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The Impact of WhatsApp Application in Clinical Management: Moderating the Role of Perceived Risk

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ABSTRACT

WhatsApp is one of the most widely employed forms of digital technology in clinical management settings. However, from previous research, the use of WhatsApp for clinical management involves certain risks, particularly the violation of patient data confidentiality. This study aims to examine the relationship of perceived risk as a moderator regarding the adoption of WhatsApp for clinical management among healthcare workers based on the unified theory of acceptance and use of technology (UTAUT). A total of 165 respondents participated in this study using an online platform. Statistical analysis was performed using partial least square structural equation modelling (PLS-SEM). This study proved that performance expectancy, effort expectancy, and social influence positively influence behavioural intention while facilitating conditions positively influence user behaviour. Furthermore, perceived risk was shown to be negatively significant in moderating the relationship between social influence and behavioural intention. This study recognised the risk perceived by healthcare workers while handling patient data even though WhatsApp is perceived to improve their performance. Thus, utilising secured mobile messaging applications among healthcare workers must be guided and cultivated to mitigate the risk and simultaneously ensure that any communication technology used is as effortless and free as WhatsApp, but secure.

Keywords:
WhatsApp; Clinical management; UTAUT; Perceived risk

1. Introduction

The new advancements in digital technology have helped to transform the healthcare sector, primarily through telemedicine [1], electronic health records [2] and smartphone usage [3]. One of the most widely used digital technology advancements in clinical management is the utilisation of the mobile messaging application, WhatsApp. WhatsApp is beneficial in assisting healthcare workers to accomplish tasks such as sending messages. This application is used in different sectors of healthcare with various objectives, including, but not limited to, obtaining a prompt response from

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medical colleagues [4] to support thinking and learning development among colleagues, personalised general health promotion with patients, and as a communication platform among colleagues [5]. Healthcare professionals also use WhatsApp to transmit photos and images to obtain a second opinion [6]. However, this transmission of information might risk the confidentiality of patient information.

A study conducted by Fernández-Robin *et al.,* [7] stipulated two groups of consumer segments among WhatsApp users. One group preferred WhatsApp for leisure purposes only, while the other group preferred WhatsApp not only for leisure but also for work, academic, and informative reasons. Mixed use of personal and clinical management purposes might risk the confidentiality of information. According to a study among healthcare workers, 92.6% of the study agreed that using WhatsApp for clinical management might put patient data security at risk [8]. This is consistent with the findings from the previous studies [9], where they observed that WhatsApp is the most effective messaging application in assisting healthcare workers to fulfilling their tasks. However, the application must be carefully used because patient data confidentiality is at risk [10]. There is also another negative effect of using WhatsApp among healthcare professionals such as the spillover effect of personal issues during work hours due to usage of mobile devices for personal use, which may possibly negatively impact work performance [5], resulting in poor sleep quality and excessive daytime sleepiness [11]. Kamel Boulos *et al.,* [12] added more weaknesses from the safety and security aspects, especially on patient confidentiality, such as in case of unauthorised access, use of patient's photos beyond the original purpose, and wrongly forwarded messages. In addition, there is difficulty in completely deleting sensitive data once it is sent, although colleagues/workers have already left the workplace [13]. Therefore, the transfer of sensitive data between healthcare workers should be observed despite the benefit of using WhatsApp [11].

Hence, with the arising issues in the use of this message application, there is still a lack of studies done in Malaysia, especially on the intention of WhatsApp usage in clinical management. This study aims to investigate the factors that influence the intentions of user behaviour in using WhatsApp among healthcare workers extracted from the extended UTAUT model moderated by perceived risk. The organisation of this study is divided into several sections. The first section is the introduction, followed by section two, which is the literature review. Section three covers the research methodology, and section four discusses the findings. Finally, section five presents the conclusion.

2. Literature Review and Hypotheses Development

2.1 Perceived Risk

Rohrmann [14] defined risk perception as a person's decision and assessments of hazards they are or are possibly exposed to, which affects their decisions about the tolerability of risks and an essential effect on behaviours before, during, and after adversity. In relation to the usage of WhatsApp as a medium of communication, even though WhatsApp has end-to-end encryption to reinforce its privacy, there is still anxiety among healthcare workers related to risks involving the conflict of confidentiality, consent, and medical-legal issues. In reality, healthcare workers perceive the risk of using WhatsApp for both patients and healthcare workers, aside from the numerous perceived benefits. Numerous previous research related to WhatsApp usage in the healthcare setting point out the safety of patient data confidentiality. However, little research has been carried out to confirm the moderation effect of this perceived risk on the relationship between factors that facilitate acceptance of WhatsApp with behavioural intention to use and user behaviour, particularly in the healthcare sector. Therefore, it is essential to study the effect of perceived risk. Enhancement can guarantee that instant mobile messaging applications for work do not cause healthcare workers

to face ethical and legal issues. The integration of perceived risk as a moderating variable in the UTAUT original model is unseen in existing research. For this reason, this paper goes further by considering perceived risk as a moderator variable in the UTAUT original model by Venkatesh *et al.,* [15] to investigate whether the perceived risk will moderate the relationship between factors of technology adoption with the behavioural intention to adopt. It is still unclear whether the perceived risk will play a moderating role and hinder or amplify the intention to use WhatsApp in a clinical setting.

2.2 Performance Expectancy

Performance expectancy is about how a person has confidence in a certain piece of technology. When they use the system, it will increase their job performance. Performance expectancy can be measured through perceived usefulness, extrinsic motivation, job fit, relative advantage, and outcome expectation [15].

According to Lee and Song [16], performance expectancy positively affects behavioural intention. Indeed, WhatsApp is used as an effective medium of communication between healthcare workers to discuss clinical cases or share interests and information in groups [17-20], whether related to single or various disciplines to ease communication, conversation, or decision-making.

Some studies reported the effectiveness of using WhatsApp to train residents and share learning programmes with them on specific clinical themes [10,21] and to medical students especially during COVID-19 pandemic period [22]. In addition, WhatsApp has also been used to expand patients' knowledge, self-efficacy, and consciousness of diabetes management [23]. WhatsApp usage has also led to effective diagnosis and sorting through essential radiographs and CT scans of tibial plateau fractures, which were sent using photo shots and directed via WhatsApp [17]. This application has also been used to gain additional views on histopathological diagnosis in oral pathology exercises and deliver tough cases [6,24] as well as evaluate radiological X-ray images of traumatic wounds in the elbows of children [25]. Moreover, WhatsApp imaging is excellent for sending images especially for the detection of pneumothorax and pneumoperitoneum with the accuracy of 90% and 95% respectively on a smartphone [26]. WhatsApp is also beneficial for online assessment of the quality of life in patients with hearing loss [27], paediatric doctors in training, neonatologists for an online new born child's chest radiograph consultation [28] delivering healthcare services to the community [29] and preventing prescribing errors among the community pharmacists involving COVID-19 patients [30].

Although numerous studies have pointed out the data privacy risks, healthcare workers still use WhatsApp for work purposes. Abdel-Qader *et al.,* [30] concluded that the application must be carefully used because data confidentiality is at risk, despite its many benefits. Other than the risk of security and safety of patient privacy, there are also significant findings related to the performance and health of health workers using WhatsApp for work purposes. Recent study by John *et al.,* [18] supported the findings that WhatsApp is a useful application to communicate in clinical management but it not complied to General Data Protection Regulation (GDPR) that required in European countries. Meanwhile, Hitti *et al.,* [5] stipulated that WhatsApp could impact work performance negatively due to the spillover effect when using mobile devices for both personal and work use simultaneously. Healthcare professionals using WhatsApp might experience poor sleep quality and excessive daytime sleepiness [11].

2.3 Effort Expectancy

Effort expectancy is about how the degree of effortlessness is linked to the use of the technology, with the elements of perceived ease of use, complexity, and ease of use as factors that represent effort expectancy [15]. In a report by Baqai *et al.,* [8], most respondents involved in their study agreed that using WhatsApp for clinical management might place patient data safety at risk. However, it is easier to use this application than other communication devices such as pagers [31]. Lafraxo *et al.,* [32] concluded that effort expectancy significantly impacts behavioural intention. Chao [33] deduced that perceived risk had a significant negative moderating effect on the relationship between effort expectancy and behavioural intention.

2.4 Social Influence

WhatsApp is extensively used for interring and intra-departmental communication, communication among healthcare workers, and inter and intra-healthcare institution communication. WhatsApp has demonstrated its effectiveness during emergency management. According to Gulacti *et al.,* [34], WhatsApp for consultations in an emergency department is beneficial since many clinical and radiological facts can be referred to emergency department consultants located outside the hospital, with the consultation appeal resolved only over WhatsApp.

Research has exposed the efficiency of WhatsApp in sending and sharing the outcomes of patient tests such as laboratory tests, ultrasonography, electrocardiogram, X-ray, and test photographs, and how it helps in making accurate medical decisions [25,26,35]. It also contributed to more unbiased and well-organised care, particularly in a medical emergency [24,36]. On the other hand, extensive usage of WhatsApp among healthcare workers or colleagues might influence the intention to use WhatsApp. According to Lee and Song [16], social influence significantly affects behavioural intention. However, the perceived risk might negatively influence the relationship between social influence and intention to use WhatsApp. Besides individual estimation and assessment of risks, sociological approaches and cultural theory attempt to recognise cultural, social, and organisational causal factors in risk perception [37].

Masoni and Guelfi [13] reported that it is not easy to delete a sensitive data transfer once it is sent to the recipient, although their colleagues had already left the workplace. The trouble of removing data that has just been transferred among healthcare workers is undeniable and could place patients' privacy at risk. In addition to that, De Benedictis [38] found that healthcare workers perceived that WhatsApp is not safe to use because it could lead to the risk of breaching patients' privacy. However, in reality, health workers keep using this application for clinical management and everyday work either with patients or colleagues, although it comes with risk.

2.5 Facilitating Condition

WhatsApp is beneficial for cutting costs, increase efficiency, and ease communication among healthcare professionals or communication with patients [39,40]. Ellanti *et al.,* [31], in their study, also agreed that WhatsApp is inexpensive. Machado *et al.,* [36] confirmed the feasibility of low-cost using WhatsApp for their clinical evaluations. It is also possible to reduce unnecessary costs of clinical services by communicating over WhatsApp [41].

On the other hand, Dhuvad *et al.,* [42] reported breach of patient confidentiality when using WhatsApp. Watson *et al.,* also found that the current form of the WhatsApp application is unsafe for handling patient data. However, there are no clear guidelines available from any of the relevant

authorities regarding patient confidentiality. Therefore, it is inappropriate to use in a clinical environment that demands a more secure instant mobile messaging alternative to operating in the clinical setting. Meanwhile, Watson *et al.,* revealed that medical doctors believed virtual communication with the patient could result in legal matters caused by potential breach of confidentiality. Thus, the majority of the doctors in that study are unwilling to practice virtual communication technology as a method of patient communication. The report also concluded that proper policy-making could enable both doctors and patients to communicate virtually in a secure setting deprived of the fear of breaching privacy and confidentiality. This is consistent with the finding from John *et al.,* [18] whereby there is a dearth of channel that genuinely secure to be used to communicate sensitive patient data between clinicians specially to meet the requirements of GDPR in the EU.

2.6 Behavioural Intention

According to Ajzen and Fishbein [43], the measure of behavioural intention will predict the performance of any voluntary act. However, it will not be consistent if the intention measure does not correspond to the behavioural criterion of action, target, context, time frame, or specificity. User behaviour is considerably affected by intention to use and facilitating conditions in the consumerism setting. This was also found to align with the suggestions by Venkatesh [15] in different studies via UTAUT model [44,45].

2.7 Research Framework

This study will test nine hypotheses based on the literature reviews that were conducted intensively. Figure 1 shows the research framework for the study.

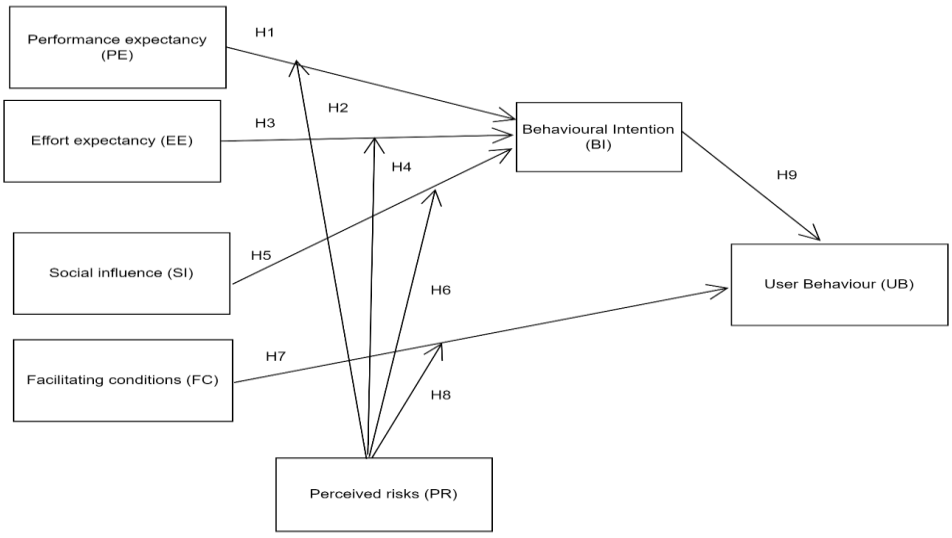

Fig. 1. Research framework

The list of hypotheses is shown below:

H1: Performance expectancy has a positive impact on behavioural intention.
H2: Perceived risk moderates the relationship between performance expectancy with behavioural intention

H3: Effort expectancy has a positive impact on the behavioural intention.
H4: Perceived risk moderates the relationship between effort expectancy with behavioural intention.
H5: Social influence has a positive impact on behavioural intention.
H6: Perceived risk moderates the relationship between social influence and behavioural intention
H7: Facilitating conditions have a positive impact on user behaviour
H8: Perceived risk moderates the relationship between facilitating conditions with the user behaviour
H9: Behavioural intention has a positive impact on user behaviour

3. Methodology

3.1 Population and Sample

The survey participants involved a population of healthcare workers who use WhatsApp for clinical management. According to Joseph and Joseph [46], healthcare workers give services and care to the sick and ill, either directly or indirectly. For this study, we focusing on healthcare workers who use WhatsApp in clinical management and are currently working in private or government health institutions as doctors (house officers, medical officers & specialists), pharmacists, pharmacy assistants, nurses, community nurses, assistant medical officers, medical laboratory technologists, radiographers, occupational therapists, physiotherapists, and have used WhatsApp as a mobile messaging application for work purposes for more than six months. Other healthcare workers such as dentists, opticians, environmental health officers, and traditional & complementary medicine practitioners were excluded from this study.

The number of samples required was analysed using G*Power [47,48]. This G*Power 3.1 software was used to determine the required sample size for six predictors. The F tests family and multiple linear regression, fixed model, R2 deviation from zero were selected with the alpha value set at 0.05. The result from the analysis deduced that the total sample to achieve actual power 0.95 was 146 respondents.

Based on this threshold, the online survey was distributed based on random sampling technique. Out of the 172 respondents who participated in this online survey, only 165 were considered as a usable response after data cleansing. Therefore, the percentage of usable responses was 84.88%.

To ensure the veracity of responses in an online survey, this study considered several steps before we distributed the survey online to respondents:

i. We clearly explain the purpose of the survey and the importance of accurate responses.
ii. We use an established survey platform with appropriate security measures, such as Google Form.
iii. We use random sampling to select our participants.
iv. We asked questions that are easy to understand and avoided leading or biased questions.
v. We ensure anonymity and confidentiality of responses.

By following these steps, we increase the likelihood that we will receive high-quality, accurate responses to our online survey.

3.2 Instrumentation

The questionnaire contained two key sections: respondents' demographics and the proposed research framework constructs. The items for the measurement of performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioural intention factors were adapted from several studies [38,50]. The items for measuring perceived risk factors were adapted from a study by Benedictis and Akram [38,49].

4. Findings

4.1 Demographic Information

Referring to Table 1, the respondents' ages ranged mostly between 30 and 39 years old. Most of these respondents had working experience between 1 and 10 years. The majority of the respondents worked as nurses (54.50%), community nurses (18.80%), and doctors (13.94%). Females made up the highest percentage of respondents at 89.70% and males at 10.30%. The female respondents were mainly work as female nurses.

Table 1
Demographic Information

Gender	Qu Frequency (%)
Female	148 (89.70)
MaleMaleM Male	17 (10.30)
Age	
20-29 years old	27 (16.36)
30-39 years old	92 (55.76)
40-49 years old	38 (23.03)
50-59 years old	8 (4.85)
Years of experience	
1-10 years	90 (54.55)
11-20 years	59 (35.76)
21-30 years	16 (9.69)
Position	
Medical officer	24 (14.55)
Pharmacist	11 (6.67)
Nurse	90 (54.54)
Others	40 (24.24)

4.2 Reliability and Validity

Results of outer loading, Composite Reliability, and average variance extracted (AVE) were shown in Table 2. Loadings above 0.708 are recommended as they indicate that the construct explains more than 50 per cent of the indicator's variance, thus providing acceptable item reliability [50]. Thus, in this study, four items below 0.7 were deleted. The value of Composite Reliability for all constructs were all higher than 0.7 to ensure internal consistency [51]. Furthermore, the AVE value for all constructs was higher than 0.5 to ensure convergent validity [50].

Table 2
Reliability and validity analysis

Constructs	Items	Outer Loading	Composite Reliability	AVE
BI	BI1	0.901	0.914	0.779
	BI2	0.854		
	BI3	0.891		
EE	EE1	Item deleted	0.845	0.647
	EE2	0.749		
	EE3	0.904		
	EE4	0.749		
FC	FC1	Item deleted	0.864	0.682
	FC2	0.873		
	FC3	0.881		
	FC4	0.711		
PE	PE1	0.776	0.884	0.658
	PE2	0.864		
	PE3	0.882		
	PE4	0.71		
PR	PR1	Item deleted	0.871	0.695
	PR2	0.894		
	PR3	0.89		
	PR4	0.702		
	PR5	Item deleted		
SI	SI1	0.756	0.893	0.676
	SI2	0.863		
	SI3	0.854		
	SI4	0.81		
UB	UB1	0.843	0.888	0.665
	UB2	0.874		
	UB3	0.722		
	UB4	0.813		

Discriminant validity was evaluated using Fornell & Larcker criterion, Heterotrait-Monotrait Ratio (HTMT), and cross-loadings. For [52], each construct's value, the square root of AVE in Table 3, was higher than the correlations with other constructs, which showed discrimination between constructs [51].

Table 3
Fornell & Larcker criterion

	BI	EE	FC	PE	PR	SI	UB
BI	0.883						
EE	0.634	0.804					
FC	0.673	0.672	0.826				
PE	0.632	0.671	0.524	0.811			
PR	0.14	0.138	0.326	0.015	0.833		
SI	0.613	0.595	0.617	0.621	0.118	0.822	
UB	0.349	0.346	0.415	0.332	0.116	0.321	0.815

Note: BI= Behavioural Intention, EE= Effort Expectancy, FC= Facilitating Conditions, PE= Performance Expectancy, PR= Perceived Risk, SI= Social Influence, UM= User Behaviour

For the second evaluation using HTMT, The HTMT values should be ≤ 0.85, the stricter criterion and the mode lenient criterion should be ≤ 0.90. The results in Table 4 showed that all value was below 0.9, which meet the requirement suggested by previous works [53-55]. Although two

constructs, FC-EE and PE-EE were higher than the stricter threshold 0.85, it still can be accepted as long as it is below 0.90 as suggested by Henseler *et al.,* [56]. Therefore, discriminant validity is established for this model.

Table 4
Heterotrait-Monotrait Ratio (HTMT)

Construct	BI	EE	FC	PE	PR	SI	UB
BI							
EE	0.787						
FC	0.832	0.882					
PE	0.734	0.872	0.674				
PR	0.158	0.159	0.382	0.079			
SI	0.694	0.752	0.761	0.74	0.137		
UB	0.406	0.438	0.501	0.393	0.15	0.369	

Note: BI= Behavioural Intention, EE= Effort Expectancy, FC= Facilitating Conditions, PE= Performance Expectancy, PR= Perceived Risk, SI= Social Influence, UM= User Behaviour

4.3 Structural Measurement Model

The structural model assessment was conducted using Smart PLS 3 with bootstrapping procedure of 5000 resampling technique [57]. According to Hair *et al.,* [58], the R^2 value was used to measure the model's predictive power with R^2 value ranging from 0 to 1, and higher levels representing higher levels of predictive accuracy. The rule of thumb for the categories is, R^2 is 0.25 for weak, 0.50 for moderate, and 0.75 for substantial [58]. Based on the analysis, the calculation of R^2 value for BI constructs was 0.556, which is moderate, showing that 55.6% of the variants in Behavioural Intention could be explained by the combined PE, EE, SI and moderating factors. Meanwhile, the R^2 of 0.200 for UB constructs' value was indicated as weak (near 0.25) predictive power, suggesting that 20% of User Behaviour could be explained by the exploratory variables and moderating factors. To further analyse the substantive impact of exogenous constructs on the endogenous constructs, the value of f^2 can be referred to where effect-size values with less than 0.02 signified no impact. The data in Table 5 showed that all factors are above 0.02 except for the behavioural intention factor's effect on user behaviour with 0.016, which indicates behavioural intention factors has no effect on user behaviour.

Table 5
Result of hypothesis testing

No. of hypothesis	Constructs	Path coefficients	t-stat	P Values	f^2	R^2	Results
H1	PE -> BI	0.222	2.284	0.011	0.040	0.556	Supported
H2	MOD_PE_PR -> BI	0.076	0.642	0.261			Not supported
H3	EE -> BI	0.252	3.137	0.001	0.066		Supported
H4	MOD_EE_PR -> BI	0.121	1.158	0.123			Not supported
H5	SI -> BI	0.313	3.688	0.000	0.109		Supported
H6	MOD_SI_PR -> BI	-0.235	2.030	0.021			Supported
H7	FC -> UB	0.358	3.801	0.000	0.078	0.200	Supported
H8	MOD_FC_PR -> UB	0.108	1.591	0.056			Not supported
H9	BI -> UB	0.158	1.607	0.054	0.016		Not supported

4.4 Hypothesis Testing

Hypothesis testing was conducted, and Table 5 shows the constructs' significance level and path coefficients. The t-values were used as a rule of thumb to show the significant relationship of the construct, and a 5% significant level ($p<0.05$; t-value>1.645) was used as a basis of acceptance decision criterion. According to the results, performance expectancy, effort expectancy, and social influence positively impact behavioural intention to use WhatsApp, thus, H1, H3 and H5 are supported. Perceived risk does not significantly moderate the relationship between performance expectancy and behavioural intention, thus, H2 is not supported. Meanwhile, perceived risk does not significantly moderate the relationship between effort expectancy and behavioural intention with 0.123; thus, H4 is not supported.

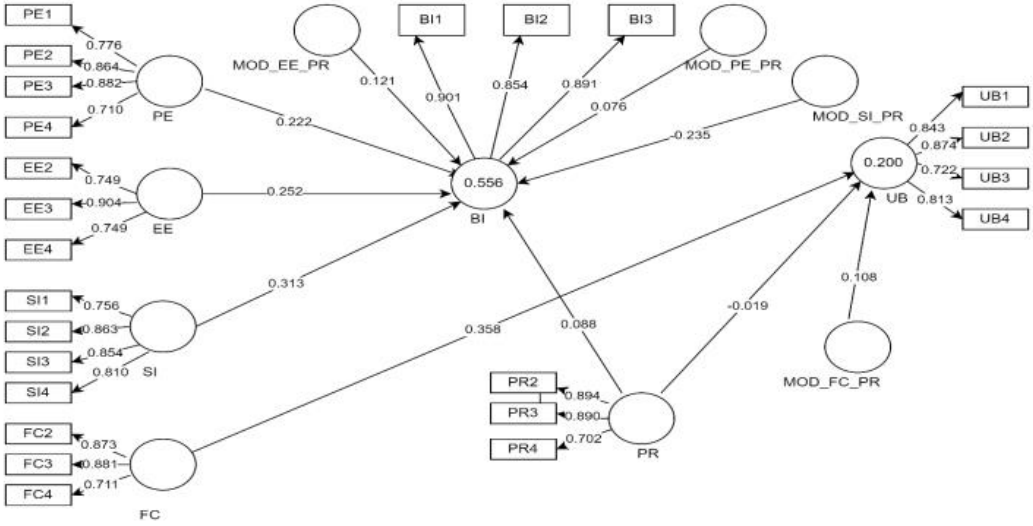

Fig. 2. Structural model of path coefficients

On the other hand, perceived risk significantly moderates the relationship between social influence and the behavioural intention to use WhatsApp. The moderating effect of perceived risk on the relationship between social influence and behavioural intention can be analysed in Figure 3. Social influence is at the graph's x-axis, while behavioural intention is at the graph's y-axis. The slope manifested that the behavioural intention will decrease when the perceived risk increases, while when perceived risk decreases, the behavioural intention will increase significantly. Therefore, perceived risk significantly moderates the relationship between social influence and behavioural intention, thus H6 is supported.

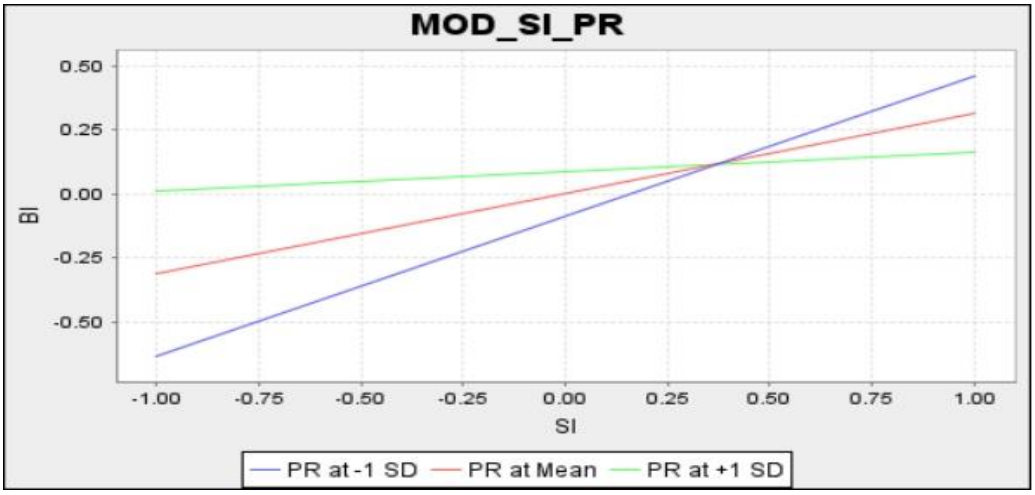

Fig. 3. Moderating effect of perceived risk (PR) on the relationship between social influence (SI) and behavioural intention (BI)

Meanwhile, facilitating conditions significantly have a positive impact on user behaviour, which supports H7. However, the perceived risk does not significantly moderate the relationship between facilitating conditions and user behaviour; thus, H8 is not supported. Finally, behavioural intention does not significantly impact user behaviour; hence, H9 is not supported.

5. Discussion

According to the findings above, the factors of performance expectancy, effort expectancy, and social influence have a positive impact on behavioural intention. These findings are aligned with previous studies [59-61]. On the other hand, behavioural intention, which does not significantly impact the user behaviour, is consistent with findings from previous studies [62,63].

Performance expectancy prevails as positively influencing behavioural intention to use WhatsApp for clinical management. The results from the survey align with the findings reported by Chao [33,64,65]; therefore, it can be deduced that performance expectancy positively influences behavioural intention to adopt information technology. This result also indicates that WhatsApp can increase healthcare workers' productivity, thus positively impacting the behavioural intention to use this application, such as setting up a daily work schedule. Healthcare workers also agree that WhatsApp will make their job easier by enabling instant communication among colleagues to ask for information. Furthermore, their task can be accomplished quickly, such as reducing the need to meet physically to receive consultation from others. In their study, Ellanti *et al.,* [31] concluded that WhatsApp increases communication efficiency better than using other communication tools such as hospital telephones or pagers.

However, from this study, the perceived risk does not significantly impact the relationship between performance expectancy and behavioural intention, despite numerous previous reports advising about the risk of patient privacy using WhatsApp for clinical management [10,11,38].

The situation might happen because the more a person perceives a benefit from risk in an event, the less fearful a person turns out to be towards the risk, as stipulated by Ropeik [66]. Therefore, due to the various benefits of using WhatsApp for clinical management, which increases their performance, they perceive less risk. For instance, the utilisation of WhatsApp for clinical management eases their task to communicate with other team members, where they can blast a message out in the specific WhatsApp group to inform of any update instantly. Furthermore, the effortlessness in using WhatsApp can make their job more efficient, potentially reducing the impact

of perceived risks over the relationship between performance expectancy and behavioural intention. Therefore, the findings of this study contradict the study by Chao [33].

Meanwhile, effort expectancy prevailed as a factor that positively influences behavioural intention to use WhatsApp. These findings are aligned with the results reported [32,67]. Healthcare workers stated that it is easy to interact with WhatsApp. Effortless application is vital for healthcare workers since they face tremendous pressure, especially during peak moments. For instance, when handling the COVID-19 pandemic, more healthcare workers felt dissatisfied with their job and life and even had positive intention turnover [68]. The easiness in using WhatsApp application increases the behavioural intention to use this application as an instant mobile messaging application in the healthcare setting [31]. This result is in line with the findings from [8], which compared WhatsApp usage to pagers in hospitals. Their results verified that WhatsApp is easier to use than traditional tools such as pagers. However, it is not considered safe due to the risk of compromising patient data security, and usage of WhatsApp is not aligned with the hospital policies in their country.

With the low degree of effort required to understand how to use WhatsApp, healthcare workers become less afraid of the risk of using it. They feel comfortable with the mobile application's easiness, thus reducing its perceived risk. Healthcare workers are not required to undergo any specific training to understand how WhatsApp could be utilised for clinical management as the application is very easily understood by users. WhatsApp's easiness and unproblematic usage for clinical management have eventually reduced the impact of perceived risk over behavioural intention. The results are aligned with the findings reported by Chao [33] where perceived risk has no moderating impact on the relationship between effort expectancy and behavioural intention due to the condition that the participants perceive the technology is too easy to use. Thus, perceived risk does not significantly affect the intention to use WhatsApp.

Moreover, social influence also prevailed as a factor that positively influences the behavioural intention to use WhatsApp, which is aligned with previous findings related to the adoption of information technology [69-71]. WhatsApp was used widely among healthcare workers; thus, the whole organisation had already supported WhatsApp, although the authorities gave no clear direction on using WhatsApp for clinical management. There is no official statement from the authorities on what healthcare workers should use as mobile messaging applications. However, the extensive usage of WhatsApp for various aspects of daily life might influence the intention to adopt WhatsApp for work [7].

The results also showed that perceived risk negatively moderates the relationship between social influence and behavioural intention. This is aligned with the study from Renn [37] regarding social amplification theory, which stated that a person perceives the risk to their safety and security as regulated by their social influences. The social influence could weaken individual and social perceptions of risk. Thus, perceived risk negatively influences the relationship between social influences and behavioural intention. The higher the social influences, the lower the impact of perceived risk on behavioural intention to use WhatsApp.

Healthcare workers might use WhatsApp due to the influence of others, where everybody around them uses this application for everyday tasks. At the same time, they may believe that the risk associated with this application has decreased. Thus, they become less fearful of being punished or reprimanded personally by superiors if they fail to wisely use WhatsApp for their work, for example by mistakenly exposing patient data, uncontrolled spread of sensitive data, or failure to document communication regarding a clinical decision in the medical records. Improving the procedures or awareness on operating WhatsApp as a communication tool for clinical management might increase perceived risk.

Facilitating conditions also prevailed as a factor that positively influences use behaviour, which is aligned with previous findings related to the adoption of information technology [59,72] . Healthcare workers agree that WhatsApp is affordable, which does not require them to purchase premium versions to fully utilise available functions. They can use WhatsApp for free. These findings are aligned with a study by Ellanti [31], which concluded that WhatsApp is inexpensive. Everybody has the same features of WhatsApp once they update their WhatsApp application to the latest version.

On the other hand, behavioural intention does not significantly impact user behaviour. These findings are aligned with a previous study related to the adoption of information technology [62,63,76]. However, it contradicts with the findings from previous study [29,60,73,74]. It indicates that healthcare workers will use WhatsApp, although they do not have the intention to use it. Therefore, these workers do not depend only on their intention or internal motivation to use WhatsApp for their work since other factors might play a role to influence the actual usage of WhatsApp, for instance, the facilitating condition factors, which significantly impact the user behaviour. Since WhatsApp has many excellent features, it is compatible with their clinical management tasks and influences the actual usage. Therefore, those conditions could influence the actual usage of WhatsApp rather than the factors of intention or internal motivation to use it.

5.2 Conclusion and Limitation of the Study

Healthcare workers can benefit from using WhatsApp; however, its use in a healthcare setting is insecure, considering the risk of compromising patient data confidentiality. This study proved that performance expectancy, effort expectancy, and social influence significantly impact healthcare workers' intention to use WhatsApp for their work. At the same time, facilitating conditions have a significant impact on the actual usage. Behavioural intention does not significantly impact the actual usage, which is against the original work of the UTAUT model [15]. Nevertheless, the rejection of the hypothesis is not very strong.

Meanwhile, to understand the role of perceived risk as a moderator on the relationship between exogenous and endogenous constructs, the study deduced that perceived risk negatively moderates the relationship between social influence and intention to use. In addition, the relationship between facilitating conditions and actual usage was also not affected by perceived risk. At the same time, there is no relationship between performance expectancy and effort expectancy with behavioural intention.

This research suggests a modified UTAUT model with perceived risk as a moderator for all factors in the original UTAUT model introduced by Williams *et al.,* [75]. The addition of perceived risk as a moderator in the original UTAUT model is beneficial to understand how perceived risk could moderate the relationship between adoption factors with intention and actual use of WhatsApp. In this study, we found that perceived risk plays a significant role as a moderator in the relationship between social influence and behavioural intention. Thus, the proposed theoretical constructs have given valuable input to developing mobile messaging applications, especially in the healthcare setting.

In terms of practical implication, the results highlight that the intention to use WhatsApp for clinical management increases when WhatsApp can enhance their job performance. The same goes for the increase of effort expectancy, where usage of unproblematic applications like WhatsApp increases the intention to use it for work. In addition, healthcare workers receive influence from their social environment, which impacts their intention to use WhatsApp. Other than that, an excellent facilitating condition might increase the actual usage of WhatsApp.

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