The Role of E-Prescription in Reducing Medication Error in The Prescribing Stage at The Puskesmas Mojoanyar, East Java

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Abstract. Electronic prescription or e-prescription has been considered as a solution to overcome errors in the early stage of medicines use. However, the electronic prescribing is still not widely implemented in Indonesia. The purpose of this study was to identify the role of electronic prescription in minimizing the incidence of medication errors at the prescribing stage. A cross-sectional study was conducted to compare errors between electronic and hand-written prescriptions in primary health care Mojoanyar. Mojokerto, East Java. Prescriptions were collected retrospectively using purposive and quota sampling based on predetermined criteria. A checklist form was used to collect and review prescriptions during the period February - March 2021 (hand-written prescriptions) and December 2022 - January 2023 (e-prescriptions). Errors in prescribing were identified in aspects related to the prescription writing process (incompleteness information; illegibility writing) and aspects related to drug selection decisions (drug interaction, drug dosage form, drug dosing and therapeutic duplication). The Chi-square test was used for testing relationships between categorical variables as appropriate. The data were presented in frequency and percentage using descriptive statistics. A total of 2570 prescriptions from 656 patients were reviewed for errors in which 1275 (328 patients) hand-written and 1295 (328 patients) electronic prescriptions. The results showed that incompleteness information was found to be significantly higher in hand-written compared to electronic prescriptions ($p < 0.05$). Illegible writing was only found in 92 (7.22%) hand-written prescriptions. The risk of drug interactions and other errors in drug selection decisions were not reduced by electronic prescribing. Electronic prescription was able to reduce prescribing errors, especially in the writing process, while for treatment decision it was necessary to add feature to the electronic support system.
Keywords: errors, electronic prescribing; hand-written, primary health care

1 Introduction

Prescription is an important aspect that needs attention by health professionals, because there are still many cases of errors in drug dispensing caused by errors in reviewing prescriptions. Study classification according to error types in a systematic review of medication errors in Southeast Asian countries reported that prescribing errors occurred 7%-35.4% [1]. In Indonesia, cases of medication errors during the prescribing phase were still relatively high [2].

Along with the development of technology, many health institutions have changed the method of writing prescriptions from hand-written to electronic (e-prescribing) systems, Computerized Physician Order Entry (CPOE). Hellström *et.al* 2009 [3] stated that electronic prescribing is easier to use and can improve patient safety. However, at this time, electronic prescription has only been used as a substitute for manual paper, and it has not been utilized optimally. Most of the electronic prescription that have been implemented, are still not optimally supported by the features in CPOE.

There are still very few research reports on identify of prescribing errors in Indonesia. The Mojoanyar sub-district was chosen because the primary health care in that area had just implemented electronic prescribing, therefore study was needed to compare errors between hand-written and e- prescribing. The results of this study are expected to add to the existing literature and can be very useful in developing policies and frameworks for the prevention of prescription-related medication errors.

2 Methods

2.1 Aim and objectives

The purpose of the study was to identify the impact of electronic prescription on reducing medication errors compared with handwritten prescriptions.

2.2 Study design and setting

A retrospective cross-sectional evaluation to assess errors in primary health care, Mojoanyar. Mojokerto, East Java settings was conducted. A check list sheet was used to collect the data and review to the type of prescribing errors during the period of February - March 2021 (hand-written prescriptions) and December 2022 -

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January 2023 (e-prescriptions). The sampling method was purposive and quota sampling based on predetermined criteria.

2.3 Study sample

The study sample consisted of electronic and hand-written prescriptions. The study used the following inclusion criteria: (1) outpatient prescriptions, (2) contains at least one drug for oral administration (3) more than one drug prescribed for systemic use (4) contains prescription drugs to be compounded. The sample size required for this study was calculated based on the sample calculation formula for the hypothesis test of the difference in the proportions of the two populations (p1 was the proportion of electronic prescriptions and p2 was the proportion of non-electronic prescriptions). Determination of p1 and p2 taken from research conducted by Gandhi *et al.,* 2005 [4].

2.4 Prescribing errors evaluation and statistical analysis

Prescribing errors in both handwritten and electronic prescriptions were evaluated in terms of: aspects related to the prescription writing process and aspects related to drug selection decision. The prescription writing process was evaluated based on the completeness and legibility of the writing regarding the information being prescribed. The completeness information included: how to administer the drug orally, how to use special preparations/dosage forms, frequency of use of drugs/dose regimens and dosage strengths. Information on how to administer the drug orally referred to the accuracy of how to use the drug, including before, with or after meals. While the variable regarding specific use was information for drugs with special dosage forms where the information on how to use them needs to be clarified, for example sprayed, dissolved, etc. Legibility evaluation was carried out by reading the written prescription whether it was easy or difficult to read and understand by one of the selected puskesmas staff and the main researcher. Evaluation of inappropriate drug selection decision included drug dosage form, drug dosing, therapeutic duplication and drug interaction. Inaccuracy in the selection of drug dosage forms if an error occurs in determining the dosage form, including in the selection of the type of drug dosage form to be compounded. Drug dosing was inappropriate dosage based on the recommended dosage from the medicine leaflet or MIMS. Symptomatic drugs or symptom relievers were not included in the category of inappropriate drug dosing. Therapeutic duplication was the practice of prescribing multiple medications for the same indication or purpose without a clear distinction of when one agent should be administered over another. The drug interaction was when there were two or more drugs affect each drug. To find out whether or not this interaction exists used the sites drugs.com and Medscape. The interaction findings based on R/ then were classified based on MIMS Indonesia online (https://www.mims.com/indonesia), Medscape (https://reference.medscape.com/drug-interactionchecker) and drug.com (https://www.drugs.com/drug_interactions.html). For testing relationships between categorical variables, analysis statistic with tables 2x2 was used. A Chi-squared test for categorical variables was used as appropriate. A p value of less than 0.05 was considered as significant. Descriptive statistics were used to illustrate results.

2.5 Ethical considerations

The study was carried out after obtaining an ethically certificate with the number KE/FK/0064/EC/2023 from the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada-DR Sardjito General Hospital, Indonesia.

3 Results

A total of 2570 prescriptions from 656 patients were reviewed for prescribing errors in which 1275 (328 patients) hand-written and 1295 (328 patients) electronic prescriptions. The results show that the total number of errors in hand-written and electronic prescriptions based on number of R/ was 662 (51.92%) & 495 (38.22%) respectively, while results based on number of patients were 370 R/ (112.8%) prescription errors for hand-written prescriptions and 278 R/ (84,8%)

Table 1. Prescribing errors found in hand-written (category A) and electronic prescriptions (category B)

Variable	Category A		Category B	
Based on number of R/	**N=1275**		**N=1295**	
	frequency (n)	%	frequency (n)	%
incompleteness information	408	61.6	329	66.5
illegibility writing	92	13.9	0	0.0
drug interaction	144	21.7	125	25.2
drug dosage form	11	1.7	26	5.3
drug dosing	3	0.5	6	1.2
therapeutic duplication	4	0.6	9	1.8
Total errors	662	51.92	495	38.22
Based on number of patients	**N= 328**		**N= 328**	
	frequency (n)	%	frequency (n)	%
incompleteness information	200	40.4	178	64.0
illegibility writing	92	18.6	0	0.0
drug interaction	60	12.1	59	21.2
drug dosage form	11	2.2	26	9.4
drug dosing	3	0.6	6	2.2
therapeutic duplication	4	0.8	9	3.2
Total errors	370	112.8	278	84.8

for electronic prescriptions. In addition, it was also found that there were drug interactions occurring in 125 (25.2%) based on R/ or 59 (21.2%) based on patients on electronic and 144 (21.7%) based on R/ or 60 (12.1%) based on patients on hand-written prescriptions. Table 1 shows the prescribing errors found in hand-written and electronic prescriptions. The problem of incompleteness information in prescription writing was still the highest in relation to prescribing errors, both in hand-written and electronic prescriptions, where these errors account for around half of all errors. The high error rate of incompleteness information was due to the fact that the evaluation focuses on the completeness of the information on the drug use dosage regimens (see Table 2). Reading what information in prescriptions was clearly no difficulty when compared to reading information in handwritten form, as can be seen in Table 1, the number of illegibility in e-prescriptions and hand-written prescriptions was 0 (0.0%) & 92 (13.9%) respectively.

Further evaluation regarding the incompleteness of information was: how to administer the drug orally, how to use special preparations/dosage forms, frequency of use of drugs/dose regimens and dosage strengths. The results of further evaluation regarding the incompleteness information are presented in Table 2. The variable administration described whether the physicians mentioned how to use the drug orally in writing the prescription. Physicians generally did not provide this information, even though it's actually easy to write in Latin abbreviations, for example *pc* (*post coenam*), which means after meal. Even though the dosage strength variable in electronic prescribing was always completely written, incomplete information was still found in electronic prescription for administration variables, specific uses, and dosage regimens.

Table 2. Distribution of incompleteness of information found in hand-written (category A) and electronic prescriptions (category B)

Variable	Category A		Category B	
Based on number of R/	**N=1275**		**N=1295**	
	frequency (n)	(%)	frequency (n)	(%)
administration	349	85.6	291	88.4
specific use	45	11.0	22	6.7
dosage regimen	9	2.2	16	4.9
dosage strength	5	1.2	0	0.00
Total incompleteness	408	32.00	329	25.41
Based on number of patients	**N= 328**		**N= 328**	
	frequency (n)	(%)	frequency (n)	(%)
administration	210	78.0	172	81.9
specific use	45	16.7	22	10.5
dosage regimen	9	3.4	16	7.6
dosage strength	5	1.9	0	0.0
Total incompleteness	269	82.0	210	64.0

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Based on the drug selection decision, the drug interactions were still found for both electronic and handwritten prescriptions. Therefore, further evaluation in terms of level drug interactions based on the number of R/ was carried out and and classified in several levels, including: minor, moderate and major. The moderate level of drug interactions was the most frequent interaction category (Table 3).

Chi-square analysis using a 2x2 contingency table was performed to describe whether there was a difference in the proportion of incompleteness informa tion between handwritten and electronic prescriptions either based on the number of R/ or based on the number of patients. The results of the analysis showed that there

Table 3. Evaluation of the level of drug interactions from handwritten (category A) and electronic prescriptions (category B) based on the number of R/

Variable	Category A N=144		Category B N=125	
number of drug interactions based on R/	**n**	**%**	**n**	**%**
Level 1 – Minor	33	22.92	28	22.4
Level 2 – Moderate	84	58.33	78	62.4
Level 3 -Major	27	18.75	19	15.2

was a significant difference ($p<0.05$) between handwritten prescriptions and electronic prescriptions regarding the incompleteness of the information. The Chi square was also performed to analyse the difference proportion of drug interaction between handwritten and electronic prescriptions either based on the number of R/s or based on the number of patients. The results showed that there was no significant difference with regard to the findings of drug interactions in handwritten and electronic prescriptions (Table 4).

Table 4. Difference in proportion of incompleteness information and drug interaction between handwritten (category A) and electronic prescriptions (category B)

Variable	A	B	p	OR	95% CI	
Evaluation based on number of R/						
Incompleteness information						
Not complete	408	329	0.0002	1.38	L	1.16367
Complete	867	966			U	1.64065
Drug Interaction						
Interaction occurred	144	125	0.1741	1.19	L	0.9252
No interaction	1131	1170			U	1.5350
Evaluation based on number of patients						
Incompleteness information						
Not complete	200	178	0.0000	2.44	L	1.8244
Complete	128	278			U	3.2642
Drug Interaction						
Interaction occurred	60	59	0.9193	1.02	L	0.6862
No interaction	268	269			U	1.5185

* A = Category A; B = Category B ;
L = Lower 95% CI ; U = Upper 95% CI

4 Discussion

Therapeutic management is a multistep process, and errors may occur at any step, from prescribing to administering the medication. Studies have shown that

drug prescription errors are the most frequent [5-7]. This study was carried out on the prescription errors in hand written and electronic prescriptions of outpatients in a primary health care, East java. Results of the present study revealed that the most common prescribing error was incompleteness prescription writing, both in hand-written and electronic prescriptions. Although previous studies have provided data related to incompleteness information in prescribing, not all studies can be compared since the methods and subjects evaluated are different. The current study is close to the one obtained by al-Madadha *et al* 2014 [8] after the implementation of the electronic system. Al- Madadha *et al* 2014 [8] study also has evaluated incomplete information in terms of drug use. The most common serious errors were dosage form not mentioned (11.6%) and drug strength not mentioned (6.2%)[8], while in the current study, the most common error was not mentioning how to use the drug (before, with or after meals). As expected, the effect of the electronic system on prescribing errors was due to the elimination of unclear handwriting errors that is consistent with the reported data from Hitti *et al* 2017 [9]. It was detected in this present study that as many as 1275prescriptions were prescribed to 328 patients, 13.9% of prescriptions found difficult to read. Prescription illegibility can lead to an increase in the risk of medication errors [10]. With the implementation of an electronic writing system, it will be able to erase prescription errors, especially data about patient characteristics

Drug interactions are a major cause of morbidity and a major source of treatment ineffectiveness. The results of the current study show that drug interactions were still found in electronic prescribing. Moderate drug interactions were the most frequent category of interactions. Selecting drug from a database that has been integrated into prescribing is much easier than writing prescription conventionally. This can assist physicians in deciding to look for alternative drugs through the database if the prescribed drugs interact. However, errors related to drug interactions did not decrease significantly with the presence of electronic prescribing at the primary health care where this study was conducted. This is because the computerized system at the current study setting, the Mojoanyar primary health care, Mojokerto, East Java had not been integrated with the drug interaction database. In electronic prescribing, special attention is needed for systems that facilitate the automatic detection of drug interactions. Several software's have been widely used to detect possible drug interactions in prescribing [11, 12]. Therefore, it is highly recommended to add a feature to electronic prescribing that can automatically give an alert signal when a physician makes error in selecting a drug. This feature will greatly assist physicians in making treatment decisions, so there is no need to check repeatedly when making drug choices. This feature can be in the form of an application or a link that can be directly integrated into the prescribing program

5 Limitation of the study

The limitation deals with the methodological approach to evaluation, as in this study was carried out retrospectively, and sampling was carried out purposively. Therefore, it is still limited to generalize to the population. Although several interviews were conducted to understand the problem of errors that occurred, the interviews were not conducted in depth with qualitative methods and only checklists were used to assess aspects of prescribing errors.

6 Conclusion

The electronic prescribing was a useful tool for reducing the number of prescribing errors in primary health care, Mojoanyar. Mojokerto, East Java settings, although, more advanced system with decision support features may be needed for more impact on the mistakes in making decisions.

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