Utilization of a hospital information system for outpatient prescription screening process at the PKU Muhammadiyah Yogyakarta Hospital

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Abstract. Prescription screening includes administrative and clinical precision of the drug, dosage, frequency and route of administration, therapeutic duplication, allergic or sensitive reactions, and actual or potential interactions. The study was aimed to identify the obstacles and compliance level of users, as well as the design of a prescription screening information system and its users’ perceptions. This study used qualitative and quantitative research design with action research studies involving pharmacists, pharmacy technicians, a programmer and clinical practice student pharmacists. The obstacle of pharmacists in doing prescription screening was the long duration in the process of manual prescription review. The compliance of pharmacists in manual prescription review was under 50%. The prescription information system was created by the programmer on the proposal of pharmacists in the form of front view, pharmacy display, sales display, prescription display, prescription display per period and display of recapped prescriptions. Perception of the usefulness was very high with a value of 4.5±0.577 and perception of ease of use was very high with a value of 4.214±0.534 from 28 respondents. The prescription information system was created by a programmer upon the recommendations of pharmacists. Perception of the usefulness and ease of use was very high.

Keywords: prescription screening, prescription information system, user perception

1. Introduction
The use of an electronic information system is a highly important support in improving the quality of hospital services. More specifically, it is utilized in pharmaceutical installations for medication management. Survey has shown that a computer-based information system management can cut total expenses by up to 5% [1].

The process of prescription screening and drug evaluation is performed by a pharmacist on: (a) The accuracy of the drug, dose, frequency and route of administration; (b) Therapeutic duplication; (c) Actual or potential allergy or sensitive reactions; (d) Actual or potential interaction between the medicine and other drugs or food; (e) Variation in the administration criteria designated by the hospital; (f) The patient’s body weight and other physiological information; (g) Other contraindications [2]. The prescription screening process is part of the application of pharmaceutical care [3].

Prescription review is still carried out manually, from recording into prescription screening files, registry, until the administration and presentation of report data. Moreover, interviews with

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prescription screening clerks have revealed that the process prolongs their work, to the extent that clerks face difficulties in recapitulating prescription review data for administration at the end of each month. A manual reporting process potentially generates errors and requires longer screening time [4].

A prescription screening information system is thus required to enhance prompt and accurate prescription screening services. Prescription screening results are then reported to the pharmacy and therapeutics committee to be analyzed and given corrective suggestions. In addition, doctors must also receive inputs about prescribing patterns with the potential for frequent errors [5, 6].

2. Materials and Methods

2.1. Research design
This was a qualitative and quantitative study with an action research design, which included a research and a participation stage involving pharmacists, pharmacy technicians, a programmer and student pharmacists in clinical internship, as well as an action stage which aimed to alter the condition of a group of people.

2.2. Research location
This study was conducted at the PKU Muhammadiyah Yogyakarta Hospital because a clinical information system development and a pharmaceutical care program were being implemented at this location.

2.3. Research subjects
The subjects consisted of 41 individuals, comprising 1 decision maker for the information system, 1 programmer, 8 pharmacy practitioners, 9 pharmacy technicians, and 22 student pharmacists practicing at the PKU Muhammadiyah Yogyakarta Hospital.

2.4. Research instruments
The instruments utilized for this study were (1) focus group discussion guidelines, (2) group interview guidelines, and (3) a questionnaire.

2.5. Research stages and data collection methods

2.5.1. Diagnosing stage
Researchers reviewed prescription screening done manually by the pharmacists covering 997 prescriptions in May, 1,340 in June and 1,239 in July from four days of prescription services per month in 2015.

2.5.2. Planning stage
A group interview was held twice; the first was attended by the 8 pharmacy practitioners and the programmer, while the second was attended by 3 pharmacy practitioners, the person in charge (PIC) of the hospital information system and the programmer.

2.5.3. Action stage
In this stage the programmer built a prescription screening information system based on the recommendations of the pharmacy practitioners.

2.5.4. Evaluation stage
This stage employed a questionnaire survey method to identify the perceptions of its users.

2.6. Data analysis
Analysis of the data in this study was run by means of content and descriptive analyses. Content analysis was undertaken to examine the results of the manual prescription screening, the focus group discussion and the group interview. Descriptive analysis was applied to assess the utility and ease of access of the information provided by the prescription screening information system by calculating the percentage of each question or statement over the respondents’ answers.

3. Results and Discussions

3.1. Description of manual prescription screening
In this study prescription screening was practiced manually by collecting prescriptions from May, June and July 2015 to oversee the compliance of the staff in following the procedure. According to the
previous study, the process of prescription screening includes administrative terms, pharmaceutical suitability and clinical considerations. The latter two comprise preparation form, dose, potency, stability, incompatibility, route and period of administration, presence of allergy, side effects, interaction, and suitability (dose, duration, drug amount, etc.) [7]. The adherence of the PKU Muhammadiyah Yogyakarta Hospital pharmaceutical personnel in performing prescription screening was considerably low, as can be seen in Figure 1.

![Figure 1. Percentages of personal compliance](image)

According to Figure 1, the observance of the outpatient pharmaceutical staff at PKU Muhammadiyah Yogyakarta Hospital in screening a total of 3,576 prescriptions was 32.36% of 998 in May, 57.23% of 1,341 in June and 44.71% of 1,239 in July. Overall, the compliance level of the staff in conducting prescription screening was below 50%.

### 3.2. Prescription screening obstacles

| FGD Participant | Result |
|-----------------|--------|
| 1               | Not much time for the prescription screening process |
| 2               | Prescription screening form filled out only when there is an issue with the prescription |
| 3               | Uncertain about the filled prescription screening form because of literature limitations |
| 4               | Filling out the form within available time while considering the queue of patients collecting their medications |

From results of the FGD as presented in Table 1, it can be concluded that the hurdles faced by the staff in operating the pharmaceutical installation prescription review process were caused by: (a) Lengthy use of time in the manual prescription screening process; (b) lack of confidence in performing prescription screening due to limited literature; (c) filling out the prescription screening form only if there is an issue in the prescription; and (d) the abundance of drug prescriptions to review.

### 3.3. Prescription screening information system needs analysis

| FGD Participant | Result |
|-----------------|--------|
| 1               | Procuring prescription screening software by exploiting the hospital information system |
| 2               | Utilizing software which automatically reviews prescriptions in order to minimize the time required for manual prescription screening |
| 3               | Training prescription screening operators |
Table 2 shows that a prescription screening information system is strongly necessary to minimize errors and reduce the time needed for the process. Prescription screening by means of an information system boasts a high degree of confidence with the integration of reliable literature into the prescription screening software. The system itself employs a computer (hardware/software), a procedure manual, a model of analysis, planning, control and decision-making, and a database [8].

Following up recommendations from pharmacy practitioners and technicians to apply a prescription screening information system, the first group interview was organized between the practitioners, the programmer and the PIC of the PKU Muhammadiyah Yogyakarta Hospital information system.

**Table 3. First group interview results on suggestions for a prescription screening information system design**

| Problem | Description |
|---------|-------------|
| Evaluation of the prescription screening information system by attending peer pharmacists | Certain clinical pharmacy activities need the help of computer technology to accelerate activity reporting and documentation, including prescription review, to enable the presentation of prescription screening documents to doctors or the Medical Committee as material for the evaluation of prescribing issues. |
| Prescription screening form design | The design adhered to the standard guidelines of accreditation. |
| Drug information master data as prescription screening support | The purchase of Lexicomp® or Medscape® software would be proposed to fulfil the need for supporting data. |

It can be noted from Table 3 that the group interview held to conceive the prescription screening software bore outcomes as follows: (a) The prescription screening form from the accreditation standards would be adapted to the requirements of the PKU Hospital and refer to other sources; (b) the prescription screening information system program would be integrated with the other hospital information system programs; (c) the prescription screening information system program would be installed at the outpatient and inpatient pharmacy, except in the patient prescription billing computer to avoid inhibiting the prescription service rate; and (d) a clinical drug information master data would be devised to support the prescription screening process by using internal and external sources, namely the drug master data recapitulated in the pharmaceutical management information system, and by acquiring paid software (Medscape®/Lexicomp®).

After the first, a second group interview was held with the pharmacy practitioners and programmer as participants.

**Table 4. Second group interview results on perfecting the prescription screening information system**

| Problem | Description |
|---------|-------------|
| Programmer’s presentation of a prescription screening information system sample | The prescription screening information system made by the programmer underwent a preliminary simulation. |
| Additional prescription screening items proposed by pharmacy practitioners | The software created by the programmer needed revision and addition of several items, such as repairing the “click/entry” menu and inserting a BPJS intervention item. |

As in Table 4, results of the second group interview decided to refine the prescription screening information system by including BPJS intervention and insurance suitability items to accommodate changes of drug administration in cases of insurance/BPJS-covered patients. The prescription screening information system was accordingly improved by the programmer.
3.4. Prescription screening information system design

Herewith is the final iteration of the prescription screening information system built by the programmer based on inputs from the pharmacists:

1. Front Display: Registration, billing, medical, support, logistics, pharmacy, medical records, nursing care, setting and windows.
2. Pharmacy Menu Display: [FAR-01] prescription, [FAR-02] prescription list, [FAR-20] UDD, [FAR-21] prescription queue list, [FAR-03] sales/DO-bill (DU-General), [FAR-09] sales/DO-bill (DU-type), [FAR-04] item handover, [FAR-05] outstanding sales list, partial DU stock reduction, prescription screening, [FAR-06] sales returns, [FAR-07] sales returns per-register, [FAR-08] label, [SALES INFO], [FAR-09] prescription, [FAR-10] prescription details, [FAR-11] prescription-analysis per item, [FAR-12] sales (general), [FAR-13] sales details (general), [FAR-14] sales details (services), [FAR-15] general sales per R, [FAR-15] profit per doctor, [FAR-22] sales per distributor, [FAR-23] largest sales, [FAR-24] prescription screening, [FAR-16] sales returns (general), [FAR-17] sales returns details (general), [FAR-18] pharmacy revenue, [FAR-19] sales analysis, [FAR-20] recapped items.
3. Sales Menu Display: Registration number entry, personal data, drug type, instructions and the prescribing doctor, drawn from outpatient prescriptions by prescription receiving clerks to determine the prices. These data are useful for labelling, prescription screening and identifying the most frequently taken drug type.
4. Prescription Screening Menu Display: Clear prescription text, right patient, right drug, right dose, right route and preparation, right time and frequency, no duplication, no drug interaction, no allergy, no contraindication, PKU Muhammadiyah Hospital formulary suitability, BPJS suitability and insurance suitability.
5. Prescription Screening per Period Menu Display: Date, time, prescription code, prescription service, doctor, register, MR number, patient name, sex, patient address, age, cover, policy number, insurer, service, prescription screening, yes/no, note.
6. Prescription Screening Details per Period Menu Display: The prescription screening item would display overall outcomes with a recapitulation item taken from each date. This summary can be printed or imported into a spreadsheet as report material.
7. Prescription Screening Results Recap Display: Items of insurance suitability, BPJS suitability, PKU Muhammadiyah Hospital formulary suitability, right dose, right drug, right patient, right route and preparation, right time and frequency, no allergy, no duplication, no drug interaction, no contraindication, clear prescription text. These can be recapped with yes/no options which would yield a certain number in a particular period.

3.5. Prescription screening information system user perception

3.5.1. Descriptive analysis of user perception on the prescription screening information system usefulness

Outcomes of the descriptive analysis on the usefulness score data are presented in Table 5. Table 5 displays that statements 1 until 6, which denote items of user perception towards the utility of the prescription screening information system, yielded a total average score of 4.5 ±0.577 from 28 respondents. This implies that user perception in general over the usefulness of the prescription screening information system application was highly positive, in that the respondents benefited well from using the system.

A study found that excessive drug administration may lead to adverse drug reaction. Test implementation of a prescription screening information system revealed that respondents in this research were able to accomplish pharmaceutical care tasks to prevent adverse drug reaction [9]. Another investigation similarly indicated that respondents as users of the prescription screening information system considered it greatly beneficial in completing pharmaceutical care tasks at the hospital [10].
Table 5. Results of usefulness score data analysis (n=28)

| No. | Statement                                                                                                                                  | Average | SD  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|
| 1   | The prescription screening information system allows pharmacists to do their work at the hospital more easily.                           | 4.571   | 0.504 |
| 2   | The information system increases pharmacists’ performance.                                                                                 | 4.500   | 0.509 |
| 3   | The prescription screening information system enhances productivity in pharmaceutical care at the hospital.                             | 4.536   | 0.508 |
| 4   | The prescription screening information system improves the effectiveness of pharmaceutical care at the hospital.                         | 4.536   | 0.508 |
| 5   | The information system makes pharmacists’ tasks at the hospital easier to fulfil.                                                           | 4.429   | 0.690 |
| 6   | Overall, the prescription screening information system is useful for the completion of pharmaceutical care tasks at the hospital.       | 4.429   | 0.742 |
|     | Total average                                                                                                                              | 4.500   | 0.577 |

3.5.2. Descriptive analysis of user perception on the prescription screening information system easy of use

Results of the descriptive analysis on the usability score data are given in Table 6. According to Table 6, statements 1 to 6, as items of user perception over the usability of the prescription screening information system, produced a total average value of 4.214±0.534 from 28 respondents. This implicates that the overall user perception towards the usability of the prescription screening information system application was largely favorable. It can thus be inferred that respondents found easy in using the system.

Table 6. Results of usability score data analysis (n=28)

| No. | Statement                                                                                                                                  | Average | SD  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|
| 1   | It was not hard for me to learn to use the prescription screening information system to support pharmaceutical care at the hospital.     | 4.250   | 0.441 |
| 2   | I did not need much time to learn to use the prescription screening information system to support pharmaceutical care at the hospital. | 4.179   | 0.548 |
| 3   | Interaction with the prescription screening information system is easy to understand.                                                    | 4.214   | 0.418 |
| 4   | Interaction with the information system is flexible.                                                                                       | 4.143   | 0.448 |
| 5   | I can easily master the prescription screening information system.                                                                       | 4.250   | 0.701 |
| 6   | Overall, the prescription screening information system is easy to use.                                                                     | 4.250   | 0.645 |
|     | Total average                                                                                                                             | 4.214   | 0.534 |

In the previous research on electronic and non-electronic prescriptions showed the difference in skill between doctors who had long employed electronic prescriptions and those who had only recently. Results of a usability and aptitude test in the use of a prescription screening information system uncovered a respondent earning a score of 2 for lacking the ability to operate the system. Proficiency and ease in operating an information system are influenced by how long the user has interacted with it [11]. Another study reported that disclosed potential errors in prescribing and in drug interaction or allergy. The prescription screening information system could reduce potential errors in drug interaction and allergy as part of pharmaceutical care [12].

A study pointed out that the implementation of electronic prescriptions could control prescribing errors. It followed that the usage of a prescription screening information system to endorse pharmaceutical care could well decrease prescribing errors [13]. A different investigation
demonstrated that the ease of use of information technology positively and significantly affected its usefulness. In practice, the application of the prescription screening information system was straightforward and greatly supported the realization of pharmaceutical care [14].

4. Conclusions
The main issue in manual prescription screening was its long duration. The adherence of pharmacists in conducting manual screening of 3,576 prescriptions in May, June and July 2015 was under 50%. The prescription screening information system design consisted of front display, pharmacy menu display, sales menu display, prescription screening menu display, prescription screening menu display per period, prescription screening details menu display per period and prescription screening results recap display. Perception over the usefulness of the prescription screening information system was largely positive.

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