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Original Research

Influence of risk factors on the adoption intentions of emerging adults towards patient portals

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Abstract: Patients now have the option to manage their health care through patient portals and internet apps as health information technology evolves. According to research, these portals can improve patient satisfaction, patient self-management, and patient engagement. Despite their advantages, patient portal acceptance and utilization are still low, particularly among self-managing emerging adults. This study examines the impact of emerging adult risk intentions on patient portal adoption and utilization using perceived risk theory. Emerging adults between the ages of 18 and 29 were surveyed, and structural equation modeling was used to ensure the accuracy of the results. The results highlight the significance of healthcare institutions and the technology developers putting into practice useful tactics and insights to get through resistance behavior and promote adoption and use of patient portals. The study also emphasizes the significance of developing training, awareness campaigns and cost-effective measures to lessen patients' risk perceptions.

Keywords: Patient portals, Health information technology, Risk factors, Privacy and security, Use and adoption, Healthcare management

Introduction

This study focuses on patient portals, commonly utilized health IT platforms within the healthcare industry [1]. A patient portal is an online application that enables communication with healthcare professionals and gives access to health information, personal health records, appointment booking, and patient prescription refill requests [1]. As healthcare professionals increasingly integrate patient portals into their practices, research has emphasized the importance of understanding the patients' intentions and attitudes toward patient portal adoption and use [2-4]. According to research, patient portals can potentially enhance patient self-management and satisfaction [5].

Although 92% of individuals accepted it based on a 2016 study by the American Hospital Association (AHA), only a fraction, less than one-third, of the population actually engages with patient portals [6]. Instead of focusing on demographic characteristics and patient necessities, healthcare organizations and programmers have mostly been concerned with portal logins and registrations [7].

The Health Information National Trends Survey (HINTS) data showed a growth in patient portal use, reaching 31.4% in 2018 from 25.6% in 2014 [8]. However, from 2019 to 2020, there was no increase, and

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a study reported that by mid-2020, fewer than half of the insured adults had accessed a portal, suggesting, usage remains limited [9,10]. According to a study of 2975 eligible patients, 83.4% did not utilize the patient portal, 8.6% hardly used it, and only 8.0% actively used it [11]. In a study with 1420 parent participants, researchers discovered that 40% of the parents were not aware that their child could use patient portals [12]. Additionally, even among those who have registered, usage of patient portals is low; of the 72.3% of patients who had registered, only 40.0% were active users [13]. These study findings collectively show limited adoption and usage rates, suggesting that there are substantial barriers and challenges preventing patients from effectively adopting and utilizing patient portals. Various research works have identified that the uptake and utilization of patient portals remain constrained because of numerous obstacles. These include issues related to computer literacy, the ability to access computers, understanding of health information, numerical skills, concerns over privacy, unawareness of the portals, challenges with signing in, and absence of internet access [14-17]. To ensure equitable benefits for all patients through this platform, ongoing focus needs to be placed on overseeing the acceptance and use statistics of patient portals, especially within groups that are not adequately served.

Understanding the behavioral intentions of different population groups towards patient portals is vital, and one such group that requires more attention in research is emerging adults, encompassing individuals aged 18 to 29. The perspectives and needs of this population group have not been thoroughly studied. According to prior studies, this group is changing from a parent-guided to an adult environment and has different perceptions of healthcare technologies [16,18]. Some young adults may find it challenging to proficiently manage health during this transitional period due to poor self-management abilities and little knowledge of healthcare services [19]. An in-depth review examining the views of teenagers and emerging adults transitioning in healthcare emphasizes the nuanced challenges they face moving from pediatric to adult health services [20]. This investigation underscores the young individuals' aspirations for healthcare professionals to be genuinely attentive and to adapt to their distinct requirements, which may stand apart from other demographic groups. Further, research focusing on young adults diagnosed with type-1 diabetes shows a decline in their self-management skills during the year post-high school, emphasizing the necessity for dedicated intervention and support during this crucial time [21,22]. Patient portals are increasingly seen as potent tools that amplify self-management [23]. Many in the healthcare domain posit that through enhanced usage, these portals can foster deeper patient participation in their self-care routines [24]. For a notable segment of young adults, their post-secondary education phase often becomes their first engagement with patient portals, marking their first independent steps in personal health management [25]. Grasping the viewpoints and experiences of emerging adults regarding patient portal utilization can help shape tactics to enhance independent management and ensure a smooth and confident transition. Thus, this research aims to explore the behavioral inclinations of emerging adults concerning the adoption and usage of patient portals. To achieve this, we will employ the perceived risk theory as a theoretical framework.

Theory development

Perceived risk theory allows us to explore how their perceptions of potential risks associated with using patient portals may influence their intentions towards adopting and engaging with this technology. Thus, perceived risk theory provides a suitable framework to investigate the behavioral intentions of emerging adults regarding patient portal adoption and usage. The use of health information technology is significantly influenced by risk, and interventions aimed at changing risk perceptions may improve health behavior, according to a meta-analysis [26].

People's intentions to embrace and use medical innovations have been shown to be significantly influenced by the perceived risk theory, which was used in multiple fields like psychology, finance, marketing, and health technology [27-30]. The risk was seen as a key construct impacting adoption and use behavior among different online applications like online ticket booking, mobile payment applications, and health care technologies [30,31]. Risk is defined as the uncertainty or potential negative consequences that an individual may perceive whether to use a product or not. Jacoby and Kaplan (1972) identified five types of risks to measure perceived risks [32]. Among them, in this study, we evaluated financial risk (loss of money), time risk (loss of time), and privacy risk (loss of control over private health information) to measure the risk perceptions of emerging adults [33].

Therefore, a theoretical framework has been developed to investigate whether risk, which comprises financial, time, and privacy risks, affects the use and uptake of patient portals. By investigating the risk perceptions of emerging adults towards patient portal usage and adoption, we can develop risk mitigation strategies to provide equitable benefits of patient portals for this demographic. For healthcare providers and technology developers, this research will be a significant resource for comprehending the preceding factors that affect emerging adults' inclinations toward the utilization and adoption of patient portals.

Methods

The survey questions utilized in this study were adapted from earlier research and are pertinent to the theoretical

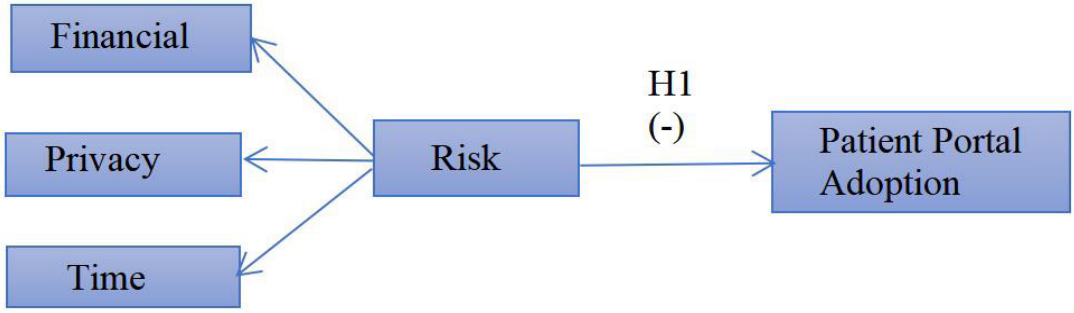

Figure 1. Research model

framework around patient portals [34,35]. Each survey question, validated for each component, along with information about its sources in earlier research. In our empirical study, we structured 2-3 measurement items per construct. Under the privacy construct, we assessed the concerns with knowing the potential for personal medical information leakage through patient portals, the unauthorized use of personal information without the user's knowledge, and possibility of family or others discovering an individual's personal health information via the portal [35]. Within the time construct, the items focused on whether the perception that patient portals might be inefficient, thus being a potential waste of time, and the apprehension that portals might lead to scheduling mistakes [34]. For the financial aspect, we used the measurement items like the belief that patient portals might not offer value for money, concerns about incurring extra expenses through portal use, the associated risks of fraud when using these portals [35]. Lastly, in measuring the patient portal adoption intentions construct, we gauged sentiments based on the inclination to use patient portals more frequently, the intention to engage with patient portals in the future, and the user's prediction or foresight of their likelihood to use the portals [35]. These are the construct measures used to understand user perceptions across varied dimensions related to patient portals. The constructs were measured using a 5-point Likert scale in the range 1 (strongly disagree) to 5 (strongly agree). Several scales were used to gather data on the demographics and experiences of the participants.

A questionnaire was distributed to both graduate and undergraduate students at a collegiate institution to evaluate the research framework and determine the inclinations of emerging adults. By offering extra credit for the survey, the professors encouraged the students to take part. Students who did not want to participate in the study were offered an alternative activity for extra credit. The student sample is a good representation because the study emphasizes the viewpoint of emerging adults. Survey responses from those between the ages of 18 and 29 were gathered.

The Institutional Review Board (IRB) approved the survey administration. At the beginning of the survey, participants received information on the study's purpose, a thorough explanation of how to complete the survey, a guarantee that their personal information would be kept confidential, and a detailed explanation of patient portals. All participants were required to give their informed consent by signing a consent form before taking the survey.

Table 1. Demographics of respondents

Characteristics	Percent
Gender	
Male	40.9
Female	54.9
Non-binary/third gender	3.7
Age	
18–24	79.5
25–29	19.6
29<	0.9
Ethnicity	
White	10.4
Black and African American (Non- Hispanic)	9.8
American Indian or Alaska Native	1.2
Asian	61.6
Native Hawaiian or Pacific Islander	0
Hispanic	14.0
Others	3.0
Experience with Patient Portals	
Yes	34.8
No	64.6

Participants were requested to complete the survey by clicking on a link that was delivered to their email addresses, and after answering demographic questions, questions about each component were asked. Participants were told to click another link after the survey was over and enter their name and student ID to earn extra credit. The survey identification information was maintained separately from the survey responses to encourage honest responses, and it was sent to the professors so they could give participating students extra credit.

Results

The majority of respondents were between the ages of 18 and 29, while the experienced respondents used patient portals rather infrequently. Despite patient portals being available at the university health center, students did not use them very often. It's essential to identify the factors that affect emerging adults' inclination to utilize and adopt patient portals.

Survey data from a sample of N = 164 was utilized to assess the constructs within the measurement model. This model was designed as a reflective-reflective second-order model. Confirmatory factor analysis and model efficacy tests were conducted using SmartPLS 4 [36]. The selection of SmartPLS 4 was apt due to its ability to provide both exploratory and predictive insights into the revised model. As pointed out by Chin et al. (2003), this tool is also more flexible concerning sample size requirements [36].

The disjoint two-stage approach is used to evaluate the second-order model. To test the suggested research model in this study, we chose to employ the disjoint two-stage technique [37]. We assessed the model in the first stage of the disjoint two-stage technique involves using all of the lower-order components together while omitting the second-order construct [37]. As seen in Figure 2, the first stage model is used to assess the validity and reliability of all lower-order notions.

Using SmartPLS 4, the measurement model's reliability and validity were assessed. To confirm construct validity, calculations were made for Cronbach's alpha, composite reliability, and average variance extracted (AVE). The results were then benchmarked against the recommended thresholds: 0.70 for both Cronbach's alpha and composite reliability, and 0.50 for AVE [38,39]. This approach ensured a thorough examination of reliability and validity. The outcomes presented in Table 2 show that the measurement model is trustworthy [38,39].

Discriminant validity and convergent validity of the constructs were assessed to gauge their validity. Factor loading and AVEs were taken into account when evaluating the convergent validity of each construct. Using the heterotrait-monotrait (HTMT) matrix, discriminant validity was evaluated [40].

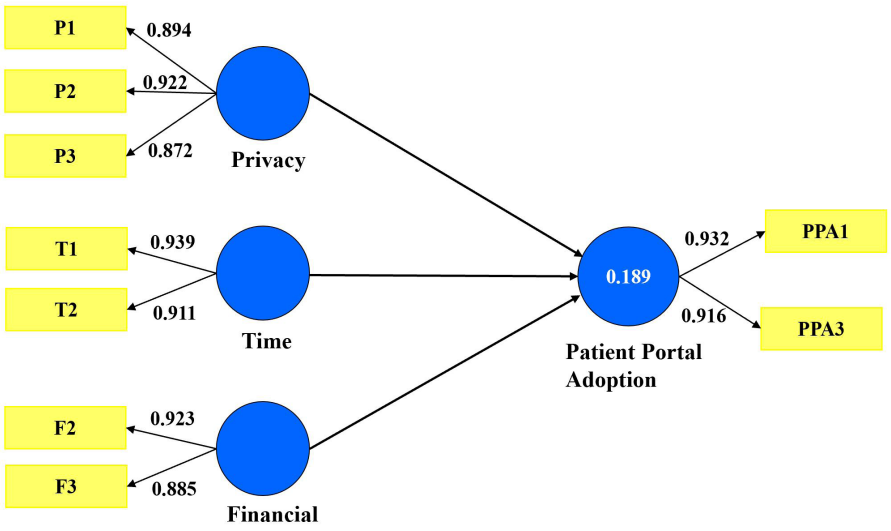

Figure 2. Results of first stage structural model

Table 2. Reliability and validity scores

	Cronbach's alpha	Composite reliability	AVE
Financial	0.779	0.9	0.818
Patient Portal Adoption	0.829	0.921	0.853
Privacy	0.878	0.924	0.803
Time	0.832	0.922	0.855

Table 3. HTMT matrix - correlations

	Financial	Patient Portal Adoption	Privacy	Time
Financial				
Patient Portal Adoption	0.524			
Privacy	0.72	0.336		
Time	0.802	0.404	0.491	

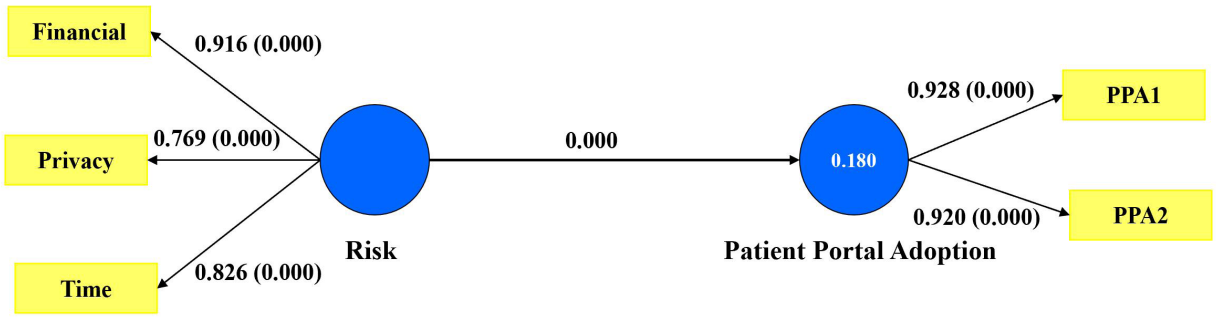

Figure 3. Results of second stage structural model

Table 4. Second-order constructs reliability and validity scores

	Cronbach's alpha	Composite reliability	AVE
Risk	0.789	0.876	0.704

Table 5. HTMT matrix - correlations

	Patient Portal Adoption	Risk
Patient Portal Adoption		
Risk	0.516	

Table 6. Collinearity statistics

	VIF
Financial	2.201
Patient Portal Adoption	2.001
Privacy	1.553
Time	1.729

Table 7. Hypothesis testing

	Path Coefficient	Standard deviation	T statistics	P values	Judgment
Risk -> Patient Portal Adoption	-0.424	0.081	5.24	0	Supported

The higher or second-order construct (Risk) in the second stage model is fed data from the latent variable scores of the lower-order first stage constructs in the second stage [37]. A second-order construct (Risk), which was included in the second stage model during its creation and estimation, was used. Figure 3 displays the second stage structural model and the path coefficients and R-square between the constructs. The size of the link between the two constructs is indicated by the path coefficients, while the proportion of a variable's variance that can be explained by another is indicated by the R-squared value. According to the analysis, the risk construct is responsible for 18% of the variance in adopting the patient portal.

In second stage, the measuring instruments' scale reliability, discriminant validity, convergent validity, and potential for common method bias were evaluated before assessing the structural equation model to enable hypothesis testing [37]. With Cronbach's alpha, composite reliability, and average variance extracted (AVE), which are higher than their respective standards of greater than 0.70, 0.70, and 0.50 in Table 4, the construct reliability and validity of the second-order concept are demonstrated. The HTMT matrix used to assess discriminating validity is displayed in Table 5. The second-order construct (Risk) in the second stage model is fed data from the latent variable scores of the lower-order first stage constructs in the second stage [37].

A collinearity analysis of all the constructs evaluating the common technique bias is displayed in Table 6 [41]. This model is devoid of common method bias, as shown by the absence of any VIF values above 3.3 in Table 6 [41].

The findings of the investigation on the connection between risk and the adoption of patient portals are shown in Table 7. The results show that patient portal adoption is negatively impacted by risk (=-0.424, P=.000), with financial, time, and privacy risks among emerging adults serving as the best predictors of risk behavior. The outcomes of the hypothesis testing are shown in Table 7. The hypotheses are supported by path analysis. In particular, the adoption of the patient portal is negatively impacted by risk, which is statistically significant.

The estimated model Normed Fit Index (NFI), was used to determine how well the model fits; nearer to 1 the NFI value is, the better the model fits. Evaluation of our model produced an NFI value of 0.73, which denotes a good model fit [42].

To verify the estimated model fit, the Standardized Root Mean Square Residual (SRMR) was also assessed [43]. SRMR calculates the discrepancy between the observed correlation and the matrix of correlations implied by the model. Because it gives an absolute estimate of the model fit, it makes it possible to assess the typical size of the discrepancies between expected and observed correlations. In general, a value less than 0.10 is seen as a sign of good model fit [43]. SRMR is a metric of PLS-SEM goodness of fit that can be used to avoid model misspecification [44]. The estimated model's SRMR value of 0.08 indicates a strong model fit [43].

Discussion

Findings

Based on the results of our research, we have confirmed that perceived risk negatively influences patient portal adoption and usage. Specifically, participants with greater perceptions of risk associated with patient portals demonstrated lower intentions to adopt and use the platform. Our conceptualization of perceived risk incorporates a second-order factor comprising privacy, financial, and time risk. If not effectively managed, these risk factors may impede technology adoption and utilization [33].

Concerning privacy risk, individuals who perceive a high-risk level may hesitate to share sensitive data or actively engage with the service [45]. A similar study focusing on patient portals in the context of HIV care identified privacy and security of information as significant risk factors [46]. This study underscores the importance of addressing privacy concerns to promote users' trust and confidence in utilizing patient portals for sensitive health information.

Likewise, financial risk perceptions can also impact user behavior. Individuals who perceive a high financial risk may display reluctance to make financial commitments or opt for basic versions of the service [45]. Addressing financial concerns through cost-effective measures and may mitigate such barriers and encourage wider adoption.

Furthermore, the perception of high-time risk can discourage users from learning how to use the service or dealing with potential complications [34].

By acknowledging and managing privacy, financial, and time-related risk factors, healthcare organizations can promote greater acceptance and utilization of patient portals, ultimately leading to improved self-management and health outcomes.

Theoretical and practical implications:

The theoretical implication is that perceived risk is a critical factor shaping individuals' attitudes and intentions toward adopting and using patient portals. This highlights the importance of considering risk perceptions as a key determinant in technology acceptance.

The study's findings highlight the importance of financial and time risks as major concerns among technology users. As mentioned in a medical economics article, certain vendors charge consumers a monthly fee for patient portals, with the cost varying depending on whether the portal is integrated or independently operated by a hospital [47]. Inconsistent services provided by these portals may lead individuals to perceive unnecessary costs and time wastage.

To address these concerns, implementing cost-effective measures, such as offering discounted portal services, can help mitigate patients' concern on financial risk. Moreover, enhancing user efficiency by organizing the portal layout effectively, ensuring quick loading times, and enabling

swift appointment scheduling can reduce the perceived time risk.

Concerns about privacy and security are the most frequent barriers to the use of health information technologies [48]. Patient trust in online apps is most significantly impacted by privacy issues [49,50]. The exposure of patients' sensitive information is the main privacy concern, raising concerns about the likelihood of information being leaked to relatives or third parties. Healthcare organizations should spread awareness of these issues, providing support and education emphasizing information security in the patient portal.

In the initial phases of navigating their healthcare, emerging adults might face obstacles in embracing and utilizing patient portals. Healthcare institutions and tech creators need to address these real-world concerns to boost the acceptance and use of patient portals among this age group."

Limitations and future work

One of the drawbacks of the study was the participant sample. The sample is only intended for college students and is valid for emerging adults. Future research may broaden the sample to include people from a variety of backgrounds, with a focus on health disparities and health literacy, in order to better understand the behavioral intentions of emerging adults toward the use and adoption of patient portals. Future research may also examine additional risk factors among emerging adults who use patient portals. The proposed theoretical model can be used to compare how elderly people and emerging adults intend to use and accept patient portals.

Conclusion

This study examined how emerging adults perceived the risks associated with using and accessing patient portals. The willingness of emerging adults to use patient portals can be attributed to risk as a primary consideration. The findings show that risk is a crucial factor influencing how emerging adults adopt and use patient portals. Considering these findings, it is advised that healthcare organizations develop education and training initiatives aimed at improving emerging adults' comprehension of patient portals, particularly about policies, practices, security, and services.

Furthermore, to mitigate risk factors, implementing cost-effective measures and emphasizing robust privacy policies, support, and training from healthcare organizations can encourage greater adoption and utilization of patient portals, ultimately leading to improved self-management and health outcomes.

Authors' contributions

Each author has participated and contributed sufficiently to take public responsibility for appropriate portions of the content.

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Competing interests

The authors declare no conflict of interest.

Institutional Review Board Statement

This research has been approved by the Institutional Review Board (or Ethics Committee) (IRB-22-444 and approved on August 22, 2022).

Informed consent statement

Informed consent has been obtained from all subjects participating in the study.

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