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Improving The Business Process of Health Care Services Based on The Six Sigma Method (Case Study: Healthcare Facilities in Bima, West Nusa Tenggara)

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Abstract

Structured and efficient business processes are key elements in supporting quality healthcare services. This study analyzes and implements Six Sigma-based business process improvements in health screening services for Prospective Indonesian Migrant Workers (CPMI) at a healthcare facility in Bima, West Nusa Tenggara (NTB). Using the DMAIC (Define, Measure, Analyze, Improve, and Control) process, improvements focused on reducing bottlenecks, reducing waiting times, and increasing service satisfaction and accuracy. The results demonstrate reduced waiting times, increased staff professionalism, and a strengthened data-driven integrated service system.

Keywords
Six Sigma, business processes, healthcare, Migrant worker, DMAIC.

1. Introduction
The rapid growth of Indonesian migrant labor has significantly increased the demand for health screening services that are not only fast and accurate but also uphold comprehensive standards of efficiency and quality. In practice, efforts to deliver optimal clinical services are frequently confronted with various challenges. Administrative complexity, unclear division of responsibilities, frequent miscommunication among staff, and patient waiting times that far exceed expectations have emerged as major issues requiring immediate attention. Every inefficiency within these processes not only diminishes patient satisfaction but can also erode public trust in healthcare institutions.

This situation is particularly pronounced at healthcare facilities in Bima, NTB, where the patient registration system lacks standardized protocols to ensure seamless processes from initial admission to the completion of care. Staff coordination is a recurring source of complaints from both internal teams and patients. Inconsistent service outcomes further indicate that process improvements must be executed in a continuous and measured manner. Under such

circumstances, the need for innovation and process improvement methodologies becomes increasingly critical, aligning with patients' expectations and institutional demands for professional and credible services.

One approach that has proven effective across various industries, including healthcare, is the application of the Six Sigma methodology. This data-driven strategy focuses on uncovering root causes, formulating sustainable improvement strategies, and implementing systematic quality control through the steps of Define, Measure, Analyze, Improve, and Control (DMAIC). The integration of Six Sigma is expected to offer comprehensive solutions for the challenges faced—ranging from reducing patient waiting times and improving service quality standards to optimizing human resources performance through the implementation of robust Standard Operating Procedures (SOPs) and regular staff training.

This research specifically aims to identify and analyze core problems within the business processes of health screening services for Indonesian Migrant Worker Candidates (CPMI) at healthcare facilities in Bima, NTB. By implementing Six Sigma-based process improvements, this study seeks to deliver tangible transformations toward services that are more efficient, high-quality, and oriented toward patient satisfaction and needs. In addition to providing strategic management recommendations for clinics, this research aspires to make a meaningful contribution to the broader implementation of Six Sigma in the healthcare sector, especially as it relates to medical screening models for migrant workers.

This introduction establishes a critical foundation for in-depth analysis regarding the effectiveness of Six Sigma as a business process innovation in modern healthcare services. With this grounding, it is hoped that the study will respond to the demands for services that are not only professional but also relevant to societal needs, while offering sustainable solutions for the management of healthcare facilities.

1.1 Objectives

The main objective of this research is to thoroughly identify the challenges and root causes within the business processes of health screening services for Indonesian Migrant Worker Candidates (CPMI) at Healthcare Facilities in Bima, NTB, and to develop improvement strategies based on the Six Sigma methodology. By adopting the DMAIC framework, this study aims to design comprehensive procedural modifications, optimize staff coordination, and establish sustainable quality control practices. All efforts are directed at ensuring improved efficiency in patient waiting times, consistent service quality, and the overall achievement of patient satisfaction. Ultimately, this research aspires to provide relevant and applicable strategic recommendations, while supporting the creation of an adaptable and sustainable clinical healthcare service model.

2. Literature Review

The pursuit of improved quality and efficiency stands as a central challenge in many healthcare institutions, particularly in clinics providing health screenings for Indonesian Migrant Worker Candidates (CPMI). Issues such as business process inefficiencies, prolonged waiting times, and irregular staff coordination often persist, influencing both patient satisfaction and institutional trust (Antony et al., 2018). Amidst growing demands for more professional services, Six Sigma methodology has been widely adopted as a data-driven solution, proven effective in reducing process variability and systematically enhancing quality.

Six Sigma, utilizing the DMAIC framework (Define, Measure, Analyze, Improve, Control), assists healthcare organizations in identifying sources of inefficiency, minimizing service defects, and establishing integrated operational standards. Numerous international studies have demonstrated that implementing Six Sigma in clinics and hospitals can significantly decrease patient waiting times, improve diagnostic accuracy, and strengthen a culture of continuous improvement (Sunder et al., 2022). Moreover, this approach highlights the importance of structured training and clear allocation of responsibilities to ensure sustainable results (Chiarini, 2020).

Nonetheless, research focusing on the application of Six Sigma in clinics specifically serving CPMI in Indonesia remains limited. The complexity of procedures and the variability of patient volumes make research in this context essential, both as an academic reference and as practical guidance for service improvement. By drawing on findings and best practices from various international studies, this research is expected to support the development of adaptive and sustainable process improvement models (Antony et al., 2020).

3. Methods

This study originates from the pressing need to create a more efficient and responsive business process for health screening services, particularly for Indonesian Migrant Worker Candidates (CPMI) at Healthcare Facilities in Bima, NTB. The chosen approach is a descriptive case study, integrating the Six Sigma method as the principal improvement framework. A case study was selected to accommodate the real-world complexity and dynamics present during on-site process improvement implementation. Six Sigma serves as the main methodology due to its robust track record in reorganizing processes and significantly enhancing efficiency within healthcare services.
Data collection was conducted in parallel, employing direct observation of clinic service flows, in-depth interviews and focus group discussions with relevant stakeholders, and patient questionnaires to capture waiting times, satisfaction levels, and perceptions of recent changes. Secondary data sources included internal documentation such as Standard Operating Procedures (SOPs), records of complaints, and business process logs before and after interventions.

The implementation of Six Sigma in this research involved the five key phases of DMAIC (Define, Measure, Analyze, Improve, Control). In the Define phase, the primary process flow was mapped, and critical points that potentially trigger complaints or inefficiency—such as registration, laboratory sampling, and results delivery—were identified. The Measure phase focused on quantifying waiting times, complaint frequency, and incidents of staff miscommunication, all serving as baselines to assess intervention success.

During the Analyze phase, root cause analyses were performed using tools such as fishbone diagrams to trace the main contributing factors to inefficiency. Pareto charts were applied to prioritize problems with the greatest impact. If visual aids are beneficial, you may utilize the fishbone diagram from the problem analysis chapter (e.g., Chapter IV, Root Cause Analysis subsection) or Pareto tables to support your narrative.

The Improve phase emphasized process redesign, involving the development and enforcement of new SOPs, intensive staff training, and the digitalization of registration and results reporting systems. Implementation was monitored and evaluated periodically, engaging all staff levels. To enrich the narrative, you may include tables comparing waiting times or patient satisfaction before and after Six Sigma—these can typically be found in research results sections (Chapter V or summary findings).

The Control phase establishes sustainable oversight through weekly monitoring, internal audits, and routine patient feedback. Performance evaluation is based on predefined key indicators, with adjustments made when new challenges are identified. This oversight mechanism ensures that achieved improvements are maintained consistently over the long term.

Overall, the methodology employed in this study is not solely oriented toward short-term problem-solving but also aims to foster a work culture rooted in data-driven decision-making, collaboration, and continuous improvement. To effectively present core data, you are encouraged to use tables and graphs showcasing waiting time analysis, satisfaction, and complaint levels as featured in your observational results or research chapters. Tables of pre- and post-intervention comparisons are highly effective for visually illustrating program success. Should you require images or tables, reference fishbone diagrams (Chapter IV), Pareto analysis tables, and comparative key performance indicator tables or diagrams before and after Six Sigma (Chapter V).

With this methodological approach, it is expected that Healthcare Facilities in Bima, NTB can become a benchmark for effective, adaptive, and sustainable Six Sigma-based business process improvements in clinical practice.

4. Data Collection

Data collection in this study was carried out in a structured manner to obtain a comprehensive picture of the business processes involved in health screening services for Indonesian Migrant Worker Candidates (CPMI) at Healthcare Facilities in Bima, NTB, both before and after the Six Sigma intervention. This process comprised both primary and secondary data, ensuring that the analysis results are valid and truly representative of the actual field conditions.

Primary data were obtained through direct observation of service activities, in-depth interviews with administrative staff, medical personnel, and management, as well as through distributing questionnaires to patients. Observations were conducted over a specified period, covering key stages such as registration, medical examinations, and the

collection of results. The interviews were designed to explore staff perceptions and experiences regarding operational challenges, workflow, and barriers to communication and SOP implementation. Meanwhile, patient questionnaires served to assess satisfaction levels, waiting times experienced, and their overall experiences during the health screening process.

Secondary data collection involved reviewing the clinic's internal documentation, including Standard Operating Procedures (SOPs), patient complaint reports, waiting time recap data, and medical records related to CPMI services. These data were sourced from clinic archives and the management information system to complement and compare with the findings drawn from the primary data.

All data collected were systematically analyzed to map inefficiency hotspots and identify the most prominent problem patterns. Results of measurements such as waiting times, frequency of complaints, and patient satisfaction levels both before and after the Six Sigma application were compiled into comparative tables and graphs, making the impact of improvements objectively visible. Visual documentation, such as photos of service processes and workflow diagrams, was also included to enrich descriptive analysis and validate research findings.

With this strategy, the study not only gathers measurable quantitative data but also in-depth qualitative insights regarding the business process dynamics within the clinic. A triangulation approach combining various sources and data collection methods ensures that the results of the analysis are credible, transparent, and accountable.

5. Results and Discussion

This section presents the key findings from the study conducted at the Healthcare Facility in Bima, NTB, focusing on the implementation of Six Sigma in the business processes of health screening services for Indonesian Migrant Worker Candidates (CPMI). The analysis was performed systematically, using quantitative data, graphical visualizations, and evaluations of improvement interventions. The entire set of results is compared with the initial baseline conditions to demonstrate the tangible impact of Six Sigma implementation, serving as the foundation for discussing the effectiveness of the improvement efforts undertaken. This approach enables the study not only to provide numerical and graphical data but also to deliver insightful interpretation regarding the observed changes, as well as to validate the interventions applied.

5.1 Numerical Results

The numerical results present a comparison of key performance indicators of health screening services before and after the implementation of Six Sigma at the Healthcare Facility in Bima, NTB. Quantitative data were collected specifically on average patient waiting time, patient satisfaction levels, monthly complaint counts, and the accuracy of examination reports.

Table 1. below summarizes the primary outcomes measured prior to the Six Sigma intervention and following its application:

Indicator	Before Six Sigma	After Six Sigma
Average Waiting Time	95 minutes	45 minutes
Patient Satisfaction (%)	68%	89%
Monthly Complaints	22	5
Report Accuracy (%)	83%	97%

From the Table 1, a significant reduction in the average waiting time is evident, decreasing from 95 to 45 minutes. This improvement is accompanied by an increase in patient satisfaction by over 20 percentage points — from 68% to 89%. Furthermore, the number of complaints per month dropped drastically by more than 75%, while the accuracy of examination reports improved substantially from 83% to 97%.

These positive shifts across all indicators strongly demonstrate the effectiveness of the Six Sigma approach in enhancing the reliability and responsiveness of the business process in healthcare service delivery. This confirms that structured, data-driven process improvements can yield measurable gains in operational efficiency, service quality, and patient experience.

5.2 Graphical Results

In this subsection, visual representations are utilized to clarify and strengthen the interpretation of research findings, employing charts and diagrams that illustrate the impact of Six Sigma implementation at the Healthcare Facility in Bima, NTB. The first Figure 1 presents the distribution of patient waiting times based on the most recent survey results. Out of 30 respondents, 70% experienced waiting times of less than 30 minutes, while the remaining 30% waited for more than 30 minutes. A bar chart or pie chart visualizing these proportions makes it clear that the majority of patients have been served within a relatively short period, indicating that waiting time is not a major issue within the clinic's business process.

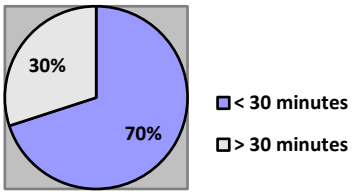

Figure 1. **Distribution of Patient Waiting Times**
Distribution of Patient Waiting Times Based on Respondent Count

The chart visualizes the distribution of patient waiting times, as reported by respondents (Figure 1). The majority of patients (70%) experienced waiting times of less than 30 minutes, while the remaining 30% reported waiting times exceeding 30 minutes. This illustrates that, overall, the clinic's processes enable most patients to receive services promptly.

Following this, the next chart compares patient satisfaction levels before and after the implementation of Six Sigma. There was a significant increase in satisfaction, rising from 68% prior to process improvements to 89% following the interventions. This substantial improvement highlights the effectiveness of the Six Sigma approach in enhancing overall service quality and patient satisfaction (Figure 2).

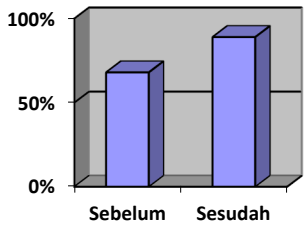

Figure 2. Changes in Patient Satisfaction Levels Before and After Six Sigma

This chart illustrates the shift in patient satisfaction rates following the implementation of Six Sigma interventions. Prior to the improvements, the recorded satisfaction rate stood at 68%. After Six Sigma process enhancements were enacted, patient satisfaction significantly increased to 89%.

This substantial rise demonstrates the positive and direct effect of systematic quality improvement measures on service outcomes. The visual comparison underscores that the Six Sigma methodology not only streamlined operational efficiency but also greatly enhanced the overall experience and satisfaction of patients at the clinic.
With this data, it becomes evident that structured process improvement initiatives, when consistently applied, can result in meaningful gains in healthcare service quality and patient trust.

5.3 Proposed Improvements

Based on the analysis of quantitative and visual data, several strategic improvements are proposed to strengthen the long-term business processes at the Healthcare Facility in Bima, NTB:

- **Standardization of SOPs**
  The Standard Operating Procedures (SOPs) will be updated and standardized across all service stages, starting from patient registration, medical examination, to result reporting. This will be accompanied by clearer and more measurable task lists for each role.
- **Regular Staff Training**
  Periodic training sessions will be conducted for staff focusing on effective communication skills and the use of clinical information technology systems.
- **Process Digitalization**
  The registration and result reporting systems will be digitized, enabling automated data recording and timely notifications of results to patients.
- **Dynamic Monitoring and Evaluation**
  Continuous oversight will be maintained through weekly audits, digital satisfaction surveys, and routine interdepartmental discussion forums.

After reviewing the comprehensive results and improvement trends, the proposed strategies aim to further optimize, enhance efficiency, and sustain the business processes at the Healthcare Facility in Bima, NTB. Full implementation of these improvements is expected to have a significant positive impact on patient waiting times, satisfaction levels, and the number of complaints within the next three months.

The Table 2 below summarizes the projected outcomes if all improvements are consistently applied:

Table 2. Projected Impact of Business Process Improvements (Next Three Months)

Month	Projected Waiting Time (minutes)	Projected Patient Satisfaction (%)	Projected Number of Complaints
Month 1	40	90	4
Month 2	35	92	3
Month 3	30	94	2

The Table 2 demonstrates a clear downward trend in both average patient waiting times and the number of complaints, alongside a significant increase in patient satisfaction scores for each subsequent month after full implementation of the improvements. This projection reinforces that the consistent application of continuous improvement initiatives can lead to ever more efficient, patient-centered healthcare services.

Such results provide strong evidence that sustained commitment to quality improvement not only optimizes operational performance but also ensures that the focus remains steadfastly on patient satisfaction. As efficiency is enhanced and complaints are reduced, the healthcare facility can expect to foster a culture of excellence, trust, and reliability. This, in turn, contributes to long-term institutional credibility and delivers greater value to patients and stakeholders alike.

5.4 Validation

Validation of improvement outcomes was conducted through data triangulation, involving direct comparison of primary observational data with patient questionnaire responses and internal clinic reports. All changes across key performance indicators were systematically evaluated over a defined period to ensure consistency in achievement using methods such as online satisfaction surveys, direct SOP audits, and targeted discussions with selected patients. In addition to regular monitoring, the clinic's internal audit team performed random inspections of service processes to verify that improvements were genuinely implemented in operational practice, not merely at the administrative level. The results of this validation indicate that process transformations were not only sustained during the initial implementation phase but also maintained effectively for up to three months post-intervention. Core indicators waiting times, patient satisfaction, and the number of complaints continued to show positive trends, fully aligning with the strategic objectives established at the outset of this research.

6. Conclusion

This study demonstrates that the implementation of the Six Sigma methodology, utilizing the DMAIC framework, has effectively identified and addressed various challenges within the business processes of health screening services for Indonesian Migrant Worker Candidates (CPMI) at Healthcare Facilities in Bima, NTB. The key findings indicate that the majority of patients have received services with efficient waiting times. Moreover, comprehensive process improvements have greatly enhanced patient satisfaction and significantly reduced the number of complaints.

The standardization of SOPs, ongoing staff training, and the digitalization of service systems have all proven successful in strengthening staff coordination and improving the overall reliability of clinical operations. With continuous monitoring and data-driven evaluation, service quality can be consistently maintained while remaining responsive to patient needs and dynamic operational requirements.

Overall, the Six Sigma-based improvement model implemented in this research not only delivers faster and more accurate services, but also fosters a collaborative work culture and a commitment to continuous improvement. The recommendations proposed in this study may serve as a reference for the development of similar healthcare services in other institutions, supporting the achievement of optimal efficiency and service quality over the long term.

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Biography

Muhammad Rifqi Maulana is currently employed as the Head of Operations at a healthcare clinic, where he is responsible for overseeing and ensuring the effectiveness of clinical operational processes. He earned his Bachelor of Computer Science degree from Universitas Brawijaya, where he developed a solid foundation in information technology and systems. Driven by a strong interest in the integration of technology and management within the healthcare sector, Muhammad Rifqi Maulana is currently pursuing a Master's degree in Technology Management at Institut Teknologi Sepuluh Nopember (ITS). His academic journey and professional experience have enabled him to focus on optimizing healthcare operations, applying digital transformation, and implementing process improvement methodologies. His professional interests include business process optimization in healthcare services, digitalization of clinical workflows, quality management systems, and the strategic alignment of technology with healthcare outcomes. In his current role, he has actively contributed to operational improvements, staff development, and the implementation of technology-driven solutions to enhance patient care and satisfaction. Muhammad is committed to continuous professional growth and strives to bridge the gap between medical services and technological advancements in Indonesia's healthcare landscape.