
DEVELOPMENT OF RMEIA: A WEB-BASED ELECTRONIC MEDICAL RECORD MANAGEMENT SYSTEM FOR MATERNAL AND CHILD HEALTH SERVICES

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ABSTRACT

Healthcare services for pregnant women and toddlers still face challenges in managing medical records through manual registration books. This approach presents several limitations, including the risk of data loss or damage, difficulties in retrieving patients' medical histories, and inefficiencies in service delivery. In accordance with Minister of Health Regulation No. 24 of 2022 concerning Electronic Medical Records, digital medical record management is needed to support more effective and integrated healthcare services. This study aimed to design and develop RMEIA (Rekam Medis Elektronik Ibu dan Anak), a webbased electronic medical record management system for maternal and child health services. A descriptive qualitative approach was employed, with system development following the Waterfall model within the Software Development Life Cycle (SDLC). The research variables included outpatient registration procedures, midwife data, patient data, and registration information. RMEIA was developed using PHP and MySQL within the XAMPP environment, while system modeling was performed using Data Flow Diagrams (DFD) and Entity Relationship Diagrams (ERD). The results produced a web-based RMEIA system consisting of ten main database tables and providing functional modules for maternal and child health services, including antenatal care (ANC), toddler immunization, postpartum care, and family planning services. The implementation of RMEIA facilitates medical record management, accelerates patient data retrieval, reduces dependence on paper-based records, and supports the availability of more structured and secure health information. RMEIA also supports the digital transformation of maternal and child health services in

	<i>accordance with national policies on electronic medical record implementation.</i>
KEYWORDS	Electronic Medical Records, Maternal, Child Health, Web-Based System, Waterfall Model
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INTRODUCTION

In this digital era, the utilization of information technology in health institutions is increasingly important to improve operational efficiency and services to patients. One of the crucial aspects is the patient registration system, which used to be done manually with long queues, but can now be done online via web or mobile. Web- or mobile-based registration systems not only accelerate administrative processes but also reduce data input errors and optimize queue management. Pregnant women health services represent a primary healthcare service that plays a strategic role in maintaining the health of mothers and fetuses. In primary service facilities such as Independent Midwife Practices (BPM), multi-service delivery is heavily influenced by the accuracy of recording, completeness of data, and speed of information access (Agung Suryadi, O. S. (2024).

However, in practice, the registration and examination workflow for pregnant women in many units still relies on master record books or general ledgers. This conventional recording pattern causes various issues, including the risk of data loss or damage, slow retrieval processes, and difficulties in conducting data analysis for reporting purposes. In Indonesia, health services encompass promotive, preventive, curative, and rehabilitative efforts aimed at improving service quality for the community. An important innovation in this field is the implementation of electronic medical records (EMR). Electronic medical records are patient health information storage systems in digital format that can be accessed and managed by authorized health workers while maintaining patient confidentiality. Implementing EMR facilitates information access, improves data security, and supports efficiency in health services. One of the healthcare providers playing a vital role in primary health services is the independent midwife. Independent midwives are health workers who provide independent health services to the community, covering maternal health, family planning, infant and toddler immunization, and general healthcare for various age groups (Agung Wibowo, A. F. (2026)..

Based on initial observations and interviews conducted by the researcher with Midwife Juni Astutiningsih, A.Md.Keb, at an independent practice located in Surakarta City, Central Java manual medical records are still utilized. The practice serves approximately 5–10 pregnant patients and 10–20 children for immunization per day, while data storage still relies on manual recording in a master book containing patient data. The challenge arises when reviewing past medical histories of pregnant women and toddlers, as it requires reopening the master book manually, consuming substantial time and impacting service efficiency. To address these problems and constraints, the author built an integrated web-based Electronic Medical Record system. Web-based systems offer the advantage of being flexibly accessed via internet-connected devices without depending on a single specific device, while facilitating centralized data management. This system enables digital patient data management, sustainable service history recording, structured service scheduling, and systematic payment administration recording. The system is expected to improve midwives' work efficiency, accelerate service processes, and support the provision of accurate and secure health information (Bima Robbi Cahyadi, S. (2023)..

RESEARCH METHOD

This study uses a qualitative descriptive method, System Development Approach: Uses the Waterfall model (classic life cycle / SDLC), which is carried out systematically and sequentially starting from system requirements analysis, design, coding, testing/validation, to maintenance.

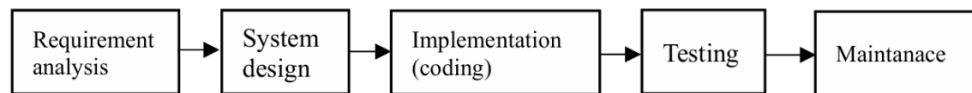


Figure 1. Waterfall Method

Requirement Analysis

Information gathering was conducted through direct observations and structured interviews with the practicing midwife and administrative staff at BPM Juni Astutiningsih. This phase identified core operational constraints under the conventional paper-based ledger system (*buku induk*), such as slow patient history retrieval and paper deterioration risks. Functional and non-functional system requirements were defined to establish the data parameters needed for digital maternal and child health record management.

System Design

The system requirements gathered in the previous stage were translated into architectural and database design specifications. Structural modeling was developed using Data Flow Diagrams (DFD) including Context Diagrams, Level 0, and Level 1 diagrams—to map the flow of data between midwives, patients, and system processes. Database conceptualization was represented via Entity Relationship Diagrams (ERD), establishing relational integrity across 10 core tables. Additionally, user interface (UI/UX) mockups were designed for dashboards, registration modules, clinical examination forms, and reporting interfaces.

Implementation (Coding)

The system design was transformed into a functional web application named RMEIA. The front-end and back-end logic were developed using the PHP programming language within the XAMPP web server environment, while MySQL was utilized to build the relational database structure.

Testing

System functionality was verified through Black Box testing to ensure that all inputs, navigation links, database operations, and output reports functioned as expected without logical or syntax errors. Furthermore, usability testing was conducted with midwives and patients to evaluate user acceptability, interface clarity, and workflow efficiency.

Maintenance

Post-implementation evaluation was conducted to ensure system stability, data security, and database backup efficiency during daily clinical operations at BPM Juni Astutiningsih.

RESULT AND DISCUSSION

The research was conducted at the Independent Midwife Practice (BPM) of Juni Astutiningsih, A.Md.Keb, located at Jl. Sungai Indragiri No. 59, Sangkrah, Pasar Kliwon District, Surakarta City, Central Java. This facility provides primary healthcare services including Family Planning (KB), Antenatal Care (ANC), childbirth/delivery, immunization, postpartum care, and general reproductive health services. Previously, patient registration, medical history recording, and financial transactions were conducted manually using master record books (buku induk), which caused drawbacks such as the risk of lost or damaged data, slow retrieval of past medical records, and inefficient administrative workflows. To overcome these limitations, a web-based Electronic Medical Record system was developed using the PHP programming language, MySQL database, and XAMPP web server, incorporating structured modeling tools such as Data Flow Diagrams (DFD) and Entity Relationship Diagrams (ERD).

The database design consists of 10 primary tables structured with One-to-Many relationships to ensure data integrity and smooth integration between master data and transactions. These tables include users for login credentials, pasien for demographic details indexed by Medical Record Number (no_rm), bidan for professional practitioners, obat for inventories and prices, jenis_pelayanan for available healthcare services, pendaftaran for patient visit queues, pemeriksaan for general clinical findings, specialized clinical examination tables dedicated to tracking specific care pathways including Immunization, Childbirth (Persalinan), Postpartum (Nifas), and Family Planning (KB), resep_obat for prescriptions, and pembayaran for automating financial transactions.

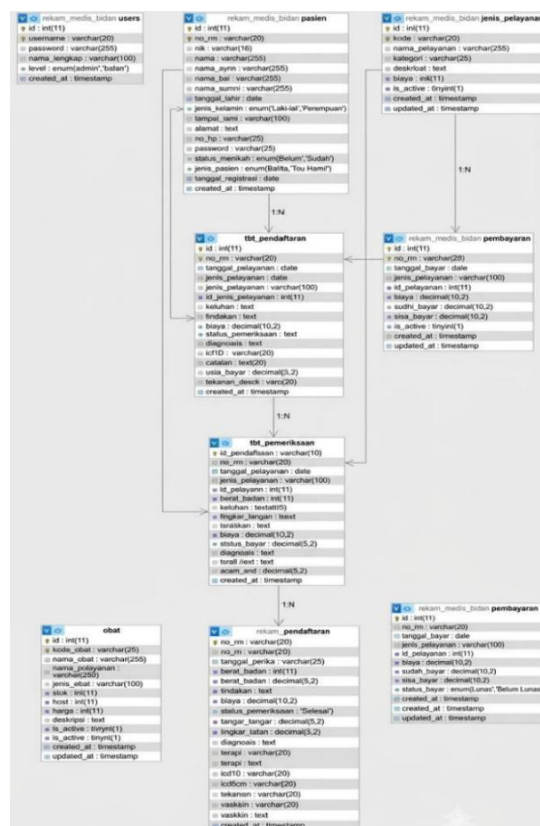


Figure 2. Entity Relationship Diagram (ERD) of the 10-table RMEIA database architecture.

Description: Figure 2 illustrates the Entity Relationship Diagram (ERD) of the RMEIA database architecture, comprising 10 primary tables structured with One-to-Many relational integrity. The primary tables including users, pasien, bidan, obat, and jenis_pelayanan are linked directly to transactional tables (pendaftaran, pemeriksaan, specialized examination tables, resep_obat, and pembayaran) to ensure accurate integration between patient demographic profiles, clinical examination records, prescriptions, and financial billing.

The implemented web application features secure role-based access for midwives and patients, providing fully functional modules. The Dashboard and Master Data Management display real-time statistical summaries of daily visits, patient demographics, drug stocks, and service tariffs, while the Registration Module streamlines new and returning patient registrations using quick searches via Medical Record Numbers (no_rm). The role-based authentication interface for midwives and patients is illustrated in Figure 3.

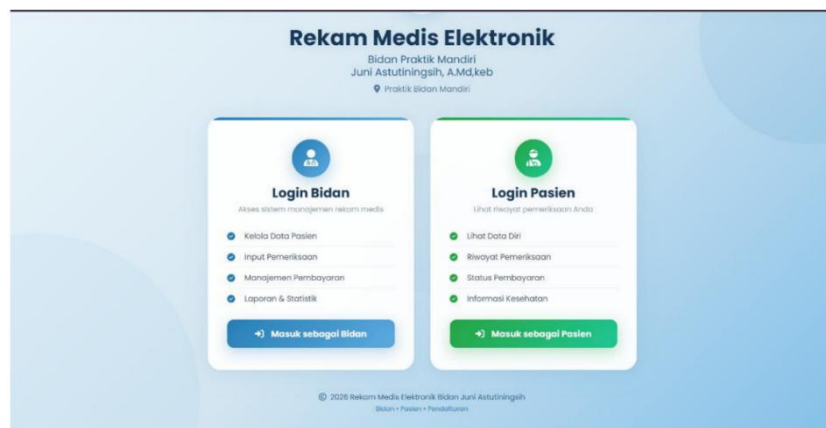


Figure 3. Role-based login portal for midwives and patients

Description: As illustrated in Figure 3, the RMEIA application features a dual-portal authentication interface designed to separate operational privileges between midwives and patients. The midwife login option provides access to patient medical record management, clinical data entry, financial billing, and report generation. Conversely, the patient login option allows registered individuals to view their personal profiles, examination histories, and payment statuses securely.

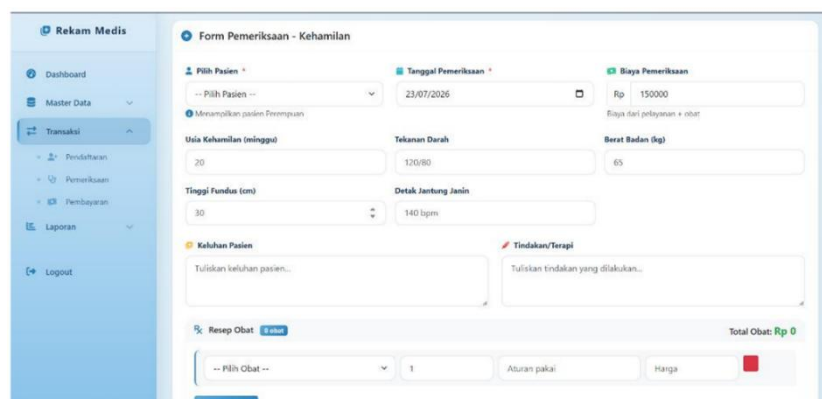


Figure 4. Digital examination interface for Antenatal Care (ANC) services

Furthermore, the Clinical Examination Modules provide customized digital forms for documenting ANC parameters, immunization doses, childbirth progress, postpartum check-ups, and contraceptive tracking, alongside a Financial and Reporting Module that automatically computes medical bills, manages payment statuses, and generates comprehensive reports ready for export or printing. The user interface for the Antenatal Care (ANC) examination module is illustrated in Figure 4.

Description: Figure 4 presents the digital examination form for Antenatal Care (ANC) services within the RMEIA system. The form captures critical maternal health parameters, including gestational age, blood pressure, fundal height, and fetal heart rate. Additionally, it integrates structured text fields for clinical symptoms and therapies, alongside an automated prescription module linked directly to the drug inventory database.

Table 1. Summary of core features implemented in the RMEIA system

Feature	Description	Status
Role-Based Authentication	Secure multi-login interface providing distinct operational access for midwives and registered patients.	Implemented
Dashboard & Master Data	Real-time statistical summaries of daily visits, patient demographics, medication inventories, and service tariffs.	Implemented
Patient Registration Module	Fast registration for new/returning patients via Medical Record Number (no_rm) or NIK search.	Implemented
Antenatal Care (ANC) Module	Digital examination forms tracking gestational age, vital signs, fundal height, fetal heart rate, and pregnancy risk factors.	Implemented
Toddler Immunization Module	Specialized clinical forms for recording child growth parameters, vaccine types, doses, and immunization schedules.	Implemented
Childbirth & Postpartum Module	Clinical documentation of labor progress, delivery outcomes, newborn details, and postpartum (<i>nifas</i>) recovery checks.	Implemented
Family Planning (KB) Module	Structured tracking for contraceptive service history, side effects, and scheduled follow-up visits.	Implemented
Prescription & Inventory Module	Digital drug prescription integration linked with real-time stock deductions in the medication database.	Implemented
Billing & Financial Management	Automated computation of total medical service fees, payment status tracking (paid/unpaid), and digital receipt generation.	Implemented
Reporting & Data Export	Automated generation of comprehensive clinical, demographic, and financial reports ready for printing or administrative export.	Implemented
SATUSEHAT API Integration	Seamless synchronization of electronic medical record data directly to the Ministry of Health's national health platform.	Planned

The testing results confirm that RMEIA significantly improves operational efficiency over manual paper ledgers. Data Management Efficiency scored highest (4.7), indicating that the relational database successfully resolves slow manual record searches. High ratings in UI/UX (4.6) and Navigation (4.5) demonstrate that the structured digital forms effectively streamline routine clinical documentation. Overall, with an average score of 4.6 out of 5.0, RMEIA proves to be a secure, user-friendly, and effective solution for digital healthcare transformation.

Usability Testing

To evaluate the operational acceptability, system performance, and user satisfaction of the developed web-based Electronic Medical Record system (RMEIA) at the Independent Midwife Practice (BPM) of Juni Astutiningsih, A.Md.Keb, usability testing was conducted following the implementation phase. The testing aimed to measure how effectively RMEIA supports midwives and patients in transitioning from manual register books (*buku induk*) to a digital medical record workflow.

The evaluation involved primary system users and stakeholders, including practicing midwives managing clinical data and registered patients utilizing the online

registration feature. The usability evaluation covered six core criteria: System Navigation & Workflow Integration, Interface Design (UI/UX), Data Management Efficiency, Speed & System Responsiveness, Login & Patient Registration Access, and Overall User Satisfaction. The usability testing results based on participant feedback and task completion are presented in Table 2.

Table 2. Usability Testing Results with Average Satisfaction Scores per Evaluation Criterion

No	Evaluation Aspect	Indicators	Average Score (1–5)	Remarks
1.	Navigation & Workflow Integration	Ease of navigating between master data, clinical transaction modules (ANC, Immunization, Delivery, Postpartum, KB), and reports.	4.5	Highly Intuitive
2.	Interface Design (UI/UX)	Visual contrast of the dashboard, layout clarity, readability of patient forms, and structural aesthetics.	4.6	Clear & Well-Structured
3.	Data Management Efficiency	Accuracy of recording patient medical histories, rapid data retrieval via Medical Record Number (no_rm) or NIK, and automated report generation.	4.7	Highly Effective
4.	Speed & System Responsiveness	System loading times, database query speed in the XAMPP/MySQL environment, and execution stability across web browsers.	4.3	Fast & Reliable
5.	Login & Patient Registration	Simplicity of midwife authentication and user access for patient queue registration.	4.4	Easy to Access
6.	Overall User Satisfaction	Overall user acceptability regarding improved clinical workflow, reduction of paper loss risks, and alignment with PMK No. 24 of 2022.	4.6	Strongly Satisfied

The usability testing results indicate that RMEIA significantly improves operational efficiency and data accuracy compared to the previous paper-based master book system. Data Management Efficiency (4.7) received the highest evaluation score, demonstrating that the 10-table MySQL relational database architecture successfully resolves the primary operational constraint slow manual record retrieval from physical ledgers. Midwives can now access long-term patient medical histories for Antenatal Care (ANC), toddler immunizations, delivery (persalinan), postpartum care (nifas), and family planning (KB) within seconds.

Interface Design (4.6) and Navigation (4.5) reflected strong user acceptance of the web dashboard and digital examination forms. The structured layout separates master data (users, patients, midwives, drugs, service types) from daily clinical transactions, thereby reducing input errors and simplifying routine documentation.

Speed & System Responsiveness (4.3) and Registration (4.4) confirmed that local web deployment using PHP and XAMPP provides stable execution and quick responses for both midwife administration and patient registration workflows.

With an overall average satisfaction score of 4.6 out of 5.0, the usability evaluation proves that RMEIA is an effective, secure, and user-friendly digital medical record solution that supports national policies on digital healthcare transformation.

Discussion

The implementation of RMEIA at Independent Midwife Practice (BPM) Juni Astutiningsih marks a crucial transition from manual paper logbooks (*buku induk*) to a structured digital health record system. By utilizing a 10-table relational database indexed by Medical Record Numbers (no_rm), RMEIA addresses the primary operational bottlenecks such as slow record retrieval, paper damage risks, and pricing calculation errors enabling midwives to access longitudinal histories for ANC, toddler immunizations,

childbirth, postpartum care, and family planning within seconds. High usability testing scores in Data Management Efficiency (4.7) and UI/UX Design (4.6) confirm that the system significantly reduces administrative burdens while providing an intuitive, well-structured interface aligned with daily midwifery workflows.

Beyond internal workflow optimization, RMEIA directly supports the digital health transformation mandated by Minister of Health Regulation (PMK) No. 24 of 2022 by ensuring data legibility, structured reporting, and enhanced security through role-based user access. Nevertheless, because the platform currently operates within a local XAMPP/MySQL server environment, future enhancements will prioritize cloud deployment and direct API integration with the national SATUSEHAT platform to achieve full interoperability across the national healthcare ecosystem.

CONCLUSION

Based on the research, design, and implementation carried out to develop a web-based Electronic Medical Record (EMR) system for pregnant women and toddlers at the Juni Astutiningsih Independent Midwifery Practice (BPM) in 2026, several conclusions can be drawn. Previously, all procedures including registration, medical history recording, and financial transaction documentation were handled conventionally using paper-based master logbooks, resulting in slow data retrieval and a high risk of data loss or damage. To address this, a new EMR system was successfully designed using structured diagrams such as Data Flow Diagrams (DFD) and Entity-Relationship Diagrams (ERD), featuring ten key database tables that seamlessly integrate master and transaction data. Built using the PHP programming language, the XAMPP software environment, and a MySQL database, this web-based system provides comprehensive functional modules to digitally record all midwifery services, including Antenatal Care (ANC), toddler immunization, childbirth, postpartum care, and Family Planning (KB). Ultimately, the system has successfully optimized daily operational workflows, automated financial transactions, streamlined report generation, and fully aligned with the national health digital transformation program mandated by the Minister of Health Regulation Number 24 of 2022.

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