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Using the logistic regression model to analyze the factors influencing the acceptance of digital health services: An applied study

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المستخلص:

في ظل التطورات التكنولوجية المتسارعة، أصبحت الخدمات الصحية الرقمية جزءًا مهمًا من أنظمة الرعاية الصحية الحديثة. وتُستخدم هذه الخدمات مثل تطبيقات حجز المواعيد الطبية، الاستشارات عن بُعد، والسجلات الصحية الإلكترونية بهدف تسهيل الوصول إلى الخدمات وتحسين جودة الرعاية. ورغم فوائدها المتعددة، لا تزال نسبة من الأفراد تحجم عن استخدامها لأسباب مختلفة مثل ضعف الثقة بالتكنولوجيا، أو قلة الخبرة، أو الفجوة الرقمية.

يسعى هذا البحث إلى تحليل العوامل التي تؤثر في قبول الأفراد لاستخدام الخدمات الصحية الرقمية، من خلال دراسة ميدانية شملت عينة من 150 مشاركًا. وقد تم استخدام نموذج الانحدار اللوجستي الثنائي لتحليل العلاقة بين المتغيرات (مثل: العمر، التعليم، الدخل، الثقة بالتكنولوجيا، والخبرة السابقة) وبين قرار استخدام هذه الخدمات (نعم/لا).

أظهرت النتائج أن هناك علاقة ذات دلالة إحصائية بين بعض هذه العوامل، حيث تبين أن الثقة بالتكنولوجيا، والمستوى التعليمي، ووجود خبرة سابقة تُعد من أبرز المؤثرات الإيجابية على قرار الاستخدام. بينما كانت الفئات ذات الثقة المنخفضة أو غير المتمرسة بالتكنولوجيا أقل ميلاً إلى استخدام الخدمات الرقمية الصحية. يوصي البحث بضرورة تعزيز التوعية الرقمية والتدريب، خاصة للفئات الأقل استخدامًا، وتبسيط التطبيقات الصحية لتناسب مختلف المستخدمين، من أجل رفع مستوى القبول والاستفادة من هذه الخدمات

الكلمات المفتاحية : الانحدار اللوجستي، الخدمات الصحية الرقمية، قبول التكنولوجيا، الثقة بالتكنولوجيا، الخبرة السابقة، النماذج الإحصائية، تحليل البيانات، السلوك الصحي الرقمي، نية الاستخدام، الابتكار الصحي.

Abstract:

In light of rapid technological advancements, digital health services have become an important part of modern healthcare systems. These services, such as medical appointment booking apps, teleconsultations, and electronic health records, are used to facilitate access to services and improve the quality of care. Despite their multiple advantages, a portion of individuals still refrain from using them for various reasons, such as low trust in technology, lack of experience, or the digital gap. This study aims to analyze the factors influencing individuals' acceptance of digital

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health services through a field study involving a sample of 150 participants. In order to analyze the relationship between the variables, the binary logistic regression model was used, (such as age, education, income, trust in technology, and previous experience) and the decision to use these services (yes/no). The results revealed a statistically significant relationships between some of these factors, indicating that trust in technology and educational level. Previous experience is considered one of the most significant positive influences on the decision to use. Meanwhile, groups with low trust or limited experience with technology were less likely to adopt these services. The study recommends enhancing digital awareness and training, especially for less frequent users, and simplifying health applications to suit different users, in order to increase acceptance and utilization of these services.

Keywords: Logistic Regression, Digital Health Services, Technology Acceptance, Trust in Technology, Prior Experience, Statistical Models, Data Analysis, Digital Health Behavior, Intention to Use, Health Innovation Abstract.

1-Introduction

In recent years, it has been concluded that there is great importance development in digital health services and a major shift toward digitization, technology becoming an integral part of healthcare delivery. This includes through smartphone applications or online platforms that facilitate appointment bookings, remote medical consultations, and access to test results. Digital health services such as electronic medical consultation apps, appointment scheduling, and accessing medical reports have become widely available. In recent decades, the world has witnessed considerable advancements in information and communication technology, and this development has extended to the healthcare sector, which is one of the vital sectors directly linked to human health and quality of life. The accelerated digital transformations, especially after the COVID-19 pandemic, have pushed healthcare institutions to adopt new models based on delivering health services remotely, such as medical smartphone applications, electronic health consultation platforms, health tracking systems, and digital health records. Although these digital innovations aim to enhance the efficiency and quality of health field and reduce the burden on the traditional health care systems, acceptance and usage levels vary across different segments of society. The adoption process is influenced by several factors such as age, education level, income, technological culture, trust in digital systems, and prior experience with health applications. Therefore, it is an essential to study these factors scientifically and systematically to understand user behavior toward these services and identify challenges that hinder their widespread adoption. This study targets to analyze the influencing factors individuals' acceptance of using digital health services (the dependent variable). It investigates variables (such as age, education, income, trust in technology, and previous experience) that affect their use, through a field study involving a sample of 150 participants. Logistic regression it is one of the most prominent statistical models used to analyze the factors influencing a binary dependent variable (such as service usage - yes/no). This model is characterized by its ability to estimate the probability of something happening based on several independent quantitative or qualitative variables. This model has proven effective in many medical and social studies, particularly when examining individuals' behaviors toward new technologies. Accordingly, this study aims to analyze the factors affecting individuals' decisions regarding the acceptance and use of digital health services, through designing a field questionnaire and analyzing the data using the binary Logistic Regression model. The expected results will contribute

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to guiding digital health policies and improving strategies for deploying and utilizing of these services, especially among groups that remain hesitant or lack sufficient technical knowledge.

2- Study Problem

What demographic and technological factors statistically influence individuals' likelihood of accepting digital health services, from a statistical perspective.

3- Study Objectives

• Identify the factors influencing the decision to use digital health services.

• Use a binary logistic regression model to estimate the impact of explanatory/independent variables.

• Provide recommendations to enhance the adoption of these services among the population.

4- Importance of the Study

• Enhance the efficiency of utilizing digital health resources.

• Enhance the use of statistical models to analyze individual behavior.

• Support decision-makers in developing digital health services that effectively address community needs.

5- Study Hypotheses

1. There is a statistically significant relation among demographic variables (age, education, gender) and the use of digital health services.

2. Trust in technology plays a key adoption procedures of services.

3. Previous experience with digital health applications increases the likelihood of their acceptance.

6. Methodology

• A quantitative approach was employed using an electronic questionnaire distributed to 150 individuals from the general community (students, employees, patients), and the data were entered into SPSS and Using binary logistic regression to analyze the effect of independent variables on the dependent variable (service usage: yes/no).

This study combines theoretical frameworks and statistical models to explain and predict individuals' behavior towards the acceptance of digital health services, by integrating behavioral concepts and quantitative models.

The study employed simple descriptive analysis (means, frequencies, percentages), using the Chi-square (x^2) test (for the relation among qualitative variables).Model goodness-of-fit test (Hosmer-Lemeshow). Nagelkerke R^2 coefficient.

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7. The Relational Framework

Based on the normal of the available data, several independent variables have been identified that are presumed to influence the decision to use the digital service: (1 = Yes, 0 = No) the dependent variable. These have been classified into more than four types, which are: (gender (male, female), age group, education level, income level, level of trust in technology, previous experience with digital services). The study assumes that gender (male/female) have a clear impact on the decision to use the service, and there are no significant differences among age groups in service usage. Similarly, income level does not strongly explain the use of the service. However, individuals with higher education are more receptive to digital services, and lower levels of trust correspond to decreased likelihood of using these services. Finally, those with prior experience are more inclined to use the digital service.

* these finding are consistent with previous studies.

8. Theories, Equations, and the Statistical Model Used

This study is based on a mix of theoretical frameworks and statistical models to explain and predict individuals' behavior towards the acceptance of digital health services, by integrating behavioral concepts and quantitative models.

1: Theories Associated with Digital Adoption Behavior l. Technology Acceptance Model (TAM)Developed by Davis in 1989, it is one of the most widely used models for explaining individuals' behavior towards technology.

This theory posits that the decision to use technology is affected by 2 primary factors:

• Perceived Usefulness (PU): The extent to thought the user believes that by using the system his performance will be enhanced..

• Perceived Ease of Use (PEOU): The degree to thought of the system is easy to use.

These two factors influence the behavioral intention to use the system, which subsequently affects actual usage behavior.

2: Theory of Planned Behavior (TPB) proposed by Ajzen (1991) posits that an individual's behavior can be predicted by:

• Attitudes

• Subjective Norms

• Perceived Behavioral Control

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This study aids in understanding the psychological and social motives behind the use of digital services. This study employs a binary logistic regression model to analyze the relation among a set of independent variables (such as age, education, trust in technology) and a binary dependent variable (service usage: yes/no) .

9. The binary logistic regression model:

$$logit(p)=log((p)/(1-p)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Where:

• p: the probability of using digital health services.

• β_0: (the constant (the intercept).

• β_1, β_2,.....: regression coefficients for each variable.

• *X1, X2,* .....: (the independent variables (such as trust, education. Conversion equation from logit to probability:

$$p = \frac{1}{1+e^{-logit(p)}}$$

The parameters of the binary logistic regression model are estimated using the maximum likelihood estimation method.

10. The applied study:

The statistical analysis of the results of the logistic regression model using the SPSS software package after coding the data as explained in Table (1), which details to the independent variables, and then entered it into the computer to obtain descriptive information for the study sample. However, represents the codes for the values of the dependent variable of service usage (Yes = 1, No = 0), in order to obtain the optimal assessment of the model parameters through the maximum likelihood method.

Table (No. 1): List of variables in the digital health database

s	Variable name in table	Description	Values/Coding	Variable type
1	Use Service	Represents whether the participant is using a digital health service	Yes = 1 No = 0	binary function
2	Gender	To determine the effect of gender on use	Male = 1 Female = 0	Independent
3	Age Group	Sorted age groups	0 = 25–40 (Reference) 1=<25 , 2=>40	Independent

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4	Education Level	Education as an indicator of digital awareness	= 0 = Primary (reference), Secondary =1 , University =2 , Postgraduate = 3	Independent
5	Income Level	as an economic factor	0=500k-1M (Reference) 1=500>K 2=>1M	Independent
6	Trust Level	Technology Confidence Scale	(High (Reference = 0 Medium = 1 Low = 2	Independent
7	Prior Experience	To measure the behavioral impact of experience	Yes =1 No =0	Independent

Table (2)

Iteration History[a,b,c]

	Iteration	-2 Log likelihood	Coefficients Constant
Step 0	1	167.895	1.013
	2	167.593	1.114
	3	167.593	1.116
	4	167.593	1.116

a. Constant is included in the model.

b. Initial -2 Log Likelihood: 167.593

c. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table No. (2) shows the iterative cycles of the maximum likelihood derivative to obtain the lowest value for negative double the logarithm of the optimal estimation function for the study's parameters. In cycle (4), we obtained the lowest value, which is (167.593). Thus, we obtained the lowest differences between the coefficients, which is the best result.

a. Variable(s) entered on step 1: gender, age, education, income, trust in technology, previous experience, predicted group.

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11. Main conclusions from the statistical analysis of behavioral variables

Table (3)

Summary of the most important results

s	variable	value	P-Value	parameter β	Step1(a)
1	(Constant)	1	.058	1.560	(Constant)
2	(Gender)	1	.840	.093	X_1
3	(Age Group)	1	.186	.825	X_2
		2	.784	.166	X_3
4	(Education Level)	1	.178	-1.234	X_4
		2	.058	-1.297	X_5
		3	.871	.123	X_6
5	(Trust Level)	1	.018	2.077	X_7
		2	.007	1.281	X_8
6	(Prior Experience)	1	.027	-1.422	X_9
		2	.016	-.435	X_{10}

From Table (3) presents the results of the binary logistic regression analysis used to identify the main factors influencing the use of digital health services. The findings indicate that the trust level and prior experience variables are statistically significant predictors of service adoption, as their P-values (0.007 and 0.027 / 0.016 respectively) are less than the 0.05 significance threshold. This implies that individuals with higher trust in digital technologies and those who have previous experience using such platforms are more likely to adopt digital health services.

On the other hand, the variables gender, age group, and education level are statistically insignificant, as their P-values exceed 0.05. This suggests that these demographic factors do not have a meaningful impact on the decision to use digital health platforms in the current sample. Although education level shows a value near the significance level (P = 0.058), its effect remains statistically weak.

Overall, the results highlight that behavioral and experiential factors, rather than purely demographic ones, play a more decisive role in influencing individuals' acceptance and actual use of digital health services.

12. Estimated Equation for the Binary Logistic Regression Model

$$logit(p)=log(\frac{p}{(1-p)}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

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$$log(\frac{\hat{p}}{(1-\hat{p})}) = 1.560 + .093x_1 + .825\ X_2 + .166\ X_3 - 1.234\ X_4 - 1.297\ X_5 + .123X_6 + 2.077X_7 + 1.281X_8 - 1.422X_9 - .435X_{10}$$

Based on the results presented in Table (5), the estimated logistic regression model explaining the probability of using digital health services (Y) can be expressed as follows: Interpretation of the Model

• Constant (β = 1.560):

This represents the expected value of the logit of the probability when all independent variables are equal to zero. It reflects the baseline tendency to use digital health services in the absence of other influencing factors.

• Gender (β = 0.093, P = 0.840):

The coefficient for gender is not statistically significant, indicating that the likelihood of using digital health services does not differ substantially between males and females in the studied sample.

• Age Group (β = 0.825, P = 0.186):

The coefficient for age is also insignificant, suggesting that age is not a decisive factor in determining the use of digital platforms. This result aligns with previous research indicating that technological awareness has become more evenly distributed across age groups.

• Education Level (β = 1.297, P = 0.058):

Although not statistically significant, the value is close to the 0.05 threshold, implying a slight tendency for individuals with higher educational levels to be more receptive to digital health services. However, this effect remains statistically weak.

• Trust Level (β = 1.281, P = 0.007):

This variable is highly significant. The positive coefficient indicates that greater trust in digital technologies substantially increases the probability of using digital health services. Higher trust levels in the reliability and security of digital systems lead to stronger acceptance and actual use.

• Prior Experience (β = -1.422 / -0.435, P = 0.027 and 0.016):

This variable is also statistically significant. The negative sign implies that individuals with no prior experience are less likely to use digital services, while those with previous experience show a higher probability of adoption. This finding is consistent with theoretical models such as the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasizes that prior experience enhances

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13. Model Classification Efficiency Test

The model classification efficiency was tested, which is one of the methods for examining the quality of the model's fit to the data. The results are shown in Table (6).

Table (4)

Classification Table

Percent correct	predicted Use of the Service		observed
	yes	no	
43.2%	21	16	Use of the Service Step1
92.9%	105	8	yes
80.7%			Total ratios

Table (4) shows that 43.2% of viewers who do not use the service were correctly classified, while 92.9% of viewers who do use the service were correctly classified. When the predictor variables were introduced, the sample, a complete overhaul right classification an average of 80.7%, representing the proportion of correct predictions over the total number of the study sample, which amounted to 80.7%, which is a high percentage. From these results, we can conclude that the model classified the second category well, and the first category averagely for the dependent variable.

14. Conclusions

1. Confidence in Trust level is the most significant factor influencing individuals' acceptance of digital health services, the results showed that a decrease in confidence is strongly associated with a lower likelihood of usage.

2. Prior experience with health or technological applications significantly increases the likelihood of adoption; individuals who have used similar applications before are more inclined to use digital health services.

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3. Educational level not plays a crucial role; the higher educational level, the greater the probability of accepting digital services, reflecting a direct relationship between education and digital awareness.

4. Demographic factors such as age and gender exhibited varying effects; however, these effects were not always statistically significant when compared to trust and experience.

5. The binary logistic regression model demonstrated a good ability to explain the influencing factors (with an accuracy of about 81%), making it a suitable analytical tool in this type of digital behavioral study.

15. Recommendations

1. Enhance trust in digital health services through awareness campaigns that emphasize privacy, data protection, and user-friendliness..

2. Design simple and efficient training programs targeted at digitally inexperienced groups, especially the elderly and individuals with limited education.

3. Encourage official health authorities to use easy and clear interactive interfaces when developing digital applications and platforms, considering cultural and educational differences.

4. Integrate digital health concepts into curricula or community education, to a healthy digital culture over.

5. It is recommended to conduct future qualitative studies to earning a deeper understanding of the psychological and social concerns attached with the use of digital services, particularly in rural areas.

6. Expanding the sample size in future studies by, targeting more diverse user segment, to enhance the generalizability and refine results across multiple comparison models.

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Conflicts of Interest

The author declares no conflict of interest.

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