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Designing an E-Health Management Framework for Social Security Organization of Iran

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ABSTRACT

Introduction: In Iran, almost half of the population receive health benefits from social security organization (SSO) that reveals the necessity of proper planning and management. As a relatively recent practice, e-health is widely using to facilitate achieving the managerial goals of healthcare organizations. The current study aimed to design an e-health management framework for SSO of the I.R. Iran.

Method: This is an applied study that was carried out using descriptive-analytical methods. Based on the results of recent studies and available reports (both national and international), a conceptual model and a researcher-made questionnaire were developed. After confirming the reliability and validity of the questionnaire, it was filled out by 557 of high and medium level managers of the SSO. Simultaneously, e-health strategies of the following countries were comparatively evaluated: Turkey, India, the UK, Estonia, Sweden, and Pakistan. Exploratory and confirmatory factor analyses were used to analyze the data.

Results: The Kaiser-Meyer-Elkin and Bartlett tests indicated the sufficiency of the sample size and correlation between items of the questionnaire. Varimax Rotation showed that for five factors the special value was higher than one (indicates items of this instrument are loaded on these five factors). 23% of the variance was accounted for in the first principal component, 15% on the second, 14% on the third, 11% on the forth, 9% on the fifth (72.47% of the variance in total). Comparative indexes and the Tucker-Lewis index are accepted in the range greater than 0.9. The root-mean-square deviation and residual of mean-square error should be less than 0.80. These conditions were true in the present study, but RMSD was higher at about 0.009. Besides, the lower the Akaike the better the fitness of the model. Which the model with five factors had the lowest Akaike. The final model consisted of 20 (out of 22) items.

Conclusion: Based on the results and included items, 20 items had a significant association with related factors. Therefore, the developed framework can be used for the SSO. Future studies are needed to evaluate and monitor this framework.

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INTRODUCTION

Health is a universal right that is emphasized by the Constitution of the I.R. Iran, including Article 19, which mentioned to enjoying social security and health benefits with respect to retirement, unemployment, aging, disability, lack of guardianship, destitution, accidents, and emergencies as well as have the right to health care services through insurance benefits or other means.

According to the paragraphs A and B, Article 35, the fifth five-year development plan of the Islamic Republic of Iran, the Ministries of Health and Welfare are, respectively, required to establish an electronic health record system for all Iranians and to organize health insurance services based on information technology in interaction with the Iranian Electronic Health Record System. The sixth five-year development plan also emphasized on similar issues.

Almost half a million Iranians receive health benefits from social security organization (SSO), as the largest health insurance fund of the country. The insures can receive services in two ways: (a) health network of the SSO; and (b) through contracted physicians/organizations. In the first method, insures can refer to more than 350 owned health facilities of the SSO, while in the latter, which is known as "indirect treatment", insures should only refer to contracted medical centers including hospitals, doctors, pharmacies, laboratories, imaging centers, and other outpatient health services.

Using the potentials of information and communication technology to improve access to health care services in developing countries was first emphasized in the World Telecommunication Development Conference in 1994. Publishing experiences of other countries in the field of electronic health (e-health) helped countries to find a better view of how to improve or expand e-health programs, particularly about insurance booklets [1-4]. Currently, SSO spends about 60 billion Toman for printing insurance booklets every year. On the other hand, the long waiting time for receiving services from physicians, pharmacies, and other services has increased dissatisfactions. Moreover, the accuracy of prescriptions is another important issue that should be considered in such situations. Also, some insures are no longer entitled to receive benefits from SSO due to changing or losing their job. In addition, there also fake insurance booklets, which pose extra costs to the organization. Based on the management principles, the main tasks of managers are as follows [5-8]: Planning, Organizing, Staffing, Direction, Coordination, Reporting, Budgeting, and Inspection. Since 2006, SSO is trying to expand e-health. In 2014, the hospital information system of the SSO was upgraded to Windows which paved the way for expanding e-health [9].

After conducting a comparative study concerning the e-health in various countries, including Turkey, India, the UK, Sweden, Estonia, and Pakistan, five components of planning, organizing, coordination, employment, and budgeting were identified to be used in the framework [10-16].

Although e-health is to some degree implemented in the country and SSO, but so far no framework is proposed for the SSO. Designing such frameworks for the SSO as the largest health insurance fund in the country and the second largest provider of healthcare services can be a great step to improve the quality of provided services as well as the expansion of e-health in the country [17].

METHODOLOGY

This is a qualitative research that used a descriptive-analytical approach. As the first step, first, a comprehensive review was conducted to identify all related articles, both national and international. Afterward, a comparative investigation was conducted concerning the e-health management systems in health insurance funds of various countries, including the SSO of Iran. In this stage, the literature review was the main data collection method and the final output was a comparative table on e-health management systems of seven countries, including Turkey, India, Sweden, the UK, Estonia, France, and Pakistan as well as the SSO of Iran. The results were used to develop a conceptual model that consists of planning, organization, employment, and budgeting. Eventually, a researcher-made questionnaire was developed.

Using the primary data, a framework was developed based on the context of the SSO. Then, a special panel was held (comprised of 12 members) to discuss the results of the comparative study and obtaining experts' opinions about the proposed framework. To achieve these goals, a series of semi-structured questions were asked from experts and their opinions were obtained. In total, two panels were held. Discussions were recorded and then transcribed. The proposed framework was presented to 30 experts, particularly in the field of e-health, to assess its compliance with the context of the SSO.

In the following, a researcher-made questionnaire was sent to 31 clinical managers, in which 22 of them were filled and sent back (by managers of hospitals and outpatient clinics), a response rate of 71%. In total, 555 questionnaires were filled, most of participants had a medical education degree (42%) and were working in the field of treatment (54%).

Bartlett and KMO indices were used for exploratory factor analysis in SPSS version 21. The results

indicated the appropriateness and sufficiency of the sample size as well as the correlation between items of the questionnaire (22 items). Exploratory factor analysis was performed using the principal component method and Varimax rotation, which confirmed 22 items. Cronbach's alpha coefficien was calculated for each factor and item. To confirm the constructed factors in the exploratory analysis, data provided by the pilot study on 278 subjects were used. The confirmatory factor analysis model was investigated by the SEM model. Initially, several SEM models were performed with 2, 3, 4, 5, and 6 factors. The goodness of fit was calculated for all models. Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) indicators should be greater than 0.9. Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) indicators should be less than 0.80. Akaike index criterion indicates the goodness of the model, and the lower its value the more valid is the model. Confirmatory factor analysis was performed in R 3.6.3 software using lavaan and semPlot packages.

RESULTS

Based on the findings, most of the components of the Turkish health system were confirmed by participants [18], including electronic registration and exchange of patient health information, health system planning by analysing patients' data to help managers, monitoring human resources and equipment, monitoring allocation of financial resources, and monitoring private providers, which is consistent with the findings of the current study. However, telemedicine and mobile health were not confirmed in the present study.

Comparing the findings with the results on the electronic health system in India [19], confirmed the importance of the components of this system, including electronic data registration, formulating strategies and policies of the health system, improved reporting, using mobile applications, and hospital information management systems, but the influence of telemedicine in the e-health is not approved by the participants.

For the Sweden health system [20], issues such as electronic registration of health data at the national level, electronic medical services billing system, human resources for the health information system, using e-health for monitoring patients' health status, creating an appropriate tool for making appropriate decisions, and planning and resource allocation were emphasized. Although still enough attention is not paid to telemedicine and mobile health.

For the UK health system [21], issues such as the implementation of a comprehensive electronic system for patient registration, patient's monitoring, and access to tools, databases, and information are confirmed. Again, telemedicine and mobile-health are ignored.

The findings on the application of electronic health systems in Estonia showed that issues such as electronic registration of health data using pharmacy information system, electronic billing system for medical services, digital prescription system, digital imaging system, human resources for health information systems, access to tools, databases, and information, and increasing the efficiency and coordination in providing healthcare services were confirmed.

For the health system of Pakistan [22], electronic health data registration system, laboratory information system, pharmacy information system, electronic billing system for medical services, using health information to increase the effectiveness of planning and designing projects were confirmed. Meanwhile, telemedicine and mobile health are ignored.

The researcher-made questionnaire was sent to 31 clinical managers (both hospitals and clinics), that 22 questionnaires were filled and sent back, a response rate of nearly 71%. Most of the respondents were working in Tehran province (13%), while the lowest was from Qom province (3%). 390 (70%) of participants were male and 30% were female. In terms of education, 26.6% had a bachelorette degree, 31.7% M.Sc., and 41.4% were Ph.D. Most of the participants were physicians (229 or 42.2%), followed by (176 or 31.7%) software engineer, and clinical manager (92 or 16.5%). The mean age of participants was 44 years. The mean duration of service was 18 years.

The framework was developed based on the findings of the pilot study (278 participants). To assess the goodness of fit, Kaiser-Meyer-Olkin measure and Bartlett tests were used, which indicated the suitability and sufficiency of the sample size and the correlation between items of the questionnaire (Table 1).

The exploratory factor analysis was performed using principal component analysis and varimax rotation, which resulted in 22 items. This analysis reduced 22 items to 5 factors, explaining 72.57% of the total variance (Table 2). For 5 factors, the specific value was higher than one, which shows that the items of this tool have been loaded on these five factors. 23% of the variance was accounted for in the first principal component, 15% on the second, 14% on the third, 11% on the forth, 9% on the fifth (72.47% of the variance in total).

The factor load of attributing items on each component is shown in (Table 3). Attributing items were defined if the factor load was greater than 0.05. According to the factor load, items 5 and 20 were not attributed to any factor.

As shown in the above table, items 5 and 20 had the lowest variance and therefore were excluded from

the model. Afterward, the remaining 5 items could explain 75.37% of the total variance.

In (Table 4), Cronbach's alpha coefficient for each factor and the number of attributing items is provided. All coefficients are higher than 0.7, that indicates an acceptable internal consistency. To confirm the constructed factors in the confirmed factor analysis, data provided by the pilot study (278 subjects) were used.

The confirmatory factor analysis model was investigated by the SEM model. First, several SEM models were implemented with 2, 3, 4, 5, and 6 factors. Then, the goodness of fit indicators were compared for each model. It worth noting that items 5 and 20 were not included in the analysis.

The goodness of fit indicators in models with two to five factors are presented in (Table 5). The comparative fit index (CFI) and Tucker-Lewis Index (TLI) should be greater than 0.9. Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) should be less than 0.8. The model with five factors had all these conditions, but the SRMR was 0.0809. The lower the Akaike the better the fitness of the model. The Model with five factors had the lowest AIC. All variables were significant at 95%.

The relationship between items and factors in the confirmatory factor analysis is shown in (Figure 1) (the numbers are standardized coefficients). The rectangles and ellipses represent the observed variables (items) and hidden variables (factors), respectively. Hidden variables are not directly measured, but are measured using observed variables. The line that connects hidden variables to observed variables represents the path coefficient or standardized loading factors.

DISCUSSION

The current study aimed to devise an e-health management framework for the social security organization of Iran. To devise such a model, first, all components and dimensions should be identified and, then, the validity of the framework should be evaluated. There are other studies that have developed such frameworks, although none of them is comprehensive.

In a study conducted in Uganda by Ittefaq & Iqbal, lack of a budgeting system and planning procedures are mentioned as the most important sources of the inefficiency of health information systems. That reveals the necessity of considering these factors in the proposed framework [23]. Fink et al. reported that models based on communication devices such as mobile phones and wireless sensor networks are useful for patients at hospitals or homes, mainly through real-time analysis of the patient's health status. The framework devised in the present study is applicable for medical applications. This study emphasizes the use of mobile-based systems, that should be further investigated in future studies on the current proposed framework [24].

Vancanaraman Kiberu & Mars, concluded that electronic health records can improve patients care, time effectiveness, and treating patients based on clinical practice guidelines, while decreasing medical errors and drug reactions [25]. Also, Baswa et al. showed that e-health can increase providers' understanding about rates of diseases and their underlying causes [26].

In the present study, 20 (out of 22) items embedded in the questionnaire were confirmed. For the first factor, the highest load was attributed to the "indirect monitoring system for imaging centers" and "laboratory and physiotherapy services". For the second factor, "electronic prescription" had the highest load. For the third factor, "electronic registration of drugs, equipment, and properties available in the warehouse", for the fourth factor, "system for exchanging radiology images", and for the fifth factor, "access to tools, databases, and information" had the highest load. Finally, after identifying components of the model and its dimensions (confirmed items), the model was validated and the significance of the items was evaluated (5 factors and 20 items) [27].

CONCLUSION

The present study, consistent with similar studies and reports on e-health structures, revealed the importance of the aforementioned components in e-health management frameworks and their potential for the SSO in Iran. The dimensions mentioned in the presented framework are confirmed by the participants, all of whom were experts and high-level managers of the SSO with an average experience of 18 years, and can be considered as an appropriate framework to implement e-health management in the SSO of I.R. Iran. Planning, organizing, human resources management, budgeting, and coordination are the main responsibilities of managers. While reporting and leading are inherent components of managers' responsibilities.

Executive Recommendations

The researcher suggests implementing the devised framework in the SSO. As the largest health insurance fund of the country (nearly 40 million insures) and one of the main provides of healthcare services, using electronic services is of crucial importance for the SSO. Administering a health insurance fund that has 70 hospitals and more than 290 healthcare centers and has contracts with hundreds of public and private providers requires using e-health for better planning, effective organization, employing human resources based on real needs, smart allocation of budgets, and

balancing the budget allocation between direct and indirect treatments.

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electronic health records on healthcare quality: a systematic review and meta-analysis, The European Journal of Public Health, 2016; 26(1): 60-64.

Table 1. Appropriate values for exploratory factor analysis

KMO		0.926
Bartlett test	value	10014.42
	Degree of freedom	231
	p-value	<0.001

Table 2. Specific values and explained variance in exploratory factor analysis after varimax rotation

Factor	Special value	Special values after Varimax	%variance	Cumulative %variance
1	9.873	5.144	23.384	23.384
2	2.554	3.301	15.005	23.389
3	1.359	3.159	14.358	52.764
4	1.270	2.466	11.117	63.683
5	0.909	1.914	8.702	72.564

Table 3. Factor load of attributing items, regarding the special values after varimax rotation

Item	**Question**	**Factor**				
		organizing	**planning**	**budgeting**	**Human resource management**	**coordination**
14	Monitoring system for monitoring physicians' offices (indirect treatment)	0.866				
15	Monitoring system for monitoring hospitals (indirect treatment)	0.886				
16	indirect monitoring system for imaging centers (for out of network services)	0.930				
17	Monitoring system for monitoring laboratories	0.928				

18	Monitoring system for monitoring physiotherapy centers (indirect treatment)	0.919				
19	Electronic billing	0.530				
1	Hospital information system		0.717			
2	Electronic health records for patients		0.736			
3	Electronic prescription		0.791			
4	Providing drugs using electronic prescription		0.730			
6	Financial and inventory warehousing systems) INV(			0.769		
7	electronic registration of drugs, equipment, and properites available in the warehouse			0.799		
8	Electronic reporting for warehouses and inventories			0.780		
9	Capital tracking system (budgeting)			0.585		
10	Electronic ID for medical equipment				0.545	
11	Electronic system for exchanging medical images				0.779	
12	Laboratory information system				0.712	
13	Online appointment scheduling system				0.542	

21	Access to tools, databases and information in the field of health					0.819
22	Electronic monitoring of patients' health					0.793
5	Registration of patients' hospitalization information based on ICD codes	0.287	0.380	0.324	0.305	0.215
20	Comprehensive human resources system	0.392	0.084	0.409	0.290	0.301

Table 4. Cronbach's alpha for internal consistency of factors

Factor	Number of items	Items' number	Cronbach's alpha coefficient
organizing	6	14, 15, 16, 17, 18, 19	0.955
planning	4	1, 2 , 3, 4,	0.860
budgeting	5	6, 7, 8, 9, 10	0.806
Human resource management	3	11, 12, 13	0.780
coordination	2	21, 22	0.767

Table 5. Goodness of fit indicators for the confirmatory factor analysis

Number of factors	**AIC**	**$\chi 2/df$**	**CFI**	**TLI**	**RMSEA**	**SRMR**
2	5994.787	802.742 / 169	0.806	0.782	0.138	0.105
3	5757.179	615.421 / 167	0.858	0.838	0.098	0.095
4	6404.903	517.616 / 164	0.891	0.874	0.088	0.098
5	5494.453	423.667 / 160	0.916	0.900	0.077	0.089

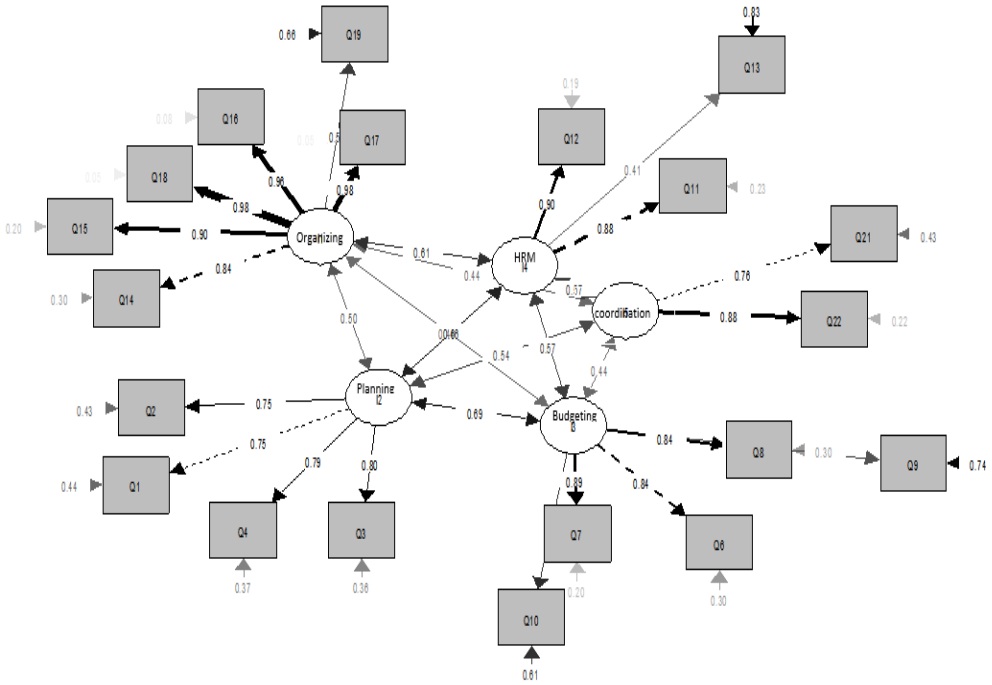

Figure 1. The relationship between items and factors (standardized coefficients) in confirmatory factor analysis