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A Visual-based Home Rehabilitation System: Determinants for Adoption

Roy Kwang Yang Chang*, Kok Swee Sim and Siong Hoe Lau

***Abstract* – Musculoskeletal disorders significantly impact the quality of life for the worldwide aging population. Rehabilitation is imperative to help individuals affected to improve their condition. Access to traditional facility-based rehabilitation is often a barrier due to issues like travel distance, time, or even the lack of services. A visual-based home rehabilitation system could prove to be a promising solution to this quandary. Though implementation of said system will depend on the individual's willingness to adopt it. This study aims to identify determinants influencing the adoption of a visual-based home rehabilitation system by proposing a framework with constructs derived from COM-B, Technology Acceptance Model, Health Action Process Approach, and Fear-avoidance Beliefs Questionnaire. Behavioural determinants examined include *self-efficacy, knowledge, memory, self-monitoring, physical ability, perceived usefulness, perceived ease of use, belief, social support, barriers*, and *resources*. A quantitative cross-sectional survey was conducted using a 59-question questionnaire given to patients (n = 250) at Melaka General Hospital. Pearson correlation and multiple regression analysis were used to examine the relationships between proposed determinants and the adoption possibility. Based on the results *knowledge* (p = 0.164), and *physical ability* (p = 0.797) was found to be not significant. All others were found to be significant predictors of *adoption* with *opportunity* (β = 0.164, p = 0.010) as the strongest. The framework proposed demonstrates modest explanatory power (R^2 ranging from 0.061 to 0.214). This study hopes to contribute to the understanding of the adoption of technology-based healthcare specifically a visual-based home rehabilitation system by providing a validated framework to guide the design.**

Keywords*— *Home Rehabilitation, Healthcare Technology Adoption, Visual-based Rehabilitation, Behavioural Determinants, Musculoskeletal Disorder, Kinect.

I. INTRODUCTION

With a global population that is ageing, it is only natural for afflictions like musculoskeletal (MSK) disorders to also increase. In line with global statistics, in Malaysia, MSK disorders are the fifth largest contributor to the total loss of healthy life years and in a small, localized sample survey found that 18.8% of patients to a primary health clinic complained of MSK pains [1]. A way to combat MSK disorders is to go through rehabilitation which requires frequent visits to facilities like hospitals and continuous supervision by a physical therapist. Though patients with MSK disorders face significant hindrance in obtaining the care they need from traditional facility-based rehabilitation, possibly in the form of travelling distance, financial issues, limited availability of services, etc. [2, 3]. In lieu of that, home-based rehabilitation can be used to overcome those hindrances, but their successful implementation depends on the patient's willingness to adopt where non-adherence can reach up to 70% [4]. Adoption of a visual-based home rehabilitation system can be determined by multiple factors, for instance psychological, behavioural, and environmental.

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Several determinants have been identified as influential in the adoption. Individual capability factors such as self-efficacy, knowledge, memory, self-monitoring, and physical ability could determine whether patients intrinsically feel confident and capable of using a visual-based home rehabilitation system. At the same time, perceived usefulness and perceived ease of use, accompanied by belief can shape the patient's attitude toward the technology, which subsequently influences their motivation to adopt it. Furthermore, elements including social support, perceived barriers, and access to resources may create opportunities that either help or hinder adoption of technology. Understanding the interrelationships among these constructs can provide valuable insights into how home-based rehabilitation systems can be designed and implemented to maximise patient's long-term adherence.

This paper aims to identify the determinants influencing the patient's adoption of a visual-based home rehabilitation system by examining the relationships between capability, motivation, and opportunity constructs and their underlying determinants. A quantitative cross-sectional survey was conducted among 250 rehabilitation patients to evaluate key constructs including self-efficacy, knowledge, memory, self-monitoring, physical ability, perceived usefulness, perceived ease of use, belief, social support, barriers, resources, and adoption behaviour. Pearson correlation analysis was conducted to examine the relationships among the variables, followed by multiple linear regression analysis to determine the predictive influence of key constructs on capability, attitude, motivation, opportunity, and adoption.

By identifying the behavioural and contextual factors that influence the patient's adoption of a visual-based home rehabilitation system, this study hopes to contribute to a deeper understanding of technology adoption within the healthcare rehabilitation context. The findings may hopefully inform the development of a patient-centred rehabilitation system and improve the patient's engagement with digital rehabilitation solutions.

II. Literature Review

A. Visual-based Home Rehabilitation

Home-based rehabilitation is where the patient performs prescribed rehabilitation exercises in their own environment rather than the usual facility-based rehabilitation. Frequency of visits to facilities like hospitals or clinics can also be drastically reduced. The idea would be that the patient will supplement the reduced facility visits by continuously performing rehabilitation exercises at home so that the patient will still make good progress in their rehabilitation. As shown in [5], it is possible for home-based rehabilitation to improve physical function of patients. However, as previously stated, adherence to home-based rehabilitation is a contentious issue with non-adherence reaching up to 70%. Clearly showing that challenges are present for home-based rehabilitation.

With some technology supported home-based rehabilitation programs requiring expensive equipment [6], attaching sensors incorrectly leading to measurement errors [7], or tele-rehabilitation platforms that still require the intervention of healthcare specialists like physical therapists [8], a visual-based home rehabilitation system does do away with a lot of the issues. The visual-based home rehabilitation system, as proposed in this study, would not require any sensors attached to the patient. A Microsoft Kinect camera is used to capture the patient's movement whilst performing their rehabilitation exercises and it will be shown live on a display (e.g. a television set) that is HDMI-capable to connect a simple PC stick. The Kinect's camera is a motion-sensing input device originally created to be paired with Microsoft's XBOX gaming platform but has been extensively used for rehabilitation as evidenced in [9, 10, 11]. The device projects a fixed near-infrared pattern onto the scene to determine depth by employing a structured light technique, before the camera is used to detect gesture and body skeletal detection [12]. The PC stick will have sufficient resources to run a simple program that interprets the video images captured by the Kinect camera using the standard Kinect SDK.

The program will also record statistics of the patient's rehabilitation exercises so that the patient's progress can be objectively reviewed by a healthcare specialist when the patient goes for their checkup.

Technology supported home-based rehabilitation programs can certainly assist the patient with their rehabilitation journey towards improving their quality of life, but the adherence or adoption is not guaranteed. More understanding of the determinants influencing the adoption of a visual-based home rehabilitation system is important to ensure it can be successfully implemented as part of the patient's rehabilitation regime.

B. Adoption of Technology in Healthcare

Adoption of technology in healthcare has been well researched using established models such as Technology Acceptance Model (TAM) [13] and the revised Unified Theory of Acceptance and Use of Technology (UTAUT) [14]. UTAUT is a newer model that also incorporates elements of TAM along with other models to predict technology adoption more comprehensively. Despite incorporating four key determinants of intention and usage (performance expectancy, effort expectancy, social influence, and facilitating conditions) and four moderating variables (gender, age, experience, and voluntariness of use), UTAUT still provides limited consideration of contextual factors. Due to that, UTAUT fails to provide stable predictive capabilities for adoption of technology in healthcare [15]. In the context of home-based rehabilitation systems, technology adoption is influenced not only by technological characteristics but also by other determinants such as individual and social factors.

C. Determinants for the Adoption of a Visual-based Home Rehabilitation System

The conceptual framework of this study incorporates constructs from COM-B model of behaviour [16], Technology Acceptance Model (TAM) [13], Health Action Process Approach (HAPA) [17], and Fear-Avoidance Belief Questionnaire (FABQ) [18].

COM-B theorizes that behaviour change, adoption in our study, derives from capability, opportunity, and motivation and the determinants that drive them. TAM is a well-known model that theorizes how the perception of technology being easy to use and useful affects the intention to adopt said technology. HAPA separates into two phases, motivational where the intention to perform a behaviour is developed, and volitional where the intention becomes actual behaviour. FABQ suggests that the perception that an activity may worsen the injury may actually prevent performing rehabilitation exercises. However, studies have shown that with visual-based rehabilitation technology, patients are more willing to perform physical activities and physical rehabilitation, indicating that patients perceive the technology as a supportive aid despite the presence of fear-avoidance behaviours. [19, 20, 21].

Self-efficacy is the internal belief that the individual has the capability to perform a behaviour that is required to achieve an intended outcome. Knowledge refers to the individual's understanding of their situation and the importance regarding the intended behaviour. Memory is about the individual's ability to remember instructions or routines. Self-monitoring is the individual's ability to track their own progress over time without external factors. Physical ability is the individual having sufficient physical capability to carry out a behaviour. Perceived usefulness is the individual's belief that a technology can improve their outcome or enhance their performance. Perceived ease of use is the individual's belief that technology can be used with minimal effort. Belief is an individual's perception that physical activity will worsen their condition or cause pain. Social support refers to assistance or encouragement an individual receives from their surroundings, be it family members, friends or even healthcare professionals. Barriers are factors that prevent an individual from performing a behaviour which can be environmental, psychological or even technological obstacles. And resources refer to available assets or advantages that can help the individual perform a behaviour. Capability can be the individual's capacity to perform a behaviour, whereas attitude is the individual's evaluation, be it positive or even negative, of performing a behaviour. Motivation is an internal drive towards behaviour to achieving a goal. Opportunity can either help or harm the performance of a behaviour. And finally, adoption is where the individual moves from intention to actually using the system.

D. Hypotheses

The hypotheses developed for this study are presented in Table 1. A total of 17 hypotheses were examined according to the relationships of the constructs. H1 to H5 examines the determinants of Capability while H6, and H7 examines the determinants of Attitude. H8 to H10 and H14 focus on the determinants of Motivation and H11 to H13 assesses factors influencing Opportunity. Finally, H15 to H17 evaluates the effects of Capability, Motivation and Opportunity on the adoption of a visual-based home rehabilitation system.

TABLE 1. Research Hypotheses.

Hypo-thesis	Statement
H1	Self-efficacy positively influences Capability to perform home-based rehabilitation.
H2	Knowledge positively influences Capability to perform home-based rehabilitation.
H3	Memory positively influences Capability to perform home-based rehabilitation.
H4	Self-monitoring positively influences Capability to perform home-based rehabilitation.
H5	Physical ability positively influences Capability to perform home-based rehabilitation.
H6	Perceived usefulness positively influences Attitude toward the visual-based home rehabilitation system.
H7	Perceived ease of use positively influences Attitude toward the visual-based home rehabilitation system.
H8	Attitude positively influences Motivation to use the visual-based home rehabilitation system.
H9	Belief positively influences Motivation to use the visual-based home rehabilitation system.
H10	Capability positively influences Motivation to perform home-based rehabilitation.
H11	Social support positively influences Opportunity to engage in home-based rehabilitation.
H12	Barriers negatively influence Opportunity to engage in home-based rehabilitation.
H13	Resources positively influence Opportunity to engage in home-based rehabilitation.
H14	Opportunity positively influences Motivation to perform home-based rehabilitation.
H15	Capability positively influences Adoption of the visual-based home rehabilitation system.
H16	Motivation positively influences Adoption of the visual-based home rehabilitation system.
H17	Opportunity positively influences Adoption of the visual-based home rehabilitation system.

E. Research Gap

Although studies have explored adoption of healthcare technology or even home-based rehabilitation, there is limited research that specifically examines determinants influencing the adoption of a visual-based home rehabilitation system. Understanding the determinants proposed in this study can help the successful implementation of said system and hopefully can alleviate the strain facing Malaysian healthcare system due to the lack of available physical therapist whilst still allowing the patients of MSK disorders to progress well in their rehabilitation. Therefore, this study aims to investigate that can influence the adoption of a visual-based home rehabilitation system by examining factors such as self-efficacy, knowledge, memory, self-monitoring, physical ability, perceived usefulness, perceived ease of use, belief, social support, barriers, and resources.

III. RESEARCH METHODOLOGY

This study used a quantitative cross-sectional survey approach to examine the determinants affecting the adoption of a visual-based home rehabilitation system. The proposed conceptual framework, as shown in Figure 1, integrates constructs from COM-B, TAM, HAPA, and FABQ.

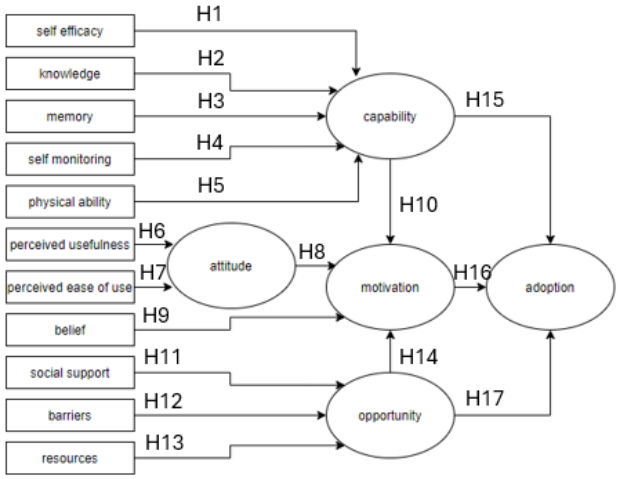

FIGURE 1. Conceptual Framework for the Adoption of a Visual-Based Home Rehabilitation System.

Convenience sampling was utilized when gathering data from rehabilitation patients at Melaka General Hospital. A total of 250 respondents were obtained which consists of males and females above 18 years old, suffering from MSK disorders or requiring rehabilitation, and a willingness to answer the survey questionnaire. A 59-question survey questionnaire available in two languages, English and Bahasa Melayu, was physically administered based on patient's preference of language. For some patients, the available researchers helped read the questionnaire to them for their input. The 59 questions included demographic information and items to measure the constructs presented in the proposed framework. Items were measured on a Likert scale. Prior to participating, respondents were given a brief explanation regarding the purpose of the study, assured of data confidentiality, and made aware this study had obtained ethical approval from National Medical Research Register (ID: 14-1263-20788). Then the respondents were given a part of the questionnaire to answer. After that, each respondent was asked to try the visual-based home rehabilitation system with a few basic exercises. Then the respondent was tasked to complete the rest of the questionnaire.

To examine the relationships between a set of independent variables and the dependent variable as outlined in the framework, Pearson correlation analysis was conducted using IBM SPSS. Multiple regression analysis was also performed in order to obtain the significant predictors influencing the adoption behaviour.

IV. Results and Discussions

A. Correlation Analysis

The Pearson correlation analysis measures the relationship of each of the independent variables to the dependent variable by looking at the relationship's strength. The values range from +1 to -1 where values closer to +1 or -1 indicate stronger relationships [22]. A positive value indicating both variables moving in the same direction and a negative value indicating the variables move in the opposite direction. This means in a negative correlation, when one variable increases, the other will decrease.

The strength of the relationship between self-efficacy, knowledge, memory, self-monitoring, and physical ability towards capability are depicted in Table 2. A significant value of less than 0.05 indicates a significant association between the independent to the dependent factors. Based on the results, all dependent factors, except knowledge, showed a significant association to the dependent variable, capability. The Pearson values for the relationship are 0.161 (self-efficacy towards capability), 0.182 (memory towards capability), 0.188 (self-monitoring towards capability), and 0.133 (physical ability towards capability). As knowledge does not have a significant outcome ($p > 0.05$), this indicates that there is no relationship between knowledge and capability. Thus, the knowledge variable is dropped from the proposed framework.

TABLE 2. Correlations between Self-efficacy (SE), Knowledge (KN), Memory (ME), Self-monitoring (SM), and Physical Ability (PA) to Capability.

	SE	KN	ME	SM	PA
r	.161	-.088	.182	.188	.133
p	.011	.164	.004	.003	.035

As indicated from Table 3, the relationships between factors perceived usefulness (r value of 0.131) and perceived ease of use (r value of 0.204) towards attitude are significant. Since both variables are positively correlated, a higher perceived usefulness and ease of use will lead to more favourable attitude towards the visual-based home rehabilitation system.

TABLE 3. Correlations between Perceived Usefulness, and Perceived Ease of Use to Attitude.

	Perceived Usefulness	Perceived Ease of Use
r	.131	.204
p	.038	.001

The association between attitude and motivation (r value of 0.144), and belief and motivation (r value of 0.242), also indicates a positive correlation and a significant relationship, as shown in Table 4.

TABLE 4. Correlations between Attitude, and Belief to Motivation.

	Attitude	Belief
r	.144	.242
p	.023	< .001

Table 5 shows the results of the association between social support, barriers, and resources towards opportunity. The Pearson values are 0.381, 0.252, and 0.129, respectively indicating a significant association towards opportunity.

TABLE 5. Correlations between Social Support, Barriers, and Resources to Opportunity.

	Social Support	Barriers	Resources
r	.381	.252	.129
p	< .001	< .001	.041

The association between capability and motivation (r value of 0.205) and opportunity and motivation (r

value of 0.224) showed that they are significant. The results are shown in Table 6.

TABLE 6. Correlations between Capability, and Opportunity to Motivation.

	Capability	Opportunity
r	.205	.224
p	.001	< .001

The final correlation test was performed on the capability, motivation, and opportunity factors toward adoption as shown in Table 7. The three relationships were shown to have a significant association, with their Pearson values of 0.172, 0.192, and 0.205, respectively. Higher levels of capability, motivation, and opportunity are associated with higher adoption of the visual-based home rehabilitation system.

TABLE 7. Correlations between Capability, Motivation, and Opportunity to Adoption.

	Capability	Motivation	Opportunity
r	.172	.192	.205
p	.006	.002	.001

B. Multiple Regression Analysis

Multiple regression analysis was done to examine the relationships between several independent variables to dependent variables such as Capability, Attitude, Motivation, Opportunity, and Adoption. This method determines the relationship between a quantitative dependent variable and multiple independent variables based on a linear regression model.

Determinants of Capability

Table 8 depicts the model summary for the determinants of Capability which are the independent variables Self-efficacy, Memory, Self-monitoring, and Physical Ability. The $R^2 = 0.072$ indicates 7.2% of the total variation in Capability can be explained by self-efficacy, memory, self-monitoring, and physical ability which can be acceptable in the research field of social science [23].

TABLE 8. Model Summary for Capability with Predictors: (Constant), Self-efficacy, Memory, Self-monitoring, and Physical Ability.

R	R^2	Adjusted R^2	SE of the Estimate
.269	.072	.057	.43646

The F-ratio reported in the ANOVA table (Table 9) tests the overall significance of the regression model, which indicates that the independent variables significantly predict the dependent variable, $F(4, 245) = 4.787$, $p < .005$, confirming that the regression model fits the data adequately.

TABLE 9. ANOVA Table for Capability with Predictors: (Constant), Self-efficacy, Memory, Self-monitoring, and Physical Ability.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	3.648	4	.912	4.787	.001
Residual	46.673	245	.191		
Total	50.320	249			

Based on Table 10, all factors, except Physical Ability (PA) ($\beta = 0.018$, $p = 0.797$), have a significant value (p-value of less than 0.05), which suggest the removal of the Physical Ability determinant from the framework. The results indicate that Capability can be significantly predicted by Self-efficacy (SE), Memory (M), and Self-monitoring (SM). Furthermore, the standardized coefficients beta values indicate that among the significant determinants, Self-monitoring has the highest impact (β value of 0.136) towards Capability. An individual with higher belief in their abilities, better memory, and more disciplined self-monitoring tends to demonstrate greater capability in performing rehabilitation tasks.

TABLE 10. Coefficients Table for Capability.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	3.863	.750		5.154	.000
SE	.169	.082	.131	2.044	.042
ME	.106	.053	.130	1.977	.049
SM	.121	.058	.136	2.074	.039
PA	.025	.096	.018	.258	.797

Determinants of Attitude

The model summary in Table 11 shows that R^2 indicates 6.1% of the total variation in the dependent variable, Attitude can be explained by the independent variables.

TABLE 11. Model Summary for Attitude with Predictors: (Constant), Perceived Usefulness, and Perceived Ease of Use.

R	R^2	Adjusted R^2	SE of the Estimate
.246	.061	.053	.39797

In Table 12 it shows that Perceived Usefulness and Perceived Ease of Use are statistically significant in predicting Attitude, $F(2, 247) = 7.971$, $p < .001$.

TABLE 12. ANOVA Table for Attitude with Predictors: (Constant), Perceived Usefulness, and Perceived Ease of Use.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	2.525	2	1.262	7.971	.000
Residual	39.119	247	.158		
Total	41.644	249			

Table 13 shows that both independent variables have a significant value (p-value of less than 0.05). Thus, the results indicate that Attitude can be predicted by Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Between these two determinants, Perceived Ease of Use has the higher impact on Attitude, as indicated by its β value of 0.208 (compared to Perceived Usefulness β value of 0.138). These results indicate that an individual's attitude is positively influenced by how they perceive the system bringing additional benefit and requiring minimal effort to use.

TABLE 13. Coefficients Table for Attitude.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	4.459	.604		7.385	.000
PU	.110	.049	.138	2.241	.026
PEU	.243	.072	.208	3.378	.001

Determinants of Motivation

Based on Table 14, the R^2 of 0.074 indicates 7.4% of the total variance in Motivation can be accounted by the variables Belief and Attitude.

TABLE 14. Model Summary for Motivation with Predictors: (Constant), Attitude, and Belief.

R	R^2	Adjusted R^2	SE of the Estimate
.272	.074	.066	.58151

The significant value, $p < .001$ indicates that overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data) with $F(2, 247) = 9.838$ as shown in Table 15.

TABLE 15. ANOVA Table for Motivation with Predictors: (Constant), Attitude, and Belief.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	6.653	2	3.327	9.838	.000
Residual	83.523	247	.338		
Total	90.176	249			

An examination of the significant values for Attitude and Belief in Table 16 indicates that they are statistically significant and thus indicates that Motivation can be predicted by Attitude and Belief. In comparing the standardized coefficients β value, Belief β value of 0.231 shows this factor has a higher impact on Motivation compared to Attitude. A positive attitude and lower fear avoidance beliefs can attribute to greater motivation to utilize the home-based rehabilitation system.

TABLE 16. Coefficients Table for Motivation.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	2.413	.928		2.600	.010
Attitude	.182	.090	.124	2.013	.045
Belief	.411	.109	.231	3.763	.000

Referring to Table 17, R^2 indicates 8.4% of the total variation in Motivation can be explained by Capability, and Opportunity.

TABLE 17. Model Summary for Motivation with Predictors: (Constant), Capability, and Opportunity.

R	R^2	Adjusted R^2	SE of the Estimate
.290	.084	.077	.57823

As presented in Table 18, the regression model significantly predicts the outcome variable, with a significant value of $p < .001$ and an F-ratio of $F(2, 247) = 11.351$, indicating a good fit for the data.

TABLE 18. ANOVA Table for Motivation with Predictors: (Constant), Capability, and Opportunity.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	7.591	2	3.795	11.351	.000
Residual	82.585	247	.334		
Total	90.176	249			

As indicated in Table 19, all determinants show a significant value. This indicates that Capability (CA) and Opportunity (OP) are significant predictors of Motivation with Opportunity (β = 0.207) having greater impact. This illustrates that internal skills and environmental factors both are needed to further enhance the Motivation to perform home-based rehabilitation.

TABLE 19. Coefficients Table for Motivation.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	3.217	.689		4.671	.000
CA	.248	.082	.186	3.034	.003
OP	.237	.070	.207	3.380	.001

Determinants of Opportunity

From the results depicted in Table 20, the R^2 indicates 21.4% of the total variation in Opportunity can be explained by Social Support, Barriers, and Resources.

TABLE 20. Model Summary for Opportunity with Predictors: (Constant), Social Support, Barriers, and Resources.

R	R^2	Adjusted R^2	SE of the Estimate
.463	.214	.204	.46761

In Table 21, the significant value of less than 0.001 signifies that, overall, the predictors (Social Support, Barriers, and Resources) statistically predict Opportunity, $F(3, 246) = 22.315$, and this means that it is a good fit for the data.

TABLE 21. ANOVA Table for Opportunity with Predictors: (Constant), Social Support, Barriers, and Resources.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	14.638	3	4.879	22.315	.000
Residual	53.790	246	.219		
Total	68.428	249			

The significant values of the determinants in the model show that they are less than 0.05 (refer to Table 22). As such, Social Support, Barriers, and Resource are significant predictors for Opportunity, with Social Support having the highest impact towards predicting Opportunity. This is indicated by the highest standardized coefficients beta value of 0.364 for Social Support. Social support, perceived barriers,

and availability of resources will significantly impact the individual's opportunity to engage with the visual-based home rehabilitation system.

TABLE 22. Coefficients Table for Opportunity.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	-.207	.902		-.230	.818
Social Support	.549	.086	.364	6.423	.000
Barriers	.267	.066	.229	4.031	.000
Resources	.186	.078	.134	2.375	.018

Determinants of Adoption

The model summary in Table 23 displays the R^2 of 0.081 which explains 8.1% of the variance in Adoption by the independent variables Capability, Motivation, and Opportunity.

TABLE 23. Model Summary for Adoption with Predictors: (Constant), Capability, Motivation, and Opportunity.

R	R^2	Adjusted R^2	SE of the Estimate
.284	.081	.069	.33281

Table 24 shows that the Capability, Motivation, and Opportunity are statistically significant in predicting the dependent variable, $F(3, 246) = 7.190$, $p < .0001$.

Table 24. ANOVA Table for Adoption with Predictors: (Constant), Capability, Motivation, and Opportunity.

	Sum of Squares (SS)	df	Mean Square (MS)	F	p
Regression	2.389	3	.796	7.190	.000
Residual	27.248	246	.111		
Total	29.637	249			

Since the coefficients results in Table 25 show that all three predictors have a p-value of less than 0.05, this indicates that Adoption can be predicted by Capability (CA), Motivation (MO), and Opportunity (OP). The determinant Opportunity shows the highest impact towards Adoption, as indicated by the highest standardized coefficients Beta value of 0.164, as compared to the other two determinants' Beta values. These results indicate that adoption of the visual-based home rehabilitation system can be positively influenced by an individual's capability, motivation, and opportunity.

TABLE 25. Coefficients Table for Adoption.

	β (Unstandardized Coefficient)	Standard Error (SE)	β (Standardized Coefficient)	t	p
(Constant)	4.984	.414		12.051	.000
CA	.100	.048	.131	2.091	.038
MO	.074	.037	.128	2.008	.046
OP	.108	.041	.164	2.611	.010

C. Summary of Hypothesis Testing

Table 26 is a summary of hypothesis testing based on the result from the multiple regression analyses. Knowledge was not tested in multiple regression as it was already found to be not significant in Pearson correlation test. Majority of the other hypotheses were supported, indicating the proposed framework is largely valid.

TABLE 26. Summary of Hypothesis Testing.

Hypothesis	Path Relationship	β (Standardized Coefficient)	p	Result
H1	Self-efficacy → Capability	0.131	0.042	✓
H2	Knowledge → Capability	–	–	Not Tested
H3	Memory → Capability	0.130	0.049	✓
H4	Self-monitoring → Capability	0.136	0.039	✓
H5	Physical Ability → Capability	0.018	0.797	×
H6	Perceived Usefulness → Attitude	0.138	0.026	✓
H7	Perceived Ease of Use → Attitude	0.208	0.001	✓
H8	Attitude → Motivation	0.124	0.045	✓
H9	Belief → Motivation	0.231	0.000	✓
H10	Capability → Motivation	0.186	0.003	✓
H11	Social Support → Opportunity	0.364	0.000	✓
H12	Barriers → Opportunity	0.229	0.000	✓
H13	Resources → Opportunity	0.134	0.018	✓
H14	Opportunity → Motivation	0.207	0.001	✓
H15	Capability → Adoption	0.131	0.038	✓
H16	Motivation → Adoption	0.128	0.046	✓
H17	Opportunity → Adoption	0.164	0.010	✓

D. Finalised Framework

Overall, as presented in Figure 2, the multiple regression analyses identified significant determinants across the proposed framework. Capability was able to be significantly predicted by self-efficacy, memory, and self-monitoring while physical ability was found to be not significant. In turn, Attitude was significantly predicted by the determinants, perceived usefulness and perceived ease of use. Two regression models were examined for motivation and concluded that it can be predicted by belief and attitude along with capability and opportunity. Opportunity was significantly influenced by social support, barriers, and resources with social support having the greatest impact. And finally, adoption of the visual-based home rehabilitation system was significantly predicted by capability, motivation, and opportunity, with

opportunity demonstrating the strongest influence. These findings support the importance of psychological, technological, and environmental determinants in influencing the adoption of a visual-based home rehabilitation system.

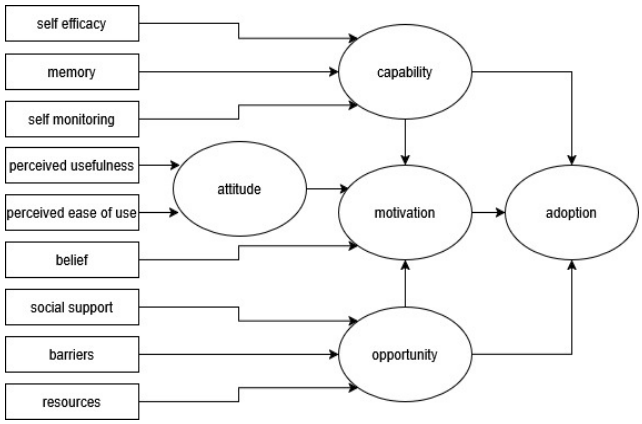

FIGURE 2. Finalized Framework for the Adoption of a Visual-based Home Rehabilitation Framework.

V. CONCLUSION

This study investigates the determinants that influence the adoption of a visual-based home rehabilitation system. Integrating constructs from well-known models such as COM-B, TAM, HAPA, and FABQ. This study proposed a conceptual framework to examine different factors contributing to adoption. From the Pearson correlation tests and multiple regression analyses, determinants that affect adoption were identified. Capability was significantly predicted by self-efficacy, memory, and self-monitoring. Knowledge was found to be not significant in Pearson correlation test and physical ability was found to be not significant in multiple regression test as determinants of capability. Attitude toward the visual-based home rehabilitation system was significantly influenced by perceived usefulness and perceived ease of use. Belief, attitude, capability, and opportunity were found to contribute to motivation. Opportunity was strongly influenced by social support, barriers, and resource availability. Social support was the most significant determinant which just goes to show how important it is for the individual to receive support from their surroundings. And adoption of a visual-based home rehabilitation system, as shown in the multiple regression analysis, to be significantly impacted by capability, motivation, and opportunity. This study hopes to highlight the collective of determinants required to predict the adoption of a visual-based home rehabilitation system. Future research may employ longitudinal study or investigate the effectiveness of the proposed system in helping rehabilitation progress over time.

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Roy Kwang Yang Chang: Conceptualization, Data Curation, Methodology, Validation, Writing – Original Draft Preparation;

Kok Swee Sim: Project Administration, Writing – Review & Editing;

Siong Hoe Lau: Writing – Review & Editing.

CONFLICT OF INTERESTS

No conflict of interests was disclosed.

ETHICS STATEMENTS

Relevant informed consent was obtained from participants of this study prior to their engagement.

DECLARATION OF AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

No artificial intelligence tools were used in the research or writing of this article.

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