The Effectiveness of Electronic Medication Administration Record: A Systematic Review

by Ratanto Ratanto

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Abstract

Background: Medication errors are currently a global issue in maintaining patients' safety. This varies among countries and the innovation in solving this issue by nurses is highly needed. Therefore, the purpose of this systematic review is to identify and evaluate the published studies related to the effects of electronic medication administration record system. **Methods**: The systematic reviews were carried out using six databases, published between January 1, 2014, and October 31, 2018. The search for articles focused on the effects of electronic medication administration records. **Results**: Based on the search for research reports conducted in six databases, 772 articles related to the effect of applying electronic medication records were obtained. From this, 23 studies that matched the inclusion criteria were collected and analyzed. Furthermore, 9 studies showed that the effect of applying electronic medication records reduce the incidence of medication administration errors. While others showed increase in the average treatment accuracy, mortality reduction, documentation process elevation, nurses' mental load decrement high job satisfaction, and lesser nursing time. **Conclusion**: Electronic medication administration record was effective in reducing error incidence. Therefore, this innovation is highly recommended to be implemented both in hospital settings and community-based health services.

Keyword: *patient safety, medication errors, electronic medication administration record, drug administration.*

Background

Medication errors are the leading causes of avoidable patient harm in the health care system across the world, posing dangerous consequences on patients, and potentially result to unexpected effects. This occurs at any stage of drug use process, from prescription, reading, copying, preparation, delivery, administration to monitoring its effects. The number of medication errors was 56.4% with the most dominant being documentation (87.5%), wrong method of administration (73.1%), and time mismanagement (53.6%) [1]. Based on a systematic review there were errors in drug administration from 8.5 to 16.9 per 100 implementations [2].

The Electronic medication system provides high quality service, safety, and accuracy in carrying out drug administration[3]. This innovation is rapidly becoming standard and implemented in many countries. Several studies showed that this type of information technology significantly reduce the incidence of medication administration errors, as well as the hospital expenses related to this condition[4]. The effect of barcode technology with electronic medication administration records increase the accuracy of drug administration from 89% to 90% [5].

The application of electronic medication administration records is very important, however, it is a complex process and errors are common, reaching an average of 25.6%[6]. The use of BCMA technology reduce drug administration errors between 41.4% to 80.7% [7]. Therefore, this technology is an important tool

in reducing the impact of drug administration errors [8].

Methodology

Sources and data search strategies

The search for research articles was conducted based on an electronic database from January 1, 2014, to October 31, 2018. The research journal databases used were: Google Scholar, EBSCO, ProQuest, Science Direct, PubMed, and Willey. The keywords used in this search were "effect OR impact AND electronic medication administration record" and "effect OR impact AND barcode medication administration".

Selection process

Inclusion criteria

The research articles focused on the effect of electronic medication administration. The keywords were located in all the texts, the articles were scientific journals, written in English, published from January 1, 2014, to October 31, 2018. The selected articles were those published in European, Asian, and American countries. This study employed quantitative, observation, and intervention technique for reviewing the collected articles, and focused more on medication administration carried out by nurses. This research was based on patient services at hospitals and community, nursing homes, clinics, and other health services.

Exclusion criteria

The exclusion criteria were articles of letters, opinions, editorials, case reports, theses, and dissertations. The research articles that do not consistently use the terms eMAR or BCMA were excluded, since they do not focus on the effects caused by the application of electronic medication administration records. The laboratory studies conducted as a trial in educational institutions were also among the exclusion criteria.

Data extraction process

The search results for articles were exported to Endnote X8 (Thomson Reuters, Times Square New York, NY, USA). Their titles and abstracts were screened and checked against the inclusion and exclusion criteria from a systematic review, followed by the full text. The articles included, were then extracted into a data collection table developed based on the research objectives. This was carried out based on the country of study, scope, length of time, design, definitions used in the research, analysis, and reports. The data from the articles were reviewed using CASP tools, then extracted and grouped for triangulation discussion, and concluded to ascertain the journal quality.

Quality assessment

The article quality assessment adopted the effective public health practice project (EPHPP) and the Jhons Hopkin Nursing Evidence Base Practice. And were analyzed based on the inclusion criteria, i.e., considering specific aspects related to the application of electronic medication administration records. Therefore, the Journals' quality were determined using Jhons Hopkin Nursing evidence-based practice, and were categorized into level I, II, III, and IV. From the 23 journals reviewed, 5 were included in level II and 18 in level III.

Results

Article search results

The search results in the journal database found a total of 772 articles. After the identification, screening, and eligibility process was carried out 23 articles were obtained and analyzed (Table 1).

Table 1 Characteristics of studies reviewed

Category	N	%
Sample Country		
USA	9	39,13%
Spain	3	13,04%
Denmark	3	13,04%
Hongkong	2	8,7%
Singapore	1	4,3%
France	1	4,3%
Australia	1	4,3%
Pakistan	1	4,3%
UK	1	4,3%
England	1	4,3%
Design		
Observational study	13	56,5%
Experimental study	6	26,1%
Quasi experimental	2	8,7%
Cohort prospective	1	4,3%
Qualitative	1	4,3%
Publication date		
2014-2015	10	43,48%
2016-2018	13	56,52%

Impact of electronic medication administration record

Reducing Errors

There were twelve research articles stating that electronic medication administration records have the effect of reducing medication errors (Table.2). The implementation of electronic medication administration also significantly increased the average accuracy [5]. The BCMA implementation also significantly reduced patients mortality rate [9]. The implementation of electronic medication administration records reduced intervention errors [10].

Table 2 The impact of electronic medication administration record (n=23)

Category	N	%
Medication errors [5,8,10–19]	12	52,17%
Mortality rate [9]	1	4,3%
Documentation completeness [20–22]	3	13,04%
Identify the factors causing medication errors [23,24]	2	8,7%
Nurse's mental burden [25]	1	4,3%
Identifying eMAR usage failures [26]	1	4,3%
Nurse satisfaction [27]	1	4,3%
Nursing time [28]	1	4,3%
Selfcare/ efficacy [6]	1	4,3%

Documentation completeness

The implementation of electronic medication administration records improved the completeness of the documentation process [20], and significantly enhanced the treatment from 1.1% to 3.2% [21]. However, one of the studies stated that it did not improve the documentation process [22].

Identifying eMAR usage failures

The failures from implementing eMAR were identified, such as a scanning without checking the patient's cognitive status, failed scans due to old patient ID, small text and icons on the computer screen, fast or slow working mouse, unresponsive barcode scanner and the inability to use it [26].

Nurse satisfaction

The electronic medication administration records increased the job satisfaction of nurses in administering drugs [27]. The implementation of electronic medication administration records reduced the nurse's mental burden [25]. Also, BCMA lessened the nurse's mental burden significantly based on the MAEs outcome.

Nursing time and selfcare

The implementation of electronic medication administration records reduced treatment time. The research stated that IPMOE significantly reduced nursing time from 61.7 to 29.81 [28]. The implementation of eMAR had an effect on improving patients' care and efficacy [6].

Discussion

There were 23 research articles in accordance with the inclusion criteria in America, Europe and Asia. This indicated that the cultural factors were not a barrier for the electronic medication records implementation, since it was applied in all countries, however, with various approaches adapted to their culture. From the 23 research articles obtained, 9 stated that the effect of applying electronic medication administration records reduced error incidences. Therefore, it is highly recommended to be applied in both hospital settings and community-based health services. Although, this application is highly recommended, it should consider the aspects of humanism, as well as maintaining the relationship between nurses and patients. The factors causing errors in implementing this application should also be avoided, especially human, in this case, the nurse

as the main application user. Therefore, It is necessary to improve the nurses ability to use electronic medication administration records, in the form of training and mentoring.

Strength and Limitations

This research covered various countries in the world, therefore, showing that electronic medication administration was applied in many cultures and countries. This study was conducted between 2014-2018, therefore, the information presented is still relevant. The limitation in this study was the lack of articles with experimental designs. Therefore, the more experimental studies, the more the prove that the implementation of electronic medication administration records is effective. This article also did not involve qualitative studies, therefore, did not explore the effectiveness of the implementation for nurses and patients.

Conclusion

The electronic medication administration records were effective in reducing error incidence, increasing accuracy in drug administration, decreasing patient mortality rates, completeness of medication documentation, reducing nurses' mental burden, identifying medication errors and reducing intervention them, increasing nurse job satisfaction, lessening nursing time, and improving patients' care. Therefore, this innovation is highly recommended in both hospital settings and community-based health services. In addition, the implementation of electronic medication administration records should consider humanity and cultural differences. since it is applied in many countries.

Conflict of Interests: The authors declare no conflict of interest.

Ethical Clearance: This research received approval from the ethics committee of the University of Indonesia (Approval Number: SK-247 / UN2.F12. D1.2.1 / ETIK 2020).

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