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Development of web-based application of medicine management dashboard for pharmacists in primary health care using a user-centered design: evidence from Indonesia

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ABSTRACT: Although the minimum standard of pharmaceutical services at the primary health centers (PHCs) has been determined, the quality of drug management at PHCs is not optimal. There is no information system in PHC to help pharmacists monitor drug management performance. This study aims to describe the systematic development of a web-based application for monitoring purposes using user-centered design and develop the initial prototype. A descriptive study with a case study approach was conducted, consisting of three stages: user needs analysis, model and prototype development, and prototype evaluation from September 2021 to April 2022. Focus group discussions and observations were used to collect data. The institutions are health centers and offices in Yogyakarta province recruited using purposive sampling. Data were analysed using descriptive qualitative and quantitative methods. The results show that PHC's pharmacists need a drug management monitoring information system, and a web-based prototype called PharmD was successfully developed.

KEYWORDS: Logistic; medicine; prototype; user-centred design; website.

INTRODUCTION

According to MOH Decree No. 74/2016, drug management is one of the standards of pharmaceutical services at primary health centers (PHCs)[1]. Drug management aims to ensure the availability and affordability of efficient, effective, and rational drugs, which is directly related to public access to drugs and patient satisfaction, influences public perceptions of the quality of health services, and determines the overall success of PHCs management[2]. In the Indonesian health system, PHCs are first-level referral health facilities that the entire community can access. Its strategic location and easy access make drug management in health centers must be effective and efficient to ensure drug availability.

Although the minimum standards of pharmaceutical services at PHCs have been determined through MOH Decree No. 74 of 2016, the quality of drug management in several PHCs is not optimal. Some PHCs have not been fully guided by the National List of Essential Medicines (DOEN), the total requests made compared to the total use of drugs are not correct, the percentage of drugs that are not prescribed within a year reaches 20%, inaccurate stock records between the stock card and the physical[3], drug selection has not gone through the medical scientific review, drug needs planning has not gone well because it only based on usage and remaining stock resulting in drug accumulation[4]. This has led to low drug availability in several regions, including Papua Province, which is still below 80%[5].

Until now, there has been no evaluation of the quality of pharmaceutical services at PHCs based on routinely carried out indicators. Indicators can be used to determine the level of efficiency of each step in drug management so that it can be used as a basis for improving the overall quality of pharmaceutical services. Drug management indicators consisting of 26 indicators were obtained through the consensus Delphi method[6]. Each indicator has a calculation formula to produce an indicator value. These indicators can be a reference in measuring the efficiency of drug management in health centers.

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Management information systems are a supporting factor for drug management, which can help management make decisions. Previous research identified the need for technology-based drug management. Manual data processing makes pharmacists experience difficulties such as causing errors in calculating drug stock, making it difficult to check drug inventory, resulting in the length of report preparation and lost documents due to the makeshift data archiving process and not using a database[7]. In addition, the difficulty of monitoring inventory due to the absence of an information system contributes to vacancies and low drug availability[8],[9].

The current information system in PHCs, known as SIMPUS [*Sistem Informasi Manajemen Puskesmas*], is limited to recording and reporting on operational processes[10]. SIMPUS has not facilitated the need for monitoring drug management performance. Previous research is limited to the prototype administration of drug entry and exit reporting[7], prototype outpatient prescription screening[11], and prototype web-based outpatient services[12]. However, there have been no studies on developing information systems to evaluate the performance of drug management in PHCs in Indonesia. This system is needed so that pharmacists can easily monitor the quality of their drug management effectively and efficiently.

A user-centered development design can address this gap. As the name implies, system development will focus on the user's needs[13]; in this case, the pharmacist is the main person responsible for drug management. Application development not only involves pharmacists at the health center but also pharmacists at the health office. PHCs are technical implementation units under the guidance and supervision of the local health office, so input, recommendations, and approval from the health office are required. There has been no research of this kind in Indonesia. Therefore, PharmD was developed to help pharmacists achieve the most optimal quality of medication management. This study describes the design, prototype development, and initial evaluation process based on user-centered design. The study's results can serve as an initial model of an information system to improve the quality of pharmaceutical services in community health centers.

MATERIALS AND METHODS

Procedure

This research uses a user-centered design approach. This method was chosen because it focuses on user needs and involves users in each phase of system development. These phases are (1) user needs analysis, (2) model design and prototype development, and (3) prototype evaluation. Figure 1 illustrates the stages of PharmD application development.

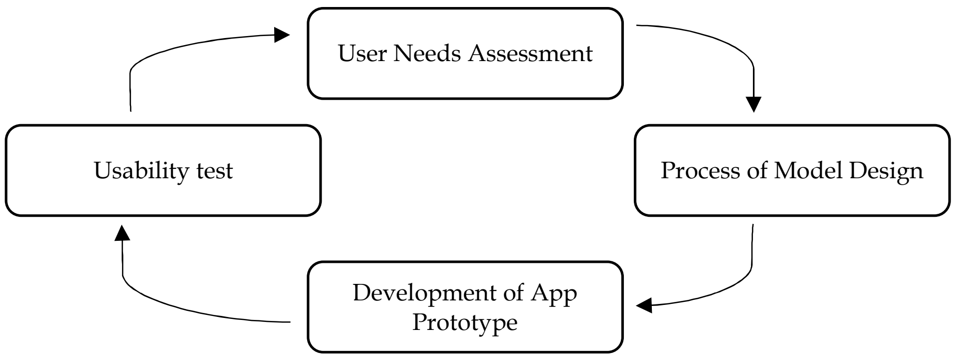


Figure 1. PharmD development stages.

Study participants

The study used a purposive sampling method to recruit respondents for the user needs analysis and usability test. Inclusion criteria were pharmacists, information system staff, and at least three years of work experience. Exclusion criteria were subjects who refused to participate or were not involved in developing information systems at work. Respondents were recruited from three districts in Yogyakarta Province: Sleman Regency, Bantul Regency, and Yogyakarta City. This research protocol was formally approved by the Faculty of Medicine Ethics Committee, Gadjah Mada University, Yogyakarta (No. KE/FK/1066/EC/2021).

Participants for the user-needs assessment or focus group discussion were invited through purposive sampling. Recruitment resulted in 15 invitations to pharmacists and information system staff at 12 health centers and to pharmacists at three health offices to participate in the study, both from 3 districts. Representation from the three districts will enrich the results and describe conditions more broadly, while the involvement of the health service is because in carrying out its duties, the health center is supervised by the health service, including the use of its information system.

The objectives and procedures of the study and informed consent were conveyed through the invitations. Unfortunately, most of the health centers did not have information system staff, and one health center and one health office were not available for the scheduled user needs analysis (focus group discussion). There were 17 respondents from 11 PHCs and two health offices. Pharmacists are users of the SIMPUS, information system staff are system managers, and health office pharmacists act as parties with a vertical working relationship with PHCs. All respondents (n=17) admitted that the current information system has not made it easy to monitor drug management performance or has not covered the 26 indicators of drug management. Table 1 shows the respondents' demographic information.

Table 1. Summary of user needs assessment respondent background.

Category	Information	Number, n = 17 n (%)
Occupation	Pharmacist at the health office	2 (12%)
	Pharmacist at PHC	11 (65%)
	Information system staff	4 (24%)
Sex	Male	3 (18%)
	Female	14 (82%)
Age	25-35	6 (35%)
	35-45	9 (53%)
	45-55	2 (12%)
Region	Yogyakarta City	7 (41%)
	Sleman Regency	6 (35%)
	Bantul Regency	4 (24%)
Practice experiences	1-5	5 (29%)
	>5-10	6 (35%)
	>10-15	3 (18%)
	>15-20	3 (18%)
Education	Pharmacy	13 (76%)
	Medical record	3 (18%)
	Informatics management	1 (6%)
User of PHC's information system	Yes	11 (65%)
	No	6 (35%)
Name of the system	SIMPUS (Sitem Informasi Puskesmas)	6 (35%)
	DGS (*Digital Government Services*)	4 (24%)
	SIMO (Sistem Informasi Manajemen Obat)	2 (12%)
	SISFOMAS (Sistem Informasi Puskesmas)	2 (12%)
	J-Care	2 (12%)
	Not using any system	1 (6%)
Whether the system can be used to monitor performance	Yes	0 (0%)
	Not yet	17 (100%)
Requires an information system to monitor drug management performance	Not necessary	0 (0%)
	A little needy	1 (6%)
	Just needy	4 (24%)
	Urgently require	12 (71%)

Participants for the usability test were user-need analysis participants. Ten respondents were invited back and willing to be involved in the usability test. So that participants can provide an objective evaluation regarding the suitability of the results of the needs analysis that has been carried out previously. Respondents came from 8 PHCs and one health office, representing all three districts. Their roles were as users, evaluators, and feedback givers on the drug management application. Table 2 shows the demographic information of respondents in the usability test.

Table 2. Summary of usability test respondent background.

Category	Information	Number, n = 10 n (%)
Occupation	Pharmacist at PHC	8 (80%)
	Information system staff	2 (10%)
Sex	Male	3 (30%)
	Female	7 (70%)
Ages	25-35	4 (40%)
	35-45	5 (50%)
	45-55	1 (10%)
Region	Yogyakarta City	5 (50%)
	Sleman Regency	3 (30%)
	Bantul Regency	2 (20%)
User of PHC's information system	Yes	7 (70%)
	No	3 (30%)

User needs assessment

The user needs analysis aims to collect information about problems, opportunities, and directions about the current information system for drug management at the PHCs. The needs analysis began with observation and continued with a focus group discussion. Observation aims to observe the condition of the information system at the health center, drug management documents, and other resources as they are. An observation checklist was used as an instrument. Seven PHCs and three health offices were observed as representatives of each region. A pilot study was conducted on the instruments for focus group discussions and usability tests to ensure the questions were easy to understand.

Focus group discussion (FGD) aims to collect qualitative data by actively involving pharmacists and information staff through interviews and group discussions. The PIECES framework tool was used to help categorise problems, opportunities, and directions[13]. Includes analysing the need to improve performance, information, economics, control, efficiency, and service. The instrument used is a questionnaire consisting of 10 open-ended questions. The questions were displayed in a slide presentation during the discussion, and respondents were asked to provide feedback directly. The data was analysed descriptively and qualitatively. Table 3 lists the user needs assessment questions.

Table 3. List of user needs assessment questions.

Item	Question
	Focus group discussion questions list
1.	What obstacles are faced regarding monitoring drug management at community health centers?
2.	What are the weaknesses and strengths of the current information system in community health centers?
3.	Is there a performance output from the information system that is expected but has not been facilitated by the current information system?
4.	Is there information or data from the information system that is needed but not yet facilitated by the current information system?
5.	To what extent are the economic benefits of information systems in monitoring drug management performance?
6.	To what extent is the control or security side of current information systems?
7.	To what extent can information systems increase efficiency in monitoring drug management performance?
8.	Are there any problems in terms of service from the current information system?
9.	To what extent is the community health center prepared to develop an information system that can help monitor drug management performance?
10.	Give an opinion about the model proposed by the researcher and convey if there are certain requests regarding the interface design or application display.

Before the FGD began, a questionnaire was distributed via Google Forms to capture data on respondent characteristics and survey prototype models. The first section of the questionnaire contained general questions about demographics and four short questions about information systems in their institution. The second section includes twenty-six prototype models (each indicator) proposed by the researcher, with the answer options agree and disagree and a blank column if the respondent wants to add comments; Table 4 shows the results of the survey. This survey aims to collect initial approval of the prototype model so that during the FGD, it can be prioritized to discuss models that have not received approval. In addition, respondents get an overview of the prototype to be developed. There are several notes, and there are indicators that the user has not approved. Some of these notes were then discussed in the FGD. After the FGD, all participants (n=17) stated that they agreed with the model proposed by the researcher. The majority of comments that emerged emphasized the definition or whether an indicator is needed in practice. However, considering that the development of these 26 indicators had gone through various stages of validation using the Delphi method in 2018, it was agreed that all indicators would continue to be prototyped. There are no special requests regarding the display or interface prototype except that the letters are made quite large, so they are easy to read.

Some notes related to indicators during the FGD include that the indicator for adequacy of funds may not be used if the health center never experiences a shortage of medicines; there is a suggestion to add an indicator for the suitability of drugs with prescriptions considering that internship doctors change periodically at the health center and sometimes their prescriptions still do not comply with the health center's prescribing rules. Storage indicators are still needed, but the system still requires manual input and can only be confirmed visually, so the efficiency of the system for storage indicators is considered insufficient. Regarding storage indicators, medicines removed from primary packaging are deemed to be rare because the pharmaceutical industry has avoided bottle packaging.

Table 4. Result of prototype model questionnaire.

Indicator	Question	Before FGD (n=17) n (%)	
		Agree	Disagree
1	Propose new drugs to be listed or delisted from the formulary	17 (100%)	0 (0%)
2	Suitability of drug item with the national formulary	16 (94%)	1 (6%)
3	Suitability of drug items with disease patterns	16 (94%)	1 (6%)
4	Adequate funds to fulfill out-of-stock drugs	14 (82%)	3 (18%)
5	Planning accuracy	16 (94%)	1 (6%)
6	Suitability of the number of drug items requested	17 (100%)	0 (0%)
7	Suitability of the number of drug items received	17 (100%)	0 (0%)
8	Drug storage according to dosage form	15 (88%)	2 (12%)
9	Drug storage according to temperature	16 (94%)	1 (6%)
10	Narcotics storage according to regulations	15 (88%)	2 (12%)
11	Drug storage is not used for storing other items that cause contamination	14 (82%)	3 (18%)
12	Drug arrangement follows FEFO method	15 (88%)	2 (12%)
13	High-alert drug storage	15 (88%)	2 (12%)
14	LASA drug storage	15 (88%)	2 (12%)
15	Storage of drugs removed from the primary packaging	13 (76%)	4 (24%)
16	Accuracy of the number of drugs distributed to pharmaceutical service sub-unit	15 (88%)	2 (12%)
17	Inventory turnover ratio (ITOR)	16 (94%)	1 (6%)
18	Availability level of drugs (month units)	16 (94%)	1 (6%)
19	Out-of-stock drug items (< 1 month)	17 (100%)	0 (0%)
20	Shortage inventory of drug items (1–< 12 months)	17 (100%)	0 (0%)
21	Adequate inventory of drug items (12–18 months)	17 (100%)	0 (0%)
22	Overstock dug items (> 18 months)	17 (100%)	0 (0%)
23	Not prescribed drug items or dead stock (> 3 months)	17 (100%)	0 (0%)
24	Values of expired and defective drugs	17 (100%)	0 (0%)
25	Accuracy of the physical amount of the drug with the amount on the stock cards or computer	17 (100%)	0 (0%)
26	Periodic evaluation of drug management	17 (100%)	0 (0%)

PharmD design and development

The second phase aims to design interfaces and prototypes based on the results of previous user needs analysis. In this phase, researchers translated the needs of respondents to IT (n=1) in the form of data flow diagrams and entity relationship data to be further realized in the form of prototypes. To develop the prototype, this research uses an open-source and free framework, namely Laravel, with SQL and PHP as the main programming languages, and a web-based database, namely MySQL. The creation of dummy data was carried out to simulate the calculation of drug management indicators in the prototype. The dummy data consists of 55 drugs and includes a recap of drug management data over one year.

Usability test of PharmD

PharmD was evaluated based on usability and involved ten respondents. The researcher conveyed the purpose of the evaluation and a brief demonstration of the prototype through video. Respondents were asked to directly interact with or operate the prototype, such as logging in, accessing existing menus, inputting data, and reviewing and providing feedback on the usability questionnaire distributed via Google Forms. Usability tests include easy to learn, efficient to use, easy to remember, few errors, and pleasant to use[14]. Consisting of 20 statements developed by the researcher, it has 4 Likert scale answer options. Feedback was analysed descriptively and quantitatively using weighting and statistics (mean and standard deviation) using Jamovi. Table 5 lists the usability test statements. In addition, respondents were also asked for their opinions regarding the strengths and weaknesses of the prototype, as well as feedback from the researcher.

Table 5. List of usability test questions.

Item	Question
	Easy to learn
1.	The system prototype is easy to operate the first time.
2.	The system prototype is easy to understand the first time it is run.
3.	The system prototype is easily recognised from the interface design.
4.	Prototype letters and symbols are easy to read and understand
5.	The prototype colour design is comfortable to look at
	Efficiency to use
6.	Users can easily find the login form.
7.	Users can easily find the information they need regarding medication management.
8.	Assessment indicators can be easily found in the prototype.
9.	The system prototype is considered easy to socialise or teach (transfer knowledge) to people who need it.
	Easy to remember
10.	The appearance and features of the prototype are easy to remember
11.	The operating procedures for each feature on the prototype are easy to remember
	Few errors
12.	Minimum system prototype error rate during testing
13.	Users experience no or few problems during testing
14.	The accuracy of indicator calculations on the prototype is the maximum
15.	The performance (response time) of the prototype is relatively fast
	Pleasant to use
16.	Users feel satisfied and comfortable when testing the prototype
17.	After the first trial, users felt the benefits of the prototype and supported its implementation
18.	Prototype according to user needs
19.	Features in complete prototype
20.	The prototype improves drug services and management effectively and efficiently.

▪ RESULTS AND DISCUSSION

PharmD was developed to be a "user-friendly" performance dashboard application for Indonesian pharmacists. Usability testing involving ten respondents found the prototype comfortable and easy to use with an average score of easy to learn (3.22), efficiency to use (3.25), few errors (3.10), easy to remember (2.98), and pleasant to use (3.04) on a scale of 4. The prototype needs to be updated, and studies on implementing this system must be conducted to ensure the needs of pharmacists in the field are met.

User needs assessment

The observations illustrate the considerable variations and gaps in drug management conditions at the health centers involved in the study. The same thing happened in the health offices. One region differs from another. In terms of the availability of information systems, some PHCs have been supported with information systems, and others have not, so drug management is done manually or using Microsoft Excel. Most PHCs do not have information system staff, although there are PHCs that already have them, although they are not from an IT background. According to the type, pharmacists use two types of systems: one system for pharmacy (owned by the PHC) and another system for inventory reports (owned by the regional asset agency). The necessity of using two systems is considered to add work where pharmacists input more or less the same data. In terms of applications, a variety of application names were identified for the current pharmacy system: SIMPUS, DGS, SISFOMAS, and J-Care, while in the health department: SIMO and E-Log. The inventory report system belongs to regional assets: SIMBARA, SIDIAN, and SIMPERSADA. Each application has different features and different system developers. Observations found that no information system can help pharmacists monitor the performance of drug management.

The focus group discussion results showed that 71% and 24% of respondents stated that they strongly and moderately needed a system that could help monitor the performance of drug management. The proposed prototype model has the same inputs and outputs. This is because the majority of indicators have calculation formulas with similar patterns. The input in question is that the user will input a monthly or annual period and then produce an output in the form of a percentage number of calculation results on each indicator. This system is used to determine the percentage value of drug management performance, so it has the nature of a report or dashboard. All participants (n=17) agreed with the model proposed by the researchers. The few comments that emerged mostly emphasized the definition or necessity of an indicator in practice. However, considering that the preparation of these 26 indicators has gone through various stages of validation in 2018 by Satibi et al., it was agreed that all indicators should continue to be prototyped. There were no special requests regarding the display or interface of the application except that the letters are rather large for easy reading.

In addition, there are problems and needs in the current system. Table 6 shows a summary of the PIECES framework. The information above indicates that a system that helps pharmacists monitor drug management is needed. However, the current information system is not optimal, so it needs to be updated. The need for system integration and the need to standardize drug naming also need to be followed up immediately. In this study, the need for a system to monitor drug management can be facilitated. Still, other needs cannot be facilitated due to limited research time, software development personnel, and costs.

Table 6. PIECES framework summary.

Aspect	Problem/challenges
Performance:	- No menu in the current system can support medication management. - Stock calculation is not yet valid. - The loading process on the pharmacy menu takes a long time when accessed, so it is not used. - The format for naming drug items is not yet standardised and errors when inputting the number of tablets still often occur. - The system does not yet provide menus for Drug Use Reports, Drug Information Services, and clinical screening.
Information:	- There are no alerts for expired and near-expired medicines. - The system is not yet able to provide non-prescription services outside the pharmacy warehouse, such as requests for auxiliary health centres, laboratory units, inpatient care and delivery rooms.
Economic:	- The existence of an information system can reduce expired medicines, deadstock medicines, and reduce paper use, - The new system is related to the budget, namely the price of the system and the need for human data sources to use the system.
Control:	- Security is reduced when users save usernames and passwords on the desktop so that other users can open them. - Data back-up system, system security is currently quite good because it uses an intranet, not the internet. - Two systems must be worked on, making the pharmacist's work inefficient.

Aspect	Problem/challenges
Efficiency:	- The new system needs to be bridged with the existing system to be efficient. - Currently, each district has its SIM so the SIM used is not yet standardised. - Having a SIM can save almost half of the pharmacist's time, as the data on the amount of medication used can be retrieved after each service so that the pharmacist does not need to enter twice to use the medication.
Service:	- Implementing the new system requires permission from the health department and the SIK (Health Information System) manager.

Table 6 shows the need for clinical services, including prescription screening. This is in line with previous research. Manual prescription screening takes a long time and has a high error rate. Using a prescription screening information system can help pharmaceutical personnel prevent medication errors and speed up patient waiting times[11]. Related to the readiness of health centers, there is a need to strengthen terms of planning and policies for the implementation of information systems in health centers, which include budgets, human resources, and strategic plans for management information system development. In line with previous research, the results of the assessment of PHC readiness show that the variable with the lowest score is the planning and policy variable of 1.9 (from a scale of 0 to 5), indicating that this variable has not been well prepared[15].

Implementing model of PharmD

Data Flow Diagrams (DFD) and Entity Relationship Data (ERD) are used to model processes and data in PharmD. DFD describes the flow of information processed from input to a certain output, which is made in the form of a context diagram. The context diagram shows the overall business process as a single process (the system itself). The primary step in creating a DFD is first identifying the external entities, processes, data flows, and data stores in the system. Based on the context diagram, the system is operated by one user, the pharmacist. Pharmacists are in charge of inputting data such as drug data, budgets, formulary proposals, and disease cases, and the output is the percentage of achievement of each drug management indicator, which is the result of drug management performance. As top management, the head of the health center can access the drug management report.

ERD aims to describe the related data in a database. The first step of creating an ERD is to identify entities (an element or object identified in the user's environment or the thing for which data is collected). The second is to draw relationships or relations between entities to show their interactions, and finally, add attributes (properties of an entity) to each entity. DFD and ERD drawings were created using Flowchart Maker and online diagram software accessed through https://app.diagrams.net. Figure 3 shows the ERD of PharmD.

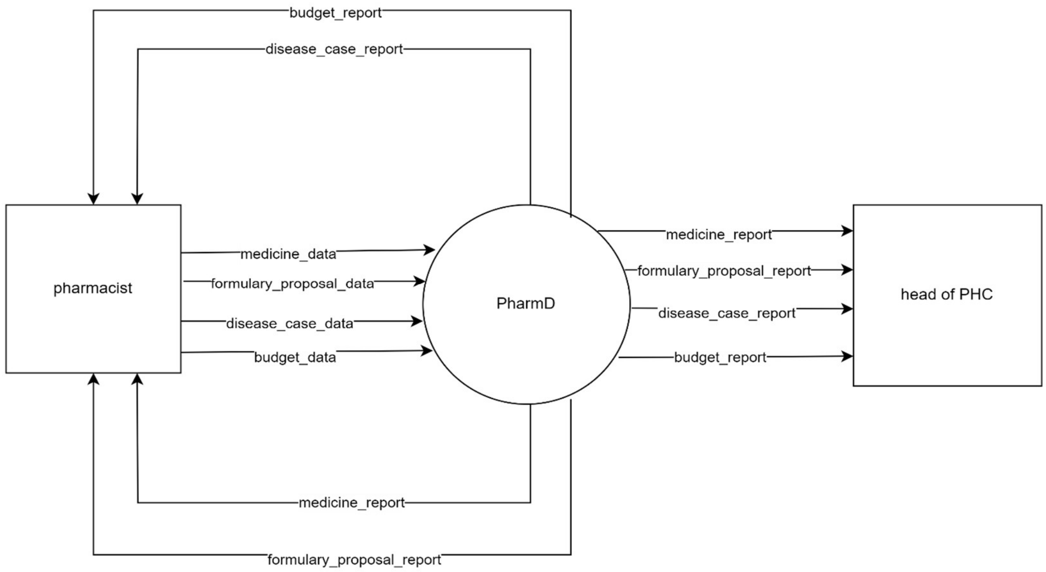


Figure 2. PharmD context diagram.

The primary key in this system is the ID of each entity, namely drug ID, budget ID, disease case ID, formulary proposal ID, account ID, and user ID. The foreign key is a unique identifier or combination of unique identifiers that connects two or more tables in the database. Foreign keys in this system are users_id on the budget, drug, disease case, proposed formulary, and account entities, budget_id and disease case_id for the drug entity, and account_id on the user's entity. The relations in Figure 2 show one-to-one (1:1) and one-to-many (1:N) relationships. One-to-one means that data in a table only relates to data in another table. While one-to-many means that data in a table has a relationship to several data in other tables. An example of a one-to-one is the user and account. One user can only have one account. Examples of one-to-many are users with drugs, formulary proposals, disease cases, and budgets. One user can access or input several drugs, formulary proposals, disease cases, and budgets.

Finally, the creation of dummy data is false data created to be experimental data. The dummy data consists of 55 items, namely 20 indicator drugs from the Indonesian Ministry of Health and 35 regular drugs. To get a percentage figure for each indicator, the data created covers one year. Each drug has a drug code, drug name, unit, therapeutic class, drug category, drug group, batch number, expiration date, price, planning amount, receipt, request, usage, distribution to sub-services, request from sub-services, as well as data on the number of ED drugs, number of damaged drugs, list of proposed formulary drugs, list of 10 diseases with the highest number of cases, amount of funds, stock, ITOR, and drug availability rate.

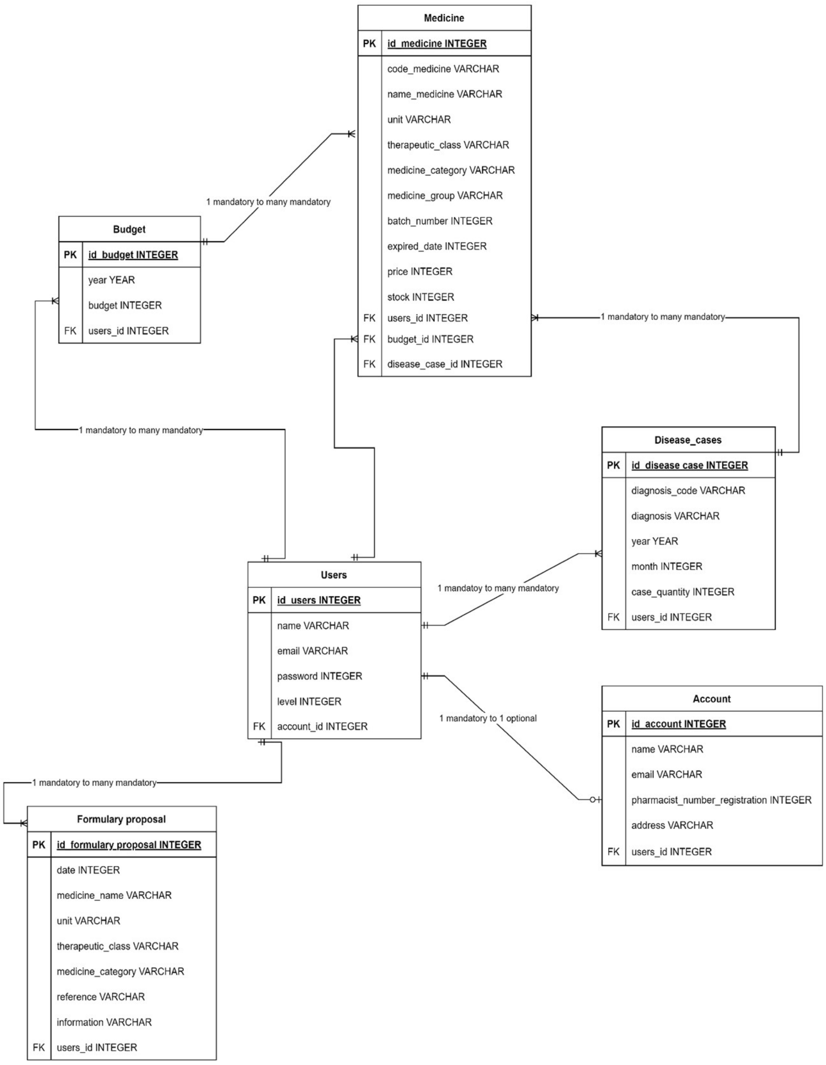
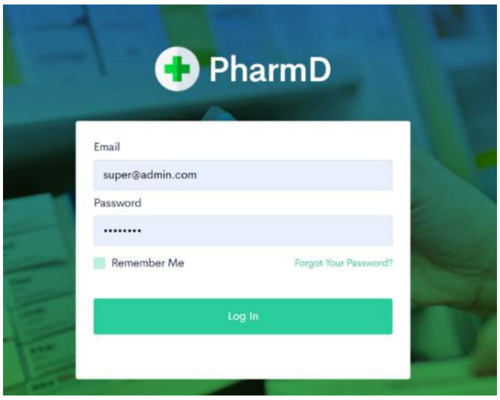


Figure 3. Entity relationship data PharmD.

This indicator-based drug management prototype is named "PharmD" from the *Pharmacy Dashboard of Drug Management*. With PharmD, pharmacists can easily monitor their drug management performance. The design of this application's user interface was made based on the needs analysis results, which include 26 indicators of drug management. Figure 4 is a screenshot of the PharmD interface. Figure 4(a) login display for a user. Users only need to enter their email and password when logging in. Figure 4(b) is the display immediately after successfully logging in. There are several PharmD main menus on the left side of the application, from top to bottom. The first menu is the dashboard, which displays the achievement percentage of five annual and twenty-one monthly indicators. The five-yearly indicators are the number of proposals to the formulary, adequacy of funds, the accuracy of indicator drug planning, average ITOR, and drugs not prescribed for three months. Meanwhile, the monthly indicators are suitable for national use, suitability for disease patterns, suitability for demand for indicator drugs, suitability for receipt of indicator drugs, storage of indicator drugs according to dosage form, storage of indicator drugs according to temperature, storage of narcotics according to regulations, storage according to place, arrangement taking into account FEFO, suitability for storage, High-alert, LASA storage suitability, storage removed from primary packaging, the accuracy of distribution, level of drug availability, empty stock items, low stock items, safe stock items, excess stock items, the value of ED drugs, the value of damaged drugs, and suitability of physical quantity of drugs indicator. Users can select the monthly or annual period dropdown and choose the desired specific month and year. At the top right, there is a quick user name icon to view the account profile and log-out options.



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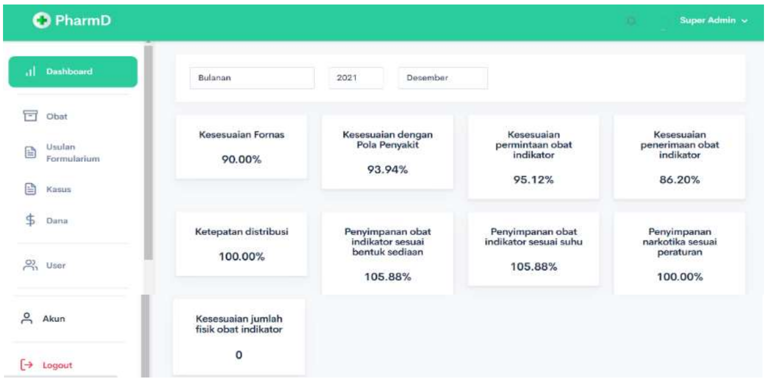

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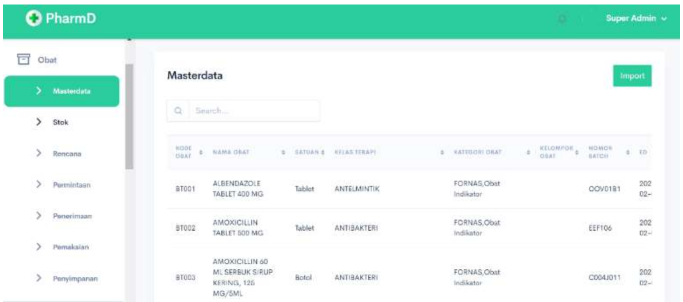

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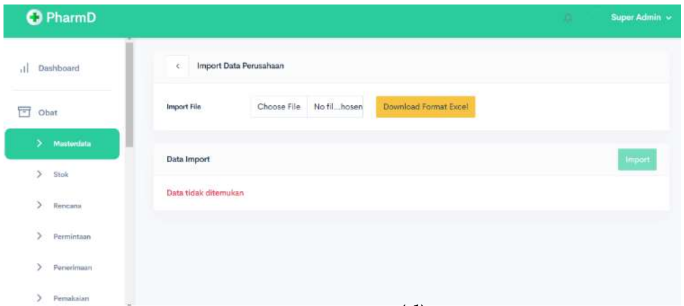

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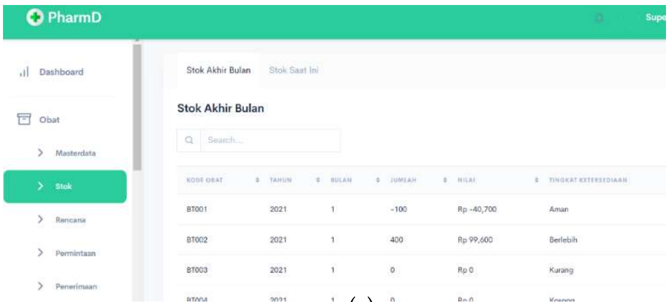
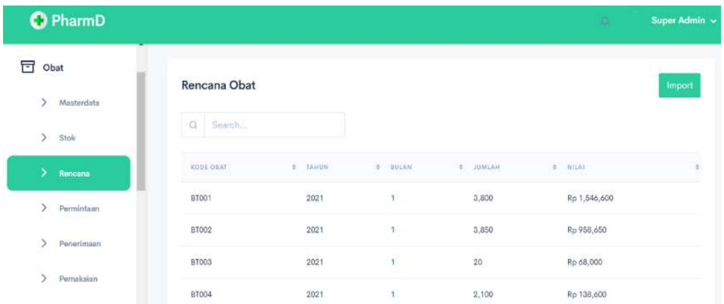
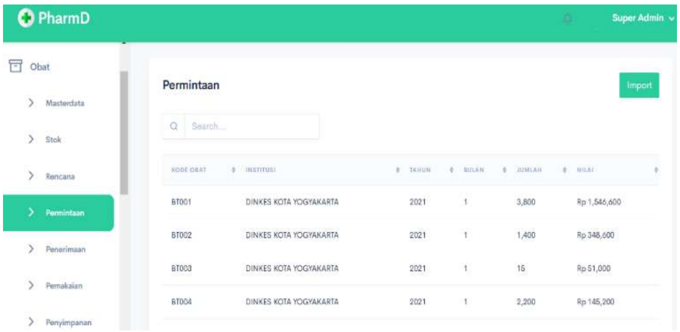


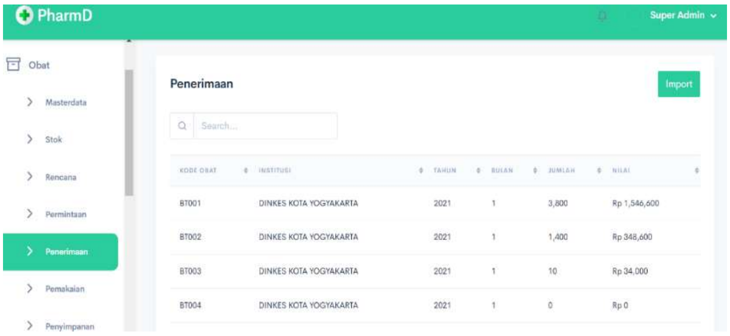
(e)



(f)


PharmD
Super Admin
Obat
Masterdata
Stok
Rencana
Permintaan
Penerimaan
Pemakaian
Penyimpanan
Permintaan
Import
BT001 DINKES KOTA YOGYAKARTA 2021 1 3,800 Rp 1,546,600
BT002 DINKES KOTA YOGYAKARTA 2021 1 1,400 Rp 348,600
BT003 DINKES KOTA YOGYAKARTA 2021 1 15 Rp 51,000
BT004 DINKES KOTA YOGYAKARTA 2021 1 2,200 Rp 145,200

(g)


PharmD
Super Admin
Obat
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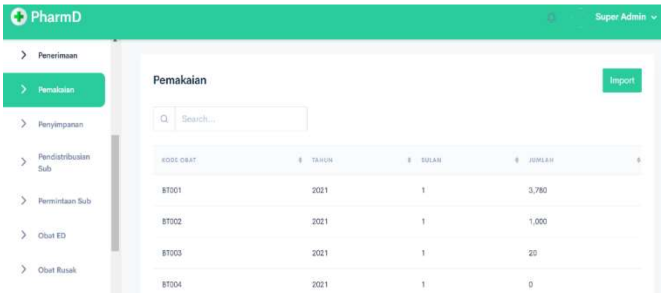
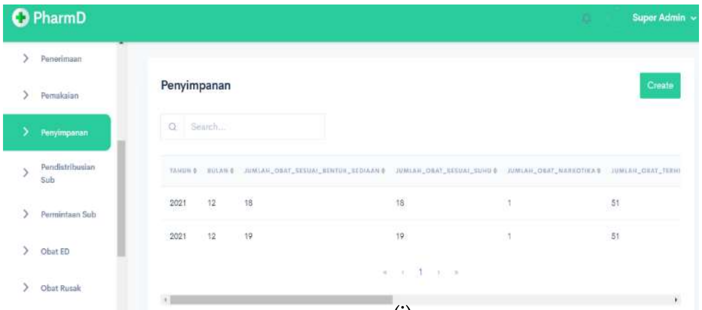
Penerimaan
Pemakaian
Penyimpanan
Penerimaan
Import
BT001 DINKES KOTA YOGYAKARTA 2021 1 3,800 Rp 1,546,600
BT002 DINKES KOTA YOGYAKARTA 2021 1 1,400 Rp 348,600
BT003 DINKES KOTA YOGYAKARTA 2021 1 10 Rp 34,000
BT004 DINKES KOTA YOGYAKARTA 2021 1 0 Rp 0

(h)


PharmD
Super Admin
Pemakaian
Import

(i)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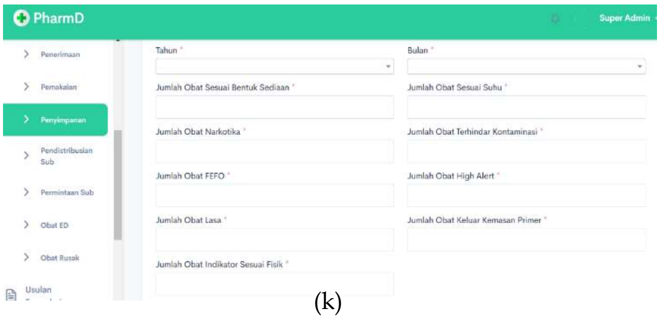
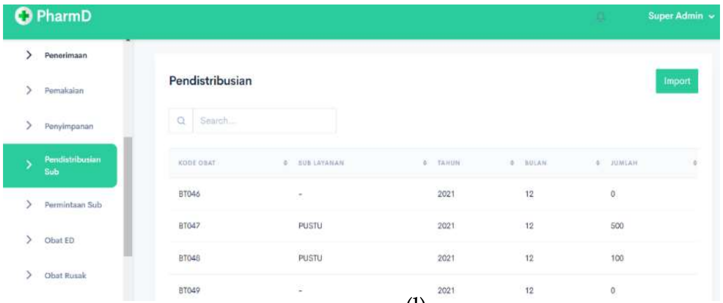
Super Admin
Penyimpanan
Create

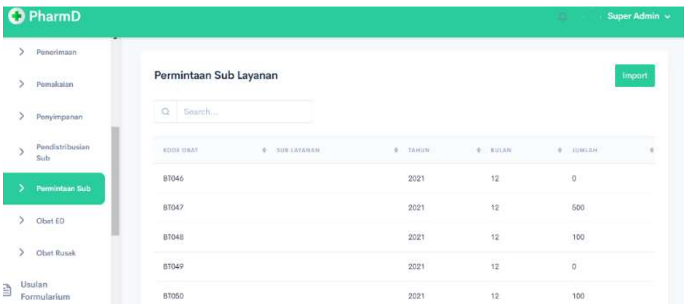
(j)


PharmD
Super Admin

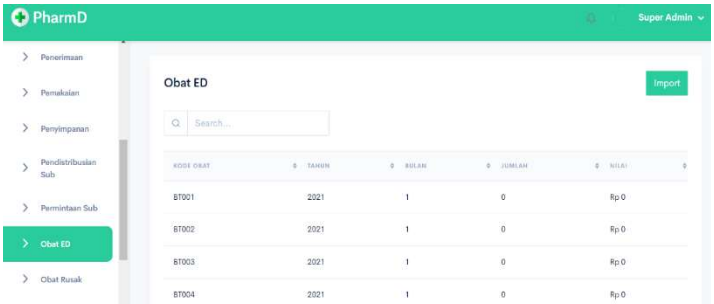
(k)


PharmD
Super Admin
Pendistribusian
Import

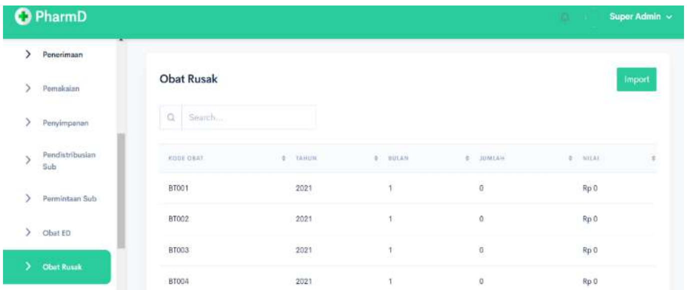
(l)


PharmD
Super Admin
Permintaan Sub Layanan
Import

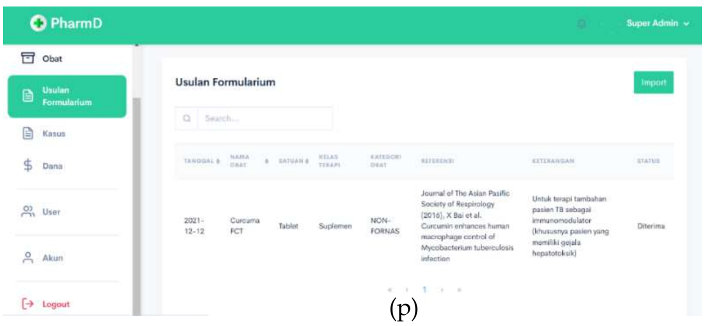
(m)


PharmD
Super Admin
Obat ED
Import

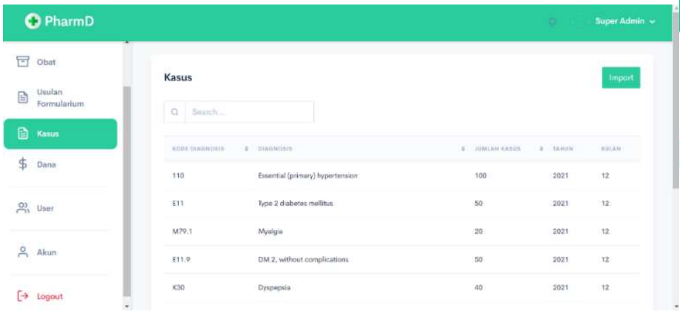
(n)


PharmD
Super Admin
Obat Rusak
Import

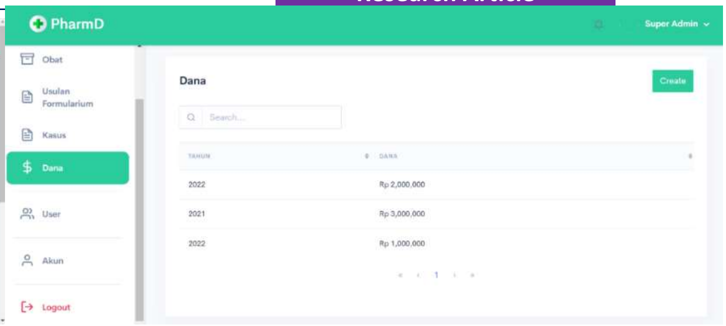
(o)


PharmD
Super Admin
Usulan Formularium
Import

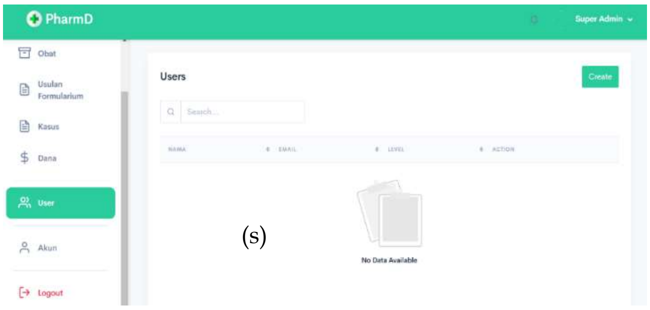
(p)



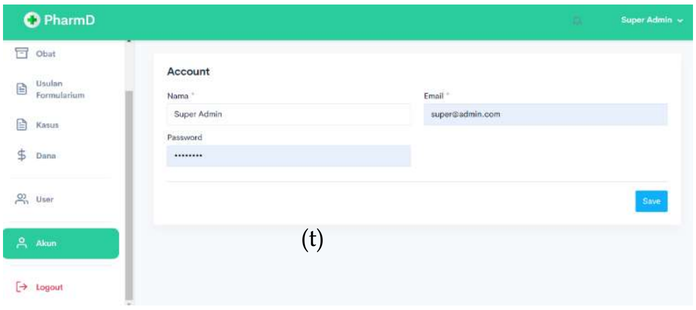
(q)



(r)



(s)



(t)

Figure 4(c) displays the medicine menu with 11 sub-menus for data input and certain information: (1) master data, for data input as master data. The import icon (Figure 4(d)) functions to add or enter data from Ms. Excel, so you don't need to input it individually. How to use it: The user clicks on the import icon, downloads the Excel format, and fills in the data, then enters the file by clicking choose file and upload. Then, the data will appear automatically on the screen. Click Import to lock the data. The import icon will be provided in another menu. (2) stock display in Figure 4(e); this feature functions to obtain information regarding the final stock of each month, current stock in real-time, and the level of drug availability. (3) drug plan in Figure 4(f); this feature is for inputting the number of drug plans each month for one year. (4) drug requests in Figure 4(g), to input the number of drug requests from the health center to the local health service or other agencies each month by importing data. (5) drug receipts in Figure 4(h) function to input the number of drug receipts received by the health center from the health service or other agencies each month by importing data. (6) drug use in Figure 4(i) functions to input the amount of drug use each month by importing data. (7) drug storage in Figure 4(j) functions to input the number of drugs stored according to the indicators: number of indicator drugs according to temperature, number of indicator drugs according to dosage form, number of narcotic drugs, number of drugs to avoid contamination, number of drugs according to FEFO, amount drugs according to LASA, the number of drugs according to high alert, the number of drugs out of the primary packaging, and the number of indicator drugs according to physical. How to input the storage amount for each indicator by clicking on the create icon located at the top right of the display, a display will appear as in Figure 4(k). (8) distribution to sub-services in Figure 4(l) functions to input the number of drugs distributed to sub-services of community health centers each month by importing data. (9) requests from sub-services in Figure 4(m) function to input the number of drugs requested by the sub-service PHC each month by importing data. (10) ED drugs in Figure 4(n) serve to input the number of drugs that have passed through the ED period each month by importing data. (11) damaged drugs in Figure 4(o) functions to input the number of damaged drugs each month by importing data.

The formulary proposal menu in Figure 4(p) is for inputting data on proposed new drugs for the approved health center formulary. Figure 4(q), the disease case menu contains the ten diseases with the highest incidence rates in community health centers in a particular month. Figure 4(r) displays the fund's menu, which functions to input the number of funds intended to purchase medicines for one year at the community health center. There is a user menu to create users who can log in to the system and an account menu to edit the account information currently logged in. Inputting drug receipt data, drug usage data, and data recap of the highest cases at health centers is still imported because the prototype is not yet integrated with existing systems such as SIMPUS, e-prescribing, the system at the health service, and the system at supporting health centers.

Usability test

The prototype consists of functions: (1) log in, (2) data input, (3) dashboard or drug management results. Data input functions to input the data needed for the calculation process. The data entered are drug master, drug plan, drug use, drug requests, drug receipt, storage, drug distribution to sub-services, drug requests to sub-services, ED drugs, damaged drugs, formulary proposals, disease cases, and funds. Meanwhile, the dashboard is for viewing the percentage of drug management performance results in a monthly or annual period, which automatically appears shortly after the system has calculated it.

The overall average usability value of PharmD is listed in Table 7. Easy to learn means that users can quickly understand the appearance and navigation features of the website when interacting for the first time. Table 7 shows that the majority of respondents agree that PharmD is easy to operate the first time, easy to understand the first time it is run, easy to recognize from the interface design, prototype letters, and symbols are easy to read and understand, and the prototype colour design is comfortable to look at. Efficient to use means the level of user mastery when using the website and website performance when executing commands. Table 7 shows that respondents agree that users can easily find the login form, easily find the information they need regarding drug management, easily find assessment results based on indicators, and the prototype is easy to socialize or teach (transfer knowledge) to people who need it.

Table 7. PharmD usability test results

Aspect	N	Mean	SD	Minimum	Maximum
Easy to learn	10	3.22	0.394	2.80	4.00
Efficiency to use	10	3.25	0.333	3.00	4.00
Easy to remember	10	3.10	0.394	2.50	4.00
Few errors	10	2.98	0.416	2.50	4.00
Pleasant to use	10	3.04	0.386	2.60	4.00

Easy to remember means that the display on the system is easy to understand or not complicated, so it is easy to recognize even during subsequent use. Respondents agreed that the appearance and features on the prototype were easy to remember, and the operating procedures for each feature on the prototype were easy to remember. Fewer errors mean the system does not make many errors, or the mistakes that occur are easily resolved. Respondents agreed that the prototype error rate was minimal during testing and experienced few problems, the accuracy of calculating indicators on the prototype was maximum, and the performance (response time) of the prototype was relatively fast. Pleasant to Use means the user feels comfortable, has no problems, and gets a good experience when interacting with the system. Respondents agreed that users felt satisfied and relaxed when testing the prototype felt the benefits of the prototype, and supported its implementation. The prototype was considered to be based on user needs, and the features in the prototype were complete. The prototype was deemed to be able to improve service and medication management effectively and efficiently. The results of the usability testing evaluation show that PharmD is easy to use, and respondents feel satisfied and comfortable in using the PharmD prototype so that this prototype can be accepted. This research reports that the prototype can be used as an initial form of a system that helps pharmacists monitor the performance of their medication management.

Some of the advantages of the prototype based on respondents' assessments include making it easier to manage drug supplies, making it more effective and efficient, complete with 26 drug management indicators that automatically appear, thereby speeding up the process of collecting indicator data, the available menu does not yet exist in other drug management information systems, user friendly, the design is quite simple. Hence, it is comfortable to look at, and the response time is quick.

The weaknesses of the prototype include that it still requires importing data per menu, and the data import form does not match the form owned by the health center, it does not yet describe if there is a drug item with the same code with a different batch number and expiry date, what it will look like in the drug master data, interface can be made more colorful, not just green and white, filling in or uploading data is still confusing, the font in the menu is not big enough, there is no report feature that can be downloaded into Microsoft Excel, there is no menu for deleting data if it is wrong when inputting, there is no name yet the drugs on some menus only have drug codes so they are prone to errors when inputting data, in the storage menu there is no information on how many drugs are stored so there is no warning if the number entered is correct or wrong, to import data in Microsoft Excel there is no explanation of how to fill it in, and the search button still has an error in the menu.

Input from respondents included adding a guide menu for using the program, and drug names were also included in another menu beside the drug master, not just drug codes; the system could be integrated with the current health center information system and the national health insurance service system and developed to support work in the field of assets, the system can be used in community health centers or health office pharmacy installations, data that has been imported can be edited for revision or deletion, can be used by several users, data input can vary, not only importing data but also manual, and the method can be clarified. Calculate indicators for drug management. The need to update the prototype is based on the respondents' assessment regarding weaknesses and input from these respondents before the application is used.

Strengths and limitations of the study

The strengths of this research include design, development, and evaluation involving end users of the application (health center pharmacists). Apart from that, this research is the first in Indonesia. However, this study has limitations. One of the limitations of this research is that there were only 10 participants involved in the usability test from one Yogyakarta province. The study results may not reflect the opinions of pharmacists in other regions. Another limitation is that the prototype is a website application, so it is only more comfortable if operated on a computer and less comfortable if accessed via a smartphone, even though it can be done. Limited research time, IT personnel, and costs for making this prototype cannot yet facilitate all user needs. A robust information system in community health centers is essential for both drug management and clinical services. Further studies on prototype updates and their implementation in Indonesia are needed.

CONCLUSION

This study describes the development of PharmD from the initial stages, namely needs analysis, prototype design, and usability evaluation using a User-Centered design approach. This prototype was developed to help pharmacists monitor their medication management performance effectively and efficiently. It has five main menus: dashboard, drugs, formulary proposals, disease cases, funds, and eleven drug sub-menus: master data, stock, plan, request, receipt, use, storage, sub-service distribution, sub-service request, ED drugs, and defective drugs. The average prototype usability scores are easy to learn (3.22), efficiency to use (3.25), few errors (3.10), easy to remember (2.98), and pleasant to use (3, 04) on a scale of 4. The study results concluded that PharmD could be used in community health centers in Indonesia because there is no similar application in the country. This application is from the end-user perspective, namely pharmacists. Further studies on implementing the application in the field are needed to demonstrate its usefulness in streamlining drug management and its potential to be developed toward more profitable inventory control.

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