

# The Effect of Health Information Technology on Time and Cost Saving in Remote areas of Iran

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## Abstract

The present study aims at investigating the effect of health information technology on time and cost saving in the perspective of users of teaching hospitals in in remote areas of Iran.

This is an applied study with a descriptive-analytical and cross-sectional method conducted on users of hospitals in remote areas of Iran using stratified random sampling. Data collection instrument was a self-made questionnaire, the face validity and reliability of which were confirmed by Cronbach's alpha 0.94. Data were collected in person and analyzed by SPSS software V. 21 and descriptive and analytical statistics.

Based on the Chi-square test results, there was a significant relationship between the effects of health information technology on time saving as well as cost saving. The results of Kruskal-Wallis test showed no significant relationship between education level, age and work experience and time and cost saving as well.

User satisfaction is one of the most important aspects of the success of information systems, therefore, it is recommended that senior managers pay attention to the individual aspects of the employees working in the organization, provide them with necessary training before implementing the information systems, and involve them in the decisions in using such technologies.

**Keywords:** Health information technology, time saving, cost saving, remote areas

## Introduction

The application of information technology<sup>1</sup> in organizational activities is one of the most important reasons that distinguishes the organizations. As such, organizations that use IT widely and optimally have a sustained competitive advantage and are more distinguished in the perspective of stakeholders.<sup>1</sup> Obviously, IT plays a significant role in organizations. It can enhance the capabilities of organizations and reduce costs.<sup>2</sup>

Based on the literature, it is expected that in health care organizations, using health information technology<sup>2</sup>

can improve the quality of health services, prevent medical errors, optimally manage health care costs, increase management efficiency, improve productivity, and reduce paperwork.<sup>3</sup> However, in practice, according to the results of various studies, using HIT can have different and sometimes contradictory effects. For example, the results of some studies indicate the positive effect of technology on enhancing the quality of documentation, frequency, accuracy and completeness of nursing diagnosis, quality of health services, preventing medical errors, managing costs and increasing efficiency<sup>4, 5, 6, 7 & 8</sup>. In addition, people who experienced numerous failures in using the clinical information system were less inclined to the new information system. They believe that the benefits of HIT depends on the type of technology used and on how the technology is applied<sup>9, 10, 11, 12, 13, 14, 15, and 16</sup>.

Nowadays, the tendency to use health information systems has grown dramatically as the role of information

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in the field of health care delivery becomes more important, but clearly, there is no clear answer to the question that how much investment and spending costs on this issue improves the quality and reduces cost of health care services and more profitability for health care providers and physicians. Responding to this ambiguity will convert the IT concept as a costly plan into a means of achieving value added, and prevents ambiguities that delay or even prevent some centers from investing in IT, and considering the importance of accurate and timely provision of health services and patient information and the role that health information technology can play in this regard, the present study is mainly concerned to investigate the effect of health information technology on time and cost saving.

**Method**

This is an applied study with a descriptive-analytical and cross-sectional method conducted on users of hospitals in remote areas of Iran in 2017, in which stratified random sampling method was used. Based on the Morgan formula, 256 subjects out of 720 Health Information System users were selected through stratified random sampling with proportional allocation. Data collection tool was a 24-question self-made questionnaire with 5-point Likert scale, designed using theoretical foundations. The first part of the questionnaire was measured the demographic information of the respondents. Out of 24 questions in the second part, 10 questions pertained to measuring the effect of health information technology on time saving and 14 questions pertained to measuring the effect of health information technology on cost saving. Considering that the Likert scale (very high, high, moderate, low, very low) was used for scoring, the range of scores varies from 1 to 5 in each phrase, therefore, all of the questions had a positive score, with the score 1 for very low and 5 for very high. Validity of the questionnaire was confirmed by health information management experts. In order to calculate the reliability, the questionnaire was distributed among 40 subjects and confirmed by Cronbach’s alpha coefficient 0.94. Data collection was conducted through in person referring to the workplace of the research population. If necessary, the research population was provided with explanations to the questionnaire items. Questionnaires were completed through self-administration at the same time and / or as a follow-up in the future. Data were analyzed by SPSS software version 21 and descriptive statistics (Frequency, standard deviation, mean,) and inferential statistics (Kruskal-Wallis, chi square tests)

and the P-value was considered 0.01. Finally, the mean scores were classified, with the mean score of 1-3 in the low effect range, 4-4 medium effect and 4-5 high effect.

**Findings**

The majority of respondents aged 26 - 35, with a work experience of less than 5 years, with a Bachelor’s degree. According to the research findings, the effect of information technology on time and cost saving was positive in the perspective of the research population, with a mean score of 4.23. Subjects evaluated the effect of information technology on time saving with a mean score of 4.09 and on cost saving with a mean score of 4.37. Chi-square test results indicated a significant relationship between the effects of health information technology on time saving as well as cost saving (Table 1).

**Table 1. The effects of health information technology on time saving as well as cost saving**

Variable	Chi2
time saving	174.969
cost saving	169.813

The Kruskal-Wallis test was used to analyze the hypotheses of the relationship between the effect of health information technology on time and cost saving in terms of education level, age and work experience. Test results indicated no significant relationship between education level, age and work experience and people’s perspective on the effect of health information technology on time and cost saving (Tables 2 - 4).

**Tables 2. The Kruskal-Wallis test on the effects of health information technology on time saving as well as cost saving by education level**

Education	Number	Chi2	Degree of Freedom	Sig
Associate	118	1.864	2	.394
B.Sc	125			
MSc	13			
Total	256			

**Tables 3. The Kruskal-Wallis test on the effects of health information technology on time saving as well as cost saving by age**

Age	Number	Chi2	Degree of Freedom	Sig
Less than 25	46	43.865	3	.000
25 to 35	160			
36 to 45 years	44			
Over 45 years	6			
Total	256			

**Tables 4. The Kruskal-Wallis test on the effects of health information technology on time saving as well as cost saving by job experience**

Job experience	Number	Chi2	Degree of Freedom	Sig
Less than 5 years	103	36.577	4	.000
5 to 10 years	91			
11 to 15 years	30			
16 to 20 years	13			
More than 20 years	19			
Total	256			

### Discussion

The findings in the present study indicated that the amount of time saving of information technology is high in the perspective of users. This finding is consistent with the results of Dehghan and Ghorbani<sup>17</sup>, Bertsche et al.<sup>18</sup>, Rollman et al.<sup>19</sup>, Lyerla et al.<sup>20</sup>, Walsh et al.<sup>21</sup>, Akbari-Nassaji et al.<sup>22</sup>, McMullin et al.<sup>23</sup>, and Nies et al.<sup>24</sup>.

To justify this issue, it can be stated that HIT plays a significant role in personal health management, health care delivery and public health. In these domains,

widespread use of IT can improve the quality of health services, prevent medical errors, increase management efficiency, reduce paperwork and increase productivity of health services.

Concerning the effect of health information technology on cost saving, the findings also indicated that information technology has significantly led to cost saving. This finding is consistent with the results of Dehghan and Ghorbani<sup>17</sup>, Bertsche et al.<sup>18</sup>, Rollman et al.<sup>19</sup>, Lyerla et al.<sup>20</sup>, Walsh et al.<sup>21</sup>, Akbari-Nassaji et al.<sup>22</sup>, McMullin et al.<sup>23</sup>, and Nies et al.<sup>24</sup>.

Investing in HIT has many benefits that may sometimes have measurable financial effects such as improving physician-patient relationships and increasing incentives for physicians and nurses, however, some of these benefits are simply measurable, including those that have the most benefits in the field of inpatient and outpatient care. These items include reducing the need for repeating tests and radiographs, reducing the cost and amount of medication, reducing patients' length of stay, reducing the cost of documentation and reducing overtime and reducing nurses' wasted time, increasing patient access to care, and reducing costs, decreasing the process time, increasing the variety of services provided, reducing the complaints from treatment personnel, and increasing the staff retention in their posts. In order to justify this point, it can be stated that according to the indicators of the US Health Care Management Information Center, there are fourteen areas of use in hospitals for information technology, so that using such applications are important in terms of affecting the quality of care, reducing costs and budgeting priorities.

Based on the results, there is no significant difference between the effects of HIT on time and cost saving and demographic information of users of hospitals in remote areas of Iran's including education, age and work experience. Younger users reported that HIT had a greater effect on time and cost saving. Also, users who had less experience reported that HIT had a greater effect on time and cost saving. No similar research was found in this regard.

In general, the results of this study were consistent with the findings of Dehghan and Ghorbani<sup>17</sup>, Bertsche et al.<sup>18</sup>, Rollman et al.<sup>19</sup>, Lyerla et al.<sup>20</sup>, Walsh et al.<sup>21</sup>, Akbari-Nassaji et al.<sup>22</sup>, McMullin et al.<sup>23</sup>, and Nies et al.<sup>24</sup>. The application of HIT not only enhances the status of clinical decision-making through the speed

and ease of information retrieval, but also affects other managerial and executive processes and other applied aspects of information in education and research which also leads to the effectiveness of the health system, which leads to the realization of the main goal of the health system, that is the promotion of community health. HIT plays a role in personal health management, health care delivery and public health. Of course, evidently achieving these benefits depends on the acceptance of technology by users, i.e. the positive attitude of users towards technology. The results of the study by Ayanlade et al.<sup>25</sup>, Kindratt et al.<sup>26</sup> and Sebetci<sup>27</sup> indicated that the strong understanding of staff and patients about the implementation and acceptance of HIT leads to achieving its benefits.

### Conclusion

User satisfaction is one of the most important aspects of the information systems success. In addition, when using a new technology is supported by health professionals with respect to existing values and professional needs, they will not only have greater confidence in the use of IT, but also a higher degree of understanding and benefits of the system and will likely make better use of this technology, therefore it is recommended that senior managers and healthcare professionals pay more attention to the individual aspects of the organization, provide the training required prior to the implementation of information system, familiarize them with the benefits and capabilities of new technologies and also involve them in the decisions made to use such technologies. In the present study, it can be concluded that the positive view of the staffs in teaching hospitals of remote areas of Iran on the effect of HIT on time and cost saving indicates the availability of proper cultural groundwork for development of the information technology in university hospitals. Considering the growing global demand for health care information systems and competitive efforts in health care centers, the awareness of system managers and users on the effectivity of this technology on the qualitative and quantitative improvement of the health care services and developing a strategic HIT programs will guarantee the effectiveness of investing in this area with greater confidence.

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### References

1. Tsiknakis M, Kouroubali A. Organizational factors affecting successful adoption of innovative eHealth services: A case study employing the FITT framework. *International journal of medical informatics*. 2009 Jan 1;78(1):39-52.
2. Lederer AL. Decision support systems uninfrastructure: The root problems of the management of changing IT. *Decision Support Systems*. 2008 Nov 1;45(4):833-44.
3. Alotaibi YK, Federico F. The impact of health information technology on patient safety. *Saudi medical journal*. 2017 Dec;38(12):1173.
4. Bruylands M, Paans W, Hediger H, Müller-Staub M. Effects on the quality of the nursing care process through an educational program and the use of electronic nursing documentation. *International journal of nursing knowledge*. 2013 Oct;24(3):163-70.
5. Daniel OU. Effects of health information technology and health information exchanges on readmissions and length of stay. *Health Policy and Technology*. 2018 Sep 1;7(3):281-6.
6. Wang T, Wang Y, McLeod A. Do health information technology investments impact hospital financial performance and productivity?. *International Journal of Accounting Information Systems*. 2018 Mar 1;28:1-3.
7. Cheramie B. Health Care Information Technology: Moving from Support to Performing Care. *Critical Care Nursing Clinics*. 2019 Jun 1;31(2):165-76.
8. Darbyshire P. 'Rage against the machine?': nurses' and midwives' experiences of using Computerized Patient Information Systems for clinical information. *Journal of clinical nursing*. 2004 Jan;13(1):17-25.
9. Poissant L, Pereira J, Tamblyn R, Kawasumi Y. The impact of electronic health records on time efficiency of physicians and nurses: a systematic review. *Journal of the American Medical Informatics Association*. 2005 Sep 1;12(5):505-16.
10. Agha L. The effects of health information technology on the costs and quality of medical care. *Journal of health economics*. 2014 Mar 1;34:19-30.
11. Hillestad R, Bigelow J, Bower A, Girosi F, Meili R, Scoville R, Taylor R. Can electronic medical record systems transform health care? Potential

- health benefits, savings, and costs. *Health affairs*. 2005 Sep;24(5):1103-17.
12. Dehnavieh R, Hekmat SN, Ghasemi S, Mirshekari N. The vulnerable aspects of application of "Health Technology Assessment". *International journal of technology assessment in health care*. 2015;31(3):197-8.
  13. Love-Koh J, Cookson R, Gutacker N, Patton T, Griffin S. Aggregate Distributional Cost-Effectiveness Analysis of Health Technologies. *Value in Health*. 2019 May 1;22(5):518-26.
  14. Vest JR, Jung HY, Wiley Jr K, Kooreman H, Pettit L, Unruh MA. Adoption of Health Information Technology Among US Nursing Facilities. *Journal of the American Medical Directors Association*. 2019 Aug 1;20(8):995-1000.
  15. Hekmat SN, Dehnavieh R, Rahimisadegh R, Kohpeima V, Jahromi JK. Team attitude evaluation: an evaluation in hospital committees. *Materia socio-medica*. 2015 Dec;27(6):429.
  16. Lomas JR. Incorporating affordability concerns within cost-effectiveness analysis for health technology assessment. *Value in Health*. 2019 Aug 1;22(8):898-905.
  17. Dehghan R, & Ghorbani V. Developing eHealth: A strategic imperative for the health care system. *Journal of Health Care Management*. 2004; 1 (2) [in Persian]
  18. Bertsche T, Pfaff J, Schiller P, Kaltschmidt J, Pruszydlo MG, Stremmel W, Walter-Sack I, Haefeli WE, Encke J. Prevention of adverse drug reactions in intensive care patients by personal intervention based on an electronic clinical decision support system. *Intensive care medicine*. 2010 Apr 1;36(4):665-72.
  19. Rollman BL, Hanusa BH, Lowe HJ, Gilbert T, Kapoor WN, Schulberg HC. A randomized trial using computerized decision support to improve treatment of major depression in primary care. *Journal of General Internal Medicine*. 2002 Jul 1;17(7):493-503.
  20. Lyerla F, LeRouge C, Cooke DA, Turpin D, Wilson L. A nursing clinical decision support system and potential predictors of head-of-bed position for patients receiving mechanical ventilation. *American Journal of Critical Care*. 2010 Jan 1;19(1):39-47.
  21. Walsh MN, Yancy CW, Albert NM, Curtis AB, Stough WG, Gheorghiade M, Heywood JT, McBride ML, Mehra MR, O'Connor CM, Reynolds D. Electronic health records and quality of care for heart failure. *American heart journal*. 2010 Apr 1;159(4):635-42.
  22. Neda AN, Fahimeh S, Tahereh ZK, Leila F, Zahra N, Bahman C, Narges CK. Lead Level in Umbilical Cord Blood and its Effects on Newborns Anthropometry. *Journal of clinical and diagnostic research*. 2017 Jun;11(6):SC01-SC04. doi: 10.7860/JCDR/2017/24865.10016.
  23. McMullin ST, Lonergan TP, Rynearson CS, Doerr TD, Veregge PA, Scanlan ES. Impact of an evidence-based computerized decision support system on primary care prescription costs. *The Annals of Family Medicine*. 2004 Sep 1;2(5):494-8.
  24. Niès J, Colombet I, Zapletal E, Gillaizeau F, Chevalier P, Durieux P. Effects of automated alerts on unnecessarily repeated serology tests in a cardiovascular surgery department: a time series analysis. *BMC health services research*. 2010 Dec;10(1):70.
  25. Ayanlade OS, Oyebisi TO, Kolawole BA. Health Information Technology Acceptance Framework for diabetes management. *Heliyon*. 2019 May 1;5(5):e01735.
  26. Kindratt T, Callender L, Cobbaert M, Wondrack J, Bandiera F, Salvo D. Health information technology use and influenza vaccine uptake among US adults. *International Journal of Medical Informatics*. 2019 Sep 1;129:37-42.
  27. Sebetci Ö. Enhancing end-user satisfaction through technology compatibility: An assessment on health information system. *Health Policy and Technology*. 2018 Sep 1;7(3):265-74.