Investing in E-Health: People, Knowledge and Technology for a Healthy Future
H. Grain et al. (Eds.)

doi:10.3233/978-1-61499-427-5-149

Does CPOE support nurse-physician communication in the medication order process? A nursing perspective

Basema SADDIK [1] PhD and Shaha AL-MANSOUR MSc (HI)
College of Public Health and Health Informatics,
King Saud Bin AbdulAziz University for Health Sciences, Saudi Arabia

Abstract. Introduction: The benefits of CPOE are many and have been recognised in the literature as important components for improving patient safety and clinician performance. However, there remain concerns about adverse effects CPOE systems may have on the medication order process and workflow processes. This study explores the perception of nurses regarding the CPOE support on nurse physician communication in the medication order process **Methods:** A survey was developed measuring perceptions of CPOE features on workflow and nurse physician communication on a Likert scale. *Results:* The majority of nurses felt that CPOE features supported the medication order process and perceived proper nurse physician communication. **Conclusions:** CPOE characteristics supported medication order processes and nurse physician communication although nurses reported additional work was required for follow up of physicians. Additional studies utilising in depth methods are recommended to fully understand medication order processes with further CPOE implementation.

Keywords. CPOE, nurse -physician communication, workflow

Introduction and Background

A computerised physician order entry (CPOE) system is a clinical application that allows healthcare providers to electronically enter orders (laboratory, medication, imaging etc.) for patient care [1]. The benefits of CPOE are many and have been recognised in the literature as an important component for improving patient safety and practitioner performance [1-3] particularly by reducing medication-related errors and the occurrence of adverse drug events [4-6].

However, despite the reported advantages of CPOE and the improvements it has brought to the medication ordering process, several attempts of implementing CPOE systems have been unsuccessful because of user resistance and unexpected patient outcomes [4, 7-9]. User acceptance and staff readiness for change regarding changes in the workflow and process are key to the success and acceptance of any health information technology [10]. Healthcare workers and in particular nurses, are central components in the delivery of healthcare and are critical key players in the successful

[1] Corresponding Author: Assistant Professor, Department of Health Informatics, College of Public Health and Health Informatics, KSAU-HS, PO Box 22490 Mail Code:2350 Riyadh 11426, Kingdom of Saudi Arabia. Email: saddikb@ksau-hs.edu

implementation of any system such as CPOE. They should be prepared for any significant changes in workflow processes, security, quality of patient care and disrupted nurse physician communication [10-11]. Reduced face to face communication between nurses and physicians has also been identified as a potentially negative impact of the CPOE system [4,12] and may in fact impede nurse-physician collaboration thus undermining the efficiency and safety of the medication process [5].

The CPOE system was implemented at the National Guard Health Affairs (NGHA) – Eastern Region in September 2009 as part of an intended complete CPOE roll-out to all NGHA hospitals in the Central, Eastern and Western Regions of Saudi Arabia. A pilot project in a department of the Central Region hospital was confronted by multiple barriers including physician resistance, lack of internal expertise in health IT, small IT team sizes and major expansion of the hospital at the time [13]. To date, complete rollout of CPOE in all of the NGHA hospitals and departments has not occurred.

A preliminary study measuring physician satisfaction with CPOE at NGHA-Eastern region, found that more than half of the physicians reported overall satisfaction with CPOE and perceived that CPOE improved patient quality care and efficiency. Physicians also reported positively on the ease of use of CPOE [14]. However, no study has yet explored nurses' perceptions of CPOE and in particular their opinions on whether CPOE supports nurse-physician communication in the medication process since its implementation at NGHA. Even though physicians plan patient medication therapy, nurses play an important role in the delivery of medication and their involvement and cooperation is critical for the successful implementation of CPOE. This study explored nurses' perceptions regarding the CPOE and its impact on nurse-physician communication in the medication order process.

1. Methods

1.1. Study Setting

The study was conducted at a 112 bed hospital of the NGHA Medical City-Eastern Region. It is considered one of the leading hospitals in the eastern region due to the international accreditation from JCIA for its recognised efforts. It was officially opened in October 2002. The hospital provides services in General Surgery, Internal Medicine, Gastroenterology, Paediatrics, Obstetrics and Gynaecology, Family Medicine, Ophthalmology, Dentistry, Endocrinology, Orthopaedic Surgery, Pulmonary, and Neurology. More than 7000 patients (both inpatient and outpatient) are seen monthly in the hospital. The CPOE system used at NGHA is an integrated feature of the existing Computerised patient record (CPR) and not a "stand alone" clinical information system. CPOE had been implemented in all units of the hospital at the time of this study [14].

1.2. Study Participants

All nurses who were working in the inpatient departments at NGHA – Eastern region and were using CPOE were the study's target population. A total of one hundred and seventy four nurses were invited to participate in the study. Convenience sampling was used due to the small number of nurses in the hospital. From the 174 nurses invited to

participate in the study, data were collected from 146 nurses, hence giving this study a response rate of 83%.

1.3. Survey Instrument

This cross-sectional exploratory study utilised a questionnaire to collect data on nurses' perceptions of CPOE in the medication order process. The questionnaire consisted of three sections: demographic data such as (age, gender, position, and years of experience), nurses' perceptions in relation to CPOE features in the medication order process such as (clarity in overview of patients medications, completeness of drug prescriptions, efficiency of the drug order process, legibility of prescriptions and accessibility to patient medication records), and nurses' perceptions regarding nurse-physician communication in the medication process which asked questions on frequency of physician contact, inaccessibility of physicians, clarity of the physicians prescription and follow-up with physicians. These were measured on a 5-point Likert scale with the options "strongly disagree" and "strongly agree" at the two extremes [15].

Face validity of the questionnaire was measured by an expert panel consisting of health professionals, nurses, and health informatics professionals. The expert panel reviewed the contents of the questionnaire in terms of content accuracy, clarity and comprehensiveness and agreed that the questionnaire met its objectives. A pilot study was carried out to ensure the clarity and reliability of items in the questionnaire. The questionnaires for the pilot study were given to the heads of nursing and team leaders of nursing informatics for completion. No further modifications were made following the pilot study. Questionnaires were distributed by hand to the nurses through their team leader.

1.4. Research Approval

Research approval was granted by the King Saud bin AbdulAziz University for Health Sciences scientific research committee in September 2010 and by the National Guard Health Affairs Hospital – Eastern Region in April 2010. Approval was also granted by the Associate Executive Director of Nursing Services in the NGHA-Dammam hospital.

1.5. Data Analysis

All data were analysed using the Statistical Package for Social Sciences (SPSS) version 17.0. Data were analysed using descriptive statistics including frequencies and percentages for demographic variables, and nurses' perceptions of CPOE features supporting work flow and nurse physician communication. Mann-Whitney U and Kruskal Wallis tests [16] were used to compare mean scores between the demographic variables and nurses perceptions of workflow and nurse physician communication. In addition, relationships between nurses' perception of CPOE nurse-physician communication and workflow were examined using correlational analyses. All p values quoted are two-sided; with an alpha level of 0.05.

2. Results

Almost all of the nurses in the study were female with ages ranging between 25-60. As shown in Table 1, the majority of the nurses were from surgery and Neonatal ICU and had years of experience between 6-10 years.

Table 1. Demographic characteristics of nurses

Characteristics		Frequency N (%)
Gender	Male	4 (2.7)
	Female	137 (93.8)
Age	25-35 years	70 (48)
	36-45 years	50 (34.2)
	46-55 years	20 (13.7)
	56-60 years	4 (2.7)
Position	Staff Nurse I	66 (45.2)
	Staff Nurse II	66 (45.2)
	Midwife	7 (4.8)
Area of specialty	Surgery	34 (23.3)
	NICU and Nursery	31 (21.2)
	L&D	23 (15.8)
	ICU	20 (13.7)
	ER	25 (17.1)
	Paediatric	13(8.9)
Years of experience	1-5 years	37 (25.3)
	6 -10 years	47(32.2)
	11- 15 years	29 (19.9)
	More than 15 years	30 (20.5)

Figure 1 presents nurses' perceptions on CPOE characteristics and support of workflow and nurse physician communication. Positive and negative perceptions were measured by combining agree and strongly agree as a positive and by combining disagree and strongly disagree as a negative perception. Neutral remained the same. Almost all of the nurses perceived that CPOE allowed easier accessibility to patients' medication records and provided complete and legible drug prescriptions. In terms of nurses' perceptions of CPOE in supporting nurse physician communication, the majority of nurses agreed that more physician contact was required with CPOE and that the physician was always followed up by phone call regarding certain prescriptions. Overall, almost all of the nurses perceived that CPOE supported their work process. The Kruskal Wallis and Mann-Whitney U tests showed that there were significant differences in nurses' perceptions of CPOE supporting nurse physician communication. Nurses who had less years of experience agreed that CPOE supported nurse physician communication $p=0.004$ and nurses who worked in surgery significantly disagreed that

CPOE supported nurse physician communication p≤0.001. Correlation between nurses perceptions of CPOE features supporting workflow and nurse physician communication revealed a Spearman's correlation coefficient of (R=0.517, p≤0.001) which indicates an intermediate positive correlation between nurses perceptions of CPOE supporting workflow and nurse physician communication.

3. Discussion

This study has explored nurses' perceptions of CPOE in supporting nurse-physician communication in the medication order process. Over half of the nurses agreed that CPOE provided clear drug overviews, complete and legible drug prescriptions and efficient and accessible drug orders. These results are supported by other studies where nurses also agreed that CPOE supported their medication work process in terms of legibility and clear drug overviews [5, 17]. However, even though nurses in our study agreed that medication orders were clear and on time, a high percentage perceived that after CPOE implementation, frequent physician contact was required. This indicates that although CPOE provides clear and timely prescriptions, nurses still need to follow

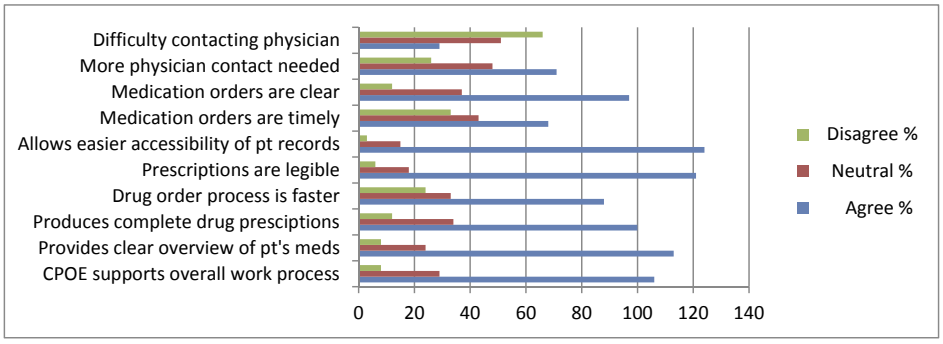

Figure 1. Nurses' perceptions on CPOE characteristics supporting workflow and nurse physician communication

up with the physician to verify and discuss the medication order. These findings are supported by Beuscart-Zephir et al, who used activity analysis to identify the differences between CPOE medication order processes and paper based systems and their impact on the nurse physician communication process. They found that CPOE orders were exhaustively documented which did not support doctor nurse cooperation and orders were complete yet highly ambiguous and that decisions which required nurse physician contribution were not provided by CPOE[12]. Additionally, another study found that CPOE negatively affected nurses' work in the medication process and failed to coordinate the medication related tasks of professionals from different disciplines, therefore other methods of communication like phone calls and paper notes were needed for checking [18].

Nurses in the current study who had been working for longer years and worked in the Surgery department reported negative perceptions of CPOE supporting proper nurse physician communication. These differences may be due to workflow changes, new work/ more work, and system demands following CPOE implementation and which have been reported in the literature as unintended adverse consequences of CPOE [4].

4. Limitations

This study had several limitations including the cross-sectional design of the study, and the sampling technique where survey participants may have more positive attitude towards CPOE implementation and are more motivated to participate than non-responders, however the high response rate of this study is encouraging. Also, the timing of the study, shortly after implementation of CPOE may reflect the perspectives of nurses who are still beginning to use and learn the system and perceptions may change with experience and time. However with these limitations in mind, the results from this preliminary study should not be ignored as they provide us with baseline results which will inform further research in this area after complete rollout of CPOE at other NGHA hospitals.

5. Conclusion

This study revealed positive nurse perceptions with CPOE features which supported their workflow and overall nurse physician communication in the medication order process, although nurses also reported the need to follow up with physicians frequently on medication orders. Furthermore, our study shows that nurses with longer years of experience and those from the surgery department did not perceive that CPOE supported workflow and nurse physician communication. Further studies are needed following the complete rollout and implementation of CPOE and nurses are better equipped with the skills required to use the system. Future research should also use qualitative methods to provide in depth activity analysis with the implementation of a CPOE system.

References

[1] R.Khajouei, P.C. Weirenga, A.Hasman, M. Jaspers, Clinicians satisfaction with CPOE ease of use and effect on clinicians' workflow, efficiency and medication safety. *Int. J Med. Inform* ***80*** (2011) 297-309

[2] A. Georgiou, A. Ampt, N. Creswick, J. Westbrook, J. Braithwaite. Computerized provider order entry-what are health professionals concerned about? A qualitative study in an Australia hospital. *Int. J Med. Inform* **78** (2011), 60–70

[3] G.J. Kuperman, R.F Gibson .(2003)Computer Physician Order Entry: Benefits, Costs, and Issues. *Ann Intern Med* **139** (2003) 31-39.

[4] J. Ash, D. Sittig, E. Poon, K. Guappone, E. Campbell, R. Dykstra.The extent and importance of unintended consequences related to computerized provider order entry.*J Am Inform Assoc.***14**(2007), 415– 423

[5] H. Prinejad, Z.Niazkhani, H. Sijs, M. Berg, R. Bal, Impact of a computerized physician order entry system on nurse-physician collaboration in the medication process. *Int J Med.Inform* **77**(2008),735–744

[6] D.Singh, S Spiers, B.W. Beasley. Characteristics of CPOE systems and obstacles to implementation that physicians believe will affect adoption. *South Med J* **104** (2011), 418-421

[7] D. Riedmann, M. Jung, W.O Hackl, W. Stuhlinger, H. Van der Sijs. Development of a context model to prioritize drug safety alerts in CPOE systems. *BMC Med Inform Decis Mak* **11** (2011) 35
[8] Y.Y. Han, J.A. Carcillo, S.T. Venkataraman, R.S.B Clark, R.S. Watson, T.C. Nguyen, H. Bayer, R.A Orr. Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. *Pediatrics* **116** (2005), 1506-1512
[9] W. Hersh, Health care information technology: progress and barriers. *JAMA* **292** (2004), 2273 – 2274
[10] S.D. Culler, J. Jose, S. Kholer, K. Rask, Nurses' perceptions and experiences with the implementation of a medication administration system. *Comput Inform Nurs***29** (2011), 280-288.
[11] M.J Wright, K. Frey, J. Sherer J, D. Hilton, Maintaining excellence in physician nurse communication with CPOE: A nursing informatics team approach. J Healthc Inf Manag. 20 (2006), 65-70.
[12] M Beuscart-Zephir, S Pelayo, F Anceaux, J.J. Meaux, M. Degroisse, P. Degoulet. Impact of CPOE on doctor-nurse cooperation for the medication odering and administration process. *Int J Med Inform.* **74** (2005) 629-641
[13] M.M. Altuwaijri, A. Bahanshal, M. Almehaid, Implementation of a computerized physician order entry at National Guard Hospitals: Assessment of critical success factors *J Family Community Med **18** (2011) 143-151.*
[14] B.Saddik, M Al-Fridan, Physicians' satisfaction with computerised physician order entry (CPOE) at the National Guard Health Affairs:A preliminary study.*Stud Health Technol Inform* **178 (**2012) 199-206
[15] R.F. DeVellis, *Scale Development: Theory and Applications*, Thousand Oaks, CA: Sage, 2003
[16] W.J. Conover*, Practical Nonparametric statistics*, 3rd Edition, John Wiley & Sons, 1999
[17] H. Prinejad, Z. Niazkhani, H.V Sijs, M. Berg, R. Bal. Evaluation of the impact of CPOE system on nurse-physician communication: A mixed method study. *Methods Inf Med* **48** (2009) 350-360.
[18] Z. Niazkhani, H. Pirnejad, H.V Sijs, J. Aarts, Evaluting the medication process in the context of CPOE use: The significance of working around the system. *Int J Med Inform* **80** (2011) 490-506.