

# A management information system for village health centers enhances the efficiency of healthcare delivery

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## Abstrak

Penerapan Sistem Informasi Manajemen (MIS) di pusat kesehatan desa mengatasi tantangan signifikan yang ditimbulkan oleh pencatatan berbasis kertas tradisional, keterbatasan sumber daya, dan perawatan pasien yang tidak konsisten. Desa A, misalnya, mendapat manfaat dari transisi ke pencatatan digital terpadu, yang memastikan entri data akurat, mengurangi waktu tunggu pasien, dan meningkatkan efisiensi layanan kesehatan secara keseluruhan. MIS juga meningkatkan manajemen rantai pasokan dengan melacak inventaris secara real time, memastikan pasokan medis penting tersedia secara konsisten. Selain itu, sistem ini mengoptimalkan penjadwalan staf, mengurangi dampak kekurangan staf. Di desa lain, MIS meningkatkan keandalan Catatan Kesehatan Elektronik (EHR), menggabungkan catatan kertas dan digital untuk akurasi yang lebih baik, dan memperkenalkan sistem manajemen antrean untuk mengefisienkan arus pasien. Dengan mengatasi tantangan ini, MIS secara signifikan meningkatkan pemberian layanan kesehatan, menjadikannya lebih efisien, responsif, dan mampu memenuhi kebutuhan khusus masyarakat pedesaan. Pendekatan yang disesuaikan ini tidak hanya meningkatkan perawatan pasien tetapi juga memperkuat fungsionalitas keseluruhan pusat kesehatan desa.

**Kata Kunci:** Management Information System, Healthcare Delivery

## Abstract

The implementation of a Management Information System (MIS) in village health centers addresses the significant challenges posed by traditional paper-based record-keeping, limited resources, and inconsistent patient care. Village A, for example, benefits from a transition to integrated digital record-keeping, which ensures accurate data entry, reduces patient wait times, and enhances the overall efficiency of healthcare services. The MIS also improves supply chain management by tracking inventory in real-time, ensuring essential medical supplies are consistently available. Additionally, the system optimizes staff scheduling, mitigating the impact of staff shortages. In other villages, the MIS enhances the reliability of Electronic Health Records (EHR), merges paper and digital records for better accuracy, and introduces queue management systems to streamline patient flow. By addressing these challenges, the MIS significantly improves healthcare delivery, making it more efficient, responsive, and capable of meeting the specific needs of rural communities. This tailored approach not only enhances patient care but also strengthens the overall functionality of village health centers.

**Keywords:** Management Information System, Healthcare Delivery

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## 1. INTRODUCTION

In many rural areas, village health centers serve as the primary point of contact for medical services, crucial in delivering essential healthcare to underserved populations. However, these centers often face

significant challenges in managing resources, maintaining accurate patient records, and coordinating care effectively. Traditional paper-based systems, still prevalent in many rural health centers, are prone to errors, inefficiencies, and delays. This can lead to suboptimal patient outcomes and strain on healthcare providers. To address these issues, the implementation of a management information system (MIS) tailored to the specific needs of village health centers offers a promising solution [1]-[6]. By digitizing and streamlining administrative processes, an MIS can significantly enhance the efficiency of healthcare delivery, ensuring that patients receive timely and accurate care.

The integration of management information systems into healthcare delivery is not a novel concept, but its application in village health centers presents unique opportunities and challenges [7]-[10]. Unlike urban hospitals with advanced IT infrastructures, rural health centers often operate with limited resources, including insufficient access to technology and training. Despite these limitations, the adoption of MIS in such settings has the potential to transform the way healthcare is delivered, from improving patient data management to optimizing resource allocation and reducing administrative burdens. The key lies in designing an MIS that is user-friendly, cost-effective, and adaptable to the specific needs of rural health environments [11]-[13]. Management information systems have been widely studied and implemented in various healthcare settings, with numerous studies highlighting their impact on efficiency and patient care quality. For instance, a study by Niu et al. [14] emphasized that electronic health records (EHRs), a core component of MIS, can lead to better patient outcomes by providing healthcare professionals with quick access to accurate patient information. This has been particularly beneficial in reducing medication errors and improving continuity of care. Similarly, the World Health Organization (WHO) has advocated for the adoption of digital health systems in low-resource settings as a means to enhance service delivery and data management, particularly in rural and remote areas.

However, the application of MIS in village health centers, specifically in rural settings, remains underexplored in the literature. Studies such as those by Mengistu and Beshah [15] have begun to address this gap by investigating the challenges and benefits of implementing MIS in rural healthcare settings in developing countries. Their findings suggest that while there are significant barriers to adoption, including a lack of infrastructure and resistance to change, the potential benefits far outweigh these challenges. These systems have been shown to improve the efficiency of healthcare delivery by streamlining processes, reducing paperwork, and enabling better tracking of patient outcomes. Furthermore, the literature points out the importance of involving local healthcare workers in the design and implementation process to ensure that the MIS is tailored to their specific needs and capabilities.

**2. METHOD**

The study began with a comprehensive needs assessment at various village health centers to understand the existing challenges in healthcare delivery and administrative processes (Figure 1). This involved conducting surveys with health care, reviewing current record-keeping methods, and observing daily operations. The data gathered provided a clear picture of the inefficiencies and bottlenecks in the system. Following this, a custom management information system (MIS) was designed, specifically tailored to address the identified issues. The design phase involved collaboration with IT specialists, healthcare professionals, and local administrators to ensure that the system would be user-friendly, accessible, and capable of integrating smoothly into the health centers’ workflow. Once the MIS was developed, the study focused on evaluating its impact on the efficiency of healthcare delivery. Key performance indicators (KPIs) such as the time taken for patient registration, accuracy of medical records, and resource allocation were tracked and compared to pre-implementation data. The data collected during this evaluation phase was then analyzed to assess the overall effectiveness of the MIS in enhancing healthcare delivery at village health centers. The study concluded with recommendations for broader implementation of the system, based on the results observed during the pilot phase.

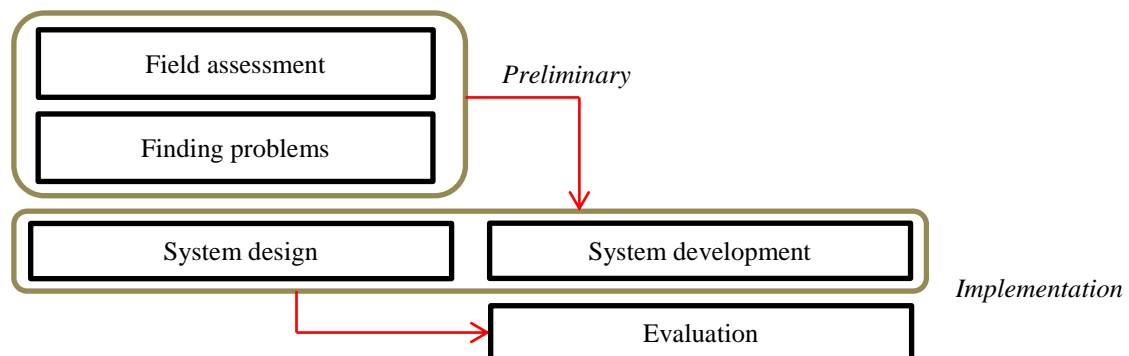


Figure 1 – The study design

### 3. RESULT AND DISCUSSION

Table 1 shows the example of assessment results from various village health centers, highlighting challenges in healthcare delivery and administrative processes:

Table 1 - The example of assessment results

Health Center	Survey Findings	Record-Keeping Methods	Observations	Challenges Identified
Village A	Limited access to medical supplies; staff shortage	Manual paper-based records; inconsistent data entry	High patient wait times; lack of basic medical equipment	Insufficient medical supplies; high staff turnover; inefficient data management
Village B	Poor patient follow-up; inadequate training for staff	Electronic Health Records (EHR) with frequent system downtimes	Ineffective patient follow-up; outdated equipment	System downtimes affecting record access; need for staff training
Village C	High patient volume; lack of specialized services	Combination of paper and electronic records; data entry errors	Overcrowded facilities; long queues	Inadequate space; high patient load; frequent data entry errors
Village D	Inconsistent treatment protocols; low patient satisfaction	Paper-based logs; delayed updates	Disorganized storage of patient records	Lack of standardized protocols; slow record updating
Village E	Insufficient preventive care programs; lack of community outreach	EHR system with incomplete patient history	Limited outreach programs; poor community engagement	Need for better preventive care initiatives; improved community involvement

Implementing a management information system (MIS) at village health centers can significantly enhance the efficiency of healthcare delivery by addressing the various challenges identified in the assessment. For instance, in Village A, where manual paper-based records and inconsistent data entry contribute to high patient wait times and a lack of basic medical equipment, an MIS can streamline record-keeping and improve supply chain management. By digitizing records and integrating inventory management, the system ensures that patient data is accurately tracked and that medical supplies are better managed, thereby reducing wait times and improving overall service delivery. Additionally, the MIS can aid in tracking staff performance and scheduling, potentially mitigating the impact of staff shortages and turnover.

In other villages, such as Village B and Village C, the introduction of a robust MIS can address issues like system downtimes and data entry errors. Village B's use of Electronic Health Records (EHR) is hindered by frequent system downtimes, while Village C faces challenges with high patient volumes and a mix of paper and electronic records. A well-designed MIS could enhance system reliability and ensure real-time access to patient information, reducing downtime and improving follow-up care. For Village C, an MIS could streamline record management and support better handling of patient load through efficient scheduling and resource allocation. Overall, an effective MIS can provide a unified platform for managing patient records, improving treatment protocols, and fostering better community outreach, ultimately enhancing the efficiency and effectiveness of healthcare delivery at the village level.

Table 2 summarizing the inefficiencies and bottlenecks identified from the assessment results:

Table 2 - The inefficiencies and bottlenecks

Health Center	Inefficiencies	Bottlenecks
Village A	- Manual paper-based records lead to inconsistent data entry and poor data management.	- High patient wait times due to manual record-keeping and lack of essential medical equipment.
	- Limited access to medical supplies affects the quality of care.	- Staff shortages cause delays in patient care and contribute to high turnover rates.
Village B	- Frequent EHR system downtimes hinder access to accurate patient records.	- Inadequate training for staff leads to ineffective patient follow-up and reliance on outdated equipment.
	- Poor patient follow-up affects continuity of care and patient outcomes.	- System downtimes create delays in accessing and updating patient records, affecting overall care efficiency.
Village C	- Mixed record-keeping methods result in data entry errors and inefficiency.	- Overcrowded facilities and high patient volumes lead to long queues and strained resources.
	- Lack of specialized services limits the scope of care available to patients.	- Inadequate space hampers the ability to manage high patient loads effectively.
Village D	- Paper-based logs are slow to update, leading to delays in patient care and record access.	- Inconsistent treatment protocols result in varied patient experiences and low satisfaction.
	- Disorganized storage of patient records makes it difficult to retrieve and manage information.	- Lack of standardized protocols causes inefficiencies in treatment and record management.
Village E	- Incomplete patient history in the EHR system hinders comprehensive care planning.	- Limited preventive care programs and community outreach lead to poor engagement and preventable health issues.
	- Insufficient preventive care initiatives result in a reactive rather than proactive healthcare approach.	- Need for better community involvement to enhance the effectiveness of healthcare services.

A Management Information System (MIS) tailored for village health centers can significantly enhance healthcare delivery by addressing the specific inefficiencies and bottlenecks identified across different centers. For example, in Village A, where manual paper-based records contribute to inconsistent data entry and poor data management, the implementation of an MIS could automate record-keeping processes, ensuring accuracy and reducing the time spent on administrative tasks. This system could also help in managing medical supplies more effectively, thereby minimizing stockouts and improving the quality of care provided to patients. Additionally, by streamlining these processes, the MIS can reduce patient wait times and help mitigate the impact of staff shortages, thereby improving overall operational efficiency.

In Village B, where frequent EHR system downtimes and inadequate staff training are major bottlenecks, an MIS could provide a more reliable and user-friendly platform that ensures uninterrupted access to patient records. This would enhance the continuity of care and improve patient outcomes by allowing healthcare providers to access and update records promptly. Furthermore, the MIS could include training modules that help staff improve their skills and ensure that patient follow-up processes are more consistent and effective. By addressing these challenges, the MIS not only improves the efficiency of healthcare delivery but also enhances the overall patient experience, making the system more resilient and capable of handling the demands of village health centers.

To address the inefficiencies and bottlenecks identified across the village health centers, the system design for a Management Information System (MIS) should include several key components, each tailored to meet the specific challenges of the respective villages (Table 3):

A Management Information System (MIS) tailored for village health centers enhances healthcare delivery by streamlining administrative processes, improving resource management, and ensuring consistent patient care. For example, in Village A, the transition from manual to integrated digital record-keeping ensures accurate data entry, reducing patient wait times and enhancing overall care efficiency. The automated supply chain management module addresses the issue of inconsistent medical supplies by tracking inventory in real-time and automating reorder processes, ensuring that essential medical equipment is always available.

Table 3 – Relevant design for a Management Information System (MIS)

Health Center	System Design Features
Village A	<ul style="list-style-type: none"> <li>- Integrated Digital Record-Keeping: Transition from manual paper-based records to a centralized digital record-keeping system that ensures consistent and accurate data entry.</li> <li>- Automated Supply Chain Management: Implement a supply management module that tracks inventory in real-time, alerts when supplies are low, and automates reorder processes.</li> <li>- Resource Allocation Module: Develop a tool for efficient staff scheduling and resource allocation to minimize the impact of staff shortages.</li> </ul>
Village B	<ul style="list-style-type: none"> <li>- Reliable EHR System: Upgrade the existing EHR system with a more reliable and user-friendly interface that reduces downtime and ensures uninterrupted access to patient records.</li> <li>- Staff Training Portal: Incorporate a built-in training module within the MIS to provide ongoing education and support for healthcare staff, enhancing their ability to follow up with patients effectively.</li> <li>- Patient Follow-Up Tracking: Implement a follow-up tracking system that automates reminders and logs patient interactions to improve continuity of care.</li> </ul>
Village C	<ul style="list-style-type: none"> <li>- Unified Record System: Merge paper and electronic records into a single, unified digital system to eliminate data entry errors and improve overall efficiency.</li> <li>- Queue Management System: Introduce an automated patient flow and queue management system that optimizes patient scheduling and reduces waiting times.</li> <li>- Specialized Services Management: Add modules for tracking and managing specialized care services, ensuring that patients have access to a broader scope of care.</li> </ul>
Village D	<ul style="list-style-type: none"> <li>- Digital Log System: Replace paper-based logs with a real-time digital logging system that updates patient records instantly, reducing delays in care.</li> <li>- Standardized Protocol Module: Develop a module to enforce standardized treatment protocols across the center, ensuring consistent care and improving patient satisfaction.</li> <li>- Centralized Record Storage: Implement a centralized digital storage solution for patient records, making retrieval and management more efficient.</li> </ul>
Village E	<ul style="list-style-type: none"> <li>- Comprehensive EHR System: Enhance the EHR system to include complete patient histories, allowing for more comprehensive care planning.</li> <li>- Preventive Care Program Management: Introduce a preventive care management module that tracks community health initiatives and engages patients proactively.</li> <li>- Community Engagement Portal: Develop a platform within the MIS for community outreach, improving engagement and participation in preventive health programs.</li> </ul>

Additionally, a resource allocation module helps optimize staff scheduling, mitigating the impact of staff shortages and improving the delivery of care. Similarly, in other villages, enhancements such as upgrading EHR systems for reliability, merging paper and digital records, and introducing queue management systems work collectively to eliminate inefficiencies, reduce bottlenecks, and ensure that healthcare delivery is both effective and responsive to the community's needs.

#### 4. CONCLUSION

Implementing a Management Information System (MIS) in village health centers offers a transformative solution to the inefficiencies and bottlenecks that hinder effective healthcare delivery. By integrating digital record-keeping, automating supply management, and enhancing staff training and resource allocation, an MIS can significantly improve the accuracy of patient data, reduce wait times, and ensure the availability of essential medical supplies. Furthermore, these systems facilitate better patient follow-up, streamline care protocols, and enhance community engagement, ultimately leading to more efficient and responsive healthcare services in rural settings.

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