

Performance, Information, and Data Security of the Public Health Center Management Information System in Indonesia

Gamasiano Alfiansyah^{1*}, *Riska Agustin Wulandari*¹, *Maya Weka Santi*¹, *Selvia Juwita Swari*¹, and *Faizatul Nikmah*²

¹Health Information Management Study Program, Health Department, Politeknik Negeri Jember, Indonesia

²Graduate Program in Public Health Sciences, Universitas Jember, Indonesia

Abstract. The Ajung Public Health Center has implemented the SIMPUS (Sistem Informasi Manajemen Puskesmas or Public Health Center Management Information System) since 2017 to serve outpatient, inpatient, and emergency department registrations. However, SIMPUS has never undergone an evaluation, leading to challenges in patient services. This research aimed to evaluate SIMPUS based on its performance, information accuracy, and security. The research employed a qualitative method, as well as observations and documentation. Data was analyzed using content analysis. The findings revealed that SIMPUS performance was insufficient, as it lacks essential features required by users. Additionally, SIMPUS produces inaccurate information and does not ensure adequate data security. Therefore, it is recommended that the health center develop SIMPUS by incorporating the necessary features and improving its security system.

1 Introduction

Health technology is one of the options available to support fast, precise, and accurate healthcare service processes in decision-making [1]. In Indonesia, the health technology used to improve the management of Public Health Centers is called the Sistem Informasi Manajemen Puskesmas (SIMPUS), or Public Health Center Management Information System. One of the Public Health Centers that implements SIMPUS in the Jember Regency is Ajung Public Health Center, which operates under the Jember District Health Office.

Ajung Public Health Center has been using SIMPUS since 2017 to manage patient data and registrations, including general patients, health insurance patients, as well as both new and returning patients. The extent of SIMPUS usage at Ajung Public Health

*Corresponding author: gamasiano.alfiansyah@polije.ac.id

Center can be illustrated by the number of patient visits from January to December 2022, as shown in the table below.

Table 1. Number of Patient Visits at Ajung Public Health Center (2022)

Months	Patient Type		Total Patients Every Month
	Returning Patient	New Patient	
January	479	335	814
February	479	263	742
March	469	299	768
April	450	273	723
May	492	279	771
June	708	473	1.181
July	730	526	1.256
August	888	487	1.375
September	902	460	1.362
October	875	423	1.298
November	989	459	1.448
December	1.044	540	1.584
Total	8.505	4.817	13.322

The table shows that the number of patient visits at Ajung Public Health Center from January to December 2022 has tended to increase. The average number of patient visits each month is 1,110, which includes both new and returning patients. This average number of patients provides an overview of the frequency of SIMPUS usage at Ajung Public Health Center, which helps to improve the effectiveness and efficiency of patient services. The number of patient visits at the health center can reflect the frequency of SIMPUS usage; thus, any issues in its implementation may lead to delays in patient services [2].

The preliminary study revealed several issues with the implementation of SIMPUS, particularly concerning the availability of menus that do not meet user needs. This has led staff to revert to manual recording to generate the required information. The problems with SIMPUS are attributed to the lack of evaluation since the system was implemented. Information systems should be evaluated periodically, at least once every two years, to review the system's implementation in meeting user needs [3]. Additionally, SIMPUS has not been integrated with the P-Care application provided by BPJS for Health or Badan Penyelenggara Jaminan Sosial (BPJS) Kesehatan (Indonesia's national health insurance). This lack of integration creates inefficiencies, as staff must enter the same patient data into two different applications, P-Care and SIMPUS. Integrating SIMPUS with P-Care could improve service quality and reduce staff workload, thereby streamlining workflows.

The implementation of SIMPUS remains suboptimal due to various issues in its execution. Performance problems with SIMPUS during use are a major factor

contributing to its suboptimal operation [4]. The issues experienced with SIMPUS affect the quality of the information generated by the system, leading to inaccuracies and inconsistencies in patient examination information. Effective implementation of SIMPUS should ensure the availability of high-quality, consistent data and information [5]. Another consequence of these issues is decreased efficiency among staff. Therefore, this study aimed to analyze the problems with SIMPUS through an evaluation of the information system.

Evaluation is the process of collecting information about how something functions to determine the most appropriate alternatives for decision-making [6]. In this study, the evaluation was conducted by analyzing the aspects of performance, information, and control related to the implementation of SIMPUS at Ajung Public Health Center. The results of this evaluation can serve as a basis for considering improvements to the SIMPUS system. The analysis of the information system's implementation provides a record of the system's performance, which serves as a foundation for recommendations on system improvement and development [7].

2 Method

This study was qualitative research aimed at evaluating SIMPUS based on the variables of performance (throughput, response time, ease of communication, and completeness), information (accuracy, relevance, and presentation), and control (integrity and data security). The participants consisted of 9 individuals: 2 registration officers, 1 emergency department nurse, 2 inpatient nurses, an information system officer, and a health department officer specializing in information systems, who serve as the primary informants. The head of administration and the head of the public health center act as supporting informants. The primary informants were selected based on their involvement in using SIMPUS, while the supporting informants were chosen based on their involvement in the implementation of SIMPUS.

Data was collected through in-depth interviews, observations, and documentation of SIMPUS usage. Interview sheets and observation sheets were used as research instruments. Data analysis involved data reduction, presentation, and conclusion. Validity was ensured through source triangulation (comparing informant interviews) and technique triangulation (comparing interviews with observations and documentation).

The researchers confirm that this study adheres to ethical standards, as evidenced by the Ethical Approval Certificate (number 143/PL17.4/PG/2024) issued by the Ethics Committee of Jember State Polytechnic. Therefore, the study was deemed suitable to proceed while upholding ethical principles to protect both the researcher and the informants.

3 Results and discussion

3.1 Performance of SIMPUS

The performance of SIMPUS was evaluated based on throughput, response time, ease of communication, and completeness of the system. Throughput refers to the system's ability to produce a certain amount of output over a specific period [8]. In this study, throughput

pertains to of SIMPUS's ability to enhance the efficiency and effectiveness of staff activities in recording and reporting. An interview excerpt illustrates throughput in SIMPUS.

"Only useful for checking patient identity data and obtaining medical record numbers" (1st Informant)

The findings indicate that the SIMPUS helps staff with patient registration, particularly in verifying patient data and obtaining medical record numbers. However, observations revealed that SIMPUS has not yet prevented the occurrence of duplicate medical record numbers, which causes delays as staff must manually locate the correct records. Additionally, SIMPUS lacks a reporting feature, requiring staff to use manual methods such as Excel spreadsheets to generate reports. Below is an example of the manual patient visit register. The existence of duplicate medical record numbers generated by the SIMPUS results in errors in identifying patient medical record files. This issue negatively impacts service efficiency, as staff are required to search for the correct medical record documents. Duplicate medical record numbers lead to difficulties in retrieving medical files, ultimately causing delays patient services due to the time spent locating the appropriate medical records [9].

Another issue identified is that the SIMPUS has not been able to assist staff in generating the reports required by users. As a result, SIMPUS users must revert to manual methods to fulfill the reporting requirements of the health center. Report generation at Ajung Public Health Center is conducted using an Excel register provided by each unit. Below is an example of the register supplied by the registration department for reporting patient visits at Ajung Public Health Center.

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5		19156	1			23						1																	
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7		19890			1	33						1																	
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Fig 1. Manual Patient Visit Register

The image above illustrates evidence that staff at Ajung Public Health Center continue to manually process patient data, despite the implementation of SIMPUS, which is intended to facilitate the recording and management information. An effective

management system is expected enhance work processes and services at healthcare facilities by systematically managing data to support decision-making by the management [10].

Response time indicates at which a system in performing tasks or the average delay in processing transactions submitted by users [11]. An information system must maintain an optimal response time to effectively support patient service processes. In this study, response time specifically to the duration required to operate SIMPUS at the Ajung Public Health Center during the patient service activities. The research findings concerning the response time of SIMPUS are illustrated by the following interview results.

“The response time of SIMPUS has been quite smooth so far” (5th Informant)

The interview results above indicate that SIMPUS at Ajung Public Health Center demonstrates a rapid response time in patient service processes. A quick response time of SIMPUS is one of the key used to assess the quality of a system. SIMPUS requires less than one minute to respond to each command issued by staff. This is further supported by the observation table detailing SIMPUS's response time during the process of retrieving for patient data, as outlined below.

Table 2. SIMPUS Response Time

Medical Record Number	Response Time
20350	1 second
80896	2 seconds
01777	1 second
680897	2 seconds
02481	1 second
680820	1 second
680599	1 second
680951	2 seconds
680953	1 second
04101	1 second
681042	1 second
12600	1 second
11206	1 second
18040	1 second
20772	1 second

Based on the observation table regarding the response time of SIMPUS above, it is evident that SIMPUS has a response time of 1 to 2 seconds for processing each user command. This aligns with the research conducted by Dinata and Deharja (2020), which indicates that a good system response time is less than 1 minute [12]. However, during its implementation, SIMPUS experienced loading delays during service due to internet network issues at the Ajung Public Health Center. However, the frequency of these loading incidents is quite rare. The internet connection significantly impacts the functionality of SIMPUS as it can lead to delays in service activities at Ajung Public

Health Center. The system's response time in delivering services may be hindered by disruptions in the internet signal, resulting in slower data entry processes [13].

Communication ease refers to the degree of ease with which the interface or display of the information system can be easily understood, facilitating user operation during service processes [12]. In this study, communication ease pertains to the clarity of the SIMPUS interface at Ajung Public Health Center, specifically regarding the menus, icons, and language utilized. This clarity ensures that staff can operate SIMPUS without complications. The research findings related to communication ease are illustrated by the following excerpts from interview.

"From my perspective, the menus in SIMPUS are simple and easy to understand" (3rd Informant)

The study found that the menus utilized in SIMPUS are both common and straightforward, making them easy for users to comprehend. A system must feature an interface composed of clear menu options to enhance user understanding. In addition to the interface, the choice of language employed in the system is also crucial [14]. The language used in SIMPUS is Indonesian, which users can easily grasp. The language and terminology within the information system should be simple enough for the general user to prevent difficulties in operating the system [15]. The illustration related to the communication aspect of SIMPUS is depicted by the system's interface as follows.

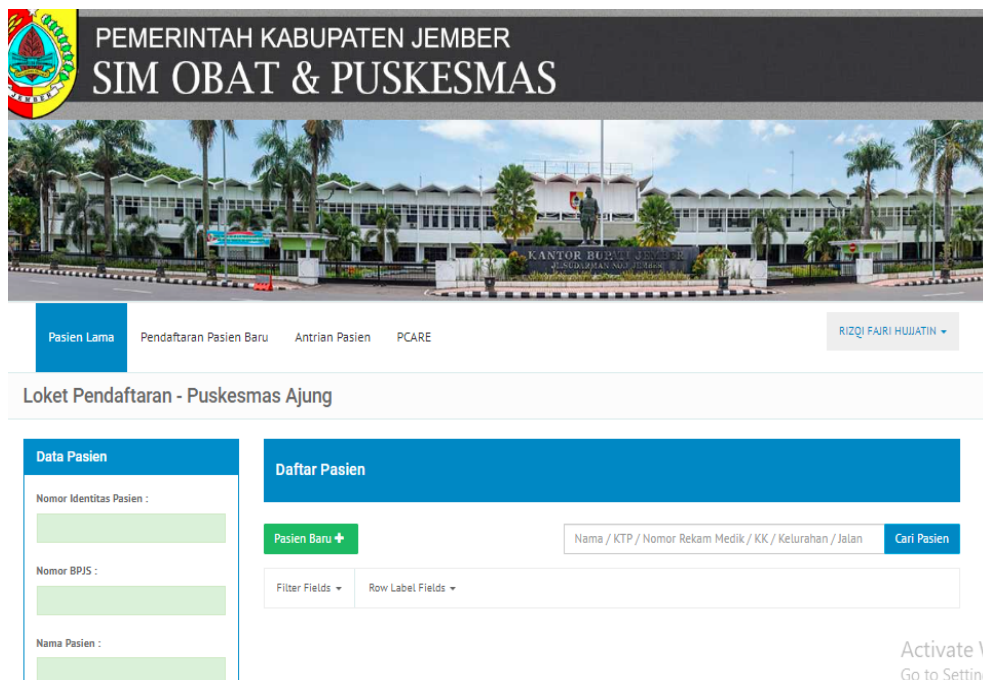


Fig 2. SIMPUS Registration Interface

The image above illustrates that SIMPUS features an intuitive interface that is accessible to laypersons, particularly regarding its menus, icons, and language. This

perspective aligns with the findings of Nurlifa et al. (2014), who assert that the design of a user interface aims to facilitate ease of use for technology users [14]. The straightforward nature of the SIMPUS interface ensures that staff members can operate and learn to use it without encountering significant difficulties.

Completeness refers to the comprehensive implementation of system functions that support users' work [16]. In this context, it pertains to the thoroughness of the menus available in SIMPUS and the optimal performance of these menus in assisting users with their tasks. Research findings regarding the completeness of SIMPUS are illustrated through the following interview results conducted by the researchers.

"The menus in SIMPUS do not function well. Only the menus in the registration section work properly, the others can only be used for data entry but cannot generate reports"
(1st Informant)

The interview results concerning to the aspect of completeness indicate that the menus provided in SIMPUS are not functioning optimally, as several menus are inoperative. The non-functional menus include the save menu, medication menu, P-Care menu, and reporting menu. When users attempt to save data, an error screen appears, requiring them to return to the previous page and refresh to save the patient's data. Similarly, the malfunctions of the medication menu and reporting menu in SIMPUS are also attributed to system errors.

The research findings indicate that SIMPUS does not offer a comprehensive set of menus tailored to user needs. Notable omissions in SIMPUS include menus for patient visit history, fee retraction, data retrieval for each staff member in the unit, control letter creation, referral letters, and reporting functionalities. Furthermore, the menus for entering patient examination results are incomplete, lacking essential components such as initial assessment forms, medical resumes, pain assessments, nutrition sheets, fluid intake sheets, general consent forms, and patient discharge forms. This inadequacy in the menu options within SIMPUS compels users to resort to manual methods for generating the necessary data. An information system is deemed to possess a satisfactory level of completeness if it effectively supports the user's workflow, particularly in the production of comprehensive medical records [16].

3.2 Information

Information is the outcome of data processing by a system. High-quality information is characterized by its relevance, accuracy, and timeliness [17]. Evaluating the information aspect of SIMPUS is essential, as it pertains to patient health information. This information can facilitate decision-making in the implementation of health programs at the public health centers. The researcher analyzed the information aspect to assess SIMPUS at Ajung Public Health Center focusing on accuracy, relevance, and presentation of the information.

Accuracy refers to the extent to which a system can generate highly precise information [12]. The evaluation of the accuracy of the information produced by SIMPUS is illustrated by the following interview excerpt.

"The accuracy is still lacking, SIMPUS encounters errors when processing data, resulting in inaccurate information" (1st Informant)

Based on the interview results, it is evident that SIMPUS currently lacks a high level of accuracy in generating the information required by users. The low accuracy of the information produced by SIMPUS can be attributed to suboptimal system performance in data processing. This is further supported by the persistent errors encountered during data processing within SIMPUS. This finding aligns with Reisita's (2019) research, which indicates that the accuracy of information generated by a system can be assessed by the frequency of errors or mistakes in data processing [18].

One example of a menu experiencing errors, affects the accuracy of the data produced by the system, is the medication menu. The error causes the recorded medication stock in SIMPUS to not match the actual medication stock. This discrepancy complicates staff efforts to monitor the available medication supply. This finding aligns with the research conducted by Hadidah and Rochmah's (2016) research, which emphasizes the importance of monitoring medication levels to avoid shortages or surpluses [19].

The research also revealed the discrepancy between the information on SIMPUS and the actual situation regarding the number of beds. SIMPUS indicates that the inpatient unit has 18 beds, while the actual count is 13. This inconsistency arises from the staff's inability to delete data when there is a reduction in the number of inpatient beds or when errors occur during data entry. This situation suggests that SIMPUS, in its current implementation, is capable of storing inaccurate information. The information needs to be free from errors to serve as a reliable foundation for an integrated recording and reporting system for health centers [20].

Information relevance refers to the degree to which the information generated by a system aligns with the user's needs. Information is deemed relevant if it is beneficial to the user and facilitates expedited work processes [11]. Research findings concerning the relevance of information produced by SIMPUS to user needs at Ajung Public Health Center are exemplified by the following interview excerpt.

"Insufficiently meets the requirements because it cannot produce the monthly reports, such as visit reports that can be directly sent to the Health Department, necessitating that staff continue to manage data manually." (1st Informant)

The interview results above indicate that the SIMPUS has not yet been able to produce information that meets user needs, particularly in terms of reporting. These findings are consistent with observational results showing that SIMPUS has not yet provided information aligned with user requirements, such as data on general and health insurance patient visit reports, patient visit and examination history, the top ten diseases, and other monthly reports. This mismatch between the information provided and user needs suggests that the implementation of the SIMPUS has not facilitated the reporting process for staff. Consequently, staff are required to perform manual recording to fulfill the reporting needs of the Public Health Center. A misalignment between job design and information technology can adversely impact the productivity of healthcare services [21].

Information presentation refers to a system's ability to deliver information in a format that is appropriate and easily understandable for users, ensuring that they do not encounter difficulties when operating the system [22]. In this study, information presentation pertains to the SIMPUS and its capability to display information, support the reporting activities of Public Health Centers, and be easily comprehensible to users, both in terms of language and the presentation of information. The research findings related to information presentation are illustrated by the following interview excerpt.

"The presentation of the information is clear and understandable." (2nd Informant)

Based on the interview results, it is evident that the information generated by the SIMPUS is presented in tables that are easy for users to understand, both in terms of layout and language. In addition to conducting interviews, the researcher also performed documentation and observations to evaluate the presentation of information in the SIMPUS at the Ajung Public Health Center. Below is a display of the information presentation obtained through documentation of SIMPUS at the Ajung Public Health Center, specifically in the patient queue menu.

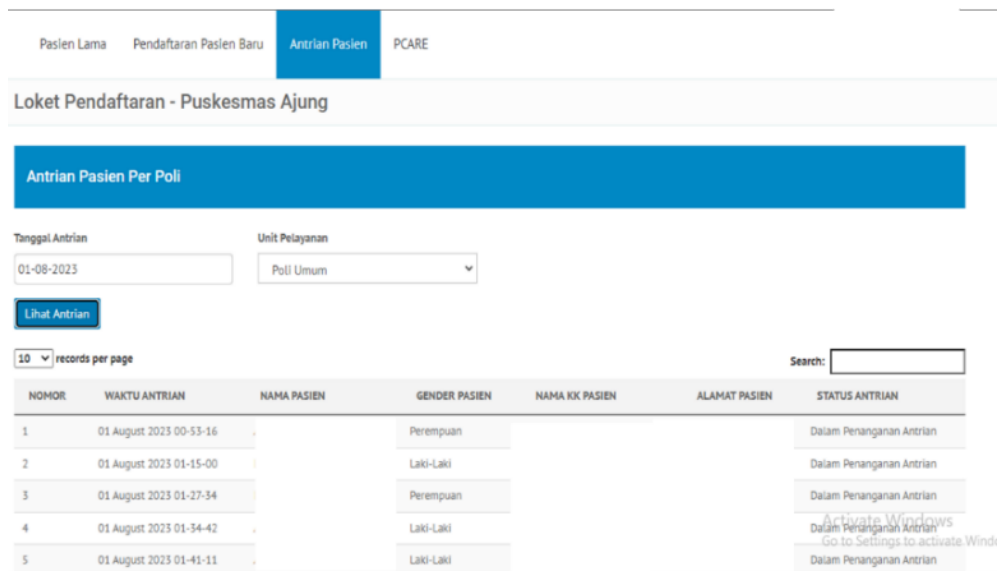


Fig 3. Format of SIMPUS Information Presentation

The image above illustrates that SIMPUS presents information in a clear and easily understandable format. Observations of the information presentation in SIMPUS reveal that the data is displayed in well organized and comprehensible tables, utilizing the Indonesian language. Information systems should present information in a manner way is easy accesible to understand to and prevent confusion. The system should be comprehensible to users, employing language that is familiar to the target audience [12]. Information presentation must be complete at both user and management levels so that the data and information provided can be used for decision-making in Public Health Center management [23].

3.3 Control

Control refers to the analysis of system security against all forms of misuse. Its purpose is to determine the level of monitoring and control over security in the implementation of SIMPUS, enabling an assessment and improvement of the system's security. The analysis of the control aspect in the use of SIMPUS is conducted to monitor the extent of oversight and control exercised over the system to ensure its proper functioning [24]. The researcher analyses the control aspect to evaluate SIMPUS at the Ajung Public Health Center based on integrity and security aspects.

Integrity refers to the level at which access to the information system or software by unauthorized individuals can be controlled. The information system should only be accessible by users with a valid username and password [12]. In this study, integrity refers to SIMPUS's ability to control access rights of users with usernames and passwords to operate SIMPUS, thereby preventing unauthorized operation of the system. The assessment of integrity in SIMPUS at Ajung Public Health Center is illustrated by the following interview excerpt.

"There is a username and password provided by the Health Department." (1st Informant)

Based on the interview results presented above, it is evident that there is a username and password to access SIMPUS. These credentials are provided to each unit and several other users, as well as to several other users, including the head of the Ajung Public Health Center, the head of Administration, and the SIK staff. Each unit receives a single username and password, which is to be used by all staff members within that unit. The purpose of the username and password in SIMPUS is to ensure that only authorized users can access the system. In information systems, usernames and passwords are essential for preventing unauthorized access attempts [25].

During the implementation of SIMPUS, registration staff accounts can be accessed by other units, such as the emergency unit and inpatient unit. This access is granted because the emergency and inpatient staff have been authorized by the head of Ajung Public Health Center to access the registration section of SIMPUS. Because the registration counter at Ajung Public Health Center does not operate 24 hours a day, and patient registration for emergencies or inpatient care must initially be processed through the registration account. When patients require care or examination outside of the operating hours of Ajung Public Health Center, the emergency and inpatient staff usually use the registration staff's account. An effective information system should implement access restrictions that are only available to specific authorized users who are permitted to operate the system [25].

The security system refers to the mechanisms employed to control or protect programs and data within an information system [12]. In this study, security specifically pertains to the protective and control measures implemented to safeguard the confidentiality of patient and Public Health Center data within SIMPUS from misuse access unauthorized access. We conducted interviews to assess the security level of SIMPUS as follows.

"For the SIMPUS application, there are no security measures beyond just the username and password." (Informant 9)

Based on the interview results presented above, it is evident that to maintain the security and confidentiality of data in SIMPUS, only a username and password are utilized. The SIMPUS lacks additional security features, such as CAPTCHA. CAPTCHA is a technique employed to protect websites from attacks by malicious programs (bots) that impersonate human users [26]. Since the security of SIMPUS relies solely on usernames and passwords, effective password management is essential to prevent unauthorized access. One effective method of good password management is to ensure the strength and complexity of the passwords used. Below are the results of the interview conducted with Informant 5.

"The arrangement consists of numbers ..." (Informant 5)

Based on the interview results above, it is evident that the password configuration for accessing SIMPUS consists of easily predictable numbers, which poses a risk of unauthorized access to the system. Fortunately, the Ajung Public Health Center has as not experienced any compromises of SIMPUS by malicious parties. To enhance the security of the information system, it is essential to create passwords using a combination of letters, numbers, and symbols that are difficult for others to guess. Furthermore, system security can be improved by implementing a feature that allows users to change their passwords regularly.

However, if users wish to change their passwords, they must first contact the Health Department. This requirement has resulted users not updating their passwords since the implementation of SIMPUS. One effective method for maintaining information system security is to require password changes every 60 days to ensure account safety. Additionally, a security feature that could be enhanced but is currently absent in SIMPUS is an automatic logout function. Observations indicate that SIMPUS can remain open for extended periods as long as the web page window is not closed. Ideally, the system should incorporate an automatic logout feature that activates after a period of inactivity. A recommended duration for automatic logout is 10 minutes, which would help to prevent unauthorized access to accounts. Automatic logout functions are essential for protecting system security when the system is left idle for a specified duration [27]. Therefore, it can be concluded that the security measures in place for SIMPUS at Ajung Public Health Center are still inadequate.

4 Conclusion

Based on the research findings, it can be concluded that there are several issues related to performance, information, and control within SIMPUS at Ajung Public Health Center. These issues include the suboptimal performance of SIMPUS in generating outputs, the incomplete menu options provided by SIMPUS, the lack of accuracy in the information generated, the failure of SIMPUS to meet user needs, insufficiently informative presentation of information, and inadequate system security. These issues with SIMPUS

need to be addressed to improve its performance. The researchers recommend the Jember District Health Office develop and improve SIMPUS with the following suggestions:

1. The Health Department is encouraged to enhance its operations by implementing a menu feature that generates reports on the number of patient visits.
2. The District Health Office is advised to display a warning if a medical record number is already in use.
3. The District Health Office is advised to incorporate a data retrieval menu in SIMPUS for each service unit. Additionally, it is recommended to include menus for patient medical record forms, such as medical summaries, medication and fluid administration records, initial medical assessments, nutritional assessments, informed consent forms, and general consent forms.
4. The District Health Office is advised to analyze each data transaction processed in SIMPUS and to correct any errors that may lead to inaccuracies in the information generated by the system.
5. The District Health Office is advised to enhance security in SIMPUS by improving password configurations, securing the server, and providing individual accounts for each user.

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