Challenges of Trustable AI and Added-Value on Health
B. Séroussi et al. (Eds.)

doi:10.3233/SHTI220435

Evaluation of a Personal Digital Assistant Device Implementation for Barcode Medication Administration with Nurses Using a Likert Questionnaire

Juan DESCALZO[a,1], Javier CASTRO[a], María SMITH[a] and Daniel LUNA[a]
[a] *Health Informatics Department, Hospital Italiano de Buenos Aires*

Abstract. The majority of preventable medication errors occur at the administration stage. BCMA systems are used to improve safety and prevent errors in this stage. A variety of devices can be used for this purpose. Hospital Italiano de Buenos Aires is a high complexity medical center implementing a BCMA project since 2015. It is currently migrating to PDA devices for nurses. The objective of this work is to evaluate the implementation of these new devices in selected wards at HIBA using a self-reported questionnaire. From 318 contacted nurses, 58 answered the questionnaire (18.2% response rate). Overall, agreement was high among all statements regarding the new devices. Nurses valued especially the increased safety to reduce errors, improvements in previous hospital processes and achieving improvements in the flow and quality of patient care. Nurses recommended the use of the device in their sector, with a mean score of 4.6/5 and 91.3% agreement, highest in total. This proved to be a cost-effective method of evaluation of the newly implemented devices and acceptance by nurses. Measures to incorporate the remaining nurses' feedback should be considered.

Keywords. BCMA, nursing, implementation evaluation

1. Introduction

The majority of preventable medication errors at the inpatient setting occur in the administration stage [1], as many as 34% according to Bates et al [2]. The Bar-Coded Medication Administration (BCMA) system makes the process safer by reading a barcode on the patient's bracelet and on medication pouches to ensure the 5 rights of medication safety: medication, patient, time, dose and route [3]. Personal Digital Assistants (PDAs) are small and portable handheld computers [4]. PDAs with a barcode scanner, linked to the hospital's computer system, have been used to ensure safety and reduce errors in hospitalized patients [5]. The Hospital Italiano de Buenos Aires (HIBA) implemented BCMA in 2015, but over the years, new technologies such as PDAs have been added. Suitable equipment selection for this project is considered a key to success.

[1] Corresponding Author, Juan Descalzo, Health Informatics Department, Hospital Italiano de Buenos Aires, Tte. Gral. Juan D. Perón 4190, C1199ABB Buenos Aires, Argentina; E-mail: juan.descalzo@hospitalitaliano.org.ar.

The objective of this work is to evaluate the implementation of PDA devices for Bar-Coded Medication Administration in some general wards at the Hospital Italiano de Buenos Aires (HIBA) using a self-reported Likert-type scale questionnaire.

2. Methods

2.1. Setting

The Hospital Italiano is a high complexity medical center located in the City of Buenos Aires. It has 750 inpatient beds, 200 for critical care. It employs more than 9000 people, including 1600 nurses. It is a university hospital that covers the entire spectrum of health care, performing around 30000 discharges per year. Since 1998, HIBA has had its own health information system [6] and it's a Stage 7 HIMSS certified institution.

A BCMA system has been implemented at the hospital since 2015, on desktop devices [7]. Starting 2017 mobile devices have been the main technology used, such as tablets incorporated into "Workstation on Wheels" or wall-mounted. Also, nurses have the possibility of using the same mobile application on their personal cell phone [8].

At the time of this work, the Health Informatics Department is going forward with the implementation of Honeywell EDA51 PDA devices for its BCMA project.

2.2. Questionnaire

A Likert scale [9] questionnaire using the Google Forms platform. The survey consisted of 14 statements regarding the recently implemented devices. Nurses could answer on a 5-point scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided or Neutral, 4 = Agree, and 5 = Strongly Agree. Questions were designed using a general IT implementation questionnaire already in use in HIBA, selecting and adapting questions for these study objectives, with support from research methodology specialists.

2.3. Sample

The implementation team selected 7 wards to survey: 3 general adult, 2 general pediatric, 1 orthopedic and 1 obstetrics ward. All of these wards were part of the implementation plan of the new PDA devices, jointly chosen with the Nursing Department. Supervisors were informed of the survey and accepted to participate.

All nurses following these inclusion criteria were contacted:

- Regular nursing staff from the selected wards in January 2021.
- Not a supervisor or supervisor aid.
- Not on vacation or other type of leave during January or February 2021.

In total, the research team contacted 318 nurses via email at their work address. Participation was voluntary and confidential

3. Results

Sample characteristics are summarized in Table 1 and the questionnaire responses in Table 2, a numerical score was assigned to each answer (from 1 for "Strongly Disagree" to 5 for "Strongly Agree") and a Mean Score was calculated for each statement..

Table 1. Sample characteristics.

Characteristic	Value
n	58
Female (%)	49 (84.4)
Ward	
General Adult (%)	40 (68.9)
General Pediatric (%)	6 (10.3)
Orthopedics (%)	7 (12)
Obstetrics (%)	5 (8.6)
Shift	
Morning (%)	12 (20.7)
Afternoon (%)	10 (17.2)
Night (%)	17 (29.3)
Weekends (%)	19 (32.8)

From 318 contacted nurses, 58 answered the questionnaire (18.2% response rate). General Adult wards are more represented (68.9%) than others. This was expected as half they represented both half the wards surveyed and the highest staffed.

Table 2. Summary of responses.

Statement	Strongly Disagree (1)	Disagree (2)	Undecided or Neutral (3)	Agree (4)	Strongly Agree (5)	Mean Score
Using the new device reduces errors.	1 (1.7%)	0 (0%)	7 (12.1%)	17 (29.3%)	33 (56.9%)	4.3
The use of the new device has achieved greater adherence to politics and procedures.	0 (0%)	3 (5.2%)	8 (13.8%)	18 (31%)	29 (50%)	4.3
Problems with the new device don't interfere with the patient care process.	6 (10.3%)	4 (6.9%)	14 (24.1%)	5 (8.6%)	29 (50%)	3.8
I feel able to assist others in using the new device.	1 (1.7%)	3 (5.2%)	3 (5.2%)	7 (12.1%)	44 (75.9%)	4.6
Using the new device is more efficient than doing things the previous way	3 (5.2%)	4 (6.9%)	2 (3.4%)	7 (12.1%)	44 (75.9%)	4.4
Using the new device allows me to spend more time on some other aspects of the care process.	5 (8.6%)	3 (5.2%)	13 (22.4%)	12 (20.7%)	25 (43.1%)	3.8
I believe that the use of the new device improves the quality of patient care.	2 (3.4%)	5 (8.6%)	4 (6.9%)	12 (20.7%)	35 (60.3%)	4.3

The information provided by the new device allows me to make better decisions about patient care.	2 (4.7%)	4 (9.3%)	10 (23.3%)	9 (20.9%)	18 (41.9%)	3.8
The implementation of the new device takes into account the specific needs of my service area.	2 (3.4%	4 (6.9%)	18 (31%)	14 (24.1%)	20 (34.5%)	3.8
The people I work with daily help me with the use of the new device.	11 (19%)	3 (5.2.%)	16 (27.6%)	8 (13.8%)	20 (34.5%)	3.4
In general, I prefer to use the new device rather than to do things the way they were done before.	1 (1.7%)	3 (5.2%)	9 (15.5%)	12 (20.7%)	33 (56.9%)	4.3
The PDA device is practical in size and weight for my work.	1 (1.7%)	3 (5.2%)	7 (12.1%)	12 (20.7%)	35 (60.3%)	4.3
Code reading (patient bracelet, drugs) with the device is easy and effective.	1 (1.7%)	2 (3.4%)	5 (8.6%)	11 (19%)	39 (67.2%)	4.5
I would recommend the use of this device in my sector.	1 (1.7%)	0 (0%)	4 (6.9%)	14 (24.1%)	39 (67.2%)	4.6

In general, there was high agreement on all statements. The statements "I feel able to assist others in using the new device" and "Using the new device is more efficient than doing things the previous way" presented the highest "Strongly Agree" scores (75.9%).

The highest disagreement was seen on the statements "Problems with the new device don't interfere with the patient care process" (10.3% Strongly Disagree, 6.9% Disagree) and "The people I work with daily help me with the use of the new device" (19% Strongly Disagree, 5.2% Disagree).

On the final recommendation to use the device in their sector, agreement was high, with a mean score of 4.6 and 91.3% some degree of agreement, highest in total.

4. Discussion

The results showed that the nurses agreed with the implementation based on increased safety to reduce errors in drug administration, better adherence to policies, improvements in previous hospital processes, achieving improvements in workflow and patient care quality.

Although the nurses felt capable of helping others with the use of PDAs, there was a low report of collaboration between them. The implementation team should continue to work on education and generate teamwork strategies between them.

This study has some limitations. Nurses may have been biased to show a high degree of agreement due to the possibility of receiving more PDAs in their ward. Finally, among the wards consulted, general adult sectors were over represented. Emergency or critical care areas should be taken into account in following studies. While response rate was

average for this type of study, measures to reach the remaining nurses should be considered. We planned to share with them this paper results asking for further feedback and collaborate with supervisors to increase the response rates.

This type of low-cost intervention can be used to evaluate implementation and generate collaboration in IT projects directly with end-users and in their work environment. In this case, a direct line of work with nurses, a sector underrepresented in the general literature and often overlooked by management.

5. Conclusions

The objective of this study was to measure nurses' agreement towards implementation of PDA devices using a self-reported questionnaire. The team achieved good collaboration with nurses. Response rate was acceptable for the intent of this work.

Nurses showed general agreement with all statements, suggesting PDAs are a good device choice for this particular implementation. Recommendation of use of these technologies was very high among nurses. This information is highly valuable for management to make informed decisions and device acquisition. This methodology was low-cost for the implementation team and proved useful for project monitoring.

References

[1] Paoletti RD, Suess TM, Lesko MG, et al. Using bar-code technology and medication observation methodology for safer medication administration. Am J Health Syst Pharm. 2007;64(5):536–543.
[2] Bates DW, Cullen DJ, Laird N et al. Incidence of adverse drug events and potential adverse drug events: implications for prevention. JAMA. 1995; 274:29-34,
[3] van Onzenoort HA, van de Plas A, Kessels AG, Veldhorst-Janssen NM, van der Kuy PH, Neef C. Factors influencing bar-code verification by nurses during medication administration in a Dutch hospital. Am J Health Syst Pharm. 2008 Apr 1;65(7):644-8.
[4] Puskar KR, Aubrecht J, Beamer K, Carozza LJ. (2004). Implementing information technology in a behavioral health setting. Issues in Mental Health Nursing, 25(5), 439-450.
[5] Baumgart DC. Personal digital assistants in health care: experienced clinicians in the palm of your hand? Lancet. 2005 Oct 1;366(9492):1210-22. doi: 10.1016/S0140-6736(05)67484-3.
[6] Plazzotta F, Luna D, González Bernaldo de Quirós F. (2015). Sistemas de información en salud: integrando datos clínicos en diferentes escenarios y usuarios. Revista Peruana de Medicina Experimental y Salud Pública, 32(2), 343-351.
[7] Maydana T, Giraldo L, González ZA, Schachner B, John III C, Luna DR, et al. (2017, January). BarCode Medication Administration in ICU: Learning from Our Nurses. In MedInfo (pp. 1095-1098).
[8] Giraldo L, Schachner B, Luna D, Benítez S. (2018). Exploring Nurses' Perceptions and Expectations Toward a BCMA Implementation Using a Mobile App and Workstations as a Change Management Strategy. Studies in health technology and informatics, 250, 134-138.
[9] Likert R. (1932). A technique for the measurement of attitudes. Archives of psychology.