Evaluation of nurses' opinions about computer physician order entry

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Abstract

This research was performed as a descriptive and analytic study to determine the perceptions of the nurses regarding the computerised physician order entry system. The study was conducted with 207 nurses working in four hospitals using this system in Bursa. Sociodemographic data form and the computerised physician order entry system perception scale were used as data collection tool. Obtained data were analysed by statistical methods and nonparametric tests. The scale met an acceptable level of reliability and validity (α = 0.94). There was a statistically significant difference between the groups according to age, position, service and institution, years of institution experience and the period of using the system in terms of scale and sub-dimensions. Finally, it was determined that the nurses perceived the system as positive in spite of some difficulties related to this system. It is suggested that the problems with the system should be solved and training programmes should be organised.

Keywords: Nurse, computer physician order entry, medication errors.

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1. Introduction

The statement in the report published by the Institute of Medicine in 1999 that medication errors were one of the most important medical errors and had a dramatic reflection in the society. There are many reasons for medication errors (Rogers, Dean, Hwang & Scott, 2008). However, illegible and deficient medication instructions written on paper appear to be the most frequent cause of physician-based medication errors (Delgado Silveira, Soler Vigil, Perez Menendez-Conde, Delgado Tellez de Cepeda & Bermejo Vinedo, 2007). Developments in the information technology area during the last 50 years reveal that medical organisations may offer safer and more efficient medical care services by integration with electronic systems. One of the studies performed in this area is the electronic patient registration system called computerised physician order entry system (CPOE). The CPOE system helps the physicians to perform their medication request or prescription online in the computer (Fiumara et al., 2008).

Nurses also perform other functions in addition to the treatment and care of patients, including computer entries, registration of patients, filling up the patient file, recording works they have done, etc. It is emphasised that the inability of nurses to read a hand-written medication instruction potentially leads to wrong medication or wrong dosage and prevention of such errors may be possible by using an electronic order system. (http://www.nccmerp.org/aboutMedErrors.html Date of Access: 19 July 2015). Following the use of CPOE, the time spent by nurses for paperwork was reduced and the time reserved for patients was increased (Gerald, Donna, Jennifer & Phillip, 2006). CPOE was demonstrated to reduce nosocomial death rates, medication errors and unexpected effects of drugs and it enhanced the quality of medical care (Rahimi & Vimarlund, 2007).

Besides numerous benefits of CPOE, certain studies suggest that hazards to the patients may continue and the rate of errors may increase (Nebeker, Hoffman, Weir, Bennett & Hurdle, 2005; Ammenwerth et al., 2006). In a study, death rates that were 2.80% before the application of CPOE were found to be 6.5% (Han et al., 2005). Findings were obtained that CPOE impaired the synchronisation of physician–nurse communication and therefore, pushed nurses out of the order process and impaired the return mechanisms (Beuscart-Zephir et al., 2005; Wright, Frey, Scherer & Hilton, 2006). Electronic medical records used for offering a quality healthcare service and CPOE, as a part thereof has not yet been used as commonly in high extent in the world. The CPOE application which was tried to be a compulsory practice with the support of healthcare policies is a rather new system in Turkey and is implemented in a limited number of hospitals. The number of studies made in Turkey in this field is quite limited.

2. Material and method

The Study was performed as a definitive research establishing the Computer Physician Order Entry applications, the opinions of nurses with respect to the benefits and difficulties of the system. The study environment consists of the nurses employed in four hospitals affiliated to the Ministry of Health in the city of Bursa and using CPOE application, and the sample consists of 207 nurses who can be accessed to and agreeing to participate in the study. As data collection tool in the study, a questionnaire form developed by investigators in line with the literature (Koppel et al., 2005; Hoonakker et al., 2013; Rahimi, Timpka, Vimarlund, Uppugunduri & Svensson, 2009).

Validity, reliability and factor analysis were performed on the scale. It was seen at the end of these studies that the scale was reduced to 40 statements from 58 statements, the general scale reliability coefficient was ($\alpha = 0.94$), it was collected under five factors. The scale with considerably high internal consistency among the questions is valid and reliable scale. The study was performed during the period between 1 February 2016 and 31 September 2016 after obtaining necessary ethical board and institution approvals. The scale was designed as 5-point Likert scale involving 'Strongly disagree = 1 point', 'Disagree = 2 points', 'Slightly Disagree = 3 points', 'Agree = 4 points' and 'Strongly agree = 5

points'. In this scale, low points show 'negative opinions' on the CPOE system and high points show 'positive opinions' on the system.

In the analysis of data, Kolmogorov–Smirnov, Spearman correlation analysis, Mann–Whitney U and Kruskal–Wallis tests were used in addition to definitive statistics such as frequency, percentile, mean and standard deviation.

3. Results

Table 1 shows that the ages of 44.9% of nurses sampled ranged between 31 and 40 years, their majority (93.2%) were females and 55.6% had a bachelor degree, 28% was employed in Institution A, 50.7% in internal units, 88.4% was employed as department nurse, 33.3% had professional experience between 6 months and 7 years, 38.7% had institutional experience ranging between 4 and 10 years and 45.4% had position experience between 2 months and 3 years.

Table 1. Findings related to individual and professional particularities of nurses

Particulars	Groups	*N*	%
Age	18–30	71	34,3
	31–40	93	44,9
	41 years and above	43	20,8
Gender	Female	193	93,2
	Male	14	6,8
Education	Medical Vocational School	24	11,6
	Associate degree	58	28,0
	Bachelor degree	115	55,6
	Master degree	10	4,8
Institution	Institution A	58	28,0
	Institution B	48	23,2
	Institution C	51	24,6
	Institution D	50	24,2
Professional experience	6 months–7 years	69	33,3
	8–15 years	57	27,5
	16–23 years	46	22,2
	24 years and above	35	17,0
Institutional experience	6 months–3 years	75	36,2
	4–10 years	80	38,7
	11 years and above	52	25,1
Position experience	2 months–3 years	94	45,4
	4–10 years	71	34,3
	11 years and above	42	20,3
Position	Supervisor(responsible)	24	11,6
	Department nurse	183	88,4
Division	Surgical units	51	24,6
	Internal units*	105	50,7
	Intensive care	40	19,3
	Emergency	11	5,3

*Internal Units *r*: (internal units, neurology, psychiatry, general clinic, etc.)

It was seen that 45.9% of nurses used CPOE system for 1 year, 52.2% received training on the system, 66.7% found the training satisfactory and 40.1% had goods skills in using computers (Table 2).

Table 2. Findings related to the particulars of nurses with respect to using the system

Particulars	Groups	n	%
Experience on the system	0–1 years	95	45,9
	1–2 years	41	19,8
	2–3 years	31	15,0
	3–4 years	40	19,3
Training on the system	No	99	47,8
	Yes	108	52,2
Satisfactory training	Satisfactory	72	66,7
	Unsatisfactory	36	33,3
Computer skills	Bad and not bad	30	14,5
	Average	70	33,8
	Good	83	40,1
	Perfect	24	11,6

CPOE scale general mean scores of nurses were found to be 140.17; mean scores of the scale with respect to the superior aspects dimension of the system 39.31; mean score with respect to patient and employee safety 29.65; mean score with respect to the benefits of the system on nurses 36.26; mean scores related to existence of support systems 20.96 and mean scores related to weaknesses of the system 14.00 (Table 3).

Table 3. CPOE scale general and sub-dimension mean scores of nurses

Sub-dimensions	Number of items	Min	Max	Mean	SD
Strengths of the system	10 (1–5)	10	50	39.31	7.91
Patient and employee safety	9 (1–5)	9	45	29.65	6.88
Benefits of the system on nurses	9 (1–5)	9	45	36.26	8.02
Existence of support system	6 (1–5)	6	30	20.96	5.49
Weaknesses of the system	6 (1–5)	6	30	14.00	5.42
General mean score	40 (1–5)	40	200	140.17	24.72

A significant difference was found among mean scores of group standings with respect to CPOE scale total score according to the institution where the nurses were employed (x^2 = 16.962; $p < 0.05$). Mann–Whitney U test was applied to define the origin of the difference. The difference in question was found to originate from Institution A.

Table 4. Comparison of CPOE total score according to the institution where the nurses were employed and to institution experience

Total scale	Groups	n	$\bar{x}_{sira}$	x^2*	SD	p	Mann Whitney U**
Institution	Institution A	58	130.81				1 > 2
	Institution B	48	97.77				1 > 3
	Institution C	51	87.57	16.962	3	**0.001**	1 > 4
	Institution D	50	95.64				
Institution experience	3 years and less	75	89.07				2 > 1
	4–10 years	80	115.49	7.724	2	**0.021**	
	11 years and above	51	105.91				

*Kruskal–Wallis H Test

**Mann–Whitney U Test

A statistically significant difference was found between Institution A and other Institutions ($p < 0.05$). No statistically significant difference was found among mean scores of other group standings ($p > 0.05$) (Table 4).

As seen in Table 4, a statistically significant difference was found between mean scores of CPOE scale standings according to Institution experience of subjects (x^2 = 7.724; $p < 0.05$). Mann–Whitney-U analysis revealed that statistically significant difference was found in favour of nurses with 4–10 years Institution experience ($p < 0.05$).

Table 5 compares CPOE scale total scores according to training received by nurses on the CPOE system and results in a statistically significant difference in favour of the group that received training ($p < 0.05$).

Table 5. Comparison of CPOE total score according to the training of nurseson the system and the adequacy of training received

Total scale	Groups	n	$\overline{x}_{sira}$	$\sum_{sira}$	U	z	p
Receiving system	Yes	108	116.38	12,568.50	4009.50	−3.106	**0.002**
	No	99	90.50	8959.50			
Adequacy of training	Adequate	72	61.74	4568.50	944.50	−2.657	**0.008**
	Inadequate	36	44.53	1647.50			

*Mann–Whitney U test

When total CPOE scale scores of subjects based on their opinion that the training received was adequate, a statistically significant difference was found in favour of the group believing that the training was adequate ($p < 0.05$) (Table 5).

As seen in Table 6, the nurses listed *ensuring legibility of medication orders, legal protection of nurses and increased patient safety as the most important three benefits of the system, resistance of physicians to the system, late medication orders and slow operation of the system* were listed as the most important three difficulties of the system.

Table 6. Distribution of the opinions of nurses with respect to the benefits and difficulties of CPOE system

Items		Line 1		Line 2		Line 3	
		n	%	n	%	n	%
Benefits of CPOE	Ensuring legible medication requests saglamasi	100	48.3	25	12.1	1	12.6
	Legal protection of nurse	36	17.4	37	17.9	2	10.1
	Increased patient safety	12	5.8	29	14.0	3	15.0
Difficulties of CPOE	Resistance of physicians to the system	50	24.2	38	18.4	3	15.9
	Delay of orders by physicians	34	26.4	40	19.3	3	15.5
	Slow automation system	49	23.7	39	18.8	1	7.2

4. Discussion

The scores of nurses on the CPOE system appear to be at the moderate level, near to positive (Table 3). Mean general scores of nurses employed in Institution A were found to be higher than mean scores of nurses in other institutions. Institution A is one of the sample hospitals, as the first in Turkey in using CPOE application in Turkey and ensuring the sustainability of the system. Consequently, it may be said that the adoption of CPOE system was higher between both managers and employees compared to other hospitals. Institution A is the one most adapted to CPOE application with the longest time of use compared to others. The nurses employed in this hospital are seen to make higher use of the advantages of the system.

As seen in Table 4, general scale mean score of nurses with 4–10 years of institution experience was higher compared to those with an institution experience of 6 months–3 years. We believe that the level of adoption of new applications by nurses employed for lesser periods in their hospitals may be correlated with their commitment to the institution. According to studies performed, this is explained by the moderate level of commitment of nurses to the institution and lower level of commitment of

younger nurses to the organisation compared to older nurses (Duygulu & Korkmaz, 2008). Integration of employees with the organisation, adaptation to institutional arrangements and increase in psychological commitment may only be possible with the increase in institutional experience and an efficient leadership (Demir, 2012). In addition, the benefits and privileges offered to employees by managers and institutional arrangements make it easier for nurses to adopt changes in the system.

General scale scores of nurses receiving training with respect to CPOE application were found to be higher than untrained nurses. The reason for this is that trained nurses dominate the processes related to the system and used the system better by developing their skills about the system and they are capable of coping with difficulties experienced in the system. In addition, trained nurses are more easily adapted to new workflow processes which were changed with the introduction of CPOE.

The nurses stated the most important three benefits of the system as ensuring legibility of medication orders, legal protection of nurses and increased patient safety. In a study performed by Hoonakker et al. (2013), 43% of nurses marked efficiency in the first line, 40% legibility in the second line and 31% easier access to patient data in the third line. The results of the study were similar to those of Hoonakker. Manually written nurse observation forms and treatment registers disappeared upon the introduction of CPOE. Use of abbreviations by physicians when ordering electronically is prevented by the system and writing the full name of the medication and using millilitre instead of cubic centimetre were defined during creating the infrastructure of CPOE system. In this study, the arrangement of patient charts in line with quality standards and increase in the legibility of medication orders appear to be the most important advantages of the system. In paper-based systems, orders written on forms manually bear the risk of being lost. Registration and backing up of data in the automation system upon transition to the electronic system prevented loss of data. In the manual system, nurses may interpret medication orders erroneously. In a well-designed CPOE system, nurses may be prevented from the administration of the medication before instructions are given. Clear statement of data such as the physician giving the order, the time of order and for which patient the order is given reduce medical errors. In malpractice cases, frequently encountered by nurses, it is stated that the CPOE system protects nurses. To prevent malpractice in medication applications, availability of qualified nurses having a bachelor or master degree, using informatics techniques, development of registration systems, efficient communication, improvement in quality reliability and care standards and creation of treatment protocols are important.

When nurses were asked to list the difficulties they experienced with respect to CPOE system according to their degree of importance, the first line was the resistance of physicians for using the system, followed by a delay in physicians giving the order and slow operation of the automation in the third line. In the study of Hoonakker et al., usability was in the first line with 31%, order changes with 27% and communication choices in the third line with 20%. Physicians resisted using the system also in countries that were the first to use the system. However, the rate of use of the system increased upon physician being convinced of the benefits of the system. In hospitals where the study was performed, physicians have been using the system rather shortly. The rate of use will increase in time when physicians are convinced of the benefits of using the system. Nurses stated that physicians did not want to add on the patient chart, any change in the treatment plan of the patient and made the change manually and orders were delayed. Additionally, upon failure in the placement of medication order at the time of the first admission of a patient treatment of patients may be delayed which creates problems between physician and the nurse and between the nurse and the patient. In addition, the computer infrastructure of hospitals appears to be inadequate and the system operates slowly, increasing the workload and causing the resistance of physicians to develop.

That systems used in many hospitals are independent of each other and have different infrastructures, with different times of use of the system may create hesitations regarding comparison of studies. Therefore, different results may be encountered at the point of usability and efficiency (Murff & Kannry, 2001).

5. Conclusion

In conclusion, it is necessary that before designing the CPOE, user friendly computer interfaces should be created based on opinions of employees, definition of workflow processes related to the subject, CPOE use before and after installation, the benefits of the system, its contribution in patient safety and quality of care and widespread training and support of users by managers.

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