Research Paper

The Role of Information and Communication Technology Use in Predicting Adherence to Treatment in Patients with Coronary Artery Disease

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ABSTRACT

Background: Non-adherence to treatment prevents the effectiveness of therapeutic interventions. This study aims to evaluate the role of Information and Communication Technology (ICT) use in predicting adherence to treatment in patients with Coronary Artery Disease (CAD).

Methods: This cross-sectional study with a predictive correlational design was performed on 400 patients with CAD referred to public and private cardiology clinics in Kashan, Iran, from September 2020 to July 2021. A consecutive sampling technique was used to select the samples. The treatment adherence questionnaire and a researcher-made Information and Communication Technology Use (ICTU) scale were used to collect the data. Data were analyzed in SPSS version 16 using independent t-test, Pearson correlation test, and linear regression analysis.

Results: The mean scores of treatment adherence and ICTU was 64.5±13.4 and 42.22±16.6, respectively. Linear regression analysis showed that the two ICTU domains of familiarity with ICT and the utilization of ICT together predicted 27% of variance in treatment adherence of CAD patients (P<0.001).

Conclusion: Adherence to treatment is higher in patients who use ICT tools for health purposes. It is recommended that health professionals and policymakers develop appropriate interventions to increase the ability of CAD patients to use ICT.

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Highlights

- Treatment adherence as a public health issue, has particular importance in CAD.

- ICT-based care can help patients and their families optimally achieve their therapeutic goals.

- Adherence to treatment is higher in CAD patients who use ICT tools for health purposes.

Plain Language Summary

Non-adherence to treatment leads to undesirable control of risk factors, unfavorable health consequences, increased hospital readmissions and mortality, and raised healthcare costs. The use of ICT tools can increase access to health education resources. This study showed that adherence to treatment was higher in CAD patients who used ICT tools for health purposes.

1. Introduction

Cardiovascular Diseases (CVDs) are a leading cause of death worldwide. In recent years, the prevalence of CVDs in developing countries such as Iran has increased (Janjani et al., 2021). Reduced cost of CVD treatment can be achieved by following the recommendations of the medical team regarding behavior, diet, and medication which is called "adherence to treatment" (Jimmy, & Jose 2011). According to the statistics related to pre-pandemic period, almost more than half of patients with coronary artery disease (CAD) may be non-adherent to their treatments (Khatib et al., 2019). After the pandemic, the situation may have worsened due to social isolation and self-quarantine (Sullivan 2020). Treatment adherence in Iran has been reported to be poor to moderate (Mikaili et al., 2019; Gholamaliei et al., 2016). Non-adherence to treatment can lead to undesirable control of risk factors, intensification of treatment complications, unfavorable health consequences, and increased hospital readmissions, mortality, and healthcare costs (Khatib et al., 2019; Du et al., 2017; Karlsson et al., 2018; Levy et al., 2018; Antoun 2016).

Patients' access to valuable resources for the management of chronic diseases is rapidly increasing (Muse 2016). one of these resources is Information and Communication Technology (ICT). There are some ICT-based interventions to support patients with chronic diseases (Lindeman et al., 2020). Offering ICT-based support can help patients and their families optimally achieve their therapeutic goals (Guo et al., 2017). ICT includes products that "store, process, transmit, convert, duplicate, or receive electronic information".(Young

2012). ICT creates new opportunities for patients and their families to have active participation in self-care (Grando et al., 2015), increase self-knowledge about the disease, and actively engage in decision-making shared with the healthcare providers (Committee Opinion, 2015).

A study in Iran has revealed that 58% of people are familiar with computers, about 80% have access to computers, 40% are familiar with the Internet, and 55% have access to the Internet; while only about 27% of them are familiar with advanced search functions (Aliakbari 2016). Due to ICT, access to educational resources have increased and reminder messages are sent directly to patients' mobile devices, which can result in increased adherence to treatment in patients (Sullivan 2020). However, cultural, economic, and social differences have led to a significant gap in the acceptance, usability, and long-term effects of ICT which necessitates further research (Dicianno et al., 2015). Treatment adherence is a multifactorial process which is affected by social, economic, and clinical factors and interactions between the patient and their caregivers (Mathews 2017; Veronese et al., 2017). Studies on relationship of treatment adherence with ICT in Iran are very limited (Sadoughi et al. 2010). Therefore, the present study aims to evaluate the role of ICT in predicting adherence to treatment in patients with CAD.

2. Materials and Methods

Design, setting, and samples

This cross-sectional study with a predictive correlational design was conducted on 400 patients with CAD referred to private and public cardiology clinics in

Kashan, Iran, from September 2020 to July 2021. A consecutive sampling technique was used to select participants. Based on a 95% confidence interval, an error level of 0.5, and standard deviation of 4.93 for adherence to treatment in a previous study (Seyed Fatemi et al., 2018) and a dropout rate of 5%, a sample size of 400 was determined. The inclusion criteria were: a minimum age of 20 years, at least a reading and writing literacy, ability to work with a smartphone, and the definitive diagnosis of CAD by a cardiologist.

Instruments

Data were collected by the Information and Communication Technology Use (ICTU) scale and a treatment adherence questionnaire. The ICTU scale is a researcher-made questionnaire with acceptable psychometric properties which was designed based on interviews and literature review. It has 28 items and three subscales of familiarity with ICT (6 items), access to ICT (6 items), and utilization of ICT (16 items) The items are rated on a 5-point Likert-type scale from 1 (never) to 5 (always). Accordingly, the scores of first and second subscales ranges 0-24, and the score of the third subscale ranges 0-64. The total score ranges 0-112 but is reported in percentage. A higher score represents higher use of ICT. The Content Validity Index (CVI), and Content Validity Ratio (CVR) of ICTU were obtained as 0.93 and 0.88 respectively. The internal consistency (reliability) using Cronbach's alpha coefficient was reported 0.85.

The treatment adherence questionnaire is a 40-item tool developed by Seyed Fatemi et al (2018) to evaluate treatment adherence in patients with chronic diseases. It has 7 subscales: Effort in treatment (9 items), willingness to participate in treatment, (7 items), ability to adapt (7 items), integration of treatment with life (5 items), stick to the treatment (4 items), commitment to treatment (5 items), and doubts in treatment (3 items). The items are scored on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). The total score is obtained by summing up of the scores of all subscales, which ranges from 40 to 200 but is reported in percentage. A higher score indicates higher adherence to treatment. The internal consistency of this questionnaire using Cronbach's alpha is 0.92 (Seyed Fatemi et al., 2018). In the present study, its test-retest reliability was assessed on 10 samples (not selected from among the study participants) at a time interval of two weeks was obtained 0.85. The questionnaires were distributed among the participants after explaining the study objectives and obtaining their informed consent. The COVID-19 health protocols were observed during the data collection stage.

Data analysis

Data analysis was performed in SPSS v.16 software. The normality of data distribution was examined by Kolmogorov-Smirnov test. A p-value <0.05 was considered as the significance level. Independent t-test was used to assess the relationships between sociodemographic variables (gender, marital status, level of education, underlying disease, salary satisfaction, and family history of the disease) and ICTU score. Pearson correlation test was used to investigate the correlation between quantitative variables. Multiple linear regression analysis (Enter method) was used to predict treatment adherence based on the domains of ICTU. Variables with P≤0.2 were entered into the model.

3. Results

The mean age of participants was 43.91± 9.73 years, ranged 20-60 years. Findings related to the relationship between sociodemographic characteristics and ICTU in patients with CAD are summarized in Table 1.

There was a significant relationship between the mean score of ICTU and having underlying diseases (P<0.001), having a family history of the disease (P<0.001), educational level (P<0.001), and salary satisfaction (P<0.001). There was no statistically significant relationship between ICTU, marital status and living alone (P>0.05). ICTU had a statistically significant negative correlation with age (r=0.52, P<0.001) (Table 1).

The mean treatment adherence score was 64.5±13.4, ranged 37.5-96.88. There was a statistically positive correlation between treatment adherence and the ICTU subscales of familiarity with ICT (r=0.32, P<0.001), access to ICT (r=0.35, P<0.001), utilization of ICT (r=0.51, P<0.001), and total score of ICTU (r=0.46, P<0.001) (Table 2). Durbin-Watson statistic was less than 2.5, which indicates the independence of the residuals; therefore, regression analysis is allowed. Based on the results, the variables entered into the regression model together explained 27% of the variance in treatment adherence of patients with CAD (Table 3).

Regression coefficients were calculated to determine the relative contribution of each of predictor variables. Based on t statistic, familiarity with ICT (P=0.03) and utilization of ICT (P<0.001) were significant predictors of treatment adherence in patients with CAD (Table 4).

Table 1. Relationship between sociodemographic characteristics and ICTU score

Characteristics		No(%)	Mean±SD	P
			ICTU	
Gender	Female	199(49.8)	43.69±16.92	t=-1.77 P<0.07†
	Male	201(50.2)	40.76±16.16	
Any underlying disease?	Yes	257(64.3)	44.8±16.15	t=4.22 P<0.001†
	No	143(35.8)	37.67±16.42	
Marital status	Married	304(76)	42.11±16.3	t=-0.23 P=0.8†
	Single	96(24)	42.56±15.42	
Level of education	Lower than high school	76(19)	26.37±11.07	t=-10.42 P<0.001†
	Diploma and higher	324(81)	45.93±15.44	
Satisfaction with salary?	Yes	176(44.6)	46.97±17.14	t=-5.25 P<0.001†
	No	224(56)	38.48±15.16	
Family history of the disease?	Yes	269(67.3)	43.37±16.62	t=-2.01 P=0.43†
	No	131(32.8)	36.84±16.33	
Age (year)	Min	70	43.91±9.73	r=-0.52 †† P<0.001
	Max	20		

† Independent t-test; †† Pearson correlation test.

Table 2. Correlation of ICTU and its domains with treatment adherence

ICTU subscales	Range of score	Min	Max	Mean±SD	P¥
Familiarity with ICT	0-24	4.17	100	48.28±23.1	r=0.32 P<0.001
Access to ICT	0-24	0	100	54.1±17.8	r=0.35 P<0.001
Utilization of ICT	0-64	0	100	35.53±16.01	r=0.51 P<0.001
Total score of ICTU	0-112	2	93.75	42.22±16.6	r=0.46 P<0.001

¥ Pearson correlation coefficient.

4. Discussion

The present study assessed the predictive role of ICT use in the treatment adherence of patients with CAD. The results showed that familiarity with ICT and utilization of ICT can predict treatment adherence in these patients. In other words, patients who are more familiar with ICT or are more capable to utilize ICT are more likely to follow their treatment.

It has been shown that, in difficult-to-control hypertension patients, ICT-integrated care is a feasible therapeutic strategy for controlling blood pressure but people have often challenges related to equity, inclusion, and

Table 3. Durbin Watson test results for detecting autocorrelation in the linear regression residuals

Model	Sum of Squares	df	R	R²	F	P	Durbin-Watson
Regression	19511.997	3	0.522	0.272	49.4	P<0.0001	1.925
Residual	52134.780	396	-	-	-	-	-
Total	71646.777	399	-	-	-	-	-

Table 4. Multiple linear regression analysis to find factors predicting treatment adherence in patients with CAD

Model	B	Std. Error	β	t	P
Constant	49.361	1.907	-	25.889	0.000
Familiarity with ICT	0.107	0.049	0.185	2.165	0.031
Access to ICT	0.043	0.063	0.057	0.689	0.491
Utilization of ICT	0.507	0.057	0.609	8.942	0.000

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access (Visco et al., 2018). A study in Ardabil city, Iran, showed that 37% of patients admitted to the hospital had used information technology to obtain information about their disease, and 27% had advanced search skills (Aliakbari, 2016). Another study in Europe found that people with chronic disease and their caregivers tended to use ICT but has no enough skills to use it (Torrent-Sellens et al., 2016). The most important factors in the use of ICT are the devices' ease of use, reliability, and design based on the needs and preferences of patients (Zare, & Jebraeily, 2018). Factors such as training and users' experience and skills play important roles in using ICT (Czaja et al., 2013). It seems that the ICT use by patients with CAD depends on their skills. In our study, familiarity with ICT and ICT utilization predicted adherence to treatment. Consistent with this result, clinical trial studies have shown that ICT training (using smartphones and multimedia) has been effective in adhering to treatment in patients with CVDs (Khajavi, Moeini, & Shafiei, 2019; Johnston et al. 2016; Khanjari, Kamrani, & Nasr-Abadi, 2018).

The use of ICT tools improves access to optimal care, strengthens the relationship between patients and health service providers, and decreases the difficulties experienced by patients in adhering to treatment (de Lima et al., 2016). The majority of patients in the present study were people in their 40s to 60s who had limitations in utilizing ICT to collect correct and appropriate information. Accordingly, the first step for the health system is to identify the patients' educational needs related to the utilization of ICT to help them receive self-care training at any time and place, and consequently have better adherence to treatment.

5. Conclusion

Familiarity with and utilization of ICT tools can predict treatment adherence of patients with CAD. To encourage greater use of ICT tools, patients should be made aware of its benefits. In addition, patients should be actively involved in the technology development process to design user-friendly, easy-to-use, and reliable ICT tools. These can help prevent inequity in utilizing ICT resources and promote fair access to health care.

This study had a cross-sectional design and cause-and-effect relationships were not studied. Therefore, the results should be used with caution. It is recommended to conduct interventional studies based on the study objective.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the ethics committee of Kashan University of Medical Sciences (Code: IR.KAUMS.NUHEPM.REC.1399.041). Informed consent was obtained from all the participants.

Authors' contributions

Conceptualization and supervision: Fatemeh Sadat Izadi-Avanji and Zeinab Hajaliakbari; Data collection: Tahere Esmaeli; Data analysis: Fatemeh Sadat Izadi-Avanji and Zohreh Sadat; Writing – original draft and Writing review & editing: Tahere Esmaeli; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interests.

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