an independent variable or a new exogenous mechanism influences the attitude of using EHR through effort expectancy [24]. The indicators include the training carried out by the respondents, which is useful in the ability to complete tasks, gives confidence in the system, and increases their understanding substantially.

Furthermore, the other independent variable or new exogenous mechanism is the administration variable which involves the process of recording patient data such as the subjective, objective, assessment, and planning recording process by medical personnel [44]. It supported by the study, which states that administration as an independent variable or new exogenous mechanism affects attitude through performance expectancy [24]. In addition, communication quality as an independent variable or new exogenous mechanism influences the attitude of using EHR in hospitals through facilitating conditions. The indicators include information that could be received on time, decision making on the use of the new system, transparent hospital management in decision-making.

Significant overall risk regarding users fear and doubts about EHR in their involvement in medical practice has several indicators, namely, (1) perceived performance risk, such as the fear that the system fails to function as expected, (2) perceived legal and privacy risks, such as fear of legal and privacy issues from using EHR, and (3) psychological risk (anxiety and stress about EHR implementation). These risks were used as an independent variable that influences behavioral intention through performance expectancy [21]. The results showed that the variable overall risk had an inverse meaning with perceived usefulness, which is an indicator of the performance expectancy variable.

Job relevance is interpreted as the suitability of the system used. Furthermore, social influence is also interpreted as the support of the surrounding environment and as an independent variable that influences behavioral intention through performance expectancy. The influence is further explained by the finding from the study of, whereby Effort expectancy as a mediating variable or new mediation mechanism is influenced by personal IT innovativeness that have a direct and indirect effect on behavioral intention and performance expectancy [21]. These are all developments from the UTAUT theory [42].

Computer literacy is the ability to understand

and use information from various sources when presented through digital tools. It involves understanding how information is generated and communicated in various forms through the creation of critical frameworks for retrieval, agency, evaluation, presentation, and use of information using digital technology tools. Computer literacy is an independent variable that has an indirect influence on the intention to use EMR which is moderated by gender, age, and experience. The influence of the EMR usage is in accordance with the study of which states that computer literacy positively influences the intentions of healthcare providers to use EMR [33]. Another study also showed that interest in internet computers which consist of indicators such as confidence, approval, and interest could have almost the same meaning as computer literacy and affect the actual use of EHR [10].

Dominant HR characteristics influencing the use of information technology systems

EMR users are categorized into doctors [14]; [26]; [31]; [34]; nurses [24]; [28]; [30]; [33]; administrators, pharmacy, radiology, IT, and physiotherapy staffs. Doctors are considered the main users because they consult with patients and further complete the primary function of the medical record. Nurses, although they do not directly complement the primary function, Nurses are also complimentary users in the primary function of medical records. They always accompany doctors and patients; therefore, they benefit the most from EMR. Nurses also take notes as a complement to medical documents made by doctors.

Based on age characteristics, about nine journals out of a total of 20, showed that 62% of people between the ages of 20 and 30 years were the most dominant among other age groups. The finding shows that the younger an individual, the higher the capability in using technology which is supported by the finding the previous study states that "the younger generation of clinicians (< 40 years old) are more willing to embrace HIS than the older ones [36]. The finding also showed that that it is because the younger generation is more familiar with the benefits of technology as a whole and they believe they could easily relate to technology implemented in the medical field." The finding is also supported by the study of Seethamraju *et al.*

At present, this younger generation, including doctors, is part of the technology era. They are exposed to many things that involve using HIS because of the convenience that is currently available, which may have a positive impact on work productivity. However, the IT infrastructure required to accommodate such systems is absent in most public hospitals in developing countries. As a result, there are often failures in the application of technology in hospitals .

In relation to the use of technology in hospitals, male officers have a stronger influence on Performance and Effort Expectancies and Behavioral Intention than

female officers [34]. Meanwhile, the female gender has a stronger influence on the Social Influence variable and Behavioral Intention than the males. The finding shows that the performance and business expectations in the use of technology in hospitals are more influenced by men. While women have more influence on the surrounding environment, such as support from colleagues.

Experience or tenure is one of the characteristics of HR in this study that is also important in determining the influence on the intention and use of technology in hospitals. Experience in TB treatment moderates the relationships between (a) effort expectancy, (b) performance expectancy, (c) social influence, and (d) facilitating condition with Behavioral intention indicates a short experience also contributes to the successful use of technology in hospitals [34]. Furthermore, the result is also supported by Bawack and Kamdjoug [14]; Venugopal *et al.* [19]; Abdekhoda and Salih [22]; Shiferaw *et al.* [26]; Lulin *et al.* [28]; Zhou *et al.* [30]; Kim *et al.* [31]; Ahmed *et al.* [33] and Shiferaw and Mehari; that a working period of < 5 years has a strong moderating effect on the variables of Performance and Effort Expectations, Social Influence, and Facilitating Condition.

Information technology systems used in hospitals

Based on the analysis from six different articles, it was found out that the use of EMR was the most dominant among other technologies in hospitals such as HIS, EHR, physician assistants (PAS), E-Prescribing, EPR, and Technology solutions for tuberculosis. In addition, further study needs to be conducted on the use of EMR technology based on the UTAUT theoretical model [37].

Hospital Management Information System (SIMRS) is a communication information technology system that processes and integrates the entire flow of hospital service processes in the form of a network of coordination, reporting, and administrative procedures to obtain precise and accurate information. It is an integrated information system that is prepared to handle the entire hospital management process such as diagnosis and treatment services for patients, medical records, warehouse, pharmacy, billing, personnel database, employee payroll, accounting processes to management control. Furthermore, the SIMRS aims to improve service quality and facilitate hospital management in various routine transactions.

Indonesia has required the use of computers in an integrated manner in Law Number 44 of 2009 which states that "every hospital is required to record and report all hospital operations in the form of SIMRS." The Ministry of Health Regulation Number 82 of 2013 concerning Hospital Management Information Systems article 3 also explains that "every hospital is obliged

to carry out SIMRS.” Therefore, it is important to be implemented in every hospital to provide maximum service to both internal and external customers.

EMR is one of the implementations of SIMRS that has become very important because it is directly related to sources of information about identity, history taking, examination, and records of all activities of health services on patients. It has become a global trend in various world hospitals as a substitute or complement to paper medical records. Furthermore, in Indonesia, hospitals need to maintain medical records, which are in accordance with Law Number 44 of 2009 concerning Hospitals, article 29, and the Ministry of Health Number 269 of 2008 concerning medical records. Article 2 paragraph (1) states that medical records need to be written in full and either clearly or electronically. Implicitly, the verse permits health-care facilities to make EMR.

According to the Ministry of Health Regulation Number 269 of 2008, Medical Records has several benefits such as (a) the basis for healthcare and treatment of patients, (b) material for evidence in legal cases, (c) for research purposes, (d) basis for payment of health-care costs, and (e) also for preparing statistics health. Therefore, these records are useful for assessing the accreditation of health services in a hospital or at a health center.

The analysis of technological use of EMR by medical professionals resulted in a decrease in medication errors, an increase in the quality of care and service to patients, and a reduction in time consumption. The study showed how to take advantage of the system, and this may be used as a reference for hospitals to improve the practice of health care professionals, thereby increasing their competitive advantage and allowing them to invest and compete internationally. Based on the findings, the EMR system may also be used in other aspects of the market, such as the clinical industry [6].

Conclusion

The implementation of EMR has the potential to present great benefits for health workers, organizations, hospitals, and also for the health of the people. However, developing countries still need an in-depth study in terms of HR related to the intention, behavior, and ability to use technology through habituation and training programs. The management of health service providers is also important in order to increase the acceptance and use of EMR. However, this has become a major concern to avoid problems of using this system in developing countries. The independent variables consisting of Performance and Effort Expectations, Social Influence, and Facilitating Condition affect Use

Behavior through Behavioral Intention [37]. The model in the UTAUT theory was also able to explain 77% of the variance in behavioral intention and 52% in use.

Furthermore, the EMR has the most dominant contribution by 30% compared to other technologies such as HIS, EHR, PAS, E-Prescribing, EPR, and Technology solutions for tuberculosis. It is directly related to sources of identity information, results of history taking, examination, and records of all health service activities. In Indonesia, the implementation of the EMR is mandatory until 2024 to ensure it is 100% available in all hospitals. In addition, the characteristics of HR in using information technology in hospitals were dominated by female officers, between the ages of 20 and 30 years with 0 and 5 years working experience in nursing.

Study Limitation

This study was limited to information and technology systems, specifically on EMR in health-care facilities. Other variables also influencing the acceptance and use of technology systems in the UTAUT model and user characteristics were used as important recommendations for solving problems and achieving improvements in the acceptance and use of this system. Furthermore, more studies need to be carried out on EMR because few studies on review were.

Future Direction

This study argued that many factors and alternative models could be improved and used to achieve better acceptance in the use of information and technology systems, such as EMR. An example is the development of the UTAUT theory model in which variables such as Performance expectation, Effort expectation, Social Influence, Facilitating condition, and Facilitating condition were used as the main constructs. This include compatibility, self-efficacy, perceived behavioral control, habit, self-perception, behavior or habit, security, privacy, individual characteristics, trust, training, administration, attitude, use behavior, computer literacy, job, the necessity for the system, and communication quality. However, the cost benefits and effectiveness obtained from users and health service facilities also need to be considered in the conceptual framework by incorporating the existing models. EMR implementation certification may be applied in developing countries in the next few years, especially in Indonesia. Further studies need to be carried out on the implementation of EMR.

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