Analysis and Design of Service Quality Improvement Strategy Using the Failure Mode and Effect Analysis (FMEA) Method at Kemala Clinic

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Abstract

Healthcare service quality is a crucial factor influencing patient satisfaction and the success of healthcare delivery. As a primary healthcare facility, Kemala Clinic is required to provide effective, efficient, and high-quality services. However, preliminary observations revealed several service-related issues, such as long patient wait times, registration queues, administrative delays, and suboptimal service communication. This study aims to identify the factors influencing service quality and to design strategies for improving service quality at Kemala Clinic. This study employs an action research design with a descriptive approach. Data were collected through observation, interviews, questionnaires, and document review. Data analysis involved identifying service issues, processing data using a Likert scale, and analyzing root causes using a Fishbone Diagram based on the categories of man, method, machine (technology), environment, and management. The results indicate that the "Opportunity" factor received the highest average score (3.91), followed by "Strength" (3.75) and "Deficiency" (3.37). The Fishbone Diagram analysis revealed that the primary causes of long patient wait times were manual administrative processes, inefficient service workflows, limited staffing, an increasing number of patients, and suboptimal monitoring and evaluation of service quality. Based on these findings, recommended improvement strategies include digitizing the administrative system, implementing an online queue and reservation system, refining service Standard Operating Procedures (SOPs), enhancing human resources, and conducting periodic monitoring and evaluation. Implementing these strategies is expected to improve service process efficiency, reduce patient wait times, increase patient satisfaction, and support the continuous improvement of healthcare service quality at Kemala Clinic.

Keywords: *Service Quality, Kemala Clinic, Fishbone Diagram, Improvement Strategy, Healthcare Service.*

A. INTRODUCTION

The quality of healthcare services is a fundamental element of medical service systems, as it directly impacts patient safety, the effectiveness of medical interventions, and service user satisfaction. Healthcare facilities are required to provide safe, appropriate, and efficient care in accordance with established standards. However, in practice, risks such as service delays, administrative errors, and workflow inefficiencies frequently occur, potentially compromising the quality of healthcare (Ali et al., 2024).

A proactive risk management approach is essential to prevent service failures before they result in adverse outcomes. One widely used method in the healthcare

sector is Failure Mode and Effects Analysis (FMEA), or Healthcare FMEA (HFMEA) (Bender et al., 2022). This method enables healthcare organizations to identify potential failures at each stage of the service process and assess severity, frequency of occurrence, and detectability, thereby allowing for the prioritization of improvements based on the Risk Priority Number (RPN) (Waseem et al., 2025).

Various studies demonstrate that the implementation of FMEA is effective in enhancing healthcare quality, particularly regarding patient safety, process efficiency, and service effectiveness. Implementing FMEA in hospitals has been shown to reduce the risk of service errors in areas such as pharmacy units, emergency departments, and health information systems (Vecchia et al., 2025). Nevertheless, most FMEA research has focused on hospitals or specific service units—such as pharmacy departments, emergency departments, and operating rooms—while studies on FMEA implementation in primary healthcare facilities—such as clinics—remain relatively limited (Ghoushchi et al., 2023). Moreover, prior studies have predominantly applied FMEA as a stand-alone risk-prioritization tool, with limited attention to systematically linking the resulting risk priorities to a structured root-cause analysis and a prioritized set of corrective actions. Accordingly, the novelty of the present study does not lie merely in applying FMEA to a new setting, but in integrating FMEA with Fishbone Diagram analysis into a single analytical sequence—service process mapping, failure mode identification, Severity–Occurrence–Detection (S/O/D) assessment, Risk Priority Number (RPN) calculation, root-cause analysis, and the design of prioritized improvement strategies—tailored to the operational characteristics of a primary care clinic, where staffing levels, patient volume, and resource constraints differ substantially from hospital settings. This integrated approach is intended to provide primary healthcare managers with both a risk-prioritization mechanism and an explanatory basis for targeted corrective action, an aspect often absent when FMEA is applied in isolation.

As primary healthcare facilities, clinics play a crucial role as the initial point of contact for public health services; however, they are susceptible to various service failure risks, such as long wait times, scheduling inconsistencies, and a lack of inter-unit coordination (Hurme, 2025). Klinik Kemala, a primary healthcare provider, faces similar challenges in maintaining consistent service quality. To date, risk identification and service quality evaluation at Klinik Kemala have remained reactive and lack a structured risk analysis methodology.

Therefore, the application of the FMEA method at Kemala Clinic is very relevant to identify and prioritize the risks of service failure systematically. The purpose of this study is to analyze the current condition of service quality at Kemala Clinic to determine the level of service effectiveness and patient satisfaction, identify potential failures in the service process using the Failure Mode and Effects Analysis (FMEA) method as a basis for risk analysis, and design a strategy for improving service quality systematically and continuously based on the results of the FMEA analysis.

B. LITERATURE REVIEW

1. Quality of Health Services

The quality of healthcare services refers to the degree of alignment between the care provided and professional standards, patient needs, and advancements in health science and technology. The World Health Organization (WHO) defines healthcare quality as care that increases the likelihood of achieving desired health outcomes and is consistent with current professional knowledge (Al-Assaf et al., 2024). Healthcare quality encompasses several key dimensions: safety, effectiveness, timeliness, efficiency, patient-centeredness, and equity. These six dimensions serve as vital indicators for assessing the success of healthcare services, whether in hospitals or primary care facilities such as clinics (Perlin, 2025).

In practice, the quality of healthcare services is influenced not only by the competence of healthcare personnel and the adequacy of facilities and infrastructure but also by the reliability of service systems and the organization's capacity to manage service-related risks. Therefore, improving service quality must be pursued systematically and continuously through quality management and risk management approaches (Amankwah et al., 2024). Healthcare quality management is a planned and systematic effort undertaken by healthcare organizations to ensure that the services provided meet established quality standards. This management approach aims to enhance process performance, reduce errors, and increase patient satisfaction (Bugdol, 2024).

A key principle of quality management is continuous improvement, wherein organizations constantly evaluate and refine their service processes. This approach necessitates an evaluation system that is not merely reactive but also preventive, identifying potential issues before they impact patients (Kayani et al., 2025). In the context of modern healthcare, quality management is closely linked to patient safety. Consequently, there is a need for analytical methods capable of proactively identifying and managing service-related risks—such as the implementation of Failure Mode and Effect Analysis (FMEA) (Amran et al., 2024).

2. Failure Mode and Effect Analysis (FMEA)

Risk management in healthcare is a systematic process for identifying, analyzing, evaluating, and controlling risks that may affect patient safety and the quality of care. Service-related risks can arise at any stage of the care process, ranging from patient registration, examinations, and medical procedures to medication administration (Mendes & França, 2025). Risk management approaches can be either reactive or proactive. A reactive approach is implemented after an incident or complaint has occurred, whereas a proactive approach aims to prevent failures before they result in adverse outcomes. Proactive approaches are considered more effective in enhancing patient safety and the quality of healthcare services (Choudhury & Haque, 2024).

One proactive risk management method widely used in healthcare is Failure Mode and Effect Analysis (FMEA), as it enables the systematic and measurable identification of potential failures. Failure Mode and Effect Analysis (FMEA) is a proactive and systematic risk analysis method used to identify potential failures (failure modes) within a process, analyze their causes and impacts, and determine priorities for corrective actions. Originally developed in the manufacturing and aviation industries, this method has since been widely adapted for the healthcare sector (La Russa et al., 2022).

In FMEA, each potential failure is evaluated based on three key parameters:

a. Severity (S): the severity of the failure's impact on the patient or the care process.
b. Occurrence (O): the likelihood of the failure occurring.
c. Detection (D): the system's ability to detect the failure before it causes an impact (Ullah et al., 2022).

These three parameters are multiplied to calculate the Risk Priority Number (RPN), which serves as the basis for prioritizing risks that require immediate remediation. In the healthcare sector, FMEA is known as Healthcare Failure Mode and Effect Analysis (HFMEA). HFMEA is designed to accommodate the complex nature of healthcare services, which involve multiple work units and interprofessional interactions (Al Saadi et al., 2026).

HFMEA enables healthcare organizations to map out entire care pathways, identify critical points, and determine which risks are most likely to compromise service quality and patient safety. Through this approach, improvement efforts can be focused on the highest-risk processes, thereby ensuring more effective resource utilization (Chia et al., 2024). The application of FMEA is effective in enhancing the quality of healthcare services, particularly regarding patient safety, process efficiency, and service quality. Implementing FMEA in pharmacy units, emergency departments, and health information systems has been proven to reduce risk levels and service-related errors (El Lithy et al., 2023).

In primary healthcare facilities such as clinics, FMEA can be used to analyze outpatient care processes, patient registration, medical examinations, and inter-unit coordination. Consequently, FMEA serves as a relevant tool for designing service quality improvement strategies based on actual risks encountered in the field. FMEA analysis results are measured using the Risk Priority Number (RPN) derived from each potential failure. RPN values are used to classify risks into low, medium, and high categories, thereby facilitating the prioritization of improvement efforts (Dalimarta & Ahmad, 2026). Furthermore, FMEA results can serve as a basis for evaluating the effectiveness of quality improvement strategies by comparing RPN values before and after the implementation of corrective actions. This approach enables organizations to assess the success of quality improvement strategies in an objective and measurable manner (Sumasto et al., 2024).

C. METHOD

This study employs an action research framework, which conventionally consists of four iterative stages: planning, action/implementation, observation, and reflection. Within this framework, the present study covers the planning stage in full—comprising problem identification, data collection, FMEA-based risk analysis, root-cause analysis, and the formulation of improvement strategies—while the action/implementation, observation, and reflection stages, which would involve carrying out the proposed strategies and evaluating their effects, fall outside the scope of the current research period. Accordingly, this study is more accurately positioned as the diagnostic and improvement-design phase of an action research cycle, rather than a complete, fully implemented action research study. The Failure Mode and Effect Analysis (FMEA) method was utilized as an analytical tool within this planning stage to identify potential failures in the service process and to design targeted, evidence-based strategies for service quality improvement, which future research or subsequent clinic initiatives may implement and evaluate. The Failure Mode and Effect Analysis (FMEA) method is utilized as an analytical tool to identify potential failures in the service process and to design targeted strategies for service quality improvement. This research was conducted at the Kemala Clinic located at Ruko Artha Niaga Block O2 No. 23-24, Jayamukti, Cikarang Pusat District, Bekasi Regency, West Java, which is one of the primary health care facilities. The research spanned three months, encompassing the stages of preparation, data collection, data analysis using the FMEA method, and the design of strategies to improve service quality. Data processing and analysis techniques in research aimed at improving service quality at clinics using the FMEA method generally involve the collection of both primary and secondary data. Primary data are obtained through Focus Group Discussions (FGDs), observations, interviews, and documentation of clinical service processes. Secondary data may consist of policies, procedures, standard operating manuals, and relevant service records (Hasan et al., 2025).

The questionnaire was distributed to 32 patients of Kemala Clinic using a convenience sampling technique, in which respondents were recruited from patients visiting the clinic during the data collection period and who were willing to participate. The respondents consisted predominantly of female patients (87.5%, n = 28) compared to male patients (12.5%, n = 4), with an age distribution of 56.3% aged 20–30 years, 31.3% aged 41–60 years, 9.4% aged 31–40 years, and 3.1% aged over 60 years. The questionnaire instrument consisted of 30 items rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), organized into three dimensions of ten items each: Strength (S), reflecting the clinic's existing service capabilities and resources; Opportunity (O), reflecting potential areas for service development; and Deficiency (D), reflecting perceived service weaknesses. These three dimensions were conceptually aligned, respectively, with the Severity, Occurrence, and Detection parameters of the FMEA framework at the level of overall clinic service perception. The instrument was developed by the researcher based on the healthcare service quality literature and the preliminary observation findings; a former statistical

validity and reliability test (e.g., Cronbach's alpha) was not conducted prior to distribution, which is acknowledged as a limitation of this study.

D. RESULT AND DISCUSSION

1. Data Collection

Data collection was conducted to gather the information needed to identify potential service failures and determine strategies for improving service quality at Kemala Clinic. The data used in this study consisted of both primary and secondary data. Primary data were obtained through observation, interviews, and the distribution of questionnaires to respondents involved in the service process. Meanwhile, secondary data were obtained from supporting documents such as Standard Operating Procedures (SOPs), patient complaint reports, and clinic service data.

Based on the results of observations, interviews, and document reviews, several potential service failures were identified for analysis using the FMEA method; these are presented in Table 1 below:

Table 1. Potential Service Failures

No	Service Process	Potential Failure (Failure Mode)
1	Patient Registration	Patient data entry error
2	Patient Registration	Long queue
3	Medical Examination	Delay in doctor's service
4	Nursing Services	The communication of information is unclear
5	Pharmaceutical Services	Medication administration error
6	Administration	Service scheduling error

The data regarding potential failures served as the basis for assessing Severity (S), Occurrence (O), and Detection (D) in order to calculate the Risk Priority Number (RPN) within the FMEA analysis. Consequently, the highest-priority risks could be identified and targeted when formulating strategies to improve service quality at Kemala Clinic.

Data analysis revealed that all indicators for the Severity (S) factor yielded average scores ranging from 3.38 to 4.06. These results indicate that respondents rated the service quality at Kemala Clinic favorably. The Severity factor shows that Kemala Clinic has strengths in the aspects of medical staff competence, staff friendliness, and environmental cleanliness, but still needs to improve the adequacy of human resources so that the quality of service can be more optimal.

Furthermore, the analysis showed that the Occurrence (O) factor had average scores between 3.69 and 4.44, suggesting significant potential for Kemala Clinic to enhance its service quality. Therefore, the most promising opportunities for improvement lie in the implementation of information technology, the digitization of administrative processes, and the development of electronic-based services.

Furthermore, the results of data processing show that the Detection factor (D) obtained an average value between 3.06 and 3.75. These results indicate that there are

still several weaknesses in the service process that need to be paid attention to by Kemala Clinic management. The Detection Factor shows that the main weakness of the Kemala Clinic is related to long waiting times, limited facilities, and service coordination that is not yet optimal, thus requiring appropriate improvement strategies.

Based on the results of calculations using the Failure Mode and Effect Analysis (FMEA) method, an average Severity value of 7.50 was obtained, an average Occurrence value was 5.17, and an average Detection value was 4.67. Furthermore, the average Risk Priority Number (RPN) value obtained was 184.33. This value shows that the risk level of service failure at the Kemala Clinic is in the medium to high category. The risk with the highest RPN value is found in long queues during the registration process of 336, so it is a top priority in designing strategies to improve service quality. The next risk is delays in doctor services with an RPN value of 240, which also requires immediate corrective action.

2. Analysis of Severity Factors (Strength)

Based on the data analysis, an average Severity factor score of 3.84 was obtained. This figure indicates that Kemala Clinic possesses considerable strength in supporting service quality. The majority of respondents rated the competence of medical personnel, the implementation of Standard Operating Procedures (SOPs), staff friendliness, environmental cleanliness, patient safety, and management commitment positively.

The indicator with the highest score was staff friendliness and professionalism, at 4.06. This demonstrates that the staff's attitude during service delivery is viewed favorably and succeeds in making patients feel at ease. Friendly service is a crucial indicator for enhancing patient satisfaction, as patients evaluate not only treatment outcomes but also their overall experience while receiving care.

Additionally, the clinic's environmental cleanliness received a score of 4.03, indicating that the service environment meets patient expectations. A clean environment enhances patient comfort while supporting infection prevention efforts within the healthcare facility (Nadi et al., 2024).

However, the indicator for staffing adequacy received the lowest score at 3.38. This suggests that the current workforce is not yet fully capable of keeping pace with the volume of incoming patients. This situation can lead to increased staff workloads and longer waiting times, potentially compromising service effectiveness if staffing levels are not adjusted promptly. Overall, the analysis of the Strength factor indicates that Kemala Clinic possesses a solid service foundation but requires improvements in human resources to maintain and enhance the quality of care.

3. Analysis of Occurrence Factors (Opportunity)

Data analysis reveals that the "Occurrence" factor has the highest mean score at 4.10. This indicates that Kemala Clinic has a significant opportunity to enhance service

quality by leveraging technological advancements and meeting the public's growing demand for healthcare services.

The indicator with the highest score was online reservations, with a score of 4.44. This score indicates that respondents believe implementing an online reservation system would be significantly helpful in reducing patient queues and speeding up the service process. Additionally, the patient data digitization indicator scored 4.34, indicating that a computer-based information system is perceived as capable of improving administrative efficiency and simplifying medical record management.

The utilization of information technology also received a high score of 4.28, reflecting respondents' high expectations for the implementation of more modern service systems. This aligns with broader trends in healthcare, where administrative and patient care processes are increasingly shifting toward digitization (Bevere & Faccilongo, 2024). Consequently, Kemala Clinic's greatest opportunity lies in digitally transforming its service systems to make administrative processes faster, more accurate, and more efficient.

4. Analysis of Detection Factors (Weaknesses)

Data analysis indicates an average score of 3.37 for the "Detection" factor (representing service weaknesses). This figure suggests the presence of several issues frequently experienced by respondents that could potentially hinder service quality. The indicator with the highest value is the long service waiting time of 3.75. This highlights waiting time as the primary issue most commonly experienced by patients. Prolonged waiting times may stem from rising patient volumes, manual administrative processes, or limited service staff (Meßner et al., 2026). The indicator regarding limited waiting room space scored 3.53, while the cleanliness of the examination room scored 3.44. These results indicate that physical facilities require improvement to better ensure patient comfort while awaiting service.

Meanwhile, the indicator for staff communication received the lowest score at 3.06. Although lower than other indicators, this result still points to coordination challenges that could affect the smooth delivery of services if left unaddressed. The analysis of the "Detection" factor reveals that the primary weaknesses of the Kemala Clinic's services relate to service efficiency, supporting facilities, and coordination among staff.

5. Analysis of Risk Priority Number (RPN) Calculation

The next step involves calculating the Risk Priority Number (RPN) using the Failure Mode and Effect Analysis (FMEA) method. The RPN is derived by multiplying the values for Severity (S), Occurrence (O), and Detection (D). A higher RPN indicates a higher priority level for the risk, requiring immediate attention.

The study results indicate that long queues during the registration process yielded an RPN of 336, the highest among all identified failure modes. This high value signifies that the queuing issue has a significant impact on service quality, occurs frequently, and has not yet been optimally controlled. This situation identifies the

registration system as a critical point in the service process, making it a top priority when formulating improvement strategies. The risk with the second-highest value is delayed service by physicians, with an RPN of 240. This high value indicates that physician delays directly increase patient waiting times and hinder the smooth operation of the overall service process.

Furthermore, unclear communication of information received an RPN of 150, while scheduling errors scored 140. These two risks highlight the need for improved service coordination to ensure patients receive accurate information and services proceed according to schedule. Meanwhile, patient data entry errors and medication administration errors each received an RPN of 120. Although these values are lower than those of the other risks, both failures still require attention due to their implications for patient safety and service quality.

This study relies on the conventional Risk Priority Number (RPN), obtained by multiplying Severity, Occurrence, and Detection scores, as the primary basis for prioritizing improvement actions. Conventional RPN was adopted because it is straightforward to calculate, widely understood by clinic staff without specialized statistical training, and consistent with the traditional FMEA approach commonly applied in healthcare settings. However, this approach has recognized limitations, most notably that different combinations of Severity, Occurrence, and Detection can yield an identical RPN despite representing risks of very different clinical importance, and that treating the three factors as equally weighted may understate risks with severe but less frequent or less easily detected consequences.

This limitation is particularly relevant when comparing long registration queues (RPN 336) with medication administration errors (RPN 120). Although registration queues yield the highest RPN, they primarily reflect an operational service-quality risk—affecting patient waiting time, comfort, and satisfaction—whereas medication administration errors, despite a lower RPN, represent a patient-safety risk with potentially serious clinical consequences for the individual patient involved. A prioritization strategy based exclusively on RPN may therefore under-prioritize lower-frequency but high-severity safety risks. Consequently, while registration queues are treated as the top priority for operational improvement given their high frequency and system-wide impact, Kemala Clinic's management should not defer corrective attention to medication administration errors, and future risk-prioritization efforts may benefit from complementing RPN with a severity-weighted or criticality-based screening step for failure modes with direct patient-safety implications.

6. Discussion of Data Processing Results

Based on the data analysis, it is evident that Kemala Clinic possesses significant potential to enhance its service quality. This is demonstrated by high scores in the "Strengths" and "Opportunities" categories, reflecting the clinic's possession of valuable resources and competent medical personnel, as well as opportunities to expand services through the utilization of information technology.

However, the study also reveals several weaknesses requiring immediate attention, particularly regarding long patient waiting times, non-digitalized administrative processes, staffing limitations, and service coordination. These issues were highlighted by the FMEA analysis, where long queues during registration yielded the highest Risk Priority Number (RPN) of 336, making it the top priority for service quality improvement strategies.

These findings indicate that improving service quality at Kemala Clinic requires not only additional facilities or staff but also a comprehensive overhaul of the service system. Strategies such as administrative digitalization, the implementation of electronic queuing systems, the refinement of Standard Operating Procedures (SOPs), staff competency development, and periodic evaluations using the FMEA method are the most appropriate measures to mitigate service risks. Implementing these strategies is expected to lower RPN scores for each failure mode, reduce patient waiting times, increase service efficiency, and ultimately boost patient satisfaction with the care provided at Kemala Clinic.

The analysis further demonstrates that the FMEA method offers significant benefits by enabling Kemala Clinic's management to objectively identify service risks and prioritize improvements based on risk levels. Consequently, decisions regarding service quality enhancement become more targeted, effective, and data-driven.

Beyond the numerical result, registration queues emerge as the critical bottleneck at Kemala Clinic because they sit at the intersection of several interacting constraints identified through the FMEA and Fishbone analyses, rather than being an isolated problem confined to the registration counter itself. Registration is the first point of contact for every patient, so any inefficiency there—manual data entry, paper-based record retrieval, and the absence of an online reservation system—propagates downstream to physician scheduling: patients arriving without pre-registration create uneven, unpredictable patient flow that misaligns with fixed physician practice hours, which in turn explains why delayed physician service emerged as the second-highest risk (RPN 240). This bottleneck is further compounded by staffing levels that were not designed to absorb the increasing patient volume, and by information-system limitations that leave staff without real-time visibility into queue length or waiting-room occupancy, making proactive workload redistribution difficult. In this sense, the registration bottleneck is best understood not merely as "what was found" but as a structural consequence of manual processes, fixed scheduling, constrained staffing, and limited information systems interacting under growing patient demand.

These findings can also be situated within broader theoretical perspectives on healthcare service quality. From a patient-centered care perspective, long registration queues represent a failure to design the service encounter around the patient's time and experience, which directly undermines the timeliness and patient-centeredness dimensions of healthcare quality (Al-Assaf et al., 2024; Perlin, 2025). From a continuous quality improvement (CQI) perspective, the study illustrates how a proactive, structured risk-identification method such as FMEA can operationalize the CQI principle of identifying problems before they escalate into patient complaints or

adverse events (Kayani et al., 2025), rather than relying on reactive, complaint-driven quality management. From a healthcare risk management perspective, the study reinforces the argument that risk in primary care settings is rarely attributable to a single point of failure; rather, as the Fishbone analysis shows, it emerges from the interaction of human, procedural, technological, environmental, and managerial factors, consistent with systems-based models of risk in healthcare organizations (Amankwah et al., 2024; Mendes & França, 2025). Thus, the contribution of this study extends beyond demonstrating that FMEA can identify service problems at Kemala Clinic: it illustrates, in a primary care setting, how a systems-based, proactive risk-identification approach can be operationalized to support patient-centered, continuously improving healthcare service quality.

7. Analysis of the Causes of the Problem

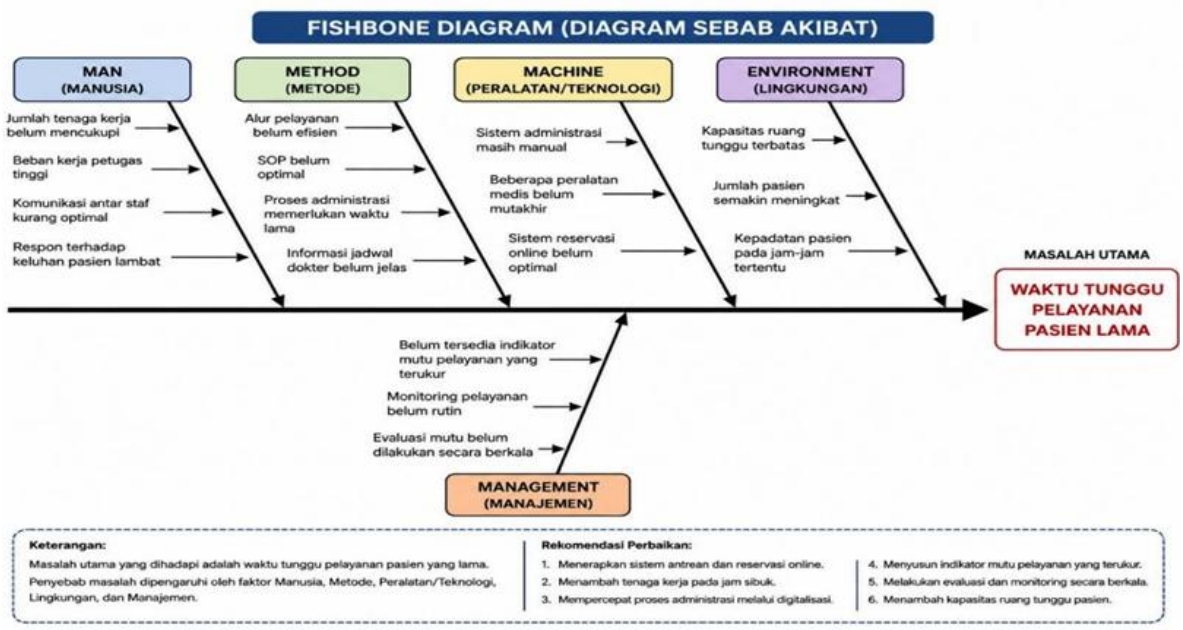
Based on observations, interviews, and a Fishbone Diagram analysis, the primary issue at Kemala Clinic is the excessive patient waiting time. This problem stems from several interconnected factors: personnel, methods, technology, the environment, and management. Regarding personnel, insufficient staffing levels and high workloads hinder optimal service delivery. In terms of methods, inefficient service workflows and suboptimal adherence to Standard Operating Procedures (SOPs) prolong the service process. Technological factors reveal that manual administrative procedures slow down registration and patient data management. In addition, the increase in the number of patients that is not balanced with the capacity of waiting rooms and service facilities causes queues to become longer. From a management perspective, the absence of measurable service quality indicators, combined with suboptimal monitoring and evaluation, prevents the effective control of various service-related issues. Consequently, improvement strategies are required, including the digitization of administration, the refinement of SOPs, increased staffing during peak hours, the implementation of an online queuing system, and enhanced periodic monitoring and evaluation of service quality.

The analytical relationship between the FMEA and Fishbone Diagram in this study follows a sequential logic: service process mapping and failure mode identification were carried out first, followed by S/O/D assessment and RPN calculation to determine the highest-priority failure modes—long registration queues and delayed physician service—both of which share long patient waiting time as their common underlying manifestation. These priority failure modes then became the focus of root-cause analysis using the Fishbone Diagram. In turn, the Fishbone findings informed the specific corrective actions proposed in the improvement strategy: manual administrative processes and inefficient workflows (Method and Machine categories) informed the recommendation for administrative digitalization and workflow refinement; insufficient staffing (Man category) informed the human resource development strategy; the mismatch between patient volume and waiting-room capacity (Environment category) informed the facility improvement strategy; and the absence of measurable service quality indicators (Management category)

informed the periodic monitoring and evaluation strategy. The overall analytical sequence therefore proceeded as follows: service process mapping → failure mode identification → S/O/D assessment → RPN calculation → priority failure identification → root-cause analysis using the Fishbone Diagram → corrective action design.

Regarding the validation of these root causes, the five categories were derived through triangulation of data obtained from observation, interviews, and focus group discussions (FGDs) involving clinic personnel directly engaged in the service process, rather than from a single data source or the researcher's judgment alone. It is also important to distinguish between symptoms, contributing factors, and root causes in this analysis. Long patient waiting time itself is treated as a symptom—an observable manifestation of the underlying problem—while manual administrative processes, inefficient workflows, insufficient staffing, patient volume growth, and inadequate monitoring and evaluation are treated as contributing causes, since they recurred consistently across the observation, interview, and FGD data and were independently corroborated by both staff and patients as factors directly generating the delays, rather than conditions merely coincidentally observed alongside long waiting times.

Based on the developed Fishbone Diagram, the core issue analyzed is the long patient waiting time. The analysis involved identifying various contributing factors grouped into five main categories: Man (Personnel), Method, Machine (Equipment/Technology), Environment, and Management.



a. Human Factors

Human factors indicate that limited human resources are a primary cause of prolonged patient waiting times. Insufficient staffing levels force personnel to attend to multiple patients simultaneously. This situation is exacerbated by heavy workloads, resulting in suboptimal service delivery. Furthermore, poor communication among staff can hinder service coordination. Slow responses to patient complaints also prolong the service process, contributing to increased waiting times.

b. Method Factors
   Regarding methods, inefficient service workflows are a major cause of service delays. Some service stages still require quite a long time, especially the administrative process. Suboptimal Standard Operating Procedures (SOPs) also lead to inconsistent service delivery. Additionally, unclear information regarding doctor schedules often results in patient congestion at specific times, causing queues to lengthen.
c. Machine Factor (Equipment/Technology)
   Regarding the technology factor, administrative systems still relying on manual processes are a primary cause of service delays. Patient data recording and management take longer compared to digital systems. Outdated medical equipment can also slow down patient examination processes. Furthermore, a suboptimal online reservation system forces patients to register in person, resulting in longer queues at the registration counter.
d. Environment Factor
   The environmental factor reveals that limited waiting room capacity is insufficient to accommodate the ever-increasing number of patients. Patient congestion during peak hours leads to longer service queues. This situation indicates that existing facilities are not yet fully capable of meeting evolving service demands.
e. Management Factor
   The management factor acts as a root cause influencing the other factors. The absence of measurable service quality indicators makes it difficult for the clinic to control patient waiting times. Furthermore, the lack of routine service monitoring and periodic quality evaluations means that various service issues go unidentified and unaddressed. Consequently, waiting time problems recur, leading to a decline in service quality.

Based on the fishbone analysis, it can be concluded that the dominant causes of long patient waiting times are:

a. Administrative processes that remain manual (Machine).
b. Inefficient service workflows (Method).
c. Insufficient staffing levels (Man).
d. An increase in patient volume not matched by service capacity (Environment).
e. Suboptimal monitoring and evaluation of service quality (Management).

These five factors are interconnected and contribute to long patient waiting times. Therefore, improvement efforts should focus on digitizing administration, refining service workflows, increasing staffing during peak hours, managing patient queues, and strengthening the system for continuous monitoring and evaluation of service quality.

Analysis using the Fishbone Diagram reveals that the issue of long patient waiting times at Kemala Clinic stems from various interconnected factors. Methods

and technology are the most dominant factors, primarily because administrative processes remain manual and service workflows lack efficiency. Furthermore, the limited workforce relative to patient volume increases staff workload, resulting in slower service delivery. Regarding the environment, rising patient numbers and limited waiting room space contribute to longer queues. Meanwhile, from a management perspective, the absence of measurable service quality indicators and suboptimal monitoring and evaluation activities prevent effective control of service-related issues. Therefore, an integrated improvement strategy is required—encompassing the implementation of digital systems, human resource development, revised service Standard Operating Procedures (SOPs), and periodic quality evaluations—to reduce patient waiting times and enhance the clinic's service quality.

8. Proposed Improvements Addressing the Root Causes of the Problem

Proposed improvements were formulated based on the identification of root causes using a Fishbone Diagram and an analysis via Failure Mode and Effects Analysis (FMEA). Both methods revealed that the prolonged patient waiting time was not attributable to a single factor but rather to a combination of interconnected factors: manpower, methods, machinery or technology, the environment, and management. Consequently, the proposed improvement strategies do not merely target specific issues but aim to enhance the entire service system to minimize the risk of failure.

The initial improvement focuses on digitizing the administrative system. Observations indicated that administrative processes at Kemala Clinic were still performed manually, resulting in significant time consumption during patient registration, medical record retrieval, and other administrative tasks. This situation led to longer queues, particularly during peak hours when patient volume increased. Therefore, the implementation of an integrated clinical information system starting from patient registration, electronic medical records, to payments is expected to speed up the service process, reduce data recording errors, and increase the accuracy of information received by officers and patients.

The next improvement involves implementing an electronic queuing system and online reservations. FMEA analysis identified long queues at the registration desk as having the highest Risk Priority Number (RPN), making this a top priority for improvement. An electronic queuing system allows patients to automatically obtain queue numbers, resulting in a more orderly and transparent service process. Furthermore, an online reservation system enables patients to select their appointment times before arriving at the clinic. This system helps alleviate patient congestion during peak periods, thereby balancing staff workloads and reducing patient wait times.

Additionally, refining Standard Operating Procedures (SOPs) is a crucial step in enhancing service quality. Observations revealed that SOPs were not being consistently implemented by all staff, leading to variations in service delivery. Consequently, the SOPs require evaluation and adjustment to align with current service conditions. Once refined, all employees must receive briefings and training on

the SOPs to ensure that every service process follows standardized procedures. Clear SOPs that are understood by all staff will make service delivery more effective and efficient while minimizing operational errors.

Improvements are also directed at enhancing the quality of human resources. Based on interview results and a Fishbone analysis, the available workforce is currently unable to fully meet service demands during peak hours, resulting in a heavy workload for staff. Furthermore, there are disparities in communication and service skills among employees. Consequently, the Kemala Clinic needs to evaluate staffing requirements, increase the number of personnel where necessary, and provide periodic training on service excellence, effective communication, patient safety, and the application of the FMEA method. Enhancing staff competence is expected to boost productivity, accelerate service delivery, and provide a superior service experience for patients.

Regarding the service environment, supporting facilities need to be upgraded to ensure patient comfort while waiting for care. Adequate waiting areas, sufficient seating, proper ventilation, and the provision of information regarding service workflows will improve patient comfort while simultaneously mitigating negative perceptions regarding long wait times. Additionally, the scheduling of doctors' practice hours and the distribution of service schedules should be aligned with patient visit patterns to prevent overcrowding during specific periods.

In addition to technical improvements, the periodic monitoring and evaluation of service quality is an equally important step. To date, service evaluations have not utilized measurable quality indicators, meaning the root causes of issues often only come to light after patient complaints arise. Therefore, Kemala Clinic is advised to establish service quality indicators such as average patient waiting time, number of patient complaints, patient satisfaction level, timeliness of doctor services, and administrative error rate. These indicators should be evaluated regularly (e.g., every three or six months) to enable management to track service quality trends and promptly implement corrective actions should any deviations occur.

As part of the continuous quality improvement process, the FMEA method should also be routinely applied as a tool for evaluating service risks. Regular FMEA implementation allows for the early identification of potential failures, followed by risk level assessments based on Severity, Occurrence, and Detection scores. This enables management to prioritize improvements based on Risk Priority Number (RPN) values, ensuring that available resources are used more effectively to mitigate the most significant risks.

These proposed improvements are expected to address the primary causes of long patient waiting times at Kemala Clinic. Implementing service digitalization, refining Standard Operating Procedures (SOPs), enhancing staff competence and increasing personnel numbers, providing adequate facilities, and conducting regular monitoring and evaluation are expected to lower the RPN values for each identified failure mode. Consequently, Kemala Clinic can achieve sustainable improvements in

service quality, boost patient satisfaction, increase service process efficiency, and minimize the risk of service failures.

To make the proposed improvement strategies more actionable for clinic management, Table 2 prioritizes each strategy according to urgency, feasibility, and the failure mode or root cause it addresses.

Table 2. Prioritization Matrix of Proposed Improvement Strategies

Priority Level	Improvement Strategy	Root Cause Addressed (Fishbone Category)	Responsible Unit*	Time Frame	Expected Outcome
High	Administrative digitalization (integrated registration, medical record, and payment system)	Manual administrative processes (Machine)	Administration / IT Unit	Short-term (0–6 months)	Faster registration, fewer data-entry errors, reduced RPN for registration-related failures
High	Electronic queuing and online reservation system	Manual processes and long queues (Machine, Man)	Administration/IT Unit; Clinic Management	Short-term (0–6 months)	Reduced registration queue length; lower RPN for the highest-priority failure mode (RPN 336)
Medium–High	SOP refinement and staff briefing/training on service procedures	Inefficient service workflows (Method)	Clinic Management/Quality Unit	Short- to medium-term (3–9 months)	More consistent service delivery; reduced RPN for physician service delay (RPN 240)
Medium–High	Human resource development: staffing needs evaluation and periodic training	Insufficient staffing levels (Man)	Human Resources Unit	Medium-term (6–12 months)	Reduced staff workload; faster service delivery
Medium	Facility improvement and alignment of physician scheduling with patient visit patterns	Patient volume–capacity mismatch (Environment)	Facilities Unit/Clinic Management	Medium-term (6–12 months)	Improved patient comfort; reduced overcrowding during peak hours
Medium	Establishment of periodic monitoring and	Absence of measurable quality	Clinic Management/Quality Unit	Ongoing (every 3–	Early detection of emerging

	evaluation using measurable service quality indicators	indicators (Management)		6 months)	risks; sustained service quality control

**Responsible units are indicated according to generic clinic organizational functions and should be adjusted to Kemala Clinic's actual organizational structure.*

This study is subject to several limitations that should be considered when interpreting its findings. First, the research was conducted at a single primary healthcare facility, Kemala Clinic, and the findings—particularly the specific ranking of failure modes and their associated Risk Priority Numbers—may not be directly generalizable to other clinics with different patient volumes, staffing structures, or operational characteristics. Second, while the questionnaire respondents are now reported (32 patients recruited through convenience sampling, predominantly female and aged 20–30 years), the number of participants involved in the interviews and focus group discussions, their professional positions, and the corresponding sampling rationale still require more detailed reporting to enable readers to fully assess the representativeness of the qualitative findings. Third, the Severity, Occurrence, and Detection scores used in the FMEA analysis are based on subjective assessments by respondents and, as with any FMEA application, are susceptible to rater bias and variation in individual risk perception; in addition, the questionnaire instrument was developed by the researcher based on the relevant literature but was not subjected to a formal statistical validity and reliability test prior to use. Fourth, as discussed above, the conventional RPN approach used for risk prioritization has recognized methodological limitations, including the possibility that different Severity–Occurrence–Detection combinations produce identical RPN values despite differing clinical significance. Fifth, this study covers the planning stage of the action research cycle—problem identification, risk analysis, and strategy formulation—while the proposed improvement strategies were not implemented or evaluated within the current research period; consequently, the expected reductions in RPN values, waiting times, and improvements in patient satisfaction represent anticipated outcomes rather than empirically demonstrated results. Finally, although patient satisfaction is discussed throughout the manuscript as a rationale and an expected outcome, it was not directly measured using a dedicated satisfaction instrument in this study; statements regarding improved patient satisfaction should therefore be interpreted as expected implications of the proposed strategies rather than as empirically supported findings. Future research is encouraged to implement the proposed strategies and evaluate their effects using before-and-after indicators, such as average waiting time, complaint frequency, patient satisfaction scores, and post-intervention RPN values, across multiple primary healthcare facilities.

E. CONCLUSION

Based on the study analyzing strategies to improve service quality at Kemala Clinic using the Failure Mode and Effect Analysis (FMEA) method, several

conclusions can be drawn corresponding to the research objectives. First, regarding the principal service quality problems, the study found that while overall service quality at Kemala Clinic was rated favorably by respondents, several operational issues, particularly long patient waiting times, registration queues, administrative delays, and suboptimal service coordination were identified as significant sources of dissatisfaction and potential compromise to care quality. Second, based on the FMEA analysis, long registration queues emerged as the highest-priority failure mode, with a Risk Priority Number (RPN) of 336, followed by delays in physician service (RPN 240); these two failure modes were identified as the critical points requiring the most immediate attention. Third, the Fishbone Diagram analysis identified five interrelated root-cause categories underlying the long patient waiting times: insufficient staffing (Man), inefficient service workflows (Method), manual administrative processes (Machine), the mismatch between rising patient volume and waiting-room capacity (Environment), and the absence of measurable service quality indicators combined with suboptimal monitoring and evaluation (Management). Fourth, based on these findings, the most important proposed improvement strategies are the digitalization of the administrative and queuing system, the implementation of an online reservation system, the refinement of Standard Operating Procedures (SOPs), the enhancement of human resource competence, the improvement of supporting facilities, and the establishment of periodic monitoring and evaluation using measurable service quality indicators.

It is important to note that the improvement strategies presented above were formulated and designed based on the FMEA and Fishbone Diagram analyses conducted during this study, but they were not implemented or evaluated within the current research period. Accordingly, the reductions in RPN values, waiting times, and improvements in patient satisfaction associated with these strategies should be understood as anticipated outcomes based on the analysis rather than as results empirically demonstrated through post-intervention data; likewise, patient satisfaction itself was not directly measured with a dedicated instrument in this study, and references to patient satisfaction throughout this manuscript should be read as the intended rationale and expected impact of the proposed strategies. Kemala Clinic's management is therefore encouraged to implement the proposed strategies, beginning with the digitalization of registration and the introduction of an online queuing system given their highest risk priority, and to evaluate their effectiveness through before-and-after measurement of waiting times, complaint frequency, patient satisfaction, and post-intervention RPN values, so that the extent of actual service quality improvement can be empirically established in future work.

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