



Determinants of completing the medication reconciliation form among nurses based on diffusion of innovation theory

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Abstract

Medical errors are one of the factors that endanger lives of many patients. One of these errors is related to drug errors caused by the wrong drug, wrong patient, wrong prescription, etc. These errors can also be attributed to transfer between wards, hospitalization, and discharge times. One of the ways to reduce drug errors is to use medication reconciliation by physicians and nurses. Therefore, this study aimed to investigate the determinants of the use of medication reconciliation by nurses based on diffusion of innovation theory. The Findings of the study regarding different structures of integrated medication reconciliation forms were as follows: Relative advantage (86.5 of the maximum score), perceived compatibility (40.75), perceived complexity (44.3), visibility (83.6), and testability (79.8). Moreover, relative advantage, compatibility, testability, and visibility structures were directly correlated with the intention of completing the medication reconciliation form. According to the results of this study, promoting the knowledge and professional attitude of nurses could increase their compatibility regarding the implementation of integrated medication reconciliation. In addition, elaboration on the proper principles of the form completion could reduce the mean score of the perceived complexity structure.

Keywords: Innovation Diffusion, Management, Medication Reconciliations, Nurse, Patient Safety

Introduction

Patient safety is a global medical concern influencing different patients in all the areas of healthcare services in developed and developing countries. Statistically, it has been found that treatment borne damages occur in approximately 10% of all hospitalized patients at variable degrees [1].

From studies conducted in Australia, 16.6%

of hospitalized patients experience adverse events, which may lead to temporary disabilities (77%), permanent disabilities (15%), and death (5%) [2].

Recent reports have confirmed that medication errors account for more than a quarter of problems affecting patients during hospitalization and treatment [3,4]. Medication

errors mostly occur during processes of preparation, prescription, distribution, and monitoring of therapeutic drugs. Time of admission has been recently proposed as a significant factor in the occurrence of treatment-related complications since more than 50% of patients had been subjected to medication errors at the time of admission due to errors in their medical history [5].

Medication errors can lead to several problems, including high hospitalization costs, increased mortality rate, and lack of patients' trust and satisfaction with hospital services [6]. In Iran, the Ministry of Health and Education allocates billions of dollars every year to compensate for the cost of medication and admission errors [7]. According to medication errors, it should be noted that a large number of these events are preventable and can be corrected with efficient management as in a study in this regard, 48% of these errors were preventable [1].

According to the results of another study, two-thirds of patients' complications upon admission were reported to be preventable with an efficient management [8]. Incompatibility in prescribed drugs after discharge plays a pivotal role in the occurrence of adverse medical events. Discharged patients are at a higher risk of complications caused by medication incompatibility as they return to normal social life [9,10]. In this regard, the findings of Forrester indicated that 23% of the patients discharged from a teaching hospital in Canada experienced unwanted side effects, 72% of which were associated with drug administration [11].

Medication reconciliation is considered as an effective strategy to reduce pharmaceutical errors and has been proven effective in several studies [12]. For instance, the results of a report confirmed that integrated medication reconciliation could reduce medical errors by 70% within a seven-month period [13]. Medication reconciliation is mainly based on providing a complete medical history, which differs from the routine medical record of the patient [1]. The required medical history is provided through a systematic process of interviewing the patient and referring to credible

sources (e.g., pharmacies and physicians) [14]. However, since patient interviews might be time-consuming, healthcare providers tend to neglect this process, which exposes patients to a higher risk of unexpected medication and treatment-related errors [15]. Furthermore, integrated medication reconciliation is widely used for patients who are unfamiliar with prescription medications.

Diffusion of innovations theory is one of the main principles used to facilitate the adaption process of healthcare providers with a specific procedure. The proper implementation of this theory requires a suitable setting and the aspect of innovation highlights the ideas, issues, and functions that are considered unprecedented by another individual. In this context, the term "unprecedented" refers to the situation in which a potential recipient has had no previous contact with the other applicant of a certain new product or idea [16].

In applying diffusion of innovations theory, health authorities are faced with unestablished interventions and their impact on a certain process [17]. For a new approach to become established and widely practiced, three main components are required as follows: 1) The new idea must be accepted by influential people; 2) The new idea must be of great quality or with notable characteristics to encourage people to follow the idea; and 3) The new idea must have remarkable environmental and social impacts [18].

In a study, Pankratz et al. measured the acceptance rate of preventive pharmaceutical procedures in a medical high school in 2002. According to the findings, the two structures of relative advantage and perceived compatibility were most effective in the adoption of new processes [19].

In this regard, another research was conducted by McGa et al. to evaluate the role of a multi-team approach in patient transfer in 2007, emphasizing the safety of patients. According to the findings, more than 90% of discharged patients had at least one potential exposure to medication side effects. In their study, adequate training of nurses and improvement of nursing

skills in medication assessment reduced the risk of mortality by at least 78%. Furthermore, less than 28% of the patients required follow-up and revisits which ultimately reduced treatment costs [20].

Considering the importance of medication reconciliation and creation of an appropriate framework for the proper acceptance of this process, the researchers tried to investigate the determinants of the use of medication reconciliation in nurses based on diffusion of innovation theory.

Method

This cross-sectional study was conducted on 91 nurses engaged in intensive care units, internal medicine departments, surgery wards, cardiac care units, gynecology, and pediatric wards from two general hospitals in Ardakan and Meybod cities in Yazd province in May 2016.

This study is section of protocol that was approved by the Ethics Committee of Shahid Sadoughi university of medical sciences, Yazd, Iran (code: IRSSU.SPH.REC.1395.76).

The participants completed researcher-made questionnaires designed based on diffusion of innovations theory. The questionnaire was designed by the researchers according to previous studies and based on diffusion of innovations theory constructs. The validity of the questionnaire was reviewed by a panel of experts and its Content Validity Ratio (CVR) and Content Validity Index (CVI) were examined and approved. To remove any ambiguity in understanding of each item, a questionnaire was sent to 10 nurses and their comments were taken into consideration. The reliability of the questionnaire was also evaluated by conducting a pilot study on 15 nurses who were later excluded from the study. The final questionnaire included the following subscales:

1) *Relative advantage*: This construct contained six items and the acquirable score was in the range of 6 to 35. In this construct, the positive results of reconciliation form were questioned. Its reliability was 0.87 in Cronbach's alpha coefficient.

2) *Perceived compatibility*: This construct

included four items to measure the compatibility of integrated medication with professional requirements ($\alpha = 0.59$).

3) *Visibility*: It included two items scoring based on a 5-point Likert scale from completely correct to completely wrong. The range of possible scores was 2 to 10 ($\alpha = 0.74$).

4) *Testability*: This construct was measured with 2 items based on a 5-point Likert scale. The possible score for the construct was in the range of 2-10 ($\alpha = 0.62$).

5) *Perceived complexity*: In this structure with four items, the answers were scored inversely. If the completion or learning of the form was considered hardly, it was given less score. The acquirable score was in the range of 4 to 20 ($\alpha = 0.56$). Subjective norms (with six items) ($\alpha = 0.75$) and intention (with three items) ($\alpha = 0.65$) were the other constructs.

The collected data were entered into SPSS-13. One sample Kolmogorov-Smirnov test showed that the data were non-normally distributed. Spearman rank correlation coefficient was used to determine the correlation between variables and Mann-Whitney U test was used to compare the groups (significance level at <0.05).

Results

In total, 91 nurses were enrolled in this study and the participants were selected via census sampling. The participating nurses were assured of the confidentiality of the information, and then the questionnaire was provided to them to complete.

The participants' mean age was 34.36 ± 7.25 years. In terms of educational status, 10 participants had a diploma in paramedical sciences, and 57 cases had a bachelor's degree in nursing. The mean of clinical experience was 10 ± 8.15 years, with the minimum and maximum of one and 26 years, respectively. In addition, 30 participants were male (33.3%) and 60 were female (65.9%).

According to Table 1, 40% of the nurses found it difficult to complete integrated medication reconciliation forms, and 80% did not consider this healthcare strategy to be in line

with clinical professional values. Moreover, 78% of the participants were concerned that the implementation of the integrated medication program might interfere with their working time frame. With respect to the structure of relative

advantage, the majority of the nurses agreed with the benefits of the integrated medication reconciliation. As such, 82% of nurses believed that the use of this healthcare strategy contributed to the effective patient management.

Table 1 Distribution of responses to items of relative advantage, perceived compatibility, and perceived complexity

	Item	Totally Agree N(%)	Agree N(%)	Do Not Know N(%)	Disagree N(%)	Totally Disagree N(%)
Perceived complexity	Learning to complete integrated medication reconciliation forms is difficult for nurses.	9(9.9)	29(31.9)	30(33)	20(22.0)	3(3.2)
	The use of integrated medication reconciliation forms	10(11)	18(19.8)	36(39.6)	22(24.2)	5(5.4)
	It is quite easy to complete integrated medication reconciliation forms even for nurses who attempt to do it for the first time.	5(5.5)	33(36.3)	29(31.8)	20(22)	4(4.4)
Perceived compatibility	It is my professional duty to implement integrated medication reconciliation.	27(29.7)	40(44)	17(18.7)	4(4.4)	3(3.2)
	Nurses are concerned whether the use of integrated medication reconciliation interferes with their working time.	1(1.1)	5(5.5)	14(15.3)	45(49.5)	26(28.6)
	Integrated medication reconciliation is in line with professional values.	1(1.1)	3(3.3)	16(17.5)	41(45.1)	30(33)
Relative advantage	The implementation of integrated medication determines the list of required drugs for patients.	41(45.1)	43(47.3)	4(4.4)	2(2.2)	1(1.1)
	The implementation of integrated medication reconciliation prevents the misuse or excessive consumption of previous drugs by the patient.	42(46.2)	36(39.6)	8(8.8)	4(4.3)	1(1.1)
	The proper use of integrated medication reconciliation contributes to the effective patient management.	39(42.8)	40(44)	9(9.9)	2(2.2)	1(1.1)

As revealed in Table 2, two structures, perceived complexity (44.3%) and relative advantage (40.75%), accounted for the lowest scores obtained by the participants, while the structures, intention (91.83%) and relative advantage (86.5%), had the highest scores obtained by the participants. The mean score of relative advantage was higher

among male participants, and there was a significant difference in this regard (p=0.034). Furthermore, the mean scores of the structures, perceived complexity (p=0.01) and intention (p=0.013), were higher among male participants, and significant differences were observed in this regard.

Table 2 The tendency of nursing staff towards the completion of integrated medication reconciliation forms based on gender in the model of diffusion of innovations

Construct	Mean and standard deviation in terms of male gender	Mean and standard deviation in terms of female gender	Total mean and standard deviation	Total Score (%)	Significance level
Relative advantage	2.74 ± 27.20	4.07 ± 25.36	3.75 ± 25.95	86.5	0.034
Perceived compatibility	2.15 ± 8.40	1.85 ± 8.06	1.96 ± 8.15	40.75	0.621
Perceived complexity	1.83 ± 9.60	1.99 ± 8.50	1.99 ± 8.86	44.3	0.010
Testability	1.28 ± 7.83	5.36 ± 8.06	4.42 ± 7.98	79.8	0.332
Visibility	1.14 ± 8.70	1.22 ± 8.16	1.22 ± 8.36	83.6	0.060
Subjective norm	3.91 ± 24.13	7.69 ± 23.63	6.62 ± 23.80	79.33	0.301
Intention	2.25 ± 11.86	2.07 ± 10.60	2.19 ± 11.02	91.83	0.013

Table 3 indicates that there was a direct correlation between the structures perceived relative advantage and intention to complete the integrated medication reconciliation forms. Therefore, a higher mean score of relative

advantage resulted in the increased mean score of the intention structure; however, this correlation was not significant. Moreover, correlations between the constructs testability and visibility were not statistically significant.

Table 3. Correlations between intention and the structures of diffusion of innovations theory based on Spearman's correlation coefficient

Construct	Relative advantage	Compatibility	Complexity	Testability	Visibility
Intention	0.325**	0.171	0.231*	0.405**	0.299**
p-value	0.002	0.12	0.02	0.001<	0.001<

Discussion

In the present study, the mean scores of different structures of diffusion of innovations theory were evaluated among the nursing staff of two public hospitals. According to the findings, the highest scores belonged to the structures perceived relative advantage, testability, and visibility, while the lowest scores belonged to the structures perceived compatibility and complexity. Therefore, it can be concluded that the majority of nurses believed the completion of integrated medication reconciliation forms is difficult or interferes with their professional values and working time frame.

As shown in Table 1, 40% of the nurses found it difficult to complete the forms of integrated medication reconciliation, 80% did not believe this strategy to be in line with professional values, and nearly 78% were concerned that this program might interfere with their working time frame. Furthermore, the results of the present study indicated that the structures relative advantage, perceived compatibility, and perceived complexity of social networks

were positively correlated with the tendency of nursing staff toward using these networks. In other studies, the lack of dissemination and acceptance of the innovation has been due to the complexity of health systems [21,22]. The complexity of systems can be structural, process and patterns. For example, to change the method of drug delivery in a hospital, there needs to be a change in the real environment. In a system, individual factors, patterns of relationships, and beliefs should be considered. The lack of paying attention to these factors can cause more complexity of the system, as observed in the present study [23].

The findings of the current study confirmed the correlation between the tendency towards the application of the innovation theory and the use of social networks.

With respect to the relative advantage construct, 82.2% of the nurses believed that the implementation of integrated medication reconciliation contributed to effective

patient management. In this regard, a study was conducted by Abdullah Al Mubariz Saud et al [24]. in which the rate of the internet acceptance was measured based on Roger's diffusion of innovations theory, and recipients were categorized into innovators, early majority, late majority, delayed recipients, and survivors. According to the results of multiple regression analysis, the researchers concluded that the innovation structures including relative advantage, perceived complexity, testability, perceived compatibility, and visibility were effective in the acceptance of the internet by the participants. Furthermore, they reported that the structure of relative advantage had the most significant effect on the rate of internet acceptance compared to the other aspects of innovation. In the present study, the relative advantage structure was positively correlated with the intention of nursing personnel to complete integrated medication reconciliation forms [25].

Compatibility is another key element of innovation diffusion, which can influence the reception and the use of innovation. In the current study, the majority of the nurses were concerned that the implementation of integrated medication reconciliation might interfere with their working time frame, which denotes the fact that using this healthcare strategy has not been considered by nursing personnel. Therefore, nurses should be assured that the implementation of this program corresponds with their professional values. This finding was consistent with the results obtained by Pankratz et al. that evaluated the attitude towards preventive procedures in a medical high school in 2002. According to their findings, the two structures, relative advantage, and perceived compatibility were essentially correlated with the tendency of healthcare staff towards the use of new pharmaceutical approaches [19].

In another study done by Vedela et al., the results indicated that in individuals with lower perception of the complexity of clinical systems, there was a direct correlation between comprehended simplicity and reduced

perceived complexity [26]. Moreover, the perception of the functionality of the system was correlated with the relative advantage structure, and concerns regarding the patient-physician relationship were associated with the compatibility of the system. Accordingly, the higher perception of the functionality of the system was correlated with the structure of relative advantage [27].

The findings of the current study were indicative of a direct correlation between the structures testability and visibility and the structure tendency to complete the forms of integrated medication reconciliation among nurses. This was in line with the results obtained by Khalesi et al. assessing the users of hospital information systems [28]. Furthermore, the authors stated that visibility had a significant effect on the tendency of hospital staff towards the use of information systems. In this regard, the findings of Putzer et al. revealed that in the proposed diffusion of innovations theory, innovation structures (visibility, perceived compatibility, professional relations, and internal and external environment) were significant predictors of the attitude of healthcare professionals towards the use of smartphones [29].

In other related studies, factors such as the reception of consumption management systems, human and ergonomics factors in the hospital, and different structures of innovation in rehabilitation management had significant associations with relative advantage, perceived compatibility, and perceived complexity, which is consistent with the results of the present study [30-32]. Therefore, it is suggested that the modified version of diffusion of innovations theory is adopted as a proper measure for clinical data collection in order to predict and comprehend the use of social networks.

Conclusion

The results of the current study indicated that acceptance of innovation in the completion of integrated medication reconciliation forms

requires the enhancement of the knowledge of nursing staff, as well as the reduction of the complexity of this strategy, in order to correspond with the nursing profession. The researcher pointed out that the study did not have any impact on the performance of the personnel and their perception could affect the process of completing the questionnaire.

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Authors' contributions

Design Study: MFA, SHS,
analysis and collection Data: EJ, MFA
Manuscript preparation: MFA
All authors have read and approved the final version.

Conflict of Interest

"The authors declare that they have no competing interests."

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Availability of data and materials

The datasets used and/or analyzed during this study are available from the corresponding author on reasonable request.

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