

# Enhancing Health Service Efficiency through the Implementation of Electronic Medical Records: A Health Management Perspective

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## ABSTRACT

Electronic Medical Records (EMRs) are digital records that enhance healthcare efficiency by reducing waiting times, improving coordination, minimizing errors, and accelerating diagnosis. This study aims to assess the efficiency of service times for hypertension patients through the adoption of EMRs. A quantitative observational design was employed, utilizing probability sampling (random) with the Slovin formula, yielding a sample size of 347 patients. Data was collected using an observation sheet during service encounters, and bivariate analysis was performed using the Paired Sample t-Test in SPSS version 30.0. Before the t-test, normality tests were conducted to ensure the data followed a normal distribution. If the data were found to be abnormal, the Wilcoxon Signed-Rank Test was applied as an alternative non-parametric test. The total service time for 347 patients using the EMR system was 271,438 seconds, while the manual system recorded a total of 666,798 seconds. On average, the service time per patient using EMRs was 782 seconds (13.02 minutes), compared to 2,248 seconds (37.46 minutes) for the manual system. The findings demonstrate that the EMR system significantly improves service time efficiency, highlighting its potential to enhance the effectiveness and timeliness of healthcare delivery.

**Keywords:** Digital Transformation, Electronic Medical Records, Health Management, Health Services, Time Efficiency.

## INTRODUCTION

Digital transformation is fundamentally reshaping the healthcare sector, offering substantial benefits to both society and the health industry (Singh et al., 2021). The integration of digital technology in healthcare is now indispensable for improving service quality, addressing medical challenges, and fostering innovation (Kraus et al., 2021; Ahmed et al., 2025). Among the most significant advancements is the adoption of Electronic Medical Records (EMRs), which has been implemented across various healthcare facilities, from primary care centers to referral hospitals (Uslu & Stausberg, 2021; Shen et al., 2025). EMRs are digital versions of manual medical records that provide various benefits, including economic, clinical, and easy access to medical information (Lewkowicz et al., 2020; Kumari & Chander, 2024; Handayani et al., 2025).

From an economic perspective, EMR is able to provide savings, increase effectiveness, and increase operational cost efficiency (Abdelaziz & Rosa, 2024; Nguyen et al., 2024; Enehua & Ibrahim, 2025). According to Minister of Health Regulation Number 24 of 2022, every health facility across Indonesia, including private practices, is required to adopt and operate EMR. This policy aims to improve the efficiency and quality of health services through the use of digital technology (Mullins et al., 2020; Osipov & Skryl, 2021). With the implementation of EMR, it is hoped that patient data recording will become more organized, accessible, and accurate, thereby supporting the medical decision-

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making process more effectively. In addition, this policy is also a strategic step in supporting digital transformation in the health sector to meet the needs of modern and data-based services (Furukawa, 2011; Akinola & Telukdarie, 2023).

The use of EMR can reduce patient waiting time, ensure continuity of care, prevent duplication of examinations, increase efficiency, strengthen coordination between medical teams, minimize the risk of errors, and speed up and simplify the diagnosis process (Ariani, 2023; Mwanswila et al., 2024; Suseno & Rosita, 2025). The duration of the waiting time to get health services is influenced by various factors, among others the type of visit (first visit or follow-up), the timeliness of the service implementation (according to schedule or experiencing delays), the type of clinic intended (for example, internal medicine clinics, dentistry, and others), the duration of consultation with a doctor, the need for diagnostic examinations (if needed), and the type of prescription given (concocted or non-concocted) (Ngandu, 2024).

One of the factors that affects the waiting time for hypertension patient services is an efficient queue system, such as the use of online registration or an electronic queue system, that can reduce waiting time for patients. Thus, hypertensive patients do not have to wait too long before getting services. According to some studies, the ideal waiting time in healthcare is around 15-30 minutes after registration. However, for hypertensive patients, the wait time can be longer if there are additional tests, such as laboratory tests, or if the patient needs further referrals. Optimization of service systems and technologies such as EMR can help reduce this waiting time (Fu et al., 2021).

A preliminary survey at the Awayan Health Centre indicated that EMR implementation began in 2024, in line with district-wide adoption across Balangan Regency. All service units, including general, dental, maternal and child health, Integrated Management of Childhood Illness (IMCI), pharmacy, laboratory, and treatment rooms, have transitioned to EMRs. Despite these advancements, several challenges persist, such as information system disruptions (difficulties obtaining authorization codes, missing monthly reports) and limited human resource capacity to operate the system. These issues can disrupt service continuity and the management of medical records, ultimately reducing the effectiveness and efficiency of healthcare delivery. This problem can affect the continuity of the implementation or performance of health services in health centers, especially in managing medical records. Disruptions to the EMR information system can cause health services to be less effective and efficient because the system cannot function properly. As a result, health workers at the health center cannot carry out their duties optimally, which impacts increasing health service time (Jannah & Latifah, 2022).

Insufficient human resource capacity in operating EMRs can compromise data quality, increase staff workload, and prolong service times. Addressing these challenges is essential to realizing the full benefits of digital transformation in healthcare. Therefore, this study aims to analyze the efficiency of service time following the implementation of electronic medical records for hypertension patients at the Regional Technical Implementation Unit (*Unit Pelaksana Teknis Daerah/UPTD*) Awayan Health Centre, Balangan Regency.

## LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

### Electronic Medical Records (EMR) in Healthcare Efficiency

The adoption of Electronic Medical Records (EMRs) has been a major development in healthcare systems worldwide, promising numerous benefits in terms of efficiency, accuracy, and patient care. EMRs replace traditional paper-based medical records with digital versions, facilitating more organized, accurate, and accessible medical data (Abdelaziz & Rosa, 2024; Elsangidy et al., 2025; Alharbi, 2025). EMR systems have been shown to reduce patient waiting times, ensure continuity of care, minimize errors, and improve coordination among healthcare providers (Ariani, 2023; Hansen & Oktami, 2025). In particular, the transition to EMRs has been identified as an essential step in

improving health service efficiency and productivity by automating record-keeping and making data sharing more efficient (Kraus et al., 2021; Elliason, 2025).

A study by Fu et al. (2021) demonstrated that EMR systems are especially beneficial in improving service quality in outpatient care, such as blood collection services, where lean management principles integrated with EMR systems led to faster processing times. Similarly, the implementation of EMRs in hypertension patient care at the UPTD Aawayan Health Center has significantly reduced service times, offering improved management of patient records and more streamlined service delivery. The study found that patients served with EMRs had an average service time of 13.02 minutes, compared to 37.46 minutes with the manual system, representing a substantial reduction in waiting times.

The use of EMRs also supports better clinical decision-making and enhances the accuracy of medical data. According to Furukawa (2011), the integration of decision support systems within EMRs allows healthcare professionals to make faster and more informed clinical decisions, improving patient outcomes. Furthermore, EMRs provide real-time access to patient records, which is crucial for the effective diagnosis and treatment of chronic conditions like hypertension. This improvement in clinical decision-making is particularly important in settings where timely intervention is critical for patient health (Weiner et al., 2022; Shen et al., 2025).

H1: There is a significant difference between manual and electronic medical record scores.

### **Challenges and Implications of Electronic Medical Records Adoption**

Despite the clear advantages, challenges remain in the adoption and operation of EMRs, especially in low-resource settings. Studies have identified issues such as system disruptions, lack of proper training, and insufficient human resource capacity as key barriers to the successful implementation of EMRs (Jannah & Latifah, 2022; Bekele et al., 2024; Alzghaibi & Hutchings, 2025). In the case of the UPTD Aawayan Health Center, challenges such as difficulties in obtaining authorization codes and missing reports highlighted the need for better system integration and training. These disruptions can hinder the full potential of EMRs, underscoring the importance of addressing these issues to realize the system's benefits fully (Tsehay & Matlhaba, 2025).

Moreover, the economic benefits of EMRs are increasingly recognized, especially in terms of reducing operational costs and enhancing administrative efficiency. Abdelaziz and Rosa (2024) noted that the digitalization of medical records helps save costs related to paper storage, document retrieval, and administrative workload. By reducing the time spent on manual documentation, EMRs free up resources for patient care, enhancing the overall productivity of healthcare facilities (Boonstra et al., 2014; Tsai et al., 2020). This is particularly beneficial for healthcare centers like Aawayan, which experience high patient volumes and need efficient systems to manage large amounts of medical data.

In conclusion, the transition to Electronic Medical Records represents a critical advancement in healthcare systems, improving efficiency, reducing service times, and enhancing the quality of care. While challenges persist, such as technical disruptions and the need for comprehensive training, the positive impact of EMRs on service efficiency and clinical decision-making cannot be overstated. The ongoing digital transformation in the healthcare sector is essential for modernizing services and meeting the growing demands for efficient and accessible healthcare delivery (Barbieri et al., 2023; Hameed et al., 2024; Păcuraru et al., 2025).

### **RESEARCH METHODS**

This study applied a quantitative design with an observational analytical method in hypertensive patients through the implementation of electronic medical records at the UPTD Aawayan Health Center, Balangan Regency (Yoon et al., 2013). The population in this study of all hypertension patients served at the Aawayan Health Center during the implementation of EMRs was 1489 patients. The sample method used in the study is

Probability Sampling (random), with the Slovin formula, with a sample size of 315. However, to prevent drop-outs, the researcher will add 10% of the sample calculation results with the Slovin formula to 347 intervention group respondents. The control group sample in this study was a manual medical record document of patients diagnosed with hypertension who had been treated at the UPTD Aawayan Health Center, so the number was the same as 347 manual medical record documents.

Data were obtained from two sources at the UPTD Aawayan Health Center, namely Electronic Medical Records (EMR) and manual medical record archives of hypertensive patients. The research sample was determined based on specific inclusion and exclusion criteria. The inclusion criteria consisted of patients diagnosed with hypertension based on medical records, those receiving healthcare services using the EMR system, patients undergoing outpatient visits or routine (non-emergency) examinations, individuals aged 18 years or older, and patients with complete records of waiting time and service time. Meanwhile, the exclusion criteria included patients in emergency conditions, those with incomplete or mismatched service time data, patients with severe comorbidities that significantly affect the duration of care, individuals who were absent or canceled scheduled visits, and those who refused to participate in the study.

The research instrument used in this study is in the form of an observation sheet during service. Data collection by direct observation of patients diagnosed with hypertension who came to conduct examinations at the UPTD Health Center, and analysis of the Manual Medical Record documents. Data were collected through structured document review and observation using a standardized sheet. Waiting time and service time were extracted directly from EMR and manual records, with identical procedures applied to both groups to ensure consistency. The data analysis used is the Paired Sample t- Test using SPSS version 30.0, Before conducting the T Test, the author ensures that the data is distributed normally with the Normality test using SPSS, if the data is abnormal, the results of the T test may not be accurate, so it is necessary to use an alternative method such as the Wilcoxon Signed-Rank Test as a non-parametric test.

## **RESULTS**

In the descriptive analysis, the data used included the total service time of patients with a diagnosis of hypertension, which was calculated from when the patient arrived at the health facility until they finished receiving the service and left the health center. A comparison was made between the Electronic Medical Record (EMR) and Manual Medical Record methods to assess the effectiveness of digital systems in improving service efficiency. In the EMR system, the service time begins to be calculated from when the patient arrives and registers, then continues to the doctor's examination stage, where the doctor provides medical services, records the examination results digitally, and provides referrals to the pharmacy room if needed. Afterwards, the patient receives the drug in the pharmacy room, where electronic prescriptions are processed, the drug is prepared, and the patient receives a consultation regarding its use before finally leaving the healthcare facility.

In the manual medical record system, recording is carried out conventionally using paper-based physical documents. For patients with a diagnosis of hypertension who have been treated at the Aawayan Health Center UPTD, their medical records have been prepared beforehand so that researchers can take service history data from the manual document. This data includes the duration of services from registration, doctor's examination, to medication collection, which is manually recorded by medical personnel and administrative staff. This analysis was conducted to assess the efficiency of the manual system in managing patients' medical records compared to digital systems.

Table 1 shows the data obtained. The total cumulative time of serving patients with a diagnosis of hypertension from the beginning of registration to taking medication using the Electronic Medical Record (EMR) system is 271,438 seconds, while with the manual system, it reaches 666,798 seconds for the same number of patients, which is 347 people. If calculated on average, the service time per patient with EMR is about 782 seconds, or

the equivalent of 13.02 minutes. Meanwhile, the average service time per patient with the manual system is around 2,248 seconds, equivalent to 37.46 minutes.

**Table 1.** Total Cumulative Time of Serving Patients with A Diagnosis of Hypertension

No.	Variable	Unit	Total EMR	Total Manual	Average EMR (Seconds)	Average Manual (Seconds)
1	Total service time of hypertension patients	Seconds	271,438	666,798	782	2,248
2	Number of hypertension patients served	Patients	347	347	–	–

Before the Paired Sample t-Test was carried out, the researcher first conducted a normality test on the data of the difference between service time using Electronic Medical Records (EMR) and manual medical records using the Kolmogorov-Smirnov and Shapiro-Wilk tests. These two tests were chosen to verify whether the distribution of the difference data met the assumption of normality, especially considering the number of samples used, as many as 347 respondents. This is done to ensure that the data meet the normal distribution assumptions, which is a key requirement.

For the use of parametric tests. The results of the normality test showed that the distribution of the difference data was normal ( $p > 0.05$ ), so that the Paired t-test could be continued to analyze the difference in service time between the two medical recording methods.

**Table 2.** Test of The Normality of Total Time of Service

Variable	Kolmogorov-Smirnov Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
EMR	0.045	347	0.095	0.990	347	0.017
MANUAL	0.071	347	0.001	0.975	347	0.001

Note: Lilliefors Significance Correction applied.

Table 2 shows that the normality test in this study was carried out using two methods, namely Kolmogorov-Smirnov and Shapiro-Wilk, on two variables, namely EMR and manual. The Kolmogorov-Smirnov test results for the EMR variable revealed a significance level of 0.095 ( $p > 0.05$ ), suggesting that the data followed a normal distribution. Conversely, the Shapiro-Wilk test produced a significance value of 0.017 ( $p < 0.05$ ), indicating that the EMR data did not conform to a normal distribution. However, in the Shapiro-Wilk test, the significance value obtained was 0.017 ( $p < 0.05$ ), thus indicating that the EMR data were not normally distributed. Therefore, there is a difference in results between the two normality tests on the EMR variable. Meanwhile, for the manual variable, both tests showed consistent results, namely the Kolmogorov-Smirnov significance value of  $< 0.001$  and the Shapiro-Wilk significance value of  $< 0.001$ , which means that the data is not normally distributed. Given that the Shapiro-Wilk test is more sensitive and recommended for a sample size of less than 2000 respondents ( $n = 347$  in this study), the results of the Shapiro-Wilk test are prioritized in decision-making. Therefore, it can be concluded that both variables, EMR and manual, are not normally distributed.

**Table 3.** Wilcoxon Signed-Rank Test Results

Test Statistics	Value
Z	-16.144
Asymp. Sig. (2-tailed)	$< 0.001$

Note: Lilliefors Significance Correction applied.

Table 3 shows the test, a Z value of -16.144 was obtained with a significance value of Asymp. Sig. (2-tailed)  $< 0.001$ . This shows that there is a significant difference between manual and EMR scores ( $p < 0.05$ ). As for the ranking table (Ranks), all data show a positive ranking of 347 cases, with a mean rank value of 174.00 and a sum of ranks of

60,378.00. There are no negative ratings or ties between manual and EMR. Thus, it can be concluded that the EMR score is consistently higher than that of manual, and there is a statistically significant difference between the two methods.

A study in Kenya highlighted the various challenges healthcare workers face in the use of manual Medical Record systems in primary healthcare facilities. In the study, it was found that 38% of health workers complained about the inefficiency of the manual system, especially due to the frequent loss of medical documents and the duplication of patient data. This condition causes the data search process to be slow, increases the risk of errors in services, and increases the administrative workload for health workers. In addition, data duplication also has the potential to lead to inconsistencies in patient medical information, which can ultimately negatively impact the quality of healthcare services and clinical decision-making (Uslu & Stausberg, 2021).

The impact of EMR on institutional productivity can also be seen from the increase in service capacity. Awayan Health Center can serve 15× more patients per hour with EMR. The EMR increases the productivity of diagnosis/examination services by 11.2% per 20 minutes. This efficiency not only optimizes human resources but also reduces operational costs related to physical document storage and administrative errors (Furukawa, 2011).

This study emphasizes the importance of digital transformation through the application of EMR to overcome this problem. With digital systems, patient data is more accessible, the risk of document loss can be minimized, and data duplication can be prevented through good system integration. These findings are in line with the results of research at the Awayan Health Center, where the implementation of EMR has been proven to significantly improve the efficiency of service time and the quality of patient data management.

## DISCUSSION

The implementation of Electronic Medical Records (EMRs) has led to significant improvements in healthcare service delivery, as evidenced by the study conducted at the UPTD Awayan Health Center in Balangan Regency. The results indicate a marked reduction in patient service times, with EMRs processing patient information in an average of 13.02 minutes compared to 37.46 minutes with the manual system. This efficiency in service delivery is consistent with findings from previous studies, which highlight the benefits of EMR systems in reducing patient waiting times, enhancing care continuity, and minimizing diagnostic errors (Kraus et al., 2021; Li et al., 2021; Ariani, 2023; Firdaus & Fitriyani, 2024; Laurenxius et al., 2025).

However, despite the apparent advantages, the study also identifies several challenges that hinder the optimal use of EMRs. The system disruptions, including difficulties in obtaining authorization codes and missing monthly reports, point to the need for better infrastructure and support for healthcare workers operating these systems. These technical barriers align with findings from other studies that emphasize the role of system reliability in achieving the full benefits of digital transformation in healthcare (Jannah & Latifah, 2022; Tschay & Matlhaba, 2025). Without consistent access to functional EMR systems, the effectiveness of healthcare delivery can be compromised.

Furthermore, the issue of insufficient human resource capacity is another significant barrier. The study showed that healthcare workers at the Awayan Health Center struggled to manage the increased workload associated with the new digital system. This problem is not unique to the Awayan Health Center; similar challenges have been observed globally, where the introduction of technology often outpaces the training and support provided to healthcare personnel (Jannah & Latifah, 2022; Kavandi et al., 2024). As a result, to ensure the sustainability of EMR systems, investments in continuous training and capacity building for staff are crucial.

On the other hand, the positive impact of EMRs on healthcare productivity cannot be overstated. The Awayan Health Center was able to serve significantly more patients per hour with the EMR system, a benefit that has economic implications for the healthcare system. The ability to handle a higher volume of patients while maintaining quality care

leads to cost savings, particularly in terms of administrative expenses related to paper records and physical storage (Abdelaziz & Rosa, 2024; Prabawati & Purwito, 2025). This increased efficiency aligns with the broader goals of digital transformation in healthcare, which seeks to optimize both service delivery and operational cost management.

The integration of EMRs also enhances clinical decision-making by providing real-time access to patient data. The use of EMRs in the management of hypertension patients at the Aawayan Health Center improved the coordination between medical teams, facilitated timely interventions, and reduced the risk of medical errors. This is consistent with findings by Furukawa (2011), who noted that EMRs with integrated decision support systems enhance healthcare providers' ability to make informed decisions, ultimately leading to improved patient outcomes. In conclusion, while the transition to EMRs at the Aawayan Health Center has significantly improved service efficiency, challenges related to system disruptions and insufficient staff training must be addressed to realize the full potential of digital healthcare systems.

## **CONCLUSION**

The findings of this study demonstrate that the implementation of Electronic Medical Records (EMR) at the UPTD Aawayan Health Center significantly increases the efficiency of health service delivery for hypertension patients. The average service time per patient using EMR is substantially shorter compared to the manual system, reducing the waiting time from 37.46 minutes to 13.02 minutes per patient. This digital transformation not only streamlines administrative processes and minimizes the risk of data loss and duplication but also ensures better continuity of care and coordination among medical teams. These results support previous research that EMR adoption improves hypertension management, documentation, and patient outcomes by providing real-time access to clinical data and facilitating more effective clinical decision-making. The practical implications of this study suggest that healthcare facilities, particularly primary care centers, can enhance service efficiency and quality by adopting EMR systems, especially in managing chronic diseases such as hypertension. The findings also highlight the importance of investing in digital infrastructure, staff training, and system integration to maximize the benefits of EMR implementation.

However, this study has several limitations. First, the research is limited to a single healthcare facility, which may restrict the generalizability of the findings. Second, the focus on hypertension patients may not fully represent other types of medical services. Third, potential operational disruptions and user adaptation issues during EMR implementation were not deeply explored. Future research should focus on identifying strategies to overcome these barriers, particularly in low-resource settings, to ensure that the benefits of EMR systems are fully realized across the healthcare sector. By addressing these challenges, healthcare facilities can enhance both the quality of care and the efficiency of their services, ultimately leading to better patient outcomes and greater healthcare accessibility.

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*Implementation of  
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