

Risk Management Analysis of Electronic Medical Record System Disruptions to Outpatient Waiting Time

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A B S T R A C T

Background: The use of Electronic Medical Records (EMR) in outpatient services at UPTD Puskesmas Liwuto still faces several disruptions, including slow internet connections, prolonged system loading, server errors/down, difficulties in patient data input, limited computer availability, and power outages. Two computers are available at the registration unit, but only one is currently operational. Under normal conditions, patient registration takes approximately 3 minutes for returning patients and 5 minutes for new patients, whereas during system disruptions, the service time can increase to approximately 30 minutes or even up to 1 hour. **Objective:** This study aimed to analyze the risk management of Electronic Medical Record system disruptions and their impact on outpatient waiting time at UPTD Puskesmas Liwuto using the Failure Mode and Effect Analysis (FMEA) method. **Sample/Research Object:** The research object was EMR system disruptions in outpatient services and their impact on patient waiting time at UPTD Puskesmas Liwuto. **Methods:** This study used a descriptive qualitative design. Data were collected through interviews and observations and analyzed using the Failure Mode and Effect Analysis (FMEA) method based on severity, occurrence, and detection levels to determine the Risk Priority Number (RPN). **Results:** The results showed several failure modes in the EMR system, namely slow internet connections, prolonged system loading, server errors/down, difficulties in patient data input, limited computer availability, and power outages. Based on the analysis of severity, occurrence, and detection, slow internet connections, prolonged system loading, and server errors/down had the highest risk levels, with an RPN value of 448. These disruptions affected service processing time and increased outpatient waiting time. **Conclusion:** Electronic Medical Record system disruptions are one of the risks affecting outpatient waiting time at UPTD Puskesmas Liwuto. Therefore, risk management, infrastructure strengthening, and continuous system evaluation are needed to support effective services and improve the quality of healthcare services.

INTRODUCTION

Electronic Medical Records (RME) are part of the digital transformation of health services that are used to support the electronic recording, storage, management, and access of patient health information. The implementation of RME in health care facilities in Indonesia is growing in line with the existence of the Indonesian Minister of Health Regulation Number 24 of 2022 concerning Medical Records (Permenkes RI No. 24, 2022). Ariani (2023), explained that the implementation of RME can improve work effectiveness, documentation efficiency, access to information, and the quality of health services. This is supported by Mulyana, Situmorang and Fatikasari (2023), who found a relationship between the use of RME and the quality of health services. Rahayu and Badruzzaman (2023), through a systematic review, also showed that the implementation of RME in health care facilities in Indonesia has not been fully optimal, so it is still necessary to strengthen the aspects of the system, resources, and implementation process. Meanwhile, Wati, Igiyany and Pertiwi (2024), show that the readiness of health service facilities in implementing RME still faces various obstacles that need to be considered before the system can be used optimally.

The application of RME in outpatient services is basically expected to speed up the service process because patient information can be accessed electronically without having to search for

documents manually. Purwanti, Syarifah and Hidayat (2024), showing the relationship between the implementation of RME and patient waiting time in outpatient services Djailolo and Katili (2025), also examined the implementation of RME on outpatient waiting time and showed that the implementation of electronic systems is related to changes in service times. Pujiastuti's (2021) research shows that the development of electronic medical record information systems in outpatient services is aimed at speeding up the service process and reducing patient waiting times. Furthermore, Perwirani G. A. and Hidayat (2023), found that the implementation of RME can provide changes to the time of providing medical records and the waiting time for outpatient services. More recent findings from Sari and Muzuh (2023) also show that waiting time is an important aspect in the implementation of RME in outpatient services at Puskesmas.

Although RME can improve service efficiency, dependence on technology also poses risks in the event of a disruption to the system. Disruptions can be in the form of unstable networks, old loading systems, server errors, server downs, application failures, device limitations, and power outages. Sitorus, Simanjuntak and Daeli (2025), found various risks in the implementation of RME risk management in health centers, including negligence in data input, leakage of patient information, power outages, server disruptions, and computer virus infections. Nugraheni and Cahyaningrum (2024) also found that the implementation of RME still faces obstacles such as network disruptions and mismatches in information output. Meanwhile, Simanjuntak et al. (2025), identified network disruptions, power outages, slow systems, and training limitations as obstacles in the implementation of RME. Putri et al. (2025), also showed that the implementation of RME in outpatient services still faces obstacles that can affect the effectiveness of waiting times. Thus, system disruptions need to be seen as a service risk that must be identified and controlled systematically.

One approach that can be used to identify and determine the priority of these risks is Failure Mode and Effects Analysis (FMEA). FMEA is a systematic method to identify potential failures (failure mode), causes, and impacts, then determine risk priorities based on Severity, Occurrence, and Detection values that produce a Risk Priority Number (RPN). Yudianti and Arini (2024), apply Healthcare Failure Mode and Effect Analysis (HFMEA) to RME implementation and show that failure analysis methods can be used to identify risks that hinder the successful implementation of RME. Simanjuntak et al. (2025), also emphasized the importance of risk analysis in RME to identify disruptions that can hinder system effectiveness. In addition, Aulia and Ningsih (2024), use FMEA to identify risks in electronic medical records, while Apriliansyah, Ellina and Ambarika (2025), show that RME risk management needs to be carried out through identification, analysis, evaluation, control, monitoring, and reporting of risks. Therefore, FMEA is relevant to determine RME system disruptions that have the highest level of risk and to prioritize improvements based on their impact on services.

Based on a preliminary study at the UPTD Puskesmas Liwuto, the use of RME in outpatient services still experiences several disturbances, namely slow internet networks, old system loading, server errors/downs, obstacles to the patient data input process, computer limitations in the registration section, and power outages. In the registration section, there are two computer units, but only one unit is functional. In addition, the number of officers with a medical recorder education background is only one person. Under normal conditions, the service time for outpatient registration is around 3 minutes for old patients and about 5 minutes for new patients, while when there is a system disruption, the service time can increase to about 30 minutes and even reach approximately 1 hour. These conditions show that RME disruption is not only a technical problem, but also has the potential to hinder the flow of services and increase patient waiting time. Therefore, this study was conducted to analyze the risk management of the Electronic Medical Record system disruption to outpatient waiting time at the UPTD Puskesmas Liwuto using the FMEA method.

METHODS

This study uses a qualitative descriptive method with the Failure Mode and Effects Analysis (FMEA) approach to analyze the risk of disruption of the Electronic Medical Record System (RME) to the waiting time of outpatients at the UPTD Puskesmas Liwuto. The research was carried out at the UPTD Puskesmas Liwuto in March-May 2026. The research informants totaled 4 people, consisting of registration officers, medical record officers, persons in charge of E-Puskesmas, and the head of medical records as triangulation informants. Data were collected through in-depth interviews and direct observation of the use of RME in outpatient services. The analysis was carried out by identifying the failure mode, causes, and impact of the disorder, then providing an assessment based on three FMEA parameters, namely severity, occurrence, and detection. The values of the three parameters were used to calculate the Risk Priority Number (RPN) so that risk priorities and recommendations for improvements to the disruption of the RME system can be determined that have the most effect on patient waiting time.

RESULTS & DISCUSSION

Identification of Failure Mode of Electronic Medical Record System Interference

Based on the results of the research through in-depth interviews and observations on the use of Electronic Medical Records (RME) in outpatient services at UPTD Puskesmas Liwuto, six potential failures were found, namely slow internet networks, old loading systems, server errors/downs, obstacles in the patient data input process, computer limitations in the registration section, and power outages. These disruptions show that the risks in the implementation of RME do not only come from the application, but also from the infrastructure and supporting facilities used in the service. Slow internet networks and old loading systems can slow down patient data access and input, while server errors/downs can cause the system to be unusable, resulting in hampered services. Data input process obstacles and computer limitations can prolong the registration process, while power outages can hinder the use of electronic devices and systems. These conditions ultimately have the potential to increase patient queues and waiting times, especially when disruptions occur at the registration stage which is the initial part of the outpatient service flow.

Table 1. Identification of RME System Fault Mode Failure

No.	Failure Mode	Impact on services
1	Slow internet network	Service slows down and wait times increase
2	Legacy loading system	Service processes and data input are hampered
3	Server error/down	The system is unusable and service is hampered
4	Patient data input process barriers	The registration process takes longer
5	Computer limitations in the registration section	Officers experience limitations in the service process
6	Power outage	Electronic systems and services cannot run optimally

Source: Primary Data, 2026

Based on the table, the six failure modes have different impacts, but overall they can hinder the smooth flow of service and potentially increase patient waiting times. Network, loading, and server disruptions mainly affect access and continuity of system use, while data input barriers and computer limitations have more effect on the registration process. Power outages can also hinder services because electronic devices and systems cannot be used optimally. Therefore, the identification of this failure mode is the basis for conducting FMEA analysis through severity, occurrence, and detection assessments so that the risk level of each disorder can be determined and the priority of control of the disorder that most affects services and patient waiting time can be determined.

These findings are in accordance with the concept of failure mode in the FMEA method. According to Prihantoro Syahdu Sutopo (2023), failure mode is a potential failure that can occur in a process or system and can interfere with the flow of services. In the context of Electronic Medical Record (RME)-based services, failure mode can occur when one of the components that support the service process cannot function as it should. This form of failure can be in the form of internet network disruptions, server errors, system downs, or errors or obstacles in the data input process. Disruptions in these components can cause the process of recording, processing, and searching for patient information to be hampered because officers rely on the system to complete service stages. RME also needs the support of internet networks, servers, computer devices, and information systems that can function properly so that the service process runs optimally in accordance with the Indonesian Minister of Health Regulation Number 24 of 2022. Therefore, identifying any potential failures is

important to find out the type of disruption that is most risky and determine the priority of improvement in the implementation of RME.

The results of this study are in line with the research of Ayuwulantari, Septian and Sutabri (2024), who explained that disruptions in the RME system can cause patient services to be slower due to system problems and data processing processes. These findings strengthen the results of research at the Liwuto Health Center because the disruptions that occur in the RME system not only hinder the application use process, but also have an impact on the length of the patient service process. The research of Aliyani et al. (2023), also shows that FMEA can be used to identify various potential failures in medical record units that can affect patient services. The use of FMEA in this study allows each disorder found to be identified and assessed based on severity, occurrence, and detection, so that it can be known which disorder has the highest level of risk. Thus, the six failure modes found at the Liwuto Health Center show that RME disruption is not only a technical problem, but can have a direct effect on the smooth running of services and patient waiting times. This condition shows the importance of systematic risk management so that disruptions that have a high level of risk can be a priority in efforts to improve and prevent repeated disruptions in outpatient services.

Risk Level Analysis Based on Severity, Occurrence, and Detection

Based on the results of the FMEA assessment, each failure mode is analyzed based on three parameters, namely severity, occurrence, and detection. Severity is used to assess the severity of the impact caused when a disturbance occurs, occurrence to see the frequency or likelihood of disturbances occurring, while detection is to assess the ability to detect disturbances before they have a greater impact on services. The results of the assessment showed that slow internet network disruptions, old loading systems, and server error/down were at a high risk level. The three disruptions had a considerable impact on the smooth running of services, occurring with frequencies that needed attention, and in some conditions it was only known when the disruption had occurred at the time of service. These conditions caused officers to experience obstacles in accessing and using the RME system so that the patient data registration and input process could take longer. Meanwhile, the patient data input process was at a moderate risk level because the disruption could slow down the service process, but the risk level was still below the three main disruptions. The computer limitations in the registration section and power outages were at a low risk level based on the results of the assessment conducted in this study.

Table 2. Priority Risk Level of RME System Disruption

No.	Failure Mode	Risk Level
1	Slow internet network	Height
2	Legacy loading system	Height
3	Server error/down	Height
4	Patient data input process barriers	Medium
5	Computer limitations in the registration section	Low
6	Power outage	Low

Source: Primary Data, 2026

Based on Table 2, there are three failure modes with a high level of risk, namely slow internet networks, old loading systems, and error/down servers. These three disturbances are the main concern because they have the greatest potential to hinder the RME service process and affect patient waiting times. Slow internet networks can hinder system access and data input processes, old loading systems can extend the completion time of each stage of service, while server error/down can cause the system to be unusable so that RME-based services experience obstacles. The patient data input process is at a moderate risk level because it can directly prolong the registration process, even though the risk level is not as high as network and system disruptions. Meanwhile, computer limitations in the registration section and power outages are at a low risk level based on the results of the FMEA assessment. The results of this grouping show that each failure mode has a different level of risk, so control measures need to be prioritized on disturbances that are at a high risk level, then continue on disturbances with medium and low risk levels according to the needs of the service.

According to Prihantoro Syahdu Sutopo (2023), severity indicates the severity of the impact of failure, occurrence indicates the frequency of failure, while detection indicates the ability to detect failures before they have a greater impact. These three parameters are the basis for determining the risk level of each failure mode through a systematic assessment of the characteristics of the failures found. In the implementation of FMEA, the assessment of the three parameters is important because each failure is not only seen from how big the impact is, but also from how often the failure occurs

and how easy or difficult it is for the failure to be known before disrupting the service process. Hartono, Sri Sarjana et al. (2022), also explained that the assessment based on the three parameters can be used to determine the level of risk based on the impact, frequency of occurrence, and the ability to detect the disturbance. Thus, the use of severity, occurrence, and detection provides a more directed basis in determining failures that need to be prioritized for handling.

In this study, slow internet networks, long loads, and server errors/down have a high level of risk because they can cause services to stop or run slower, increase queues, and extend patient waiting times. Internet network disruptions can hinder the process of accessing and entering data into the system, while long loading can extend the time needed by officers to complete each stage of service. Meanwhile, server error/down can cause the system to be unusable, so that service processes that depend on RME become hampered. This condition shows that the greater the impact of disruption and the more frequent disruptions occur, while the ability to detect it is still limited, the higher the risk to service. Therefore, these three failure modes are a priority in risk management because they have greater potential to hinder service flow and increase patient waiting time compared to other disruptions. These findings are in line with the research of Fannya et al. (2025), which uses severity, occurrence, and detection parameters to determine the level of risk in medical record services. These results reinforce that the use of the three FMEA parameters can help identify and prioritize risks based on the level of impact, frequency of occurrence, and ability to detect failures so that corrective actions can be directed to the failure mode that has the highest risk.

Risk Priority Number (RPN) Calculation

After assessing severity, occurrence, and detection, the next stage is to calculate the Risk Priority Number (RPN) to determine the priority level of each failure mode that has been identified. The RPN value is obtained by multiplying the three parameters using the formula $RPN = S \times O \times D$. This calculation provides numerical values that can be used to compare the risk level of each disorder based on a combination of impact severity, frequency of occurrence, and detection ability. The results showed that the internet network was slow, the loading system was old, and the server error/down had the highest RPN value of 448. The patient's data input process was hindered with an RPN value of 343, while the computer limitations in the registration section obtained an RPN value of 180 and the power outage obtained an RPN value of 168. The difference in these values shows that each failure mode has a different level of risk, so it is necessary to determine priorities in efforts to control RME disturbances.

Table 3. RPN Failure Mode RME System Fault Values

No.	Failure Mode	RPN	Priorities
1	Slow internet network	448	Height
2	Legacy loading system	448	Height
3	Server error/down	448	Height
4	Patient data input process barriers	343	Medium
5	Computer limitations in the registration section	180	Low
6	Power outage	168	Low

Source: Primary Data, 2026

Based on Table 3, it shows that the RPN 448 value is the highest value and is found in three failure modes, namely slow internet network, old loading system, and server error/down. This value shows that the three disorders have the highest combination of risks compared to other failure modes, making them the most prioritized risk in the management of RME at the Liwuto Health Center. These three disorders have the potential to hinder access and use of the system, slow down the process of patient data input and recording, and in certain conditions cause RME-based services to not run optimally. Furthermore, the obstacle to the patient data input process with an RPN value of 343 is at a moderate priority because it still has the potential to hinder the service process, especially at the registration stage. Meanwhile, the limitations of computers with an RPN value of 180 and power outages with an RPN value of 168 are at a low priority based on the results of the research calculations. Thus, the results of RPN provide a more measurable basis in determining the order of control priorities, namely focusing repair actions first on the internet network, loading system, and server error/down, then continuing with control of other failure modes according to the level of risk.

According to Prihantoro Syahdu Sutopo (2023), RPN is used to determine risk priorities by multiplying severity, occurrence, and detection. The higher the RPN value, the higher the risk priority that needs attention and treatment. The RPN value helps researchers compare the risk level of each failure mode based on a combination of impact severity, frequency of incident, and failure detection

ability. Hartono, Sri Sarjana et al. (2022), also explained that the RPN value can be used to determine the risk priority of each failure in a service system. With the RPN value, risk management can be carried out in a more targeted manner because failure modes with higher risk values can be placed as a priority in control and improvement efforts. Meanwhile, research by Ayuwulantari, Septian and Sutabri (2024), shows that RPN calculation can be used to determine the highest risk in the RME system so that control can be prioritized at the greatest risk.

In this study, the RPN 448 value on slow internet networks, long loading, and server error/down shows that the three disturbances have a combination of impact level, frequency of incident, and detection ability that produces the highest risk. This value shows that the three failure modes are a top priority because they have a greater potential to hinder the RME service process and have an impact on patient waiting time. Slow internet network disruption and long loading can slow down the process of accessing and entering patient data, while server error/down can cause the system to be unusable, so that service processes that depend on RME are hampered. Meanwhile, the RPN value of 343 on the patient data input process obstacles shows that the disruption also needs attention because it directly prolongs the service process in the registration section. Thus, the results of the RPN provide a clearer basis in determining the disturbances that must be handled first, so that control efforts can be focused on the failure mode with the highest risk and then directed to other disturbances that have lower RPN values.

Priority Risk Analysis of Electronic Medical Record System Disruption

Based on the results of the priority risk analysis of the disruption of the Electronic Medical Record System at the Liwuto Health Center, six failure modes with different Risk Priority Number (RPN) values were obtained. Each failure mode was analyzed based on the effect of failure, the cause of failure, as well as the assessment of severity (S), occurrence (O), and detection (D). The results showed that the internet network was slow, the old loading system, and the server error/down had the highest RPN value, which was 448, while the patient's data input process had an RPN of 343, computer limitations in the registration section 180, and a power outage of 168. The difference in these values showed that each disturbance had different risk characteristics for the continuity of RME services. Disturbances with higher RPN values indicated a combination of impacts, frequency of events, and detection capabilities that were riskier so that they required attention and control measures earlier than other disturbances.

Table 4. Priority Risk Analysis of Electronic Medical Record System Disruptions at Liwuto Health Center

No	Failure Mode	Effects of Failure	Causes of Failure	S	O	D	RPN
1	Slow internet network	Registration services are slow and patient queues increase	Unstable internet connection and concurrent network usage	8	8	7	448
2	Legacy loading system	The patient data input process slows down and the waiting time increases	System access load increases when the number of patients is crowded	8	8	7	448
3	Server error/down	Service is interrupted and temporarily switched manually	Server and system connection disruptions	8	7	8	448
4	Patient data input process barriers	The registration service process becomes longer	Network and system interference during patient data input	7	7	7	343
5	Computer limitations in the registration section	Service becomes less optimal and the queue process is longer	Limited number of active computers	6	6	5	180
6	Power outage	Temporary registration services hampered	Power supply disruption	7	4	6	168

Source: Primary Data, 2026

Based on Table 4, the three failure modes have the highest RPN value of 448, namely slow internet networks, long loading systems, and error/down servers. These three disturbances are a top priority because they have a significant impact on registration services, occur quite frequently, and are relatively difficult to detect before hindering services. Slow internet networks have severity values of 8, occurrence 8, and detection 7, which indicates that these disturbances can have a major impact on service, occur with high frequency, and have suboptimal detection capabilities. The old loading system also gets the same values, namely severity 8, occurrence 8, and detection 7, because the increase in access load when the number of patients is crowded can slow down the data entry process and increase the waiting time. Meanwhile, the server error/down gets severity values of 8, occurrence

7, and detection 8. This value shows that server disruption has a large impact and is relatively difficult to detect before the system experiences a disruption, so that when it occurs, it can cause RME services to be disrupted and temporarily switched manually. The obstacles to the patient data input process with an RPN value of 343 are at a medium priority level because the disruption has severity, occurrence, and detection values of 7 each and can directly prolong the registration process. The limitations of computers with RPN 180 and power outages with RPN 168 are at a lower priority based on the results of the research assessment. Thus, the results of the analysis show that risk control needs to be directed first to the internet network, loading system, and error/down server because all three have the highest RPN value and have the greatest potential to hinder the smooth running of services and increase patient waiting time at the Liwuto Health Center.

In the Failure Mode and Effects Analysis (FMEA) method, the Risk Priority Number (RPN) value is obtained by multiplying Severity (S), Occurrence (O), and Detection (D). Severity indicates the severity of the impact caused by a failure, Occurrence indicates the frequency of failure, while Detection indicates the ability to detect failures before they cause a greater impact. According to Prihantoro Syahdu Sutopo (2023), these three parameters are used to determine the risk level of each failure mode, while the RPN value is used to determine the priority of risk management. Thus, the RPN assessment provides an overview of the failure mode that has the highest level of risk so that it can be the basis for determining the priority of control and improvement actions in a service process.

The results showed that slow internet networks, old loading systems, and error/down servers both obtained an RPN value of 448. These values show that the three disorders have a combination of severity, frequency of occurrence, and detection ability which makes them the main risk in the use of RME at the Liwuto Health Center. Internet network disruptions can hinder officers' access to the system, old loading systems can extend the time needed to open and input patient data, while server error/down can cause the system to be temporarily unusable. These conditions can hinder the registration process, prolong the data input process, increase queues, and in certain conditions cause services to be manually switched. These results are in line with the research of Ayuwulantari, Septian and Sutabri (2024), which shows that disruptions in the RME system can cause patient services to be slower due to system disruptions and patient data processing processes.

The research of Fannya et al. (2025), also shows that FMEA can be used to identify potential failures in medical record units and determine the disorders that have the most effect on services. This supports the use of FMEA in this study because the method not only identifies the type of disorder, but also helps determine the disorders that need to be prioritized based on their risk level. In addition, Hartono, Sri Sarjana et al. (2022), explained that severity, occurrence, and detection assessments can be used to determine the level of risk based on impact, frequency of occurrence, and ability to detect disorders. Thus, the use of these three parameters provides a systematic basis for determining the priority of controlling disturbances found in the RME system.

Based on the results of the analysis, slow internet networks, long loading systems, and server error/down are the highest priority risks because each has an RPN value of 448. These three disruptions are the main focus in efforts to control RME risk at the Liwuto Health Center because they have the greatest potential to hinder the smooth service process and increase patient waiting times. Therefore, improving network stability, improving system reliability, and readiness to handle when server errors/downs occur need to be priorities in managing RME risks.

Recommendations for Fixing Electronic Medical Record System Disturbances

Based on the results of the risk priorities in Table 4, improvement recommendations are then prepared for each failure mode that has been identified. Improvement recommendations are prepared by considering the level of risk and the impact of each disruption on the smooth running of outpatient services and patient waiting times. Disturbances with a high level of risk are a top priority because they have a greater potential to inhibit the use of RME and disrupt the service process. Therefore, the main recommendations are directed at improving the quality and stability of the internet network, maintaining systems and servers, and providing backup systems to maintain service continuity when disruptions occur. In addition to high risk, disturbances with medium and low risk levels are still given control recommendations so that potential disturbances can be minimized and do not develop into greater risks. The recommendations include evaluating the data input process, improving the ability of officers to use RME, adding computer devices to the registration section, and providing backup power sources.

Table 5. Recommendations for Repairing Electronic Medical Record System Disturbances at Liwuto Health Center

Yes	Failure Mode	Risk Priority	Recommended Improvements
1	Slow internet network	Height	Improve the quality and stability of the internet network and conduct regular network checks
2	Legacy loading system	Height	Perform system maintenance and server optimization to make the system run faster
3	Server error/down	Height	Monitor the server regularly and provide a backup system (backup server)
4	Patient data input process barriers	Medium	Evaluate the data input process and improve the ability of officers in the use of the RME system
5	Computer limitations in the registration section	Low	Adding computer facilities to the registration section to support the service
6	Power outage	Low	Provide backup power sources such as UPS or generators to support service when power goes out

Source: Primary Data, 2026

Based on Table 5, repairs are prioritized in three high-risk failure modes, namely slow internet networks, old loading systems, and server error/down. In internet network disruptions, repair actions are directed at improving network quality and stability as well as periodic checks to reduce the possibility of disruptions that can hinder patient data access and input processes, while in old loading systems, system maintenance and server optimization are required so that system response time can be improved and service delays can be minimized. Meanwhile, on error/down servers, regular server monitoring and the provision of server backups are needed to maintain service continuity if the main system experiences a disruption. These three recommendations are priorities because they are directly related to the three risks that obtain the highest RPN of 448 and have great potential in increasing patient waiting time. In addition, failure modes with medium and low risk levels still require control measures according to the level of risk, namely patient data input process obstacles are handled through the evaluation of the input process and improving the ability of officers to use RME, computer limitations in the registration section are controlled through the addition of computer facilities, while power outages are anticipated by providing backup power sources such as UPS or generators. Thus, improvement recommendations do not only focus on the risks with the highest RPN values, but include all failure modes according to their priority levels so that RME risk management at the Liwuto Health Center can be carried out comprehensively and support the smooth flow of outpatient services.

These recommendations are in accordance with risk management principles, namely risks that have been identified and analyzed need to be taken control measures to reduce the likelihood of occurrence and impact on services. In FMEA, the results of the RPN calculation are used as a basis for determining the priority of improvement actions. Prihantoro Syahdu Sutopo (2023) explained that risks with higher RPN values need to receive greater attention in determining corrective actions. Prioritization is important so that available resources can be directed first to the disturbances that have the greatest potential to hinder the service process. Thus, control actions not only focus on solving disturbances when they occur, but are also directed at prevention efforts so that the same disturbances do not recur and cause a greater impact on patient services.

In this study, improving network quality and stability is the main recommendation because network disruption is one of the risks with the highest RPN. An unstable network can cause officers to experience difficulties in accessing the system, opening patient data, and entering data so that each stage of service takes longer. Therefore, increasing network capacity and stability, monitoring connection quality periodically, and coordinating with related parties need to be carried out to reduce the possibility of repeated interruptions. System maintenance and server optimization are also needed to reduce the occurrence of long loading, so that the system can respond better to user requests. In addition, server backup can be used as an effort to maintain service continuity when a server error/down, so that services are not completely stopped when the main system experiences a disruption. These recommendations are in line with the research of Fannya et al. (2025), which shows that the results of the FMEA analysis can be used as a basis for the preparation of mitigation strategies and recommendations for improvements to disruptions in medical record services. Thus, the results of the risk analysis in this study can be the basis for determining more targeted corrective actions for RME disruptions that have a high level of risk.

In addition to the technical aspect, improvement recommendations also include the data input process and supporting facilities. Ayuwulantari, Septian and Sutabri (2024), stated that risk control in RME can be carried out through improving system quality, providing SOPs, and improving service processes. Therefore, evaluation of the input process and improving the ability of officers is still

necessary even though the risk value is below network and server disruptions. Evaluation of the input process can be carried out by identifying the stages that most often experience obstacles so that the cause of the delay can be determined and the corrective steps can be determined. The addition of a computer to the registration section is also needed to reduce dependence on one functional device and prevent the accumulation of work when the number of patients increases. In addition, the provision of a backup power source can support the continuity of services when there is a power outage so that the service process and the use of RME are not immediately stopped. The support of these facilities is important because the smooth use of RME is not only determined by the application, but also by the readiness of the infrastructure that supports the overall service process.

Improvement recommendations need to be prioritized on the internet network, loading system, and server because all three have the highest risk with an RPN value of 448. Control of these three risks needs to be directed at prevention, maintenance, and readiness to handle when a disruption occurs. Control is then strengthened through the evaluation of the input process, improving the ability of officers, adding computers to the registration section, and providing backup power sources. With the implementation of these controls, it is hoped that RME disruptions can be minimized, the service process can run more smoothly, and the increase in patient waiting time due to system disruptions can be suppressed. Therefore, the results of FMEA not only provide an overview of the level of risks contained in the use of RME, but also become the basis for determining improvement priorities that can be applied to improve the continuity and effectiveness of outpatient services at the Liwuto Health Center.

CONCLUSION

Based on the results of the study, the risk management of the Electronic Medical Record System (RME) at the UPTD of the Liwuto Health Center shows that there are six failure modes, with a slow internet network, a long loading system, and an error/down server as the highest priority risk with an RPN value of 448 each, which can hinder the registration process and increase patient waiting time. Therefore, the Liwuto Health Center is advised to prioritize improving the quality and stability of the internet network, maintaining and monitoring the server periodically, providing server backups, and evaluating the data input process, adding computers to the registration section, and providing backup power sources to support the continuity of RME services.

This study has limitations in the scope of research which is only conducted at the UPTD of the Liwuto Health Center and focuses on RME disorders related to outpatient services, so the results of the study have not described conditions in other health service facilities. In addition, the FMEA risk assessment based on severity, occurrence, and detection is still influenced by the results of observation and assessment of informants.

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