

Development of an Integrated Hybrid (Manual-Digital) Electronic Medical Record System at Damai Clinic

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Informasi Artikel	Abstract
E-ISSN : 3026-6874 Vol: 4 No: 7 July 2026 Page : 39-49	The advancement of information technology has accelerated digital transformation in healthcare, particularly through the implementation of Electronic Medical Records (EMRs). However, many healthcare facilities still use hybrid systems that combine manual and digital record-keeping without proper integration, resulting in inefficient patient data management. This study aims to develop an integrated hybrid electronic medical record (EMR) system at Damai Clinic to improve healthcare services and patient data management. A descriptive research method with a system development approach was employed through system analysis, problem identification, and system design. The results indicate that the proposed system successfully integrates patient registration, medical examination, pharmacy services, payment, and reporting into a single system. The hybrid implementation allows paper-based records to remain as supporting archives while electronic records become the primary source of patient information. The developed system is expected to improve service efficiency, reduce documentation errors, enhance data security, and support digital transformation in healthcare facilities.
Keywords: Electronic Medical Record, Hybrid System, Clinic, Health Information System, Digital Transformation.	

Abstrak

Perkembangan teknologi informasi mendorong transformasi digital di bidang kesehatan, salah satunya melalui penerapan Rekam Medis Elektronik (RME). Namun, masih banyak klinik yang menerapkan sistem hybrid berupa kombinasi pencatatan manual dan digital yang belum terintegrasi sehingga menimbulkan berbagai kendala dalam pengelolaan data pasien. Penelitian ini bertujuan mengembangkan sistem Rekam Medis Elektronik (RME) terintegrasi berbasis hybrid pada Klinik Damai untuk meningkatkan efisiensi pelayanan dan pengelolaan data pasien. Penelitian menggunakan metode deskriptif dengan pendekatan pengembangan sistem melalui analisis kondisi sistem yang berjalan, identifikasi permasalahan, dan perancangan sistem yang diusulkan. Hasil penelitian menunjukkan bahwa sistem yang dikembangkan mampu mengintegrasikan proses pendaftaran, pemeriksaan dokter, pelayanan farmasi, pembayaran, hingga pelaporan dalam satu sistem. Implementasi sistem hybrid memungkinkan penggunaan dokumen kertas sebagai arsip pendukung sekaligus memanfaatkan sistem elektronik sebagai media utama pengelolaan data. Pengembangan sistem ini diharapkan mampu meningkatkan kecepatan pelayanan, mengurangi kesalahan pencatatan, meningkatkan keamanan data, serta mendukung transformasi digital di fasilitas pelayanan kesehatan.

Kata kunci: Rekam Medis Elektronik, Sistem Hybrid, Klinik, Sistem Informasi Kesehatan, Digitalisasi Pelayanan.

INTRODUCTION

The rapid advancement of information technology has significantly transformed healthcare systems worldwide. Healthcare institutions are increasingly adopting digital technologies to improve the quality, efficiency, accessibility, and continuity of healthcare services. One of the most important innovations in healthcare information management is the implementation of Electronic Medical Records (EMRs), which enable healthcare providers to record, store, manage, and retrieve patient information electronically. Compared with conventional paper-based medical records, EMRs provide faster access to patient data, reduce documentation errors, facilitate information sharing among healthcare professionals, and support evidence-based clinical decision-making.

In many developed countries, EMRs have become an essential component of modern healthcare delivery. The use of electronic records has been associated with improved patient safety, better coordination of care, increased administrative efficiency, and enhanced healthcare service quality. Healthcare providers can access patients' medical histories, diagnoses, medications, allergies, laboratory results, and treatment plans more quickly and accurately. Furthermore, electronic records support healthcare reporting, data analysis, health surveillance, and strategic decision-making at both organizational and national levels.

In Indonesia, digital transformation in the healthcare sector has become a national priority. The government has encouraged healthcare facilities to gradually implement electronic medical records as part of the national health information system development. This transformation is reinforced by Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022 concerning Medical Records, which mandates healthcare facilities to organize medical records electronically. The regulation aims to improve the quality of healthcare services, strengthen patient data management, enhance interoperability among healthcare systems, and support the national digital health transformation agenda.

Despite these policy initiatives, the implementation of EMRs in Indonesia still faces various challenges, particularly in primary healthcare facilities and clinics. Many healthcare institutions continue to rely on conventional paper-based documentation due to limited infrastructure, financial constraints, insufficient information technology resources, and varying levels of digital literacy among healthcare personnel. As a result, some healthcare facilities have adopted a hybrid system, which combines manual paper-based records with electronic documentation. Although this approach allows healthcare facilities to gradually transition toward digitalization, it often creates new challenges when the manual and electronic systems are not fully integrated.

A hybrid medical record system refers to a documentation model in which patient information is recorded partly on paper and partly in electronic form. In practice, healthcare providers may still use paper forms for clinical examinations, prescriptions, medical procedures, or supporting documents, while administrative data are entered into a computer system for reporting purposes. This condition frequently results in fragmented information management because data are stored in different formats and locations. Consequently, healthcare personnel may experience difficulties in accessing complete patient information when needed.

The lack of integration between manual and electronic records can lead to several operational problems. Healthcare workers may need to enter the same patient information repeatedly into different forms or systems, resulting in duplicate data entry and increased administrative workload. Retrieving patient records may take considerable time because physical files must be searched manually in the archive room. In addition, inconsistencies may occur when information recorded on paper differs from data stored electronically. These issues can affect service efficiency, delay patient care, and reduce the overall quality of healthcare services.

Another important concern related to manual and partially integrated systems is the risk of document loss or damage. Paper-based medical records are vulnerable to physical deterioration, misplacement, unauthorized access, and environmental hazards such as fire or flooding. When patient records cannot be retrieved promptly, healthcare professionals may not have access to complete clinical information during patient examinations. This situation may increase the risk of medical errors, repeated examinations, inappropriate treatment decisions, and compromised patient safety.

The implementation of an integrated EMR system is expected to address these challenges by providing a centralized database that can be accessed by authorized healthcare personnel. Through system integration, patient information entered during registration can be directly available to physicians, nurses, pharmacists, billing officers, and other relevant healthcare units. This integration

reduces repetitive documentation, improves data consistency, accelerates service delivery, and supports more coordinated healthcare services.

Previous studies have demonstrated that EMR implementation can improve healthcare service efficiency and the quality of data management. Electronic medical records facilitate faster access to patient information and improve the accuracy of medical documentation (Handiwidjojo 2009). Organizational readiness is also crucial to the successful implementation of EMRs during digital transformation (Lestari & Amalia 2023). Moreover, the transition from manual to electronic medical records can improve information management in inpatient services (Mawardi et al. 2025), while hybrid medical records can serve as a transitional strategy toward the digitalization of healthcare services (Oktamianiza et al. 2025).

Although many studies have discussed EMR implementation in hospitals and healthcare institutions, research specifically focusing on the development of an integrated hybrid EMR system in a clinic setting remains limited. Clinics often have different operational characteristics compared with hospitals, including smaller organizational structures, limited human resources, and more constrained technological infrastructure. Therefore, the implementation strategy for EMRs in clinics requires a practical and gradual approach that can accommodate existing operational conditions without disrupting healthcare service continuity.

Damai Clinic is one of the healthcare facilities that currently implements a hybrid medical record system. The clinic provides outpatient and inpatient healthcare services, including patient registration, physician examinations, nursing services, pharmacy services, medical procedures, and payment administration. However, the existing medical record management process still relies heavily on paper-based documentation with limited support from digital applications. Patient demographic data, examination results, diagnoses, prescriptions, and supporting documents are often recorded manually and subsequently re-entered into a computer system for administrative reporting.

This condition creates several problems in daily healthcare operations. Medical record officers require additional time to locate physical patient files in the archive room. Physicians and other healthcare professionals may experience delays in accessing previous patient histories before conducting examinations. Administrative staff may need to perform repetitive data entry for reporting purposes. Furthermore, the separation between manual and electronic records increases the risk of incomplete information, inconsistent documentation, and difficulties in generating accurate healthcare reports.

Considering these challenges, the development of an integrated hybrid electronic medical record (EMR) system is necessary for Damai Clinic. The proposed system is designed to integrate patient registration, medical examination, nursing services, pharmacy services, billing, and reporting into a single centralized database. At the same time, the system maintains the use of paper-based documents as supporting archives and legal documentation during the transition period toward full digitalization. This approach is considered more practical because it allows the clinic to gradually adapt to electronic medical record implementation without causing significant disruption to existing healthcare services.

The hybrid approach also provides operational flexibility. In situations where technical problems occur, such as internet connectivity issues, power outages, or system failures, healthcare services can continue using paper-based documentation. Once the system is functioning normally, essential patient information can be entered into the electronic database. Therefore, the hybrid model serves as a transitional strategy that balances the need for digital transformation with the operational realities of healthcare facilities that are still adapting to information technology.

From an organizational perspective, the development of an integrated hybrid EMR system can provide several benefits. The system can improve service efficiency by reducing patient waiting time and minimizing repetitive documentation. It can enhance data accuracy and consistency across healthcare units. It can strengthen patient data security through user authentication, role-based access control, audit trails, and regular data backup procedures. In addition, the system can support healthcare reporting and management decision-making by providing more complete and accessible information.

Furthermore, the development of an integrated hybrid EMR system is expected to contribute to the broader digital transformation of healthcare services in Indonesia. By implementing a practical and gradual digitalization strategy, clinics can improve their readiness for future integration with national health information systems, such as the SATUSEHAT platform and BPJS Health information system. This integration is important for improving interoperability, continuity of care, and national healthcare data management.

Based on the background described above, this study aims to develop an integrated hybrid (manual–digital) electronic medical record (EMR) system at Damai Clinic. Specifically, the study seeks to analyze the existing medical record management system, identify operational problems and user requirements, design an integrated EMR system, and evaluate the potential benefits of the proposed system in improving healthcare service efficiency, patient data management, data security, and support for digital transformation in healthcare facilities.

The findings of this study are expected to provide practical recommendations for Damai Clinic and other healthcare facilities that are still implementing hybrid medical record systems. In addition, this study is expected to contribute to the development of knowledge regarding practical strategies for implementing integrated electronic medical records in clinics and primary healthcare facilities, particularly in the context of gradual digital transformation in Indonesia.

METHOD

This study employed a descriptive research method with a system development approach. The method was selected to provide a systematic description of the existing medical record management process at Damai Clinic and to formulate an appropriate system design based on the clinic's operational conditions. The research focused on the development of an integrated hybrid electronic medical record (EMR) system that combines electronic data management with paper-based documentation during the transition toward full digitalization.

The research process consisted of several stages, including analysis of the existing system, identification of operational problems, assessment of user requirements, system design, and development planning. The system analysis was conducted to examine the current workflow of patient registration, medical examinations, nursing services, pharmacy services, billing, and reporting. User requirements were then identified to determine the functions, information needs, accessibility, and security features required by healthcare personnel.

Research data were collected through direct observation of healthcare service workflows at Damai Clinic, analysis of the existing medical record system, and a review of relevant literature. The literature review covered electronic medical records, health information systems, healthcare service integration, data security, and healthcare digitalization policies. The collected data were analyzed descriptively and used as the basis for designing an integrated hybrid EMR system that corresponds to the clinic's needs and available resources.

RESULTS AND DISCUSSION

RESULTS

The results of this study are based on observations, interviews with healthcare personnel, and analysis of the existing medical record management system at Damai Clinic. The findings indicate that

the clinic has initiated the use of digital technology in several administrative processes; however, the overall medical record management system remains predominantly paper-based and lacks integration between service units. Consequently, the existing workflow creates inefficiencies in patient data management, delays in healthcare services, and increased administrative workload. Based on these findings, an integrated hybrid (manual–digital) Electronic Medical Record (EMR) system was proposed to address the identified problems.

1. Existing Medical Record Management System

The analysis revealed that Damai Clinic currently operates a hybrid documentation system in which paper-based medical records remain the primary source of clinical documentation, while selected administrative information is entered into a computer system for reporting purposes. Patient demographic information is first recorded manually during registration and subsequently re-entered into the digital system by administrative staff. Similarly, physicians document diagnoses, treatments, prescriptions, and clinical notes on paper forms before some information is transferred electronically.

Because manual and digital records are maintained separately, patient information is often fragmented across multiple documents and databases. Healthcare professionals frequently experience delays in obtaining complete patient information, especially when patients return for follow-up visits. Medical record officers must retrieve physical records from the archive room before physicians can review previous medical histories. This manual retrieval process increases patient waiting time and disrupts service efficiency.

Furthermore, several service units—including registration, medical examination, nursing, pharmacy, and billing—maintain their own documentation processes. As a result, patient information is repeatedly written on different forms, creating duplicate documentation and increasing the possibility of transcription errors.

2. Problems Identified in the Existing System

The analysis identified several operational problems associated with the current hybrid medical record system.

First, the absence of a centralized patient database results in repeated data entry throughout the healthcare process. Administrative staff, physicians, nurses, and pharmacy personnel often record identical patient information multiple times using different forms or software applications.

Second, retrieving patient medical records requires considerable time because healthcare personnel must manually search archived paper documents. This delay becomes particularly evident during repeat patient visits, emergency situations, or when multiple patients require simultaneous services.

Third, paper-based documentation increases the risk of incomplete, damaged, or misplaced medical records. Physical records are susceptible to deterioration, filing errors, and accidental loss, potentially affecting the continuity of patient care.

Fourth, report preparation remains largely manual. Daily, monthly, and annual healthcare reports are compiled by collecting data from multiple paper documents before entering them into reporting software. This process consumes substantial administrative time and increases the likelihood of reporting inaccuracies.

Finally, communication between healthcare units is less efficient because patient information cannot be accessed simultaneously by authorized personnel. Physicians, nurses, pharmacists, and administrative officers often rely on paper documents to exchange clinical information, reducing coordination and delaying service delivery.

3. User Requirement Analysis

Interviews with healthcare personnel demonstrated a strong need for an integrated electronic medical record (EMR) system capable of supporting all healthcare service activities within a single platform.

Administrative personnel emphasized the importance of faster patient registration, automatic patient identification, and simplified reporting functions. Physicians requested immediate access to previous medical histories, diagnoses, laboratory results, medication histories, allergies, and clinical documentation to improve diagnostic accuracy and treatment planning.

Nurses highlighted the need for standardized electronic nursing documentation that could be accessed and updated collaboratively with physicians. Pharmacy personnel expected electronic prescriptions to reduce handwriting interpretation errors and accelerate medication dispensing.

Medical record officers expressed the need for a centralized database that would eliminate manual file retrieval, simplify document management, and facilitate electronic reporting. Collectively, these findings indicate that users require a comprehensive system integrating all clinical and administrative processes while maintaining data accuracy, accessibility, and security.

4. Proposed Hybrid Electronic Medical Record System

Based on the identified problems and user requirements, an integrated hybrid electronic medical record (EMR) system was designed. The proposed system maintains paper-based documentation as supporting legal archives while introducing electronic documentation as the primary source of patient information.

The proposed system consists of eight integrated modules:

- • Patient Registration
- • Electronic Medical Records
- • Physician Services
- • Nursing Services
- • Pharmacy Management
- • Billing and Payment
- • Reporting
- • Patient Data Management

All modules are connected through a centralized database. Once patient demographic information is entered during registration, it becomes immediately available to all authorized healthcare providers without requiring repeated data entry. Each modification to patient information is automatically updated throughout the system, ensuring data consistency across all service units.

The hybrid approach allows healthcare personnel to continue using paper documentation whenever technical interruptions occur while ensuring that essential patient information remains electronically available during routine clinical practice.

5. Integrated Healthcare Service Workflow

The proposed system redesign is intended to improve the integration of healthcare services.

The workflow begins when patients register at the administrative counter. Patient demographic information is entered once into the electronic system, automatically generating a unique patient identification number. This information immediately becomes accessible to physicians and nurses before patient examination.

During medical consultation, physicians document patient complaints, physical examination findings, diagnoses, treatments, prescriptions, and follow-up recommendations directly into the electronic medical record. Nurses simultaneously record nursing assessments, vital signs, interventions, and patient education using the same database.

Electronic prescriptions are automatically transmitted to the pharmacy module, allowing pharmacy personnel to prepare medications without manually interpreting handwritten prescriptions. Billing officers receive information regarding consultations, procedures, laboratory services, and medications directly from the system, enabling automatic calculation of patient charges.

Finally, healthcare reports are generated automatically from the centralized database without requiring repetitive manual recapitulation.

Compared with the previous workflow, the redesigned process eliminates unnecessary documentation steps, reduces patient waiting time, and improves coordination among healthcare professionals.

6. Data Security Features

Information security was incorporated as a fundamental component of the proposed system.

Each user accesses the system through individual usernames and passwords. Role-Based Access Control (RBAC) ensures that users can only access information relevant to their professional responsibilities. Physicians have access to clinical documentation, while administrative personnel are restricted to administrative functions. Pharmacy staff are limited to prescription and medication management modules.

Every user activity is recorded through an audit trail that logs user identity, date, time, and type of activity performed. This mechanism supports accountability, system monitoring, and compliance with healthcare information management standards.

To reduce the risk of data loss, the proposed system also incorporates scheduled database backup procedures. Backup copies are stored separately from the operational database, enabling data recovery in the event of hardware failure, software malfunction, or cybersecurity incidents.

7. Expected Benefits of the Proposed System

The proposed integrated hybrid EMR system is expected to generate several significant improvements in healthcare service delivery.

Operational efficiency is anticipated to increase through faster patient registration, reduced duplicate documentation, and immediate access to patient information. Medical record retrieval time can be substantially reduced because healthcare providers no longer depend solely on physical archives.

The centralized database is expected to improve data accuracy and consistency by ensuring that all healthcare units access identical patient information. Electronic documentation also supports better communication among physicians, nurses, pharmacists, and administrative personnel, thereby improving continuity of care.

Automated reporting functions reduce administrative workload while producing more accurate and timely management reports. In addition, the implementation of authentication, role-based authorization, audit trails, and regular data backups enhances the confidentiality, integrity, and availability of patient information.

Overall, the proposed hybrid electronic medical record (EMR) system provides a practical solution for supporting the gradual digital transformation of Damai Clinic while maintaining operational continuity during the transition from paper-based documentation to a fully integrated electronic healthcare information system.

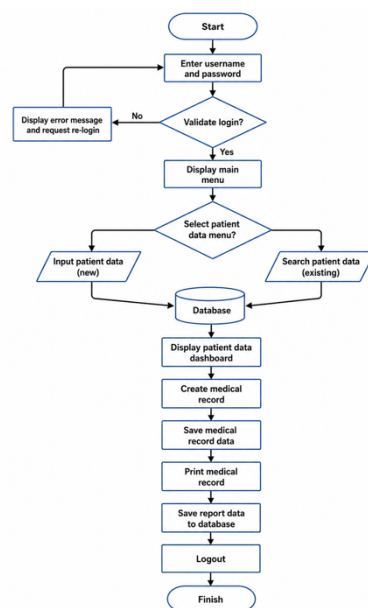
DISCUSSION

1. Development of the Hybrid Electronic Medical Record System

The development of the electronic medical record (EMR) system was designed according to the actual operational conditions of Damai Clinic, which is currently transitioning from a conventional paper-based recording system to a digital healthcare information system. Therefore, the hybrid approach was considered the most practical strategy because it minimizes operational disruption while facilitating gradual organizational adaptation.

The hybrid system allows healthcare professionals to continue utilizing paper-based documentation whenever necessary while simultaneously recording essential clinical information into the electronic database. This gradual transition reduces resistance among healthcare workers and provides sufficient time for users to adapt to the new information technology.

This development is consistent with the Indonesian Ministry of Health Regulation Number 24 of 2022 concerning electronic medical records, which encourages healthcare facilities to progressively implement electronic medical record systems. Previous studies have also reported that phased implementation significantly improves organizational readiness and user acceptance.



2. Integration of Healthcare Service Workflow

Prior to system development, each service unit performed documentation independently, requiring patient information to be repeatedly recorded on different forms. Following the implementation of the hybrid EMR system, all healthcare units utilize a shared centralized database.

The healthcare service workflow begins with patient registration. Once demographic information has been entered by administrative staff, the data become immediately available to physicians during medical examinations. After clinical assessment, diagnoses, treatment plans, prescribed medications, and clinical notes are automatically accessible to pharmacy personnel and billing officers without requiring duplicate documentation.

This integrated workflow is expected to reduce repetitive documentation, accelerate healthcare delivery, and improve data consistency across departments. Previous studies have similarly identified interoperability among healthcare units as a key determinant of successful EMR implementation.

3. Improvement of Service Efficiency

The implementation of the hybrid electronic medical record (EMR) system contributes significantly to improving operational efficiency at Damai Clinic. Medical record officers no longer spend excessive time locating physical patient files because clinical histories are electronically available through the integrated database.

Physicians are able to review patients' previous diagnoses, medication history, allergies, laboratory results, and clinical notes before conducting examinations. This immediate access to patient information supports more accurate clinical decision-making and reduces unnecessary repetition of medical procedures.

The proposed system is also expected to improve administrative efficiency. Previously, patient visit reports were compiled manually from paper-based records. Under the proposed system, daily, monthly, and annual reports can be generated automatically from the electronic database, thereby reducing the administrative workload and improving reporting accuracy.

These findings are consistent with previous research indicating that EMR implementation enhances healthcare efficiency, improves access to clinical information, and supports higher-quality healthcare services.

4. Data Security and Confidentiality

Information security represents one of the most critical aspects of EMR development. The proposed system applies user authentication through usernames and passwords based on role-based access control. Physicians are authorized to access clinical information, while administrative personnel are limited to administrative data according to their responsibilities.

In addition, every user activity is recorded through an audit trail mechanism, allowing all modifications to patient information to be traced according to the user, date, time, and type of activity performed. Regular database backup procedures are also implemented to minimize the risk of information loss resulting from hardware failure, software malfunction, or cybersecurity incidents.

These security mechanisms support the confidentiality, integrity, and availability of electronic medical records and promote compliance with healthcare information security regulations.

5. Supporting Factors for System Implementation

Several factors contribute to the successful implementation of the hybrid electronic medical record (EMR) system at Damai Clinic, including:

- Strong commitment from clinic management toward digital transformation.
- Availability of adequate computer hardware and internet connectivity.
- Continuous user training for healthcare professionals.
- Clearly established Standard Operating Procedures (SOPs).
- Technical support from information technology personnel.

These supporting factors facilitate organizational adaptation and improve user acceptance during the transition process.

6. Challenges of Implementation

Despite its numerous advantages, several challenges remain during system implementation. These include healthcare workers' dependence on conventional paper-based documentation, varying levels of information technology competence, dependence on stable electricity and internet infrastructure, financial investment for hardware and software procurement, and the necessity of continuous system maintenance.

These findings are consistent with previous studies indicating that successful EMR implementation depends on organizational readiness, human resources, infrastructure availability, financial support, and management commitment.

7. Sustainable Development Strategy

To ensure long-term implementation success, several strategic recommendations are proposed:

- Conduct continuous training programs for all healthcare personnel.
- Continuously improve system functionality based on user feedback.
- Integrate the electronic medical record (EMR) system with the SATUSEHAT platform and the BPJS Health information system.
- Perform regular evaluations of medical record data quality.
- Strengthen cybersecurity through data encryption and periodic security audits.
- Gradually digitize historical paper-based medical records.
- Monitor implementation using indicators such as service waiting time, completeness of medical records, user satisfaction, and data quality.

Through these strategic initiatives, Damai Clinic is expected to gradually transform from a hybrid documentation model into a fully integrated electronic medical record (EMR) system without disrupting healthcare service continuity. Ultimately, the integrated system is anticipated to improve operational efficiency, patient safety, healthcare quality, and evidence-based clinical decision-making while supporting Indonesia's ongoing digital transformation in the healthcare sector.

CONCLUSION

This study demonstrates that the development of an integrated *hybrid (manual-digital)* Electronic Medical Record (EMR) system is an effective solution for supporting the gradual digital transformation of healthcare services at Damai Clinic. The hybrid approach enables the clinic to maintain paper-based medical records as legal documentation and operational backups while simultaneously integrating patient information into an electronic system that provides faster, more accurate, and secure access for healthcare professionals.

The developed system successfully integrates patient registration, medical services, nursing services, pharmacy, billing, and reporting into a centralized database. This integration minimizes duplicate documentation, accelerates patient information retrieval, improves service efficiency, and supports more accurate clinical decision-making. Furthermore, the implementation of user authentication, role-based access control, audit trails, and regular data backup enhances the security, confidentiality, and integrity of electronic medical records.

Nevertheless, several challenges remain, including limitations in information technology infrastructure, varying levels of user competence, investment requirements for hardware and software, and the need to transform organizational culture from conventional paper-based documentation to digital systems. Therefore, successful implementation depends on strong management commitment, organizational readiness, continuous staff training, well-defined standard operating procedures, and regular system evaluation.

Overall, the development of the integrated hybrid electronic medical record (EMR) system at Damai Clinic has the potential to improve the effectiveness and efficiency of health information management while serving as a strategic step toward the full implementation of electronic medical records in accordance with Indonesia's national digital health transformation policy.

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