ORIGINAL ARTICLE

The Acceptance of the Electronic Payment System for Healthcare Services at Hospital Universiti Sains Malaysia

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ABSTRACT

Introduction: A successful electronic payment system (EPS) in public healthcare services depends on user acceptance, yet little is known among Malaysians. This study assessed the prevalence, EPS users' characteristics, and factors influencing acceptance at a public hospital. **Methods**: A cross-sectional survey was conducted on adults making payment transactions at Hospital USM. Participants were selected using systematic random sampling and complete self-administered questionnaires. Sociodemographic background and EPS acceptance were measured using validated perceived usefulness (PU) and perceived ease of use (PEU) instruments rated using a five-point Likert scale. **Results**: Of the 203 participants, 82.6% were current EPS users. Higher PU and PEU mean scores were significantly associated with younger age, higher education levels, higher income, smartphone ownership, and prior knowledge of and experience with EPS (all $p<0.05$). The Multiple Linear Regression analysis revealed four predictors of EPS acceptance: higher education level ($p < 0.001$) and experience using multiple EPS systems ($p = 0.009$) were significantly associated with greater acceptance whereas prior knowledge of EPS ($p < 0.001$) and younger age ($p = 0.034$) were also significant ($R = 0.337$, Adjusted $R = 0.324$). **Conclusion**: EPS was widely accepted in public hospitals, though acceptance was lower among older adults with limited smartphone and digital payment experience. These findings highlight the importance of education and digital literacy in shaping EPS adoption in healthcare settings and the need for strategies to improve accessibility. Similar research is recommended to understand EPS acceptance among rural and less affluent populations.
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INTRODUCTION

Electronic payment systems (EPS) for online financial transactions are widely accepted in Malaysia (1–3), with increasing utilisation across various sectors, including higher education (4), taxation (5), and government and district office businesses (6,7). Prior studies indicate that EPS acceptance in these industries is driven mainly by its benefits, such as convenience, ease of use, time efficiency (4,5), reduced bureaucratic delays, and minimisation of transaction errors (6,7). Given these advantages, EPS can potentially enhance efficiency in various settings, including healthcare. However, despite its widespread use in other industries, its adoption in Malaysian public hospitals remains inconsistent, facing several implementation challenges. Several factors contribute to this uneven implementation, including concerns over data security, patient trust in digital payments (8), varying levels of digital literacy among patients, and limited accessibility among elderly or low-income populations (9,10). Additionally, infrastructural challenges and system interoperability issues within hospital administrative processes create significant barriers to seamless EPS integration. Furthermore, unfamiliarity with technology, lack of compatible devices or payment cards, and frequent system or internet failures disrupting transactions further diminish interest in using EPS (11).

The EPS for public hospital services in Malaysia was introduced in 2015 as part of the country's broader healthcare digitalisation agenda. With the government's ongoing efforts to enhance digital healthcare

infrastructure, streamline hospital administrative processes, and promote cashless transactions, EPS adoption is expected to continue increasing, which is crucial in improving service efficiency and patient convenience (12–14). By simplifying the payment process, EPS allows hospital clients to pay medical expenses online anytime and anywhere, eliminating the need to queue at counters or carry cash (5). From a hospital management perspective, EPS reduces operational costs, increases efficiency, streamlines financial transactions, and improves coordination, ultimately enhancing the availability and flexibility of healthcare delivery (15).

Globally, technology acceptance in healthcare has been widely explored, particularly in telemedicine, e-health systems, and electronic health records (EHRs). Research has been concentrated in countries like Taiwan and the USA, where studies have primarily focused on telemedicine and electronic medical record solutions (16). Meanwhile, the adoption of EPS in healthcare is gaining increasing global interest. Krishnaswamy (2011) analysed the role of EPS in healthcare payments in the USA and supported the recommendation that transitioning from a paper-based system to an electronic payment system can reduce costs and enhance operational efficiency (15). More recently, Sagare et al. (2023) highlighted the benefits of cashless healthcare services in Malaysia, emphasising their role in streamlining payments, enhancing security, and improving convenience for patients and healthcare providers (9).

Despite this growing interest in EPS adoption worldwide, research on EPS implementation in Malaysia remains limited, particularly in public hospitals. While studies from other countries highlight the importance of digital literacy, system usability, and infrastructure in technology acceptance, empirical evidence on Malaysian patient acceptance of EPS, the characteristics of EPS users and non-users, and the factors influencing adoption remain unexplored. Understanding these factors is essential for enhancing payment efficiency, improving patient access to digital healthcare services, and optimising hospital operations and patient experience. Therefore, this study aims to determine the prevalence of EPS usage and identify the factors influencing its acceptance in a public hospital setting.

MATERIALS AND METHODS

Study Design and Participants

A cross-sectional study was conducted on payees who paid for hospital charges at Hospital USM's payment counter. It systematically and randomly selected participants aged 18 years and above who understand the Bahasa Malaysia language. Sample size calculation based on 80% power, 95% confidence interval (CI), and accounting for 10% non-response rate showed that 203 participants were needed.

Data Collection

Every 10th payee who performed a transaction was approached and explained about the study. Consented participants were asked to complete a set of questionnaires adapted from Davis (1989) and Ming & Jais (2022) and collected information on the sociodemographic background, EPS Usage Frequency, Modes, Preferences, and acceptance of EPS. The questionnaire consisted of three sections with a total of 28 questions. Sociodemographic section included seven questions, adapted from the NHMS 2019, National Institute of Health, Ministry of Health Malaysia (17), covering variables such as age, gender, ethnicity, education level, occupation, and monthly income. The Experience, Frequency, and Usage comprised ten questions, adapted from Ming & Jais (2022) (18,19), assessing EPS usage status, transaction frequency, preferred EPS mode, and prior experience with EPS. Participants were categorised as EPS or non-EPS users based on their self-reported usage experience. The PU and PEU contained five PU items and six PEU items, adapted from Ming & Jais (2022) (19,20). The PU section probed the participants' perceptions about the speed, effectiveness, ease of financial transaction procedures, financial improvement, and overall benefits of EPS at the hospitals. The PEU probed straightforwardness, ease of learning and mastering, flexibility, accessibility, and user-friendly options for using EPS in hospitals. The acceptance of EPS was assessed according to the Technology Acceptance Model, 1989 (TAM), in which two theoretical constructs, perceived usefulness (PU) and perceived ease of use (PEU), were considered fundamental in influencing acceptance of technology use (19,20). Each item was scored using a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree), and individuals' mean scores of PU and PEU, as well as the total scores of the two variables, were obtained to reflect the acceptance of EPS (20).

Validity and Reliability

The instruments underwent forward and backward translation from English into Bahasa Malaysia language. Content and face validation on the Malay-translated questionnaire were satisfactory, with a high content validation index (0.95)(21) and face validation index (0.93)(22). Test-retest reliability on 40 participants showed that PU demonstrated excellent reliability, with a Cronbach's Alpha value of 0.97 and an Intraclass Correlation Coefficient (ICC) of 0.932 (95% CI: 0.876, 0.963). PEU also showed strong reliability, with a Cronbach's Alpha of 0.97 and an ICC value of 0.94 (95% CI: 0.889, 0.968).

Nerves

Nerve injuries are devastating due to their severe physiological and psychological effects on the patient. When damage occurs in the nervous system, including

the central and peripheral nervous system, repair and recovery are deemed challenging after a reconstructive surgery [28]. Autografts have been the gold standard in tissue reconstructive, including nerve and bone tissue. Nonetheless, limitations including low availability and donor site morbidity are significant, where allografts have been an increasingly promising alternative to the gold standard [29-31]. Application of allografts from the same or different species requires the effective removal of cells from the tissue or organ. Perfusion-mechanical agitation decellularization technique was widely applied in various studies, resulting in good viability of the nerve autografts [8, 32]. Regardless, optimization of the decellularization process was studied to reduce processing time to be cleanroom compliant, as well as better storage conditions that can preserve the structure of the autografts [8, 33]. Nonetheless, it is important to note that due to the delicate structure of nerves, decellularization methods that include physical methods can significantly damage the ultrastructure [29]. Although this method can provide low immunogenicity, application on nerve grafts may not be the most suitable.

Statistical Analysis

A descriptive analysis was carried out to describe the sample and characteristics of use. The Pearson chi-squared test assessed associations between categorical variables, such as EPS usage status (user vs. non-user) and demographic characteristics (e.g., gender, education level, and income). The independent t-test and one-way ANOVA were conducted to compare PU and PEU mean scores across different groups based on EPS usage frequency, mode of payment, and preferences. To further analyse the factors influencing EPS acceptance, single linear regression was conducted with acceptance of EPS usage to identify potential predictors. Variables that showed significant associations ($p < 0.05$) in univariate analyses were considered for inclusion. A multiple linear regression analysis (MLR) was performed to identify significant predictors of EPS acceptance, with total PU and PEU scores as the dependent variables. Independent variables included age, education level, monthly income, prior knowledge of EPS, smartphone ownership, frequency of EPS use, number of EPS systems used, and preferred EPS mode. Multiple linear regression (MLR) was performed using the backward elimination method, where non-significant variables were systematically removed to improve model fit.

Additionally, multicollinearity was assessed to ensure that the included variables were independent and meaningful contributors to EPS acceptance. The final model retained variables that demonstrated theoretical justification and statistical significance ($p < 0.05$), ensuring that only the most relevant predictors were included in the analysis. All statistical analyses were conducted using SPSS version 27.0, with a significance level of 5%.

Ethical Consideration

This research protocol was approved by the Human Research and Ethics Committee, Universiti Sains Malaysia, JEPeM Reference Code: USM/JEPeM/KK/23010088 and National Medical Research Register (NMRR ID-23-00901-GS2).

RESULTS

About 82.6% of the 203 payees in the study were EPS users. Compared to non-users, EPS users were significantly younger, had higher education levels, were more likely to be employed, and had higher monthly incomes ($p < 0.01$), as shown in Table I. EPS users were also more likely to own smartphones, be aware of EPS, perceive it as important, and intend to use it for healthcare services. Additionally, they strongly supported the integration of EPS in healthcare facilities, with these differences being statistically significant ($p < 0.001$). Table II shows the total mean PU score was 3.47 (SD = 0.58), with relatively consistent ratings across questionnaire items. The total mean PEU score was 3.50 (SD = 0.57), though scores varied slightly across different aspects. Clarity and understanding of EPS interaction received the lowest ratings, while interaction flexibility scored the highest.

Table I: Summary of The Sociodemographic of The Participants (N=203)

Variables		Frequency, n (%)			
		N=203	EPS User	Non-EPS User	P-value
Experience using EPS	Frequency (%)	-	175 (86.2)	28 (13.8)	-
Age (Years)	Mean (SD)	35.5 (12.46)	34.1 (11.10)	44.0 (16.72)	<0.01[a]
Gender	Female	110 (54.2)	95 (54.3)	15 (53.6)	0.9[b]
	Male	93 (45.8)	80 (45.7)	13 (46.4)	
Ethnicity	Bumiputera	189 (93.1)	165 (94.3)	24 (85.7)	0.1[b]
	Non-Bumiputera	14 (6.9)	10 (5.7)	4 (14.3)	
Education Level	Bachelor's Degree or higher	77 (37.9)	73 (41.7)	4 (14.3)	<0.01[b]
	Primary and Secondary Education	65 (32.0)	47 (26.9)	18 (64.3)	
	Diploma or equivalent	38 (18.7)	34 (19.4)	4 (14.3)	
	Post Secondary Education	23 (11.4)	21 (12.0)	2 (7.1)	
Occupation	Employed	137 (67.5)	125 (71.4)	12 (42.9)	<0.01[b]
	Unemployed	66 (32.5)	50 (28.6)	16 (57.1)	
Monthly Income	Less than RM2,500	82 (40.3)	70 (40.0)	12 (42.9)	<0.01[b]
	More than RM2,500	74 (36.5)	72 (41.1)	2 (7.1)	
	No income	47 (23.1)	33 (18.9)	14 (50.0)	
Own a smartphone	Yes	200 (98.5)	175 (100.0)	25 (89.3)	<0.001[b]
	No	3 (1.5)	0 (0.0)	3 (10.7)	
Know about the EPS	Yes	188 (92.6)	172 (98.3)	16 (57.1)	<0.001[b]
	No	15 (7.4)	3 (1.7)	12 (42.9)	
EPS is important in daily life	Yes	194 (95.6)	174 (99.4)	20 (71.4)	<0.001[b]
	No	9 (4.4)	1 (0.6)	8 (28.6)	
Plan/Intend/Interested in using EPS for healthcare services*	Yes	178 (87.7)	161 (92.0)	17 (60.7)	<0.001[b]
	No	25 (12.3)	14 (8.0)	11 (39.3)	
Agree with EPS to be integrated with healthcare facilities*	Yes	188 (92.6)	169 (96.6)	19 (67.9)	<0.001[b]
	No	15 (7.4)	6 (3.4)	9 (32.1)	

[a]=Independent t test, [b]=Pearson chi-squared test. The significant level was at P<0.05

Table II: Mean and Standard Deviation Scores for PU and PEU Questionnaire Items

PU and PEU Questionnaire Items	Mean Score (SD)	Total Mean Scores (SD)
1. E-payment systems will allow me to pay faster for healthcare services	3.49 (0.67)	
2. E-payment systems are effective	3.43 (0.67)	
3. E-payment systems make payment easier	3.49 (0.63)	
4. E-payment systems would improve financial transactions forhealthcare services	3.49 (0.63)	
5. E-payment systems would be beneficial for healthcare services	3.43 (0.63)	
Total mean PU scores		3.47 (0.58)
1. Interaction with e-payment systems is clear and understandable	3.33 (0.63)	
2. I think it is easy to use e-payment systems to do what I want it to do	3.49 (0.66)	
3. I would find using e-payment systems flexible to interact with	3.58 (0.63)	
4. Learning to operate e-payment systems would be easy for me	3.55 (0.68)	
5. It would be easy for me to be skilful at using e-payment systems	3.52 (0.69)	
6. I would find e-payment systems easy to use	3.56 (0.61)	
Total mean PEU score		3.50 (0.57)

***Responses were measured using a 5-point Likert scale, where 0 = Strongly Disagree, 1 = Disagree, 2 = Somewhat Agree, and 3 = Agree, 4 = Strongly Agree. Each item was scored accordingly, with higher scores indicating a more positive perception of EPS and greater acceptance of its benefits.**

Factors Associated with EPS Usage

Table III shows that the association analysis revealed similar trends for PU and PEU. Higher PU and PEU mean scores were significantly associated with younger age, higher education levels, higher income, smartphone ownership, and prior knowledge of EPS (all $p < 0.05$). Additionally, participants who perceived EPS as important in daily life, intended to use EPS and supported its integration into healthcare services exhibited significantly higher PU and PEU scores ($p < 0.001$).

Table III: Association between Sociodemographic, EPS Perception and Acceptance of EPS with Perceived Usefulness (PU) and Perceived Ease of Use (PEU) of The Electronic Payment System for Healthcare Services at Hospital USM (N=203)

Variables	Perceived Usefulness (PU)			Perceived Ease of Use (PEU)		
	Mean Score PU (SD)	Mean difference (95% CI)	P-value	Mean Score PEU (SD)	Mean difference (95% CI)	P-value
Age (Years)[a]	-0.27*	-	<0.001[a]	-0.27*	-	<0.001[a],
Gender						
Male	3.52 (0.51)	0.10 (-0.57, 0.27)	0.2[b]	3.56 (0.46)	0.09 (-0.06, 0.25)	0.2[b]
Female	3.42 (0.64)			3.46 (0.63)		
Ethnicity						
Bumiputera	3.47 (0.59)	0.07 (-0.25,0.39)	0.7[b]	3.51 (0.56)	0.56 (-0.25, 0.36)	0.7[b]
Non-Bumiputera	3.40 (0.47)			3.45 (0.54)		
Education Level						
Bachelor's Degree or higher (A)	3.71 (0.42)		<0.001[c]	3.73 (0.36)		<0.001[c]
Primary and Secondary Education (B)	3.14 (0.58)			3.18 (0.62)		
Diploma or equivalent (C)	3.47 (0.68)			3.52 (0.61)		
Post Secondary Education (D)	3.57 (0.46)			3.65 (0.40)		
A-B		0.58 (0.40,0.75)	<0.001[d]		0.54 (0.31,0.78)	<0.001[e]
A-C		0.24 (0.03,0.45)	0.03[d]		0.21 (-0.09,0.50)	0.3[e]
B-C		-0.34 (-0.55,-0.12)	<0.01[d]		-0.34 (-0.67,0.00)	0.05[e]
B-D		-0.43 (-0.68,-0.17)	<0.01[d]		-0.47 (-0.78,-0.16)	<0.01[e]
Occupation						
Employed	3.45 (0.61)	0.06 (-0.11, 0.24)	0.5[b]	3.52 (0.57)	-0.05 (-0.22,0.11)	0.5[b]
Unemployment	3.51 (0.53)			3.47 (0.53)		

CONTINUE

Variables	Perceived Usefulness (PU)			Perceived Ease of Use (PEU)		
	Mean Score PU (SD)	Mean difference (95% CI)	P-value	Mean Score PEU (SD)	Mean difference (95% CI)	P-value
Monthly Income						
Less than RM2,500	3.36 (0.64)	-0.24 (-0.43,-0.04)	0.02[b]	3.41 (0.61)	-0.25 (-0.42,-0.07)	<0.01[b]
More than RM2,500	3.60 (0.56)			3.65 (0.51)		
Own a smartphone						
Yes	3.47 (0.58)	0.54 (0.32,0.76)	<0.01[b]	3.51 (0.55)	0.68 (0.05,1.31)	0.04[b]
No	2.93 (0.12)			2.83 (0.17)		
Know about the EPS						
Yes	3.53 (0.53)	0.85 (0.56,1.13)	<0.001[b]	3.57 (0.49)	0.94 (0.68,1.20)	<0.001[a]
No	2.68 (0.65)			2.63 (0.66)		
EPS important in daily life						
Yes	3.50 (0.55)	0.81 (0.44, 1.19)	<0.001[b]	3.55 (0.50)	1.03 (0.69, 1.38)	<0.001[b]
No	2.69 (0.72)			2.52 (0.79)		
Plan/Intend/Interested in using EPS for healthcare services[f]						
Yes	3.58 (0.46)	0.90 (0.57,1.22)	<0.001[b]	3.61 (0.41)	0.89 (0.56,1.23)	<0.001[b]
No	2.68 (0.77)			2.72 (0.80)		
Agree with EPS to be integrated with healthcare facilities[f]						
Yes	3.56 (0.47)	1.21 (0.80,1.62)	<0.001[b]	3.60 (0.42)	1.24 (0.81, 1.67)	<0.001[b]
No	2.35 (0.73)			2.36 (0.77)		

[a]=Pearson's Correlation, [b]=Independent t-test [c]=One-way ANOVA analysis; [d]=LSD Test, [e]= Tamhane Test, [f]=Each Likert scale score=1; each item score=4.*Significant at the 0.01 level (2-tailed). Ethnicity was categorised as follows: 01 = Melayu, 02 = Cina, 03 = India, 04 = Orang Asli, 05 = Bumiputera Sabah, 06 = Bumiputera Sarawak, 07 = Lain-lain (Other, specify). For analysis, respondents were regrouped into two categories: Bumiputera (Melayu, Orang Asli, Bumiputera Sabah, Bumiputera Sarawak) and Non-Bumiputera (Cina, India, Lain-lain).

Further analysis indicated the associations between EPS usage frequency, modes, preferences, and PU and PEU. The analysis showed that EPS users who used the system more than seven times per week had the highest PU (Mean score = 3.75, SD = 0.56) and PEU (Mean score = 3.78, SD = 0.49). These scores were significantly higher than users with lower usage frequency, with the difference being statistically significant ($p < 0.001$). Card users reported the highest PU (Mean score = 3.64, SD = 0.43) and PEU (Mean score = 3.69, SD = 0.33) compared to net banking and mobile payment users. The difference was statistically significant ($p < 0.001$), suggesting that card transactions are perceived as more secure and convenient for healthcare payments. Additionally, participants using more than three EPS systems exhibited significantly higher PU (Mean score = 3.62, SD = 0.45) and PEU (Mean score = 3.69, SD = 0.35) than those using fewer systems, with the difference statistically significant ($p < 0.001$). Participants who preferred net banking as their EPS mode and those using more than three EPS systems reported significantly higher PU (Mean score = 3.68, SD = 0.41) and PEU (Mean score = 3.70, SD = 0.32), as well as PU (Mean score = 3.61, SD = 0.47) and PEU (Mean score = 3.73, SD = 0.34) respectively, compared to mobile payment and card users and those preferring fewer systems. The difference was statistically significant ($p < 0.001$), as presented in Table IV.

Table IV: Association between Electronic Payment System (EPS) Usage Frequency, Modes, and Preferences with Perceived Usefulness (PU) and Perceived Ease of Use (PEU) of EPS for Healthcare Services at Hospital USM (n = 175)

Variables	Frequency, n (%)	Perceived Usefulness			Perceived Ease of Use		
		Mean PU (SD)	Mean difference (95% CI)	P-value	Mean PEU (SD)	Mean difference (95% CI)	P-value
Frequency							
0-3 times a week (A)	85 (41.9)	3.37 (0.54)		<0.001[b]	3.45 (0.47)		<0.001[b]
4-7 times a week (B)	46 (22.6)	3.67 (0.43)			3.73 (0.35)		
More than 7 times a week (C)	44 (21.7)	3.75 (0.56)			3.78 (0.49)		
A-B			-0.30 (-0.49,-0.11)	<0.01[c]		-0.29 (-0.46,-0.11)	<0.01[c]
A-C			-0.38 (-0.57,-0.19)	<0.001[c]		-0.33 (-0.51,-0.16)	<0.001[c]
Mode of the EPS used							
Net banking (D)	72 (35.5)	3.54 (0.56)		<0.001[b]	3.60 (0.51)		<0.001[b]
Cards (E)	63 (31.0)	3.64 (0.43)			3.69 (0.33)		
Mobile Payment (F)	40 (19.7)	3.41 (0.64)			3.49 (0.57)		
Number of EPS mode used							
Use more than 3 systems (H)	108 (53.2)	3.62 (0.45)		<0.001[b]	3.69 (0.35)		<0.001[b]
Use less than 3 systems (I)	67 (33.0)	3.41 (0.65)			3.47 (0.60)		
I-H			-0.21 (-0.43,0.01)	0.7[d]		-0.22 (-0.41,-0.02)	0.02[d]
Preferred EPS mode							
Mobile Payment (K)	99 (48.8)	3.46 (0.61)		<0.001[b]	3.53 (0.55)		<0.001[b]
Net banking (L)	58 (28.5)	3.68 (0.41)			3.70 (0.32)		
Cards (M)	18 (8.9)	3.54 (0.48)			3.72 (0.34)		
K-L			-0.22 (-0.44,-0.00)	0.05[d]		-0.18 (-0.36,0.01)	0.07[d]
Preferred number of EPS							
Less than 3 systems (O)	144 (70.9)	3.53 (0.56)		<0.001[b]	3.58 (0.49)		<0.001[b]
More than 3 systems (P)	31 (15.3)	3.61 (0.47)			3.73 (0.34)		

[a]=Independent t-test, [b]=One-way ANOVA analysis; [c]=LSD Test. [d]=Tamhane Test.

As shown in Table V, a multiple linear regression analysis was conducted to identify factors influencing EPS acceptance among users. The overall model was statistically significant ($F(4, 198) = 25.156$, $p < 0.001$), explaining 33.7% of the variance in EPS acceptance ($R = 0.337$, Adjusted $R = 0.324$). Among the predictors, higher education level ($\beta = 1.269$, 95% CI: 0.692 – 1.846, $p < 0.001$) and use of multiple EPS systems ($\beta = 1.536$, 95% CI: 0.383 – 2.688, $p = 0.009$) were significantly associated with greater EPS acceptance. Similarly, prior knowledge of EPS ($\beta = -6.135$, 95% CI: -9.139 – -3.130, $p < 0.001$) and younger age ($\beta = -0.063$, 95% CI: -0.121 – -0.005, $p = 0.034$) were also significant predictors, suggesting that familiarity and exposure to digital payment systems positively influence EPS adoption in healthcare. However, the model indicates that other unexplored factors may also contribute to EPS adoption, highlighting the need for further research to understand these influences better.

Table V: Multiple Linear Regression Analysis of Factors Influencing PU and PEU Scores (N=203)

Variables	Simple linear regression			Multiple regression		
	β coefficient	95% Confidence Limit	P-value	β coefficient	95% Confidence Limit	P-value
Age (Years)	-0.136	-0.201, -0.071	<0.001	-0.063 (0.029)	-0.121, -0.005	0.034
Gender	-1.092	-2.771, 0.588	0.2	-	-	-
Race	-0.688	-4.002, 2.626	0.7	-	-	-
Education Level	1.903	1.301, 2.505	<0.001	1.269 (0.293)	0.692, 1.846	<0.001
Occupation	-0.013	-1.807, 1.780	0.988	-	-	-
Monthly Income	1.188	0.095, 2.280	0.03	-	-	-
Own a smartphone	-6.788	-13.686, 0.110	0.05	-	-	-
Know about the EPS	-9.885	-12.787, -6.983	<0.001	-6.135 (1.523)	-9.139, -3.130	<0.001
Frequency of Use	-0.602	-1.370, 0.167	0.124	-	-	-
Mode of the EPS used	2.336	1.576, 3.096	<0.001	-	-	-
Number of EPS modes used	3.643	2.588, 4.699	<0.001	1.536 (0.584)	0.383, 2.688	0.009
Preferred EPS mode	2.699	1.746, 3.653	<0.001	-	-	-
Preferred number of EPS	4.036	2.582, 5.490	<0.001	-	-	-

***R = 0.337 indicates that the model explains 33.7% of the variance in EPS acceptance. Adjusted R = 0.324 accounts for model complexity. The model was statistically significant (F(4, 198) = 25.156, p < 0.001).**

DISCUSSION

This study investigated the acceptance of EPS for healthcare services in a public hospital, focusing on perceived usefulness (PU) and perceived ease of use (PEU). The findings suggest that EPS implementation is generally well-received, with younger participants showing better acceptance regardless of gender and ethnicity, likely due to their better adaptation to modern technologies than older individuals. However, the societal trend suggests that people of all ages are becoming more familiar with technology in the last two decades (23). Consistent with previous studies, younger individuals were more likely to find EPS useful and easy to use. This aligns with Morris and Venkatesh (2000), who found that younger users tend to be more adaptable to new technology (24). Yang and Shih (2020) further suggested that individuals who perceive themselves as mentally younger are more inclined to adopt technology, regardless of age (25). The present study suggests that early exposure to digital technology, such as smartphones or EPS, fosters familiarity and confidence, making individuals more open to adopting cashless healthcare payment methods (26,27).

Beyond age, socioeconomic factors play a role in EPS adoption. Participants with higher income and education levels were more likely to perceive EPS as useful and easy to use, supporting findings from Teo and Zhou (2014) that individuals with prior technology experience exhibit stronger perceptions of usefulness and ease of use (28). Similarly, Qashou (2021) found that greater technological self-efficacy enhances the perceived benefits of mobile learning systems, a trend reflected in this study, where prior experience with EPS contributed to higher PU and PEU scores (29).

However, this study contrasts with findings from Arizoni (2016), who argued that perceived usefulness does not significantly influence smartphone adoption, as social prestige rather than functional benefits often drive ownership (30). While this perspective may be relevant to smartphone ownership, it holds less weight regarding EPS adoption in healthcare, where ease of use and accessibility play a crucial role in ensuring smooth financial transactions and enhancing patient convenience.

More than half of those not using EPS on their smartphones are aware of EPS and recognise its importance. Smartphone provides access to user-friendly mobile apps that make it easy to transfer funds and manage payments anytime, anywhere (6). They also support various EPS methods, including net banking, mobile payments, and card transactions, allowing users to choose the best option. Over the years, the growing functionality of mobile phones has further enhanced the appeal of mobile payments, offering convenience, security, seamless financial integration, and improved transaction reliability (31,32). This explains why mobile payments are the preferred EPS mode. However, participants in this study perceived net banking as more useful and card payment methods as easier to use, highlighting the diverse preferences in digital payment methods.

Despite owning smartphones and being aware of digital payments, many participants have not adopted EPS due to a lack of familiarity rather than access to technology. Idoga et al. (2019) suggested that targeted digital literacy programs are essential, particularly for older adults and lower-income groups. By providing training and workshops that enhance understanding of EPS

functionalities and benefits, healthcare institutions can facilitate a smoother transition to electronic payments (33). While the study does not specifically mention the concerns regarding the security of electronic transactions, it is known that such concerns can influence technology acceptance. Addressing security concerns through user education about transaction safety and implementing improved authentication measures, such as two-factor authentication, is generally advisable in enhancing user trust in EPS. Rahimi et al. (2018) showed that usability and security perceptions directly influence the acceptance of new technologies (34).

Many participants preferred mobile payment methods due to their ease of use, rewards, and budgeting features. This suggests that public hospitals should develop mobile-friendly EPS platforms to improve patient convenience and encourage wider adoption. Su et al. (2017) emphasised that user experience significantly impacts mobile payment system adoption, particularly in healthcare settings (35). While cashless transactions can improve efficiency in healthcare settings, legal and administrative barriers impede the adoption of EPS. Previous studies show that regulatory policies often play a crucial role in determining the success of technological integrations within public sectors (34). Policymakers are encouraged to streamline regulations and ensure alignment between EPS and existing healthcare policies to foster an environment conducive to successful implementation. Attitudes toward technology are also crucial in determining whether people are willing to adopt new systems. Madav and Yadav (2016) have shown that performance expectancy, effort expectancy, and social influence significantly impact users' intentions to adopt new payment technologies (36). Therefore, measuring user perceptions and providing incentives for early adopters could facilitate broader acceptance of EPS in public hospitals.

Our study identified several factors associated with accepting EPS in healthcare settings. Age was negatively associated with PU, indicating that younger individuals were more likely to perceive EPS as useful, which aligns with Morris & Venkatesh's study (2000) (24). Interestingly, Yang and Shih (2020) suggested that individuals who mentally perceive themselves as younger are more inclined to recognise the utility of technology, regardless of chronological age. (25). At the same time, higher education levels were associated positively with PU and PEU. Additionally, numerous studies have shown that individuals with more advanced education tend to have a higher acceptance of technological innovations due to their greater familiarity with and exposure to these systems. For example, a study by Teo and Zhou (2014) found that higher education students with prior experience with technology exhibited stronger perceptions of usefulness and ease of use, significantly influencing their intention to adopt technology (28).
Prior exposure to technology has consistently been linked to improved perceptions of usefulness. Qashou (2021) reported that mobile learning systems were perceived as more beneficial by users with greater technological self-efficacy (29). However, in contrast to the association between higher education and the PU and PEU of technology, some studies suggest that these factors are not universally significant. For instance, Rienties et al. (2016) found that perceived usefulness was unrelated to task performance when academic staff interacted with virtual learning environments, suggesting that higher education alone does not guarantee a positive perception of technology's utility (37). Similarly, Garcia and Silva (2016) found that students perceived more value in using social media for academic activities than institutional platforms, indicating that perceived ease of use may not be sufficient to drive technology acceptance and adoption in higher education settings (38). These findings suggest that demographic factors, prior exposure, and technological experience significantly influence how individuals perceive the usability of EPS in healthcare settings.

However, this study was conducted at Hospital USM, Kelantan, which may limit the generalisability of the findings to other settings. As a cross-sectional study, it does not establish causal relationships between variables. Nevertheless, the results provide valuable insights into the Kubang Kerian Kelantan population and may apply to urban areas in the state and similar healthcare environments. Future research should explore longitudinal studies or qualitative approaches to gain deeper insights into capturing complete factors driving or hindering EPS adoption. Given these limitations, careful interpretation of the results is necessary, considering the study's specific demographic and regional context.

CONCLUSION

This study is the first in Malaysia to examine the acceptance of EPS for healthcare services, reinforces widespread acceptance among younger individuals with higher education levels, and prior exposure knowledge to payment systems significantly influences acceptance patterns, reinforcing the role of technological familiarity in shaping EPS perceptions. To maximise the benefits of EPS integration in healthcare settings, stakeholders must improve accessibility, strengthen security measures, and expand user education efforts to build trust and ease adoption.

As healthcare systems worldwide embrace digital transformation, EPS plays a pivotal role in modernising Malaysia's healthcare payment infrastructure. Future studies should focus on underserved communities' barriers, long-term adoption trends, and healthcare providers' insights to develop a more inclusive and sustainable digital payment system. While EPS has the potential to enhance efficiency and convenience, further research is needed to assess its impact in rural areas,

ensuring that all Malaysians, regardless of location, have access to secure and seamless healthcare payment options.

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