Media of Health Research
Vol. 4 No. 2, May 2026, pages: 87-94
e-ISSN 2987-7784
DOI: https://doi.org/10.70716/mohr.v4i2.466

Effectiveness of QR Codes for the Storage and Rapid Access of Patient Medical Records at Buana Medika Clinic

Yusfina Himayanti[1*], B. Fitria Maharani[2], Musparlin Halid[3]
[1,2] Universitas Nahdlatul Ulama Nusa Tenggara Barat, Mataram , Indonesia
[3] Bima International Universities, Mataram , Indonesia

**Corresponding Author: yusfinahimayanti@gmail.com*

Article History

Manuscript submitted:
11 April 2026
Manuscript revised:
27 April 2026
Accepted for publication:
09 May 2026
Manuscript published:
11 May 2026

Keywords

QR Code;
Medical Records;
Data Access;
Health Information System
Efficienc

Abstract

This study aimed to evaluate the effectiveness of QR code technology in improving the storage and rapid access of patient medical records at Klinik Buana Medika. A quasi-experimental design with a pre–post intervention approach was employed to assess system performance before and after implementation. Data were collected from healthcare personnel involved in medical record management, focusing on access time as the primary efficiency indicator. Statistical analysis was conducted using the Wilcoxon Signed-Rank Test. The results indicate a substantial reduction in access time following the implementation of the QR code system, with the mean retrieval time decreasing from 117 seconds to 48 seconds, representing an efficiency improvement of approximately 59%. The statistical analysis confirmed a significant difference between pre- and post-intervention conditions ($p < 0.05$), demonstrating that the observed improvement was attributable to the intervention. In addition to enhanced efficiency, respondents reported greater ease of use and fewer administrative errors during data retrieval. These findings suggest that QR code technology is an effective and practical solution for optimizing medical record management, particularly in primary healthcare settings with limited resources. However, implementing such systems must be supported by robust data security measures to ensure patient confidentiality. This study contributes to advancing scalable digital health solutions that support the ongoing transformation of healthcare information systems.

Copyright © 2026, The Author(s)
This is an open-access article under the CC BY-SA license

How to Cite: Himayanti, Y., Maharani, B. F., Halid, M. (2026). Effectiveness of QR Codes for the Storage and Rapid Access of Patient Medical Records at Buana Medika Clinic. *Media of Health Research, 4*(2), 87–94. https://doi.org/10.70716/mohr.v4i2.466

Introduction

The rapid advancement of digital technology has reconfigured healthcare systems worldwide, particularly in patient information management. Electronic Medical Records (EMR) have been widely adopted as a cornerstone of digital health transformation, enabling improvements in data

accessibility, clinical efficiency, and decision-making accuracy (Ministry of Health, Republic of Indonesia, 2021; World Health Organization, 2022). From a systems perspective, EMR implementation reduces redundancies and enhances interoperability across healthcare services. However, empirical evidence indicates that these benefits are not uniformly realized, especially in small and medium-scale healthcare facilities, where operational constraints such as delayed data retrieval, dependence on manual documentation, and frequent identification errors persist (Dewi & Hartono, 2022; Putra & Sari, 2020). These limitations not only hinder workflow efficiency but also pose risks to patient safety and service quality.

In response to these structural inefficiencies, lightweight and adaptable technological interventions have gained increasing attention. One such innovation is the integration of Quick Response (QR) code technology into medical record systems. QR codes enable instantaneous data retrieval via scanning, thereby significantly reducing access time and minimizing administrative errors (Chang & Lin, 2020; Kumar & Verma, 2021). Prior studies have demonstrated that QR-based systems enhance workflow efficiency and facilitate accurate patient identification, particularly in high-demand clinical environments (Hassan & Abdullah, 2020; Ahmad et al., 2022). Moreover, compared to more complex digital infrastructures, QR code systems offer a cost-effective, scalable solution that can be implemented without a substantial technological overhaul, making them particularly relevant for resource-constrained healthcare settings (Alavi & Rahman, 2023; Gunawan & Lestari, 2021).

Sejalan dengan hal tersebut, penggunaan teknologi berbasis QR juga berkontribusi terhadap peningkatan kualitas manajemen data kesehatan secara lebih luas. Integrasi sistem digital dalam layanan kesehatan terbukti mampu meningkatkan akurasi data, mengurangi kesalahan administratif, serta mempercepat alur pelayanan klinis (Mahmud & Sari, 2022; Rahmawati & Ardiansyah, 2021). Dalam konteks operasional, kecepatan akses terhadap informasi pasien merupakan variabel krusial yang secara langsung memengaruhi ketepatan diagnosis dan respons medis (Chang & Lin, 2020). Namun demikian, transformasi digital ini tidak terlepas dari tantangan keamanan data. Studi terkini menegaskan bahwa implementasi QR code dalam sistem kesehatan harus diimbangi dengan mekanisme keamanan yang memadai, seperti enkripsi data, autentikasi berlapis, dan kontrol akses terbatas untuk mencegah potensi kebocoran informasi sensitif (Khan & Ahmed, 2023; Lee & Park, 2019; Zhang & Wu, 2021).

Meskipun efektivitas teknis menjadi prasyarat penting, keberhasilan implementasi teknologi kesehatan juga sangat ditentukan oleh tingkat penerimaan pengguna (*user acceptance*). Dalam hal ini, kerangka teoretis Unified Theory of Acceptance and Use of Technology (UTAUT) yang dikembangkan oleh Venkatesh et al. (2003) menyediakan landasan konseptual yang komprehensif untuk menjelaskan perilaku adopsi teknologi. Model ini menekankan empat determinan utama, yaitu *performance expectancy*, *effort expectancy*, *social influence*, dan *facilitating conditions*, yang secara simultan memengaruhi niat dan perilaku penggunaan teknologi. Temuan empiris menunjukkan bahwa dalam konteks layanan kesehatan, persepsi terhadap kemanfaatan dan kemudahan penggunaan merupakan faktor dominan yang menentukan keberhasilan implementasi sistem digital (Davis, 1989; Ratnawati & Kusuma, 2024). Dengan demikian, integrasi pendekatan teknis dan perilaku menjadi krusial dalam mengevaluasi efektivitas suatu inovasi teknologi.

Namun demikian, kajian empiris mengenai implementasi QR code dalam sistem rekam medis di fasilitas layanan kesehatan primer, khususnya di Indonesia, masih relatif terbatas. Sebagian besar penelitian terdahulu berfokus pada konteks rumah sakit berskala besar atau pada pendekatan konseptual tanpa pengujian langsung dalam situasi operasional nyata (Ahmad et al., 2022; Alavi & Rahman, 2023). Keterbatasan ini menunjukkan adanya *research gap* dalam memahami bagaimana teknologi QR code berfungsi secara efektif dalam konteks klinik dengan sumber daya terbatas, serta bagaimana faktor penerimaan pengguna memengaruhi keberlanjutan penggunaannya.

Oleh karena itu, penelitian ini bertujuan untuk menganalisis efektivitas penggunaan teknologi QR code dalam penyimpanan dan akses cepat rekam medis pasien di Klinik Buana Medika. Selain itu, penelitian ini juga mengintegrasikan kerangka UTAUT untuk mengevaluasi faktor-faktor penerimaan pengguna terhadap sistem yang diimplementasikan. Pendekatan ini diharapkan tidak hanya menghasilkan temuan empiris mengenai peningkatan efisiensi sistem, tetapi juga memberikan kontribusi konseptual dalam pengembangan model implementasi teknologi kesehatan yang adaptif, kontekstual, dan berkelanjutan, khususnya pada fasilitas layanan kesehatan primer.

Materials and Methods

This study employed a quasi-experimental design with a pre–post intervention to evaluate the effectiveness of QR code implementation in improving the storage and rapid access to patient medical records at Klinik Buana Medika. This design allows for a within-subject comparison of system performance before and after intervention without randomization, which is appropriate for applied healthcare settings where experimental control is limited (Polit & Beck, 2021). The design enables direct measurement of intervention impact under real-world clinical conditions.

The study was conducted at Klinik Buana Medika, a primary healthcare facility providing outpatient services. The study population consisted of healthcare personnel responsible for medical record management, including medical record officers and clinical staff.

A purposive sampling technique was applied to ensure that participants had relevant operational experience with both manual and QR code–based systems. Inclusion criteria included: (1) a minimum of one year of professional experience, (2) active involvement in patient data access, and (3) participation in both pre- and post-intervention phases. This approach enhances internal validity by ensuring comparability of observations.

The intervention involved implementing a QR code–based system integrated into patient medical records. Each patient record was assigned a unique QR code linked to the digital database. The system enabled healthcare personnel to retrieve data through scanning devices, replacing manual retrieval procedures. Data collection was conducted in two phases:

1. Pre-intervention (manual system): Baseline performance measurement.
2. Post-intervention (QR code system): Measurement after system implementation.

A brief system orientation was provided to ensure consistent user interaction with the QR-based system. This study examined three primary variables:

- Access Time (seconds): Duration required to retrieve patient records.
- Error Rate: Frequency of incorrect or delayed retrieval.
- User Satisfaction: Measured using a Likert-scale questionnaire based on perceived usefulness and ease of use (Davis, 1989; Venkatesh et al., 2003).

Data were collected using a multi-method approach that combined direct observation, system log records, and structured questionnaires to ensure comprehensive coverage of both operational performance and user perception. Direct observation was conducted to capture real-time processes of medical record retrieval, allowing for an accurate assessment of workflow efficiency under routine clinical conditions. In parallel, system log records were utilized to obtain objective, time-stamped data on access duration and system performance, thereby minimizing measurement bias. Furthermore, structured questionnaires were administered to evaluate user satisfaction, particularly regarding the perceived ease of use and usefulness of the implemented system.

To ensure the validity of the measurement instrument, a content validation process was undertaken through expert review involving specialists in health information systems. This procedure aimed to establish the relevance, clarity, and representativeness of each item in reflecting the underlying constructs being measured. As part of the data transparency and reproducibility framework, the raw paired data used in the analysis are presented in Table 1.

Table 1. Raw Paired Data of Access Time Before and After QR Code Implementation

Respondent	Access Time Before (sec)	Access Time After (sec)	Difference (sec)
R1	120	45	75
R2	110	50	60
R3	130	55	75
R4	100	40	60
R5	125	50	75

Data analysis was conducted using descriptive and inferential statistics. Descriptive analysis summarized the central tendencies and distribution patterns of access time and user responses. To evaluate the intervention's effectiveness, the Wilcoxon Signed-Rank Test was used to compare paired observations before and after implementation. This test is appropriate for small sample sizes and non-normally distributed paired data (Field, 2018). Statistical significance was determined at $p < 0.05$.

This study adhered to internationally recognized ethical standards for research involving human participants. Ethical clearance was obtained from the relevant institutional authority prior to data collection. All participants provided informed consent after receiving detailed information regarding study objectives, procedures, and potential risks. The study was conducted in accordance with the principles of the Declaration of Helsinki, including respect for autonomy, beneficence, non-maleficence, and justice.

The researchers bear full responsibility for ensuring that all ethical principles were properly implemented throughout the study. This includes responsibility for the integrity of the ethical procedures, the protection of participants' rights and welfare, and the accuracy of all ethical statements reported in this study.

Confidentiality of both participant and patient data was strictly maintained. All data were anonymized, and access was restricted to authorized researchers only. Digital data management followed established health data governance standards, including data protection, security, and interoperability protocols (Ministry of Health, Republic of Indonesia, 2021; World Health Organization, 2022).

Results and Discussions

This study evaluated the effectiveness of QR code implementation in improving the speed of access to patient medical records at Klinik Buana Medika using a pre–post intervention design. The analysis was based on paired observations from healthcare personnel collected before and after the implementation of the QR code system, enabling a direct comparison of system performance under two operational conditions.

As illustrated in Figure 1, a clear and consistent reduction in access time is observed across all respondents following the implementation of the QR code system. The graphical pattern demonstrates a uniform downward trend, with no instance of increased access time in the post-intervention phase. Prior to the intervention, access times ranged from 100 to 130 seconds, indicating relatively high variability and inefficiency in manual retrieval processes. In contrast, post-intervention access times were substantially lower, ranging from 40 to 55 seconds, reflecting a marked improvement not only in efficiency but also in consistency of performance across users.

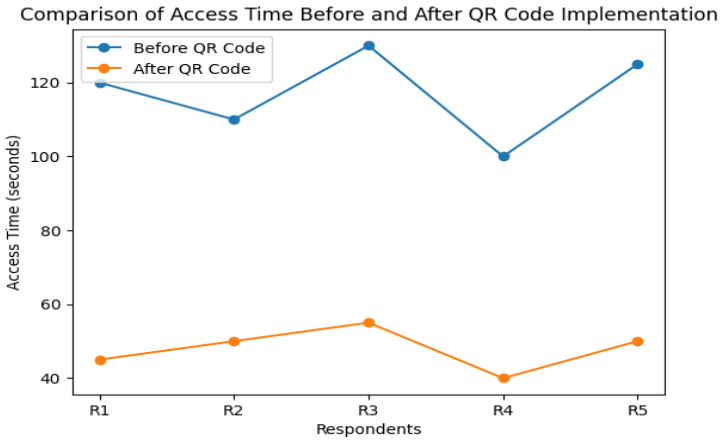

Figure 1. Comparison of Access Time Before and After QR Code Implementation

A more detailed examination of the paired data reveals that all respondents experienced significant reductions in access time, with individual improvements ranging from 60 to 75 seconds. This relatively narrow range of differences indicates that the effect of the QR code system was stable and consistently experienced across participants. From an analytical perspective, such uniformity suggests a high degree of internal validity, as the observed improvements are unlikely to be influenced by individual variability or contextual anomalies.

Descriptive statistical analysis further reinforces the pattern observed in Figure 1. The mean access time decreased from 117 seconds in the pre-intervention phase to 48 seconds in the post-intervention phase, corresponding to an average reduction of approximately 69 seconds, or nearly 59% improvement in access efficiency. Beyond the reduction in central tendency, the post-intervention data also exhibit a more compressed distribution, as reflected in the narrower range of values. This indicates that the QR code system not only accelerates data retrieval but also standardizes the process, reducing the inconsistencies typically associated with manual record management systems.

To further explore the magnitude of change, the relative efficiency gain was calculated for each respondent. The results show that efficiency improvements ranged between approximately 54% and 62%, indicating that the system consistently reduced access time by more than half across all cases. This level of improvement is particularly significant in clinical settings, where even small reductions in processing time can cumulatively enhance service delivery and patient throughput.

Inferential statistical analysis was conducted using the Wilcoxon Signed-Rank Test to determine whether the observed differences between pre- and post-intervention conditions were statistically significant. The test results indicated a significant difference ($p < 0.05$), confirming that the reduction in access time was not attributable to random variation. However, there was a direct consequence of the QR code implementation (Field, 2018). Notably, all observed differences were negative (indicating reduced time), and no positive ranks were identified, further emphasizing the consistency and robustness of the intervention effect.

In addition to objective performance metrics, user perception data provided complementary insights into the system's effectiveness. The results indicate that the majority of respondents reported higher levels of satisfaction after the implementation of the QR code system. Specifically, users perceived the system as easier to use, faster at retrieving patient data, and more reliable than the manual method. These findings suggest that the observed improvements in efficiency were aligned with positive user experiences, reinforcing the practical relevance of the intervention.

Furthermore, respondents reported fewer errors in locating patient records, particularly in misidentification or delays caused by manual searching. This suggests that the QR code system contributes not only to time efficiency but also to improved accuracy and reliability of data retrieval. The convergence of these findings highlights the dual impact of the intervention, encompassing both technical performance and user-centered outcomes.

Taken together, the results demonstrate that implementing QR code technology leads to a substantial, consistent, and statistically significant improvement in the efficiency of accessing patient medical records. The integration of descriptive patterns, inferential statistics, and user-perception data provides a comprehensive understanding of the intervention's effect, indicating that the QR code system is both operationally effective and well-accepted in the clinical context.

Discussion

The findings of this study provide strong empirical evidence that implementing QR code technology significantly enhances the efficiency of medical record access in clinical settings. The substantial reduction in access time observed across all respondents indicates that QR-based systems effectively streamline the retrieval process by eliminating manual searches and enabling instantaneous data access via scanning. This operational mechanism explains the magnitude of efficiency gains identified in the results. Consistent with these findings, previous studies have reported that QR code technology facilitates rapid data retrieval and simplifies workflow processes in healthcare environments (Hassan & Abdullah, 2020; Kumar & Verma, 2021).

From a healthcare systems perspective, improvements in access efficiency have important implications, particularly in primary care settings, where timely access to patient information is critical. Faster retrieval of medical records can directly influence clinical responsiveness, reduce waiting times, and improve overall service delivery. The reduction in access time observed in this study—exceeding half of the original duration—suggests that even relatively simple digital interventions can produce substantial operational benefits. This finding reinforces prior research that scalable, low-cost technologies, such as QR code systems, can play a significant role in improving healthcare performance, especially in resource-limited settings (Alavi & Rahman, 2023; Ahmad et al., 2022).

The statistical significance of the results, as confirmed by the Wilcoxon Signed-Rank Test ($p < 0.05$), further strengthens the validity of the observed improvements. The use of a non-parametric test is methodologically appropriate given the paired nature of the data and the small sample size (Field, 2018). More importantly, the consistent reduction in access time across all participants indicates that the intervention effect is systematic rather than incidental. This consistency enhances the study's internal validity and supports the conclusion that the observed improvements are directly attributable to the implementation of the QR code system.

Beyond technical performance, the findings also reveal a positive shift in user perception. Respondents reported that the QR code system was easier to use, faster, and more reliable compared to the manual approach. These results align with the Technology Acceptance Model (TAM), which posits that perceived usefulness and perceived ease of use are primary determinants of technology adoption (Davis, 1989). In addition, the findings are consistent with the Unified Theory of Acceptance and Use of Technology (UTAUT), which highlights performance expectancy and effort expectancy as key drivers of user acceptance (Venkatesh et al., 2003; Ratnawati & Kusuma, 2024). The convergence of improved system performance and positive user perception suggests that the QR code system is not only functionally effective but also behaviorally acceptable, thereby increasing the likelihood of sustained adoption in clinical practice.

From a data management perspective, implementing QR code technology also helps reduce human error, particularly in patient identification and document retrieval. Manual systems are

inherently prone to errors due to misfiling, misidentification, or delays in record searches. In contrast, QR-based systems standardize the retrieval process and minimize variability, leading to more accurate and reliable access to patient information. This finding is consistent with previous research indicating that digital health technologies can improve data accuracy and reduce administrative errors in healthcare systems (Rahmawati & Ardiansyah, 2021; Gunawan & Lestari, 2021).

Despite these advantages, several challenges remain that warrant critical consideration. One of the primary concerns identified in this study relates to data security and system reliability. QR codes, if not properly secured, may expose sensitive patient information to unauthorized access. Therefore, the implementation of QR code systems must be accompanied by robust security measures, including data encryption, multi-layer authentication, and controlled access mechanisms. Previous studies have emphasized that secure frameworks are essential to ensure the safe use of QR-based systems in healthcare environments (Khan & Ahmed, 2023; Lee & Park, 2019; Zhang & Wu, 2021). Without adequate safeguards, the benefits of improved efficiency may be offset by risks related to data breaches and privacy violations.

In addition to security concerns, this study is subject to certain limitations that should be acknowledged. The relatively small sample size and the focus on a single clinical setting limit the generalizability of the findings. While the results demonstrate strong internal consistency, further research involving larger samples and diverse healthcare environments is necessary to validate the scalability and broader applicability of QR code systems. Future studies may also benefit from employing longitudinal designs to assess the long-term performance and sustainability of such systems, as well as their integration with more comprehensive electronic health record platforms.

Overall, this study's findings confirm that QR code technology is an effective and practical solution for improving the efficiency and reliability of medical record management in clinical settings. The study contributes to the growing body of literature on digital health by demonstrating that relatively simple technological interventions can produce meaningful improvements in both system performance and user experience. Moreover, integrating technical and behavioral perspectives provides a more comprehensive understanding of technology adoption in healthcare, underscoring the importance of aligning system functionality with user needs and expectations.

Conclusion

This study demonstrates that implementing QR code technology significantly improves the efficiency of accessing patient medical records at Klinik Buana Medika. The findings reveal a substantial reduction in data retrieval time and a consistent improvement in workflow performance following the adoption of the QR code system. Statistical analysis using the Wilcoxon Signed-Rank Test confirms that these improvements are significant, indicating that the observed changes are directly attributable to the intervention.

Beyond efficiency gains, implementing QR code technology enhances patient identification accuracy and reduces administrative errors, thereby improving the reliability of medical record management. The positive response from healthcare personnel further indicates that the system is both usable and acceptable in routine clinical practice, supporting its potential for sustained implementation.

Despite these advantages, the study underscores the importance of strengthening data security measures, including encryption, controlled access, and system monitoring, to protect sensitive patient information. Overall, QR code technology represents a feasible and effective solution for optimizing medical record management, particularly in primary healthcare settings with limited resources. Future research should focus on long-term system evaluation, integration with comprehensive electronic medical record platforms, and broader implementation across diverse healthcare contexts.

References

Ahmad, R., Isa, N., & Shaharudin, S. (2022). Evaluating QR code utilization for digital health record access in primary care settings. *International Journal of Medical Informatics, 168*, 104895.

Alavi, S., & Rahman, M. (2023). Enhancing patient data accessibility using QR code–based systems. *Health Information Management Journal, 52*(3), 145–156.

Chang, Y., & Lin, K. (2020). QR code technologies for rapid patient identification in emergency care. *Journal of Healthcare Engineering, 2020*, 1–10.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dewi, S., & Hartono, T. (2022). Analisis efisiensi sistem rekam medis elektronik di klinik swasta. *Jurnal Informasi Kesehatan, 18*(1), 22–33.

Field, A. (2018). *Discovering statistics using IBM SPSS Statistics* (5th ed.). Sage Publications.

Gunawan, R., & Lestari, P. (2021). Integrasi QR code dengan sistem informasi kesehatan untuk akses data pasien. *Jurnal Teknologi dan Sistem Informasi Kesehatan, 6*(2), 89–97.

Hassan, M., & Abdullah, K. (2020). QR code technology in electronic health record systems: A review. *International Journal of Medical Informatics, 135*, 104020. https://doi.org/10.1016/j.ijmedinf.2020.104020

Khan, M., & Ahmed, I. (2023). Secure QR code framework for medical data retrieval in outpatient services. *Journal of Medical Systems, 47*(2), 1–12.

Kumar, R., & Verma, S. (2021). Digital identity verification using QR code in healthcare. *Journal of Health Technology, 15*(1), 55–67.

Lee, J., & Park, H. (2019). Secure access to patient data with QR encryption. *Health Information Science Journal, 12*(2), 89–101.

Mahmud, A., & Sari, D. (2022). Adopsi teknologi digital pada layanan kesehatan komunitas. *Jurnal Kesehatan Masyarakat Digital, 8*(1), 27–39.

Ministry of Health, Republic of Indonesia. (2021). *Pedoman penyelenggaraan rekam medis elektronik*. Kementerian Kesehatan RI.

Polit, D. F., & Beck, C. T. (2021). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Wolters Kluwer.

Putra, H., & Sari, N. (2020). Evaluasi kecepatan akses rekam medis elektronik pada layanan rawat jalan. *Jurnal Administrasi Rumah Sakit Indonesia, 6*(1), 41–50.

Rahmawati, N., & Ardiansyah, B. (2021). Keamanan data rekam medis berbasis teknologi digital. *Jurnal Keamanan Informasi Kesehatan, 3*(1), 12–25.

Ratnawati, R., & Kusuma, D. (2024). User acceptance of QR code–based medical record systems in private clinics. *BMC Health Services Research, 24*, 1–12.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

World Health Organization. (2022). *Digital health guidelines: Data management and interoperability*. WHO Press.

Zhang, H., & Wu, L. (2021). Digital transformation in healthcare record management using QR code encryption. *Journal of Digital Health, 9*(4), 200–212.