Factors Influencing Patients' Attitudes to Exchange Electronic Health Information in Saudi Arabia: An Exploratory Study

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Abstract—Health Information Exchange (HIE) systems electronically transfer patients' clinical, demographic, and health-related information between different care providers. These exchanges offer improved health care quality, reduced medical errors and health care costs, increase patient safety and organizational efficiency. However, technologies cannot bring such improvements if patients are reluctant to share personal health information which could impede the success of HIE system. The purpose of this study is to identify different factors that determine patients' acceptance for sharing their medical information among different care provider. Based preliminary on the Theory of Planned Behavior (TPB) and Technology Acceptance Model (TAM) combined with patients' perspective an integrated model is proposed. A questionnaire survey is conducted to measure the proportion of respondents' willingness to share their information with the residence of the eastern province of Kingdom of Saudi Arabia. A sample of 300 respondents over 18 years of age is collected. Basic descriptive statistical analysis, reliability and validity assessment is conducted to analyze data and measure the goodness of model. Furthermore, Structural Equation Modelling is used to test research hypothesis. The finding shows that perceived benefit, perceived risk, subjective norms and attitude are the main predictors of patients' willingness or unwillingness to share their health information. The study revealed that more attention should be directed to these factors during the design and implementation of future HIE system to avoid expected barriers.

Keywords—Health Information Exchange; Electronic Medical Record; TAM; Theoretical Model Introduction

I. INTRODUCTION

Saudi Arabia government is consuming billions to enhance quality of healthcare and to extends its coverage over the last three decades [1]. This lead to increase in number of care providers, out of them, 60 % of healthcare services are provided by the ministry of health, the remaining services are provided by others governments bodies such as National Guard, Ministry of Defense and Aviation, Ministry of Interior, University Hospitals and private sector. Different care providers are managing and accomplishing health care services with significant variation in the information system used. Many of them using Electronic Medical Record (EMR) systems for rendering health care services. As a result, patient information has scattered in various healthcare providers, and hospital staff is unable to review the medical history of patients who have visited other hospitals. It leads to redundant diagnostic tests or prescription of medications, which would compromise the quality of patient care. There is a need of integrated EMR among different hospitals to improve quality of care provided to patients, and improve efficiency of health care sector [2, 3].

Studies have shown despite the benefits of electronic Health Information Exchange (HIE) systems there is a potential threat to the confidentiality of information and their implication on patients' privacy. Due to these threats HIE system are either not available or underutilized. One of the classical examples is Care. Data [4] launched by NHS England 2013 where they took an initiative to integrate patient records stored in the machines of general practitioners with information from social services and hospitals to make one centralized data archive. Unfortunately, this data share project failed due to risk of privacy it posed between patient and practitioners. Another example is doctor boycott to use inter organizational network with in British National Health service design to improve exchange of information on the ground of potential threat to information confidentiality [5]. Therefore, without balancing patient's preferences for spreading their information over potential benefit that occurred to society the successful implementation of such system is challenging task. This issue is of particularly importance in context of Saudi Arabia where impact of social norms is relatively high as compare to western world. Unless patients are sure that personal information will not be distributed against their wish they may be reluctant to disclose sensitive information that is crucial to their correct treatment.

Although patient interests are at the core of medical confidentiality policy their understanding and view of possible information usage is at the margin of scholarly attention. In order to implement HIE system understanding patients' perceived need for HIE, their preference, acceptance of technology, perceived benefit and concerns about information exchange technology is essential. Thus, this study explored the antecedent factors of patients' intentions to accept HIE system from the perspective of information system adoption. It investigates the direct and indirect effect of various factors such as privacy, trust, social norms and patient involvement respectively on their intention and attitude towards sharing health information. Based on Technology Acceptance Model (TAM) [6] and Theory of Planned Behavior (TPB) [7] combined with patients' attitude and concerns, a conceptual

model is proposed to explain the intention of patients' to share their sensitive health information. The main goal is to study patients' preferences that affect the acceptance of HIE. These preferences should be considered when developing and implementing systems, standards and policies to eliminate the expected barriers.

Rest of paper is organized as follow: Literature related to health information system and its acceptance is presented in Section II. The proposed model and research method is presented in section III and IV. Research results and research implications are discussed in section V. Finally, section VI concludes the paper.

II. LITERATURE REVIEW

Prior studies have identified HIE related privacy and security concerns [8] and public attitude toward adoption of HIE system [9, 10]. Some studies discussed attitude of doctors [11-14] and nurses [3] toward the usage of EMR and few of them discussed patient's acceptance of Health information system [15, 16]. However, these studies mainly focus on consumers' reluctance to use new technology.

There are very few studies which exclusively focus on patient attitudes toward sharing their health information. E.g. Whiddett, et al. [17] conducted a study of primary care patients in New Zealand and found that patient would like to be consulted about type of information before being released. Simon, et al. [18] surveyed Massachusetts community of northeastern United States to collect patient opinions about distribution of their information. The study found that patients are more concerned about privacy over HIE benefits. A proportion of respondent shows willingness to share information if they are consulted prior to sharing their information. Dhopeshwarkar et al. [19] conducted a survey to understand consumer preferences regarding the privacy and security of HIE. The study explored that patients prefer to view and permit the portion of information being shared with other parties. All these studies are exclusively validated in context of western culture, whereas in Saudi Arabia the impact of subjective norms on individual to share information is markedly different. Furthermore, previous studies based on general perception of consumers' behavior by considering privacy and security concerns.

Compared to previous studies, this study highlighting the factors driving patients' intention by developing a theoretical model adopted from psychological and social science theories describing user attitude and behavior toward specified behavior. These theories include Theory of Reasoned Action (TRA) [20], Theory of Planned Behavior (TPB) [7] to describe user behavior and attitude and Technology Acceptance Model

(TAM) [6] that predict and explain health IT acceptance and use.

TRA is a general social-psychological/behavioral theory that had been proven useful for understanding a variety of behaviors. It suggests that a person's behavior is determined by persons' attitude and subjective norm [20]. TPB [7] is an extension of TRA, suggesting that in addition to attitude and subjective norm, a person's perceived behavioral control (PBC) also influences behavioral intention. It refers to a person's behavior based on past experience (such as privacy protection and invasion) and the anticipated abilities to carry out the behavior. Although TPB is adopted by many researchers to explain the behavior of persons toward certain action, however, it does not specify belief set that is relevant to specific behavior of IT usage and acceptance. Since the major antecedent to IT use is behavioral intention (BI) to use it, hence TPB is extended to Technology Acceptance Model (TAM). TAM determines that the intention to use a system is effected by individual's attitude towards using the system. Perceived usefulness is influenced directly by behavioral intention (BI) [21]. Furthermore, perceived usefulness and perceived ease of use are two factors influenced by additional external variables and determines users' attitude and perceived ease of use i.e. the easier it is to use the more useful it can be.

Based upon these three theories combined with general consumers' perception of health care literature a theoretical model is proposed in next section to identify antecedent factor to determine patient attitude towards sharing their health information.

III. PROPOSED MODEL AND HYPOTHESIS

Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) are selected as the reference to develop theoretical model for determining patients' intention to accept Health Information Exchange system. Proposed model is shown in Fig. 1. It consists of eight external variable (constructs) based on theoretical arguments from HIE acceptance perspective. The selection of these constructs is supported by previous studies from Health Information System and Technology acceptance literature [6, 8, 12, 21, 22]. Behavior Intention is adopted from original TAM model as the primary predictor of actual usage behavior [21]. Subjective Norms and external variables such as Age, gender and background are adopted from TPB. Furthermore, we extended the model with other constructs such as Perceived Benefits of HIE, Perceived Risk, Trust, Privacy Concerns and Patients' Involvement to provide precise understanding of patients' behavioral antecedents based upon theoretical arguments from HIE perspective [11, 16, 23, 24]. Description of constructs adopted in proposed model is shown in Table I.
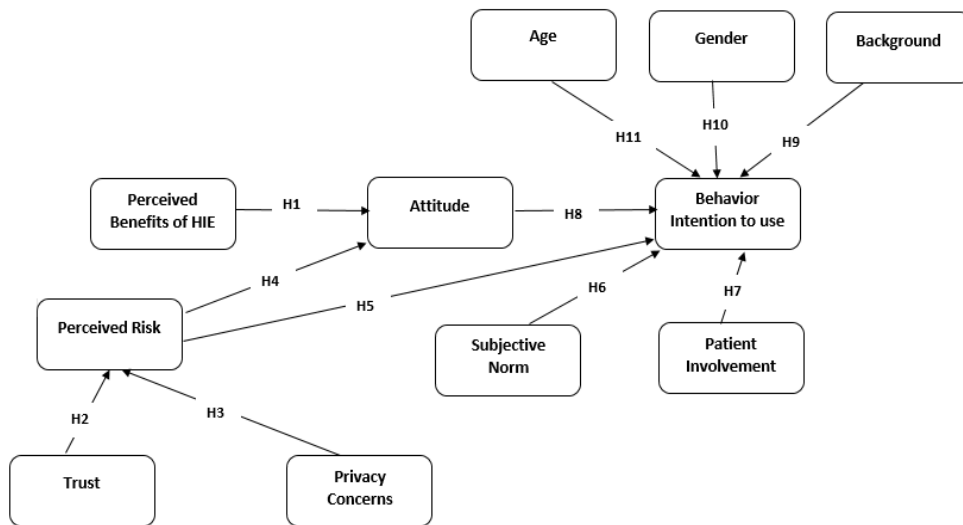
Fig. 1. Proposed Model of Health Information Exchange

TABLE I.   THEORETICAL CONSTRUCTS WITH DESCRIPTION

Construct	Description
Behavior Intention (BI)	Measure the strength of person's formulated conscious plan to perform or not perform some specified future behavior [15]
Perceived Benefits (PB)	Degree of persons understanding for the efficacy of HIE system.
Perceived Risk (PRisk)	Level of patient's uncertainty in use of Health information system
Subjective Norms (SN)	Refer to the persons' perception of performing some action based upon other people expectations [20].
Trust	Measures the level of patients' perception about the legality, standard and technology adopted by HIE system.
Privacy Concerns (PC)	Patients concern who will access and how to use their information.
Attitude (ATT)	Refers to persons' behavior which directly influence the strength of that behavior.
Patient Involvement (PI)	Measures the degree of patient involvement in process of information sharing and usage.

Following eleven hypotheses are constructed to examine proposed model.

H1: Higher level of perceived benefits of HIE leads to more positive attitude to share health information.

H2: Higher level of trust leads to low perceived risk to share their health information.

H3: High level of privacy concerns lead to high perceived risk to share health information

H4: Higher level of perceived risk lead to more negative attitude to share health information.

H5: Patient's perceived risk has a negative effect on their behavior intention.

H6: A higher level of subjective norms leads to more positive behavior intention to share health information.

H7: Patient involvement has a positive effect on their behavior intention to share their health information.

H8: A positive attitude leads to more positive behavior intention to share health information.

H9: Patients' higher level of HIE related background has a positive effect on behavior intention.

H10: Gender will positively influence on behavior intention to share health information more for men.

H11: Age will positively influence on behavioral intention to share health information more for younger than elderly.

In this study, we considered the patients' age above 18 years because the patients younger than 18 could not have their own account or respond the survey [16]. Furthermore, they will influence negatively since they are unable to take a decision about their health information and most of them rely on their parents.

IV.   RESEARCH METHODOLOGY

A. Survey Instrument Development

Data is collected from surveys administered through structured questionnaire. Survey items used to operationalize the construct investigated in proposed model are adopted from previous studies as shown in Table II. To adopt them for Saudi culture, items were first drafted in English and test for clarity and face validity by team of two professors. To get the maximum response, items were also translated into Arabic language. A backward translation method was used where items were translated back and forth to English and Arabic language by team of two bilinguals' professors. The Arabic and English version were subject to three patients for content clarity and completion time estimation. All items were measured using a five-point Likert-type scale, with anchors ranging from "strongly agree" to "strongly disagree." Survey

was distributed via email, WhatsApp, tweeter, Facebook as well as conducted online.

Constructs	Survey Items
BI [12, 22]	BI1: I intend to share my health information when it becomes available with my physician.
	BI2: I intend to share my health information with other caregivers as often as needed.
	BI3: To the extent possible, I would share my health information with others providers frequently.
ATT [12, 24]	ATT1: Sharing my health information would be a good idea.
	ATT2: Sharing my health information is unpleasant.
	ATT3: Sharing my health information is beneficial for my health care.
PB[14, 25]	PB1: Sharing my health information save time and decrease cost.
	PB2: Sharing my health information reduce duplication in medication, reports and lab tests.
	PB3: Sharing my health information help physician to accurately diagnosis
SN[24, 26]	SN1: People who are important to me would think that I should share my health information with other organizations.
	SN2: People who influence me would think that I should share my health information.
	SN3: People whose opinions are valued to me would prefer that I should share my health information with other organizations [26].
PI[27]	PI1: I prefer to sign a consent before my information being released.
	PI2: I prefer to approve which information that I agree to share.
	PI3: I want to receive notification before sharing my information.
PRisk [13, 24]	PRisk1: Sharing my health information lead to breach of privacy because my information could be used without my knowledge.
	PRisk2: Sharing my health information would pose risks to my treatments and diagnoses.
Trust [13, 15]	Trust1: I can trust health care providers to share my information.
	Trust2: I cannot trust on information technology used due to potential threats
PC [28, 29]	PC1: I am concerned that another care provider could misuse my health information.
	PC2: I am concerned about sharing my health information because of what others might do with them.
	PC3: I am concerned about sharing my health information because it could be sold to third parties.

B. Tool and Techniques

Data is analyzed using SPSS V24.0 and WarpPLS 5.0 [30]. SPSS is a well-known and commonly used program for statistical analysis and used to compute descriptive statistics, frequencies, and percentages of collected data. WarpPLS 5.0 is used to assess the reliability, validity as well as hypothesis testing. Structural Equation Modeling (SEM) is used for hypothesis testing. SEM is most commonly used multivariate technique [31] for instrument validation and model testing to identify series of relationship constitutes in large-scale model or an entire theory.

C. Demographic Characteristics

A total number of 300 responses from Saudis and non-Saudis residence in Eastern province is collected. Table III presents the sample distribution of gender, age and background. Results show that the most respondents were female (59.3%). The majority of the respondents (58%) indicate that the respondents do not have previous background about health information exchange. Statistics also shows that the majority of the respondents (38.7%) were between 18 to 30 years of age group.

Measure	Item	Frequency	Percentage
Gender	Female	178	59.3
	Male	122	40.7
Age	18 to 30 years	116	38.7
	31 to 40 years	93	31
	41 to 50 years	51	17
	51 years and above	40	13.3
Background	Yes	126	42
	No	174	58

V.   DATA ANALYSIS AND RESULTS

The analysis of data from the 300 samples is conducted in two stages. At first stage, the model is estimated using Confirmatory Factor Analysis (CFA) to test whether constructed variable possesses sufficient reliability and validity. Based upon CFA, constructed variable and measuring items that best fitted the data are identified. Constructs and items that do not best fit the data are removed from model. In second stage structural relationships among the model constructs identified to test whether proposed hypothesis are supported by data or not.

A. Assessment of the Measurement Model

Model reliability, Convergent and Discriminant validity [32] is examined to identify the adequacy of measurement model. Cronbach's Alpha is used to assess reliability. Its values varies between 0 and 1, the higher the values the more reliable and desirable are the measuring items pertaining to given construct [33]. According to C. E. Lunneborg [34] values should be more than 0.70, however, 0.60 or 0.50 is also acceptable [35, 36]. It can be observed from the Table IV, the range of the Cronbach Alpha varies -0.023–0.831 where, *Attitude* and *Trust* has negative values. The items with value less than recommended are dropped from model. The item dropped are *Trust* construct and item-2 *(ATT2)* from the *Attitude* construct to achieve recommended value of Cronbach's Alpha as shown in Table V. Convergent validity is assessed by using Composite Reliability and Average Variance Extracted (AVE).   It can also be observed from Table VI composite reliability and AVE are greater than recommended value of 0.70 and 0.50 [36, 37]. Discriminant Validity is measured to identify that one construct is truly distinct from all other construct in research model [32, 38]. It is measured by examining AVE to ensure that each construct share large variance with the other constructs. Hair et al. [39] stated that the discriminant validity is supported when the square root of individual construct is higher than the variance shared between the constructs. Table VII shows square roots of AVEs

(diagonal cells) greater than the correlations between constructs.

TABLE IV. RELIABILITY TESTING

Construct	No. of Items	Mean	Std. Dev.	Cronbach's Alpha
BI	3	4.09	0.75	0.744
ATT	3	3.58	0.93	-0.386
PB	3	4.35	0.79	0.767
SN	3	3.76	0.93	0.831
PI	3	4.06	0.97	0.687
PRisk	2	2.97	1.14	0.535
Trust	2	3.44	0.98	- 0.023
PC	3	3.19	1.11	0.803

TABLE V. RELIABILITY TESTING AFTER DROPPING *TRUST* AND *ATT2*

Constructs	No. of Items	Mean	Std. Dev.	Cronbach's Alpha
BI	3	4.09	0.75	0.744
ATT	2	4.16	0.87	0.677
PB	3	4.35	0.79	0.767
SN	3	3.76	0.93	0.831
PI	3	4.06	0.97	0.687
PRisk	2	2.97	1.14	0.535
PC	3	3.19	1.11	0.803

TABLE VI. CONVERGENT VALIDITY

Constructs	Comp. Rel.	AVE
BI	.855	.663
ATT	.861	.631
PB	.866	.684
SN	.899	.747
PI	.827	.615
PRisk	.811	.682
PC	.884	.717

TABLE VII. DISCRIMINANT VALIDITY

Constructs	BI	ATT	PB	SN	PI	PRisk	PC
BI	**0.814**						
ATT	0.618	**0.794**					
PB	0.471	0.592	**0.827**				
SN	0.486	0.438	0.432	**0.864**			
PI	-0.046	-0.005	0.103	0.070	**0.784**		
PRisk	-0.207	-0.430	-0.166	-0.113	0.310	**0.826**	
PC	-0.159	-0.263	-0.105	-0.076	0.360	0.434	**0.847**

B. Assessment of Structural Model

The structural model is evaluated and hypothesis are tested after establishing adequacy of measurement model. Structural Equation Model (SEM) is built to indicates the path relationship among the construct. It is done by determining the predictive power of model and by analyzing the hypothesized relationship among the constructs. Firstly, the coefficient of determination R-Square (R^2) for each of three endogenous constructs is calculated to determine the predictive power of research model. It can be observed from Fig. 2. that model has high predictive power since it shows 42% variance in Behavior Intention *(BI)* and 45% variance in Attitude *(ATT)* which is supported by meta-analysis of research on TRA and TPB [40] where average variance in intention is 40–50%. The Perceived Risk *(PRisk)* account for 19 % variance. Secondly, direct effect of each exogenous construct on the endogenous construct to estimates the standardized path coefficients *(beta)* between constructs. It is indicated by β value with p significance level presented numerically on solid line leading from the exogenous construct to the endogenous construct in Fig. 2.

C. Hypothesis Testing

Result of hypothesis testing are summarized in Table VIII. The 'Findings' column indicates whether that hypothesis was supported or not supported depending on the path coefficients β and *p*-value. The result shows that five hypotheses were significantly supported and five hypotheses are not empirically supported by the data.

Following is the summary of hypothesis test:

- **H1:** A higher level of Perceived Benefits *(PB)* of HIE lead to more positive attitude *(ATT)* to share health information. *PB* achieved a strong positive direct influence on ATT (beta = 0.585, p <0.001). Hence, H1 is supported.

- **H2:** Higher level of *Trust* leads to low perceived risk to share their health information. H2 is removed due to removal of Trust construct during testing for constructs' reliability.

- **H3:** High level of Privacy Concerns *(PC)* lead to high perceived risk *(PRisk)* to share health information. *PC* achieved a strong positive direct influence on *PRisk* (beta =0.435, p <0.001). Hence, H3 is supported.

- **H4:** higher level of *PRisk* lead to more negative Attitude *(ATT)* to share health information. *PRisk* achieved a strong negative direct influence on *ATT* (beta =-0.228, p <0.001). Hence, H4 is supported

The result shows that H1 has more effect in this study than H4. This mean *PB* effect on patient's *ATT* with beta coefficient = 0.585 is higher than the effect of *PRisk* on *ATT* (beta coefficient = -0.228). Perceived benefits and perceived risk are considered as two factors that influence the attitude of patients to share their health information.

- **H5:** Patient's Perceived Risk *(PRisk)* has a negative effect on their Behavior Intention *(BI)* to share their health information. *PRisk* achieved a strong positive direct influence on BI (beta =0.149, p = 0.004). Hence, H5 is not supported.

- **H6:** A higher level of Subjective Norms *(SN)* leads to more positive Behavior Intention (BI) to share health information. *SN* achieved a strong positive direct influence on *BI* (beta =0.203, p <0.001). Hence, H6 is supported.
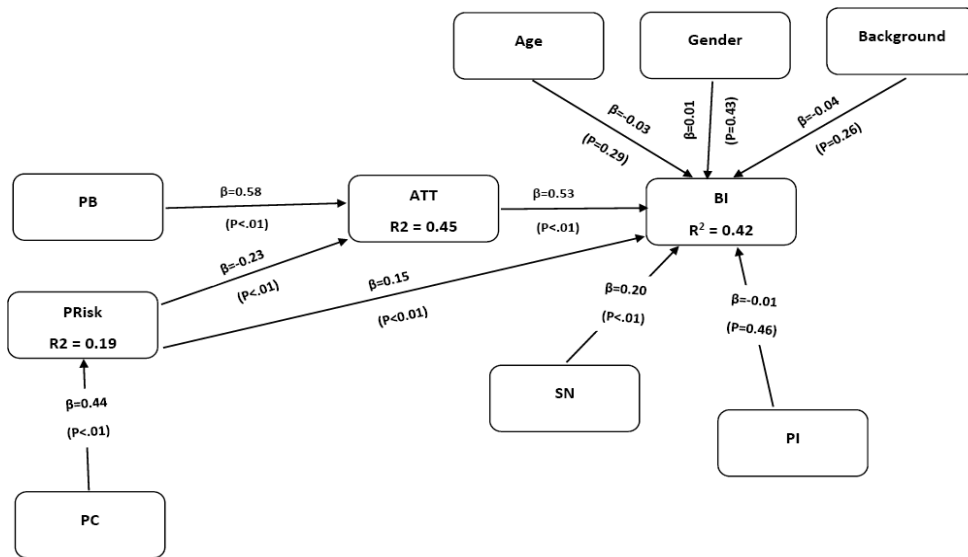
Fig. 2. Structural Model Results (Denotes significance at the p<0.01 level)

- **H7:** Patient Involvement (*PI*) has a positive effect on their Behavior Intention *(BI)* to share their health information. PI achieved a strong negative direct influence on *BI* (beta =-0.006, p = 0.461). Hence, H7 is not supported.

- **H8:** A positive Attitude (*ATT*) leads to more positive Behavior Intention (*BI*) to share health information. *ATT* achieved a strong positive direct influence on *BI* (beta =0.534, p <0.001). Hence, H8 is supported.

The result shows that H8 has more effect than H6. This mean patients' attitude effect on behavior intention with beta coefficient = 0.534 is higher than the effect of subjective norm on intention behavior (beta coefficient = 0.203).These findings are supported by another IS acceptance studies [13] in which the attitude positively effect on behavior intention. Accordingly, attitude explained 42% of the variance in patients' intention to share their information. Similar to our study the outcomes [41] indicate that attitude of patients and subjective norm are the main determinants to share health information. Patients' decisions about HIE system acceptance could be strongly effected by their peers and friends.

- **H9:** Patients' higher level of HIE related background has a positive effect on behavior Intention (*BI*) to share their health information. Background achieved a strong negative direct influence on *BI* (beta =-0.037, p = 0.261). Hence, H10 is not supported.

- **H10:** Gender will positively influence on BI to share health information more for men. Gender did not display significant interactions with behavior intention (beta = 0.010, p = 0.428). Hence, H11 is not supported.

- **H11:** Age will positively influence on BI to share health information more for younger than elderly. Age did not show significant interactions with behavior intention (beta = -0.032, p = 0.290). Hence, H12 is not supported.

TABLE VIII.   SUMMARY OF RESEARCH FINDINGS

Hypothesis / Path	Beta value	P value	Finding	R²
H1: PB →ATT	0.585	<0.001	Supported	.45
H3: PC →PRisk	0.435	<0.001	Supported	.19
H4: PRisk → ATT	0.228	<0.001	Supported	.45
H5: PRisk → BI	0.149	0.004	Not Supported	.42
H6: SN → BI	0.203	<0.001	Supported	.42
H7: PI → BI	0.006	0.461	Not Supported	.42
H8: ATT → BI	0.534	<0.001	Supported	.42
H9: Background → BI	0.037	0.261	Not Supported	.42
H10: Gender → BI	0.010	0.428	Not Supported	.42
H11: Age → BI	0.032	0.290	Not Supported	.42

VI.   CONCLUSION

Governments in developing countries are spending huge amounts of money in implementing and exchanging EMR which is becoming progressively complex and leads to implementation failures. In addition, low acceptance of such system has been a major problem for health care providers.

This study developed the understanding of the determinant of HIE system acceptance. It identifies the patients concerns and their preferences to share their sensitive health information disseminated among different health care providers through such systems. The result of the analysis indicated that *Perceived Benefits* and *Perceived Risks* are the two factors influence the attitude of patients to share their health information. Moreover, *Attitude* and S*ubjective Norm*s have significant effects on *Behavior Intention* to share health information. Based on these findings this study revealed that more attention should be directed toward ensuring that patient is fully informed about the benefits of HIE and they have high level of trust on HIE legality, standard, policies and

technology. Furthermore, they should be trained and educate time to time to maximize HIE acceptance and usage. The findings also imply that the design and development of future systems should also incorporate sophisticated and flexible access control policies that can be adapted to meet the preferences of individual patients to reduce expected barriers.

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