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Research article

The effect of the information systems literacy of emergency health employees on their technology acceptance levels

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Abstract

Background: Using mobile electronic health record (EHR) systems in emergency health services (EHS) will reduce the negativities that occur during handling cases and referrals to physicians. **Objectives:** This study aimed to examine the effect of the information systems literacy of the 112 EHS employees on their technology acceptance levels in the transition to the mobile EHR system.

Methods: In the cross-sectional study of 233 112 EHS employees, we collected the data through a personal information form, Information Systems Literacy (ISL), and Technology Acceptance Model (TAM) Scales. We evaluated the data via descriptive statistics, independent group t-test, ANOVA, Tukey HSD, Pearson Correlation, and Multiple linear regression analysis.

Results: The relation of the ISL of the 112 EHS employees with the number of shifts per month was at a low level, and the perceived usefulness (PU) and perceived ease of use (PEU) in technology acceptance was at a moderate level, and all the relations were positive and statistically significant. As a result of the SEM analysis, ISL had a moderate level and statistically significant effect on PU and PEU.

Conclusions: This is the first study revealing that emergency healthcare workers' information systems literacy directly affects their intention to use technology. Using digital technologies in emergencies will increase service efficiency by ensuring that health records are complete and accurate. It will allow healthcare professionals to save more time with patients.

Keywords

emergency health service, prehospital emergency care, information systems, information literacy, technology acceptance model, digital health record

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Introduction

The readiness for technology includes the tendency and belief of being able to use new technologies for the purpose and goal employees determine. This belief is determined by employees' tendency to accept, adopt, and interact with technology and their ability to use it.[1]

Information systems (IS) are formal, socio-technical organizational systems designed to collect, process, store, and distribute information.[2] Organizations use information and communication technologies to support their business processes and how their people interact with that technology.[3] The healthcare field is one of the sectors that use systems intensely, as in all organizations. Information Systems Literacy (ISL) combines computer and information literacy with the development of artificial intelligence and deep learning. This suggests that information systems software such as web, mobile, and personal computers can be used separately and effectively.[4] With the pandemic, this concept has become more critical, especially for healthcare professionals. ISL can be defined for healthcare professionals as "the ability to search, find, understand, and evaluate information from electronic sources and apply it to address or resolve the information obtained".[5] Technological advancements are closely followed in order to increase service quality and to have a competitive advantage by obtaining high productivity. Therefore, 112 Emergency Health Services (112 EHS) employees need to adopt and use

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technology effectively since it has direct positive or negative effects on their work conditions.[6] Protecting the health records of patients by storing them in the digital environment and obtaining retrospective information makes the need for information technologies obligatory.[7] When authorized healthcare professionals can access patients' disease information at any time and place, employee performance and success improve.[8] The fact that using information technologies has become inevitable in the health sector forces 112 EHS employees to use technology. However, since the technology acceptance levels of the employees are not the same, their knowledge and experience about information technologies are different.

In the digital transformation process, together with globalization, employees come across new information technologies in their business lives as well as in their daily lives, and they are expected to make it a part of their work. Digital literacy (DL), as the fundamental component of digital transformation, is a skill set that includes the competence, awareness, and attitude of individuals to use digital tools and resources for conscious, effective, and constructive social actions.[9] Whether employees are ready for new developing information technologies determines the strategies of the institution they work for regarding the spread of these technologies.[10] While employees ready for technology accept technological developments rapidly, the adaptations of those who are not prepared for technology take time. It is known that employees who are able to use information technologies adapt to the work they do and work more efficiently.[11] Therefore, the readiness of 112 EHS professionals for information systems technology is essential. The most crucial step to be taken to create an information society is to increase and generalize ISL through using information systems technology efficiently.[12] Improving and generalizing information systems technology ensures strengthening teamwork in a digital environment by increasing communication through computers and digital technologies and producing solutions for problems by using the internet efficiently.[13] Fred D. Davis developed the "technology acceptance model" (TAM) in 1986 to determine individuals' behaviors of technology acceptance.[14] This model has two objectives. The first one tries to estimate whether users accept computer-based information systems, and the second model explains which changes should be made in knowledge-based information systems in order to increase the acceptability.[15] Individuals' decision of using or not using a technology is determined by two dimensions perceived usefulness (PU) and perceived ease of use (PEU). While PU expresses the belief level of an individual that using a particular system will increase their performance at work, PEU is the belief level of an individual that using a specific system does not require a special effort.[14]

Technologies that users perceive as applicable are more likely to be adopted and integrated into their workflows, leading to increased productivity and efficiency. A system with a high PEU reduces cognitive load, allowing users to focus on their tasks rather than on the technology itself. PEU affects PU: If a system is easy to use, users are more likely to see its usefulness, which further increases adoption and performance gains. According to this model, individuals tend to use the technologies that they believe will be useful for facilitating their work, and the use of which is easy. In healthcare, PU and PEU play an important role in improving performance in the adoption of new medical technologies, electronic health records (EHRs), telemedicine, and AI-based diagnostic tools. For example, in the adoption of EHR systems, if healthcare professionals believe that an EHR system will improve patient care by providing quick access to patient history, they will be more likely to use it. If the system has an intuitive interface and is easy to use with minimal training, adoption will be accelerated. This, in turn, will improve performance by reducing medical errors, increasing documentation efficiency, and improving patient outcomes. Research shows that when health technologies are perceived as useful and easy to use, they are more likely to be adopted by healthcare professionals, leading to improved performance and better patient outcomes.[16–18] A study of nurses found that PU and PEU mediate between technology sophistication (TS) and nurses' performance improvements.[19] The study also states that PU improves performance by increasing efficiency, accuracy, and quality of patient care, while PEU enhances performance by reducing stress, improving workflow, and promoting faster adoption.[19]

In the digital age, organizations are dependent on digital technology in most of their business processes. Therefore, employees' skills, attitudes, and intentions toward using digital technology are important for organizational performance. Parasuman revealed in his study that technology has both negative and positive effects, and the emotions it creates may cause differences in individuals' tendency to use it.[20] As a result, he divided people's attitudes toward technology into four parts: optimism, innovativeness, discomfort, and distrust. While optimism and innovativeness constitute the driving force, discomfort and distrust are identified as retarding factors.[20]

Objective

As of January 13, 2021, Emergency Health Services processes in our country, which were conducted by filling out all information on paper case forms, have begun to be digitized with the gradual implementation of the "Smart Ambulance" and "Tablet Application" initiated by our Ministry of Health.

All information on paper case forms was completed by reading to the physician and obtaining their wet signature upon the patient's referral to the health care facility. The physician was responsible for storing the copy of the case form handed to them. After the physician's signature, further markings could be made on the paper-based case

form, allowing for independent actions apart from the physician. To eliminate such and similar drawbacks, a digital case form application working on mobile devices has been developed, and the paper case form has been eliminated. Physicians complete patient admissions by signing the biometric signature field in the application, and they can view the information of all cases they sign digitally. The patient delivery process is completed upon the physician's approval of the digital signature field.

Mobile EHR systems can help reduce errors associated with illegible handwriting, misplaced documents, and incomplete medical histories. This, in turn, can enhance patient safety and prevent adverse events. In legal and judicial situations, physicians can download the digital form and submit it to the necessary authorities. This enables physicians to instantly view patient information upon receipt, avoiding issues if they cannot access the paper copy and ensuring that the emergency team can make no changes after the form is sealed with a time stamp.

While the adoption of mobile EHR systems holds significant promise for improving emergency healthcare delivery, it's essential to address challenges such as data security, interoperability, and user training to maximize their effectiveness and ensure successful implementation.

According to Davis's technology acceptance models based on rational action theory, the successful implementation of new Technologies depends on various factors.[14,21,22] The use of new technology has different levels of acceptance. Igbara and Iivari proposed a framework that further developed Davis' model based on social cognitive theory (SCT).[22] SCT provides a theoretical basis for understanding individuals' behavioral and emotional responses to computational technologies. According to this framework, technology acceptance is affected by individual factors and environmental elements such as computer experience and institutional support.[22] There are also studies in the literature showing that information literacy (IL) and digital literacy (DL) are new antecedents of the technology acceptance model.[23–25] Nikou et al. stated that employees' DL and IL levels have a direct effect on the perceived ease of use of technology but not on perceived usefulness, and both literacies have an indirect effect on the intention to use digital technology at work through attitudes toward the use.[23] There is no study in the literature examining the role of these new antecedents in technology acceptance from the perspective of healthcare professionals. Our study aims to fill this gap in the literature. For this purpose, a conceptual model was created that included PU and PEU structures from the SCT and TAM framework, which included the ISL dimension.

This study aims to analyze the effect of the information systems literacy of 112 EHS employees on technology acceptance levels in the process of recording case registration forms in the digital environment. No study has been conducted on 112 EHS employees regarding these variables, and no studies have been conducted on these variables in the national and international literature review. In this respect, it is thought that this study will be original research by analyzing the issue comprehensively and will contribute to the literature.

The study seeks answers to the following questions:

- Is there a significant relation between the TAM levels of 112 EHS employees and their ISL levels?
- How do the TAM levels of 112 EHS employees affect their ISL levels?
- Is there a significant difference between the demographic-socio-cultural and work-life variables of the 112 EHS employees and the score average of the ISL scale?
- Is there a significant difference between the demographic socio-cultural and work-life variables of 112 EHS employees and TAM scale total score averages and the score averages of the subscales of PU and PEU?

Methods

Study group

The population of this cross-sectional study includes 600 employees, including physicians, paramedics, and emergency medical technicians, working for 112 EHS in the center and districts of Kayseri. The sample size was determined as 235 with a 95% confidence interval and a 5% margin of error, and 233 112 EHS employees were included in the study.

Data collection tools

The survey consisted of three parts, as shown in the Appendix. We used a personal information form including the demographic and socio-cultural characteristics of the 112 EHS employees, the ISL Scale, and TAS as data collection tools in the study. A volunteer consent form was added to the first item of the survey administered online to 112 EHS employees via Google Forms, and volunteer participants completed the survey after answering yes in the relevant column.

Information systems literacy (ISL) scale. Sebetçi (2019) developed the scale and completed its validity-reliability study.[26] It is a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree), including eight items and one dimension. All items in the scale are affirmative. As the score increases, the ISL level also increases. The Cronbach's Alpha (α) value of the scale was calculated as 0.94 in this study.

Technology acceptance model (TAM)scale. Davis (1989) developed the scale, and Yeke et al. (2019) adapted it to Turkish. A validity-reliability study was conducted.[14,27] This 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree)

Table 1. The descriptive statistics of the subscales of the research variables.

Scale dimensions	Cronbach alpha	Arithmetic mean	Standard deviation	Min	Max	Skewness	Kurtosis
Information Systems Literacy	0.938	4.32	0.78	1.5	5	−1.212	0.900
Perceived Usefulness	0.972	4.48	0.79	1.33	5	−1.423	1.466
Perceived Ease of Use	0.961	4.42	0.72	1.5	5	−1.255	1.374

includes 12 items and two subscales as perceived usefulness (PU) and perceived ease of use (PEU). The reliability values of the subscales were found as $\alpha = 0.97$ for the PU subscale and $\alpha = 0.96$ for the PEU subscale.

Statistical analysis

We used the IBM SPSS Statistics program version 26.0.0.0 and AMOS 24 programs for the analysis. Multivariate normal distribution measurement was analyzed using the Skewness and Kurtosis test and presented in Table 1. Tabachnick and Fidell state that the data can be accepted as normally distributed in the cases where the sample group was greater than 50, and the skewness and kurtosis values are between +1.5 and −1.5.[28] Since the scale items' scores did not exceed the limit scores, it was considered that these scales and their subscales were normally distributed, and parametric test techniques were used in the study. We used Tukey (post-hoc test) as the multiple comparison analysis. In the evaluation of the relation between variables, the Pearson correlation coefficient was calculated. We used multiple linear regression analysis in the multivariate assessment of the relation between ISL and TAM scale subscales. We tested the conceptual model created by structural equation modeling (SEM) and presented the results in a diagram. SEM is a comprehensive statistical method widely used in many scientific fields to simultaneously analyze the causal and mutual relationships between observed and latent variables.[29] In addition, we indicated summary concordance and the size of the relations by beta values. The significance level was accepted as $p < 0.05$ in the statistical evaluations.

Results

The age average of the individuals in the research group was 33.04 ± 5.44. 58.8% of the participants were female, 75.1% were married and 47.2% had bachelor's degree. 27.9% of them had a working time of 6–10 years in the profession, and 35.6% had been registered with records related to their duty in the digital environment for 7–9 years.

It is seen that the ISL of the 112 EHS employees is high, with a score of 4.32, and their PU score in the TAM is 4.48, which is higher than the score of PEU (Table 1).

It was determined that 82.8% of the 112 EHS employees had received digital health registration training, and 54.9% stated that they had received in-service training. 93.1% of the EHS professionals stated that digitalization of the case registration forms had made things easier (Table 2).

The TAM scale PU subscale scores of the 112 EHS professionals did not reveal a statistically significant difference in terms of gender. Still, the usefulness female participants perceived was higher than the male ones. In addition, the PU subscale scores of those stating that the digitalization of the case registration forms had made their work easier were significantly higher than those who thought that it had not made things easier (Table 2). Analyzing the PEU subscale scores of 112 EHS employees according to their length of service in the profession, we found a statistically significant difference between the scores of those who worked in the profession for 1–5 years and those who worked for 16–20 years (Table 2). As for the state of receiving digital health record training, we found that those receiving training had statistically significantly higher scores on the ISL scale and PEU when compared to the participants who did not have training (Table 2).

Analyzing Table 3, we determined that the PEU participants perceived in TAM had a low level of statistically significant negative relation with their ages ($r = -0.138$, $p < 0.05$), a low level of statistically significant relation with the number of shifts per month ($r = 0.132$, $p < 0.05$), a moderate level of statistically significant positive relations with ISL scores ($r = 0.683$, $p < 0.01$) and the PU scores in TAM ($r = 0.665$, $p < 0.01$). We found that the relation of the ISL of the 112 EHS employees with the number of shifts per month ($r = 0.153$, $p < 0.05$) was at a low level, and with the PU ($r = 0.516$, $p < 0.01$) and PEU($r = 0.683$, $p < 0.01$) in TAM was at a moderate level. All the relations were positive and statistically significant.

We determined in the SEM analysis that ISL affected PU at the level of $\beta = 0.585$ ($t = 7.868$) and PEU at a level of $\beta = 0.782$ ($t = 9.866$). The effect was at a moderate level and statistically significant ($p < 0.001$)(Table 4). We found that the items in the scales represented the whole significantly and strongly (Figure 1). The goodness of fit values of the structural equation modeling created: chi-square/degree of freedom was determined as $(402.243/153) = 2.629$, GFI = 0.868, TLI = 0.923, IFI = 0.939, CFI = 0.938and RMSEA value as0.074. We found that the model was concordant with the data and acceptable according to the goodness of fit values.[29,30]

Table 2. The distribution of information systems literacy scale and technology acceptance scale scores regarding Various variables.

Variables		n (%)	Information systems literacy	Technology acceptance levels	
				Perceived usefulness	Perceived ease of use
Gender	Female	137 (58.8)	4.34	4.57	4.44
	Male	96 (41.2)	4.29	4.35	4.39
	p		0.598	0.034*	0.545
Marital Status	Single	58 (24.9)	4.31	4.44	4.47
	Married	175 (75.1)	4.32	4.49	4.40
	p		0.925	0.636	0.519
Educational Background	High school	9 (3.9)	4.43	4.26	4.48
	Associate Degree	96 (41.2)	4.32	4.57	4.44
	Bachelor's Degree	110 (47.2)	4.35	4.45	4.43
	Graduate	18 (7.7)	4.06	4.30	4.24
	p-value		0.515	0.377	0.731
Working Time in the Profession	1–5 Years	35 (15.0)	4.55	4.62	4.68^{a}
	6–10 Years	65 (27.9)	4.36	4.54	4.47^{ab}
	11–15 Years	64 (27.5)	4.39	4.48	4.46^{ab}
	16–20 Years	59 (25.3)	4.08	4.39	4.21^{b}
	21 years and above	10 (4.3)	4.21	4.15	4.15^{ab}
	p-value		0.055	0.398	0.021*
Unit	Emergency Health Service Station	207 (88.8)	4.30	4.47	4.41
	Command and Control Center	12 (5.2)	4.61	4.71	4.57
	Other #	14 (6.0)	4.29	4.47	4.42
	p-value		0.400	0.586	0.766
The period of registration of the work-related records on the digital environment	1–3 years	45 (19.3)	4.15	4.39	4.41
	4–6 years	47 (20.2)	4.45	4.59	4.48
	7–9 years	83 (35.6)	4.35	4.51	4.44
	10–12 years	31 (13.3)	4.19	4.40	4.32
	13 years and above	22 (9.4)	4.46	4.42	4.39
	p-value		0.251	0.729	0.896
The State of Receiving Training on Digital Health Record	Yes	193 (82.8)	4.41	4.51	4.47
	No	40 (17.2)	3.87	4.33	4.20
	p-value		0.000***	0.186	0.035*
The way of receiving digital health record training	University education	14 (6.0)	4.73	4.76	4.80
	In-service training	128 (54.9)	4.44	4.53	4.44
	From colleagues	23 (9.9)	4.34	4.38	4.45
	Other ##	28 (12.0)	4.17	4.39	4.45
	p-value		0.099	0.387	0.338
The state of the making things easier of the digitalization of the case registration form	Yes	217 (93.1)	4.33	4.52	4.44
	No	16 (6.9)	4.22	3.99	4.13
	p-value		0.595	0.010**	0.087

Note: *$p < .05$, **$p < .01$, ***$p < .001$, a, b, c: There is no difference in the groups having the same letters.
#Those working in the hospital and administrative units. ##Certification programs, social media and, etc.

Table 3. Correlation analysis results regarding age. Number of Shifts. Information Systems Literacy and Technology Acceptance Subscales.

Variables	1.	2.	3.	4.	5.
1. Age ($\bar{X} = 33.04 \pm 5.44$)	1				
2. Number of Shifts per Month	0.102	1			
3. Information Systems Literacy	−0.105	**0.153***	1		
4. Perceived Usefulness	−0.041	0.127	**0.516****	1	
5. Perceived Ease of Use	**−0.138***	**0.132***	**0.683****	**0.665****	1

Note: *$p < .05$, **$p < .01$, ***$p < .001$.

Table 4. SEM analysis results.

	Dependent variables			
	Perceived usefulness		Perceived ease of use	
Predictor variables	β	SH	β	SH
Information Systems Literacy→Perceived Usefulness	0.585***	0.094		
R^2	0.34			
Information Systems Literacy →Perceived Ease of Use			0.782***	0.099
R^2			0.61	

Note: *$p < .05$, **$p < .01$, ***$p < .001$.

Discussion

There are numerous studies in the national and international literature on computer use by healthcare professionals in healthcare services. These studies aim to determine the ISL levels, TAM levels, and DL levels of healthcare professionals and their attitudes toward electronic medical record systems and information systems.[5,31–34]

In our study, we found the usefulness that female participants perceived in technology acceptance statistically higher. TAM differs in terms of gender in the literature.[35] We determined that the PU subscale scores of the participants stating that the digitalization of the case registration forms made their work easier were found to be significantly higher when compared to those who thought it did not make things easier. In a study conducted to evaluate the DL levels of the employees working in healthcare services and their attitudes towards information systems, it was found that they had a high level of DL, they had confidence in using technology, and they developed positive attitudes towards information systems.[36]

When we analyzed the PEU subscale scores of the 112 EHS professionals in terms of the working time in the profession, we found statistically significant differences between the scores of those working for 1–5 years and the ones working for 16–20 years. The ISL scale scores and the PEU scores of the 112 EHS employees who had received digital health record training were found to be significantly higher. In a study conducted across Turkey, it was found that ISL levels differed in terms of position, educational state, and income state but did not differ in terms of gender.[37]

In the study, the PEU scores in TAM of the EHS professionals had a low-level negative relation with their ages, a low-level positive relation with the number of shifts per month, and there was a moderate level of positive relation between ISL scores and the scores of the PU in TAM. All the relations were statistically significant. There was a low-level correlation between ISL and the number of shifts per month and a moderate positive correlation between the PU and PEU in TAM. The correlations were statistically significant. In the literature, no study was found on the effect of the ISL levels of 112 health professionals on their TAM levels in the process of recording to the digital environment. However, in a study conducted on healthcare professionals, it was found that the age, working field, educational status, and the state of receiving computer training previously of the primary healthcare center professionals had a significant relation with their habits of using computers.[32] In addition, in a study analyzing the application of TAM on healthcare services, more than 20 studies related to clinicians using health information technology for patient care were analyzed. It was determined that the health information technologies analyzed had great differences in terms of research models, correlations tested, and structure operationalization. While some TAMs were found significant, some were inconsistent.[38]

In addition, we found that PU and PEU positively affect the acceptance of technology by healthcare workers in ISL. Similar to our results, Borekci and Celik (2024) stated that the DL levels of university students have a direct positive effect on perceived PU and PEU.[25] Nikou et al. found that the DL and IL levels of employees in different sectors have a direct effect on perceived ease of use of technology but not on perceived usefulness.[23] Compared to other studies on ISL and TAM fields, we concluded that our study had similar results to the large part of the literature, but different results were also observed.

Conclusion

The study revealed that the correlation between the two structures was moderate and had a significant coefficient in the structural equation modeling analysis created to confirm the effect of the ISL on the PU and PEU in TAM on a model.

The use of all kinds of information software and hardware related to healthcare, from emergency health services to lifelong health, from early diagnosis to differential diagnosis, on

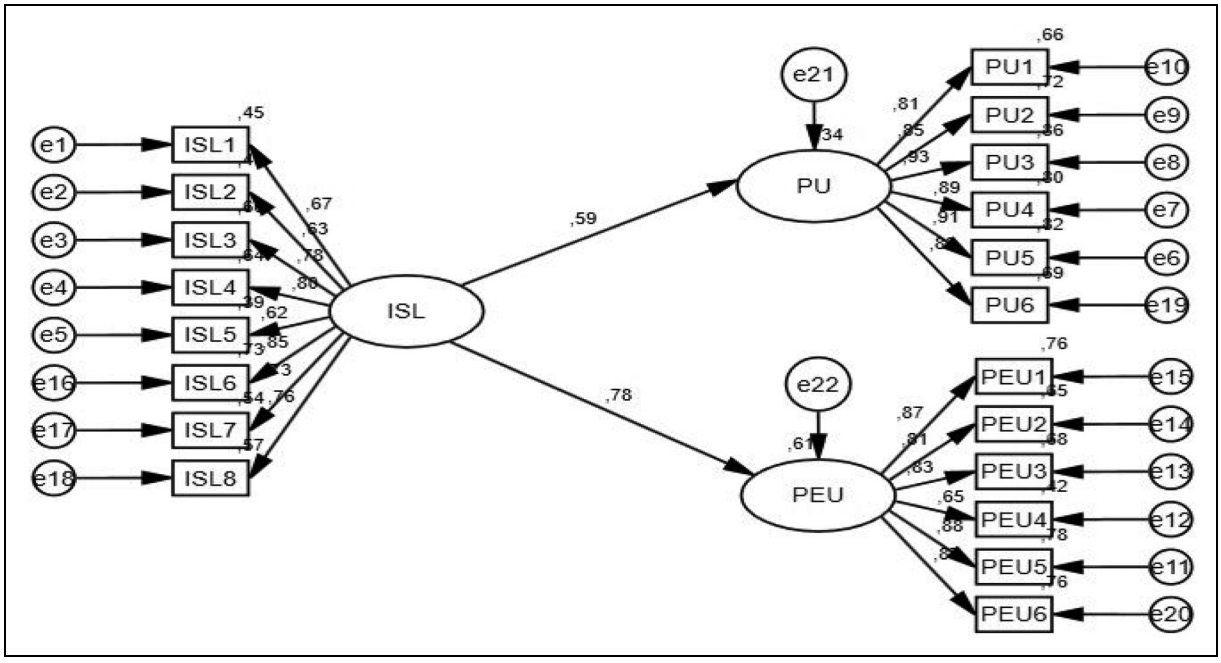


Figure 1. The structural equation modeling analysis of the effect of information systems literacy on the perceived usefulness and perceived ease of use in technology acceptance.

both mobile and computer-based devices has become mandatory for healthcare professionals. Information systems literacy of healthcare professionals at all levels of healthcare services is important for increasing individual and organizational performance. This study is the first study to address information systems literacy, which combines digital literacy and information literacy, from the perspective of emergency healthcare workers. The study also shows that information systems literacy has a direct impact on the intention to use technology. Effective use of digital technologies by healthcare professionals who create the first electronic health record in emergencies will ensure that records are kept completely and accurately. This will allow healthcare professionals to provide healthcare services more efficiently and use their time in a way that will benefit patients more. For this reason, policymakers should provide more in-service training to increase the literacy skills of healthcare workers to increase their level of acceptance of digital technologies. Within the scope of the digital transformation process, it is of great importance to develop policies and strategies to encourage healthcare workers to use digital technologies effectively in every environment.

Strengths and weaknesses of the study

The fact that this study analyzed ISL and TAM practically, especially EHS professionals, is believed to be a superior study among the others conducted to analyze the issues in question in health services.

The limitation of the study is that the sample is limited to only Kayseri City and 112EHSs.

Recommendations for further studies

We analyzed the effect of ISL on PU and PEU in the study and revealed that there was a moderate statistically significant relation between the two structures. It is thought that in future studies, researchers investigating the variables of "Information Systems Literacy" and "Technology Acceptance" for other healthcare professionals in terms of digital hospitals will provide significant contributions to the literature.

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Ethical considerations

This study was approved by the Ethical Committee of Kayseri University (25.11.2022 dated and 43397 numbered approval).

Informed consent

Informed consent was obtained from all participants.

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