



Literature Review: Identification of the Root Causes of Medical Record Data Duplication Based on Continuous Improvement Solutions

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Abstract

Research Objective: This study aimed to identify the root causes of medical record-number duplication and synthesize evidence-informed continuous-improvement recommendations. **Methodology:** A Systematic Literature Review (SLR) was conducted in Google Scholar in June 2026 using combinations of “medical record duplication,” “Electronic Medical Records (EMR),” and “continuous improvement.” Articles published between 2022 and 2026 were screened using predefined eligibility criteria. Of 7,580 records identified, 11 articles were included and analyzed through qualitative thematic coding and narrative quality appraisal. **Results:** The evidence was grouped into five interrelated dimensions: human resources, systems and technology, processes and Standard Operating Procedures (SOPs), policies and governance, and infrastructure. Human-resource factors were the most frequently reported, while system limitations, weak identity-verification procedures, limited governance, and infrastructure disruptions also contributed to assigning more than one medical record number to the same patient. The findings were mapped to PDCA, Kaizen, data cleansing, and Master Patient Index (MPI) strategies. **Conclusion:** Medical record-number duplication is a multidimensional patient-safety and data-quality problem. The proposed continuous-improvement framework should be interpreted as an evidence-informed synthesis that may help healthcare facilities reduce new duplication and strengthen patient-identity management; its effectiveness requires local implementation and evaluation.

Keywords: *continuous improvement, data duplication, PDCA, medical records*

INTRODUCTION

Medical records are documents containing complete information related to patient identity, examination results, diagnoses, medical procedures, and various healthcare services received during treatment at healthcare facilities (Hermawan et al., 2024). Accuracy and completeness of medical record data play a crucial role in ensuring continuity of care and patient safety. However, medical record data duplication remains a challenge that has not been fully resolved in various healthcare facilities in Indonesia.

Medical record-number duplication occurs when one patient is assigned more than one medical record number, causing clinical information to become fragmented and poorly integrated. This differs from record overlap, in which one medical record number is incorrectly used for more than one patient. Although both conditions threaten patient-identity integrity, this review focuses on duplication. Duplication can affect service quality through administrative inefficiency and the risk of clinical errors caused by incomplete information. Luh Gede Asri Martania Dhansunu and Bambang Hadi Kartiko (2024) reported impacts on medical-record provision time, communication among healthcare providers, medication safety, and BPJS Health claim verification.

Ironically, digital transformation through the implementation of Electronic Medical Records (EMR) has not been entirely successful in overcoming duplication problems. Rahma Nisaa Ramadhani Kusetiono (2024) reported that an average of five duplication cases per month were still found within

the EMR system, influenced by human, system, method, and workflow factors. This finding is supported by Chresia Ericha, Nanda Aula Rumana, and Wiwik Viatiningsih (2023), whose literature review of 10 journals found that 60% of the institutions studied still experienced duplication despite already having registration SOPs, with 5 out of 10 journals reporting duplication rates above 10%.

Previous studies have identified medical record duplication from several perspectives. Rahmawati and Ulfah (2024) examined data-cleansing-based solutions, while Rizkhika et al. (2022) identified 5M elements associated with duplication in hospitals. Laila, Huda, and Arwani (2023) and Sari et al. (2021) reported that structured socialization and admission-officer training could support duplication prevention. Wahyuningsih and Licia (2025) examined causal factors at RSUD Prof. Dr. Margono Soekarjo using Armstrong and Baron theory and the USG matrix. Rahmadanti (2023) used the FOCUS PDCA method to analyze the medical-record numbering process, while Rokhman et al. (2020) described data-cleansing procedures for preventing and removing duplicate records. However, these studies generally focused on particular institutions or individual improvement components and did not integrate the findings into a single continuous-improvement framework.

This study addresses two related but distinct questions: which root causes of medical record-number duplication are reported in the literature, and how can those findings be mapped to evidence-informed continuous-improvement recommendations? Unlike previous single-institution studies, this review provides a cross-study synthesis of causal factors from several dimensions and links them with preventive and sustainable improvement strategies. The recommendations are presented as a synthesis of the available evidence rather than as independently proven intervention effects. Therefore, this study aimed to identify the root causes of medical record data duplication and formulate evidence-informed continuous-improvement recommendations through a systematic literature review.

METHODS

This study employed a Systematic Literature Review (SLR) design, a research method conducted systematically, transparently, and reproducibly to identify, evaluate, and synthesize research findings relevant to specific research questions (Marzi, Balzano, and Pellegrini, 2025). The SLR approach was chosen because it provides a comprehensive and evidence-based overview of medical record duplication while minimizing selection bias through a structured search protocol.

The literature search was conducted in Google Scholar in June 2026. This database was selected because it provides broad coverage of Indonesian scientific journal articles in health information management and medical records. Publication years were limited to 2022–2026 to reflect current medical-record management conditions in Indonesia, particularly after the issuance of Ministry of Health Regulation Number 24 of 2022 concerning Electronic Medical Records.

The search strategy used the terms “medical record duplication,” “duplicate medical record number,” “Electronic Medical Records,” “EMR,” “SIMRS,” “continuous improvement,” “PDCA,” “Kaizen,” and “Master Patient Index.” Representative combinations included (“medical record duplication” OR “duplicate medical record number”) AND (“Electronic Medical Records” OR EMR OR SIMRS), and (“medical record duplication”) AND (“continuous improvement” OR PDCA OR Kaizen OR “Master Patient Index”). The terms were also searched separately to improve sensitivity. Only full-text articles accessible in PDF format were considered during selection.

The inclusion criteria applied in this study are as follows:

- a) Document type: Peer-reviewed journal articles reporting empirical research, literature synthesis, or documented quality-improvement activities relevant to medical-record data quality.
- b) Accessibility: Articles available in full-text PDF format through Google Scholar.
- c) Topic relevance: Articles directly examining medical-record duplication or clearly addressing mechanisms and improvement components relevant to duplication prevention, such as patient identification, EMR/SIMRS workflows, staff training, data cleansing, or continuous improvement.

d) Publication year: Articles published between 2022–2026.

Exclusion criteria included textbooks, institutional reports, editorials, inaccessible full-text records, and publications discussing medical records only in general terms without a clear connection to duplication, patient identification, or data-quality improvement. Sources cited only to provide conceptual or implementation context were not counted among the 11 included articles or in the thematic frequencies.

Screening was conducted in two stages: title-and-abstract screening followed by full-text eligibility assessment. Decisions were based on the predefined criteria, and potentially ambiguous records were rechecked before final inclusion. The search identified 7,580 records. After 7,192 irrelevant records were removed, 388 records remained; 341 records that did not address duplication were then excluded, leaving 47. Four records outside the targeted healthcare settings were excluded, leaving 43, and a further 32 records were excluded because the full text was inaccessible, the publication was a book, or the eligibility criteria were not met. Eleven articles were included in the final review.

Methodological quality and relevance were appraised narratively using four criteria: clarity of the study design, relevance to the review question, transparency of data collection and analysis, and applicability to duplication prevention. The strengths-and-weaknesses evidence table summarizes this appraisal. No study was excluded solely because of a methodological limitation because the review aimed to map causes and practical improvement options across heterogeneous evidence.

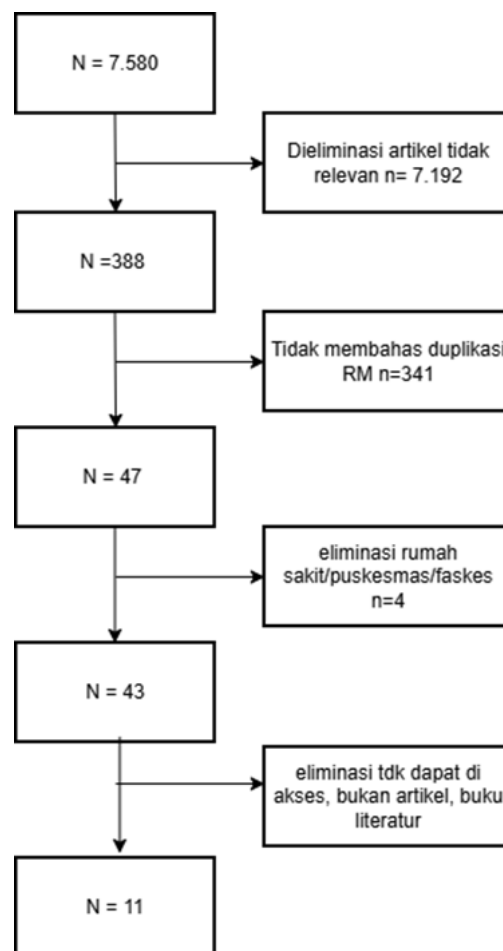


Figure 1. Literature Selection Flowchart

Literature Selection Flow

Data from the 11 selected articles were extracted and analyzed descriptively using a qualitative thematic approach. Article identity, study design, setting, main findings, duplication factors, and improvement implications were recorded in a structured extraction process. The analysis included:

1. Collecting study information, including article identity, methods, healthcare setting, main findings, and identified duplication factors.
2. Coding the findings into five predefined dimensions—human resources, systems and technology, processes and SOPs, policies and governance, and infrastructure—while allowing specific subthemes to emerge from the studies.
3. Comparing studies to identify recurring patterns. One article could contribute evidence to more than one dimension; therefore, theme frequencies represent the number of reporting studies rather than effect sizes or mutually exclusive categories.
4. Mapping the identified causes to evidence-informed continuous-improvement actions involving PDCA, Kaizen, data cleansing, and MPI.

RESULTS

No	Title	Weaknesses	Strengths
1	Effectiveness of Training in Completing Electronic Nursing Care Documentation in Inpatient Units (Indrayani & Siswadi, 2025)	The main weakness of this article is that it has not deeply discussed the effect of workload and the type of documentation system used (paper-based or electronic). In addition, this review still lacks detailed explanation regarding the most effective training methods.	This article effectively demonstrates that training interventions have a real impact on improving documentation quality, making it relevant as a basis for managerial policy in hospitals.
2	Analysis of the Impact of Using Dual Medical Record Systems on Service Efficiency at Mata Dr. H. Asri Ainun Habibie Hospital, Bogor (Heri Irawan, 2026)	The simultaneous use of two different media increases the risk of inconsistency between manual and electronic data, which ultimately hinders productivity and the efficiency potential of the hospital information system.	The advantage of implementing a dual system lies in the creation of data redundancy that increases the security of medical information. This system is more adaptive for healthcare workers who are not yet familiar with technology, allowing operations to continue while minimizing the risk of data loss if technical issues occur.
3	Analysis of Risks and Preventive Measures for Electronic Medical Record Data Leakage of Patients at RS P Jakarta (Budiman, Isa, & Soekiswati, 2025)	There has not been an in-depth evaluation regarding the costs and resources required to implement such complex security protocols.	Identifies various dimensions of risk, ranging from physical environmental factors and human error to technical complexity. By using comprehensive information security principles (Confidentiality, Integrity, Availability) and the HMN framework. In 24-hour service facilities, this study provides very practical guidance for hospital management.
4	Review of Factors Causing Duplication of Medical Record Numbering at RS Panti	The use of a cross-sectional design only provides a snapshot at one point in time, making it less capable of monitoring the effectiveness of the	Identifies the issue comprehensively from the perspectives of method, machine, and environment using a fishbone diagram (Ishikawa). The

	Waluyo (Saryadi, 2023)	Surakarta Ambar Seti,	proposed solutions over the long term.	study not only explains the causes but also provides practical solutions applicable to hospital management, ranging from SIMRS aspects and procedures to merging files to maintain medical record numbering consistency.
5	Factors Causing Duplication of Medical Record Numbering in Health Service Facilities (Erawantini et al., 2022)		There is insufficient discussion regarding strategies for integrating the latest technologies, such as biometric utilization or NIK validation (Population Identification Number), which is currently a national standard to minimize duplication.	The use of a comprehensive management analysis framework (5M: Man, Money, Method, Material, Machine) reveals that duplication of medical record numbers is not merely a technical issue, but also involves human resources, budget limitations, and infrastructure. This study provides a thorough overview for policymakers in health facilities to determine service improvement priorities and efficiency efforts.
6	Socialization of Electronic Medical Records and Duplication Prevention for Registration Officers at Arvat Medika Tunon General Hospital 2022 (Laila, Huda, & Arvani, 2023)		Identification of problems in accessing computers that are difficult to access and manual writing systems places a greater burden on staff (manpower), whereas infrastructure improvement (hardware) should be an additional recommendation for management.	The use of very systematic problem analysis with fishbone diagrams and the 5 why method successfully identified root causes down to the most basic level. In addition, the implementation of PDSA and HISO as concrete coordination steps for deactivating duplicate numbers greatly supported integrated data management and strengthened preventive efforts.
7	Analysis of the Identification of SIMRS as a Cause of Medical Record Number Duplication at Muhammadiyah Lamongan Hospital from January to March 2022 (Rizkhika et al., 2022)		The research method is still descriptive and lacks statistical analysis to determine the most dominant factors causing medical record duplication. The study was only conducted in one room, so the findings cannot be generalized to all health facilities. In addition, discussion on improvements in registration work flow and data security has not been deeply explored. The discussion regarding the use of SIMRS technology and electronic data security is also not comprehensively addressed.	The use of the 5M management analysis approach (man, money, material, machine, method) enables the causes of medical record duplication to be analyzed thoroughly and systematically. The study also strengthened the data with findings of 236 duplicate medical record cases from January–March 2022, making the discussion more measurable and evidence-based. In addition, this study identified the main causes of duplication, such as lack of carefulness among registration officers, patients not carrying KIB cards, and SOPs that were not optimally implemented. The language used is sufficiently simple and easy to understand, making it suitable as a reference for students and practitioners in the health sector.
8	Analysis of Factors Causing Duplication of Medical Record Numbers at TPRJ RSUD Prof. Dr.		There is still insufficient discussion regarding the technical details of SIMRS integration failures mentioned, whereas the health	The use of a highly comprehensive theoretical framework, namely Armstrong's theory and the 5D fishbone diagram (Urgency,

	Purwokerto (Desi Wahyuningsih, 2025)	information system is the main issue in automatic duplication prevention.	Seriousness, Growth). The use of the fishbone triangle method validated the findings very well, resulting in recommendations with a strong theoretical and systematic basis.
9	Analysis of the Duplication Level in Clinical Information System Data Completeness at Anhari Hospital Using the Pieces Method (Marsyahda, Widiyanto, & Sukmaningsih, 2026)	The study did not include a quantitative comparison of efficiency between before and after EMR implementation, making it difficult to measure how much efficiency and registration time reduction were generated by the system.	The use of the PIECES method, which measures evaluation comprehensively from six crucial dimensions, from performance to service aspects. This analytical approach is very suitable for examining operational impacts, especially since the findings showed a time reduction of 7 to 10 cases per month and increased work productivity in a health information system environment.
10	Analysis of Factors Causing Duplication of Electronic Medical Records (RME) in the Hospital Management Information System (SIMRS) at AMC Hospital (Rahma Nisaa Ramadha Kusetiono, 2024)	The number of informants in the study was still limited, so the results did not fully represent all units in the hospital. The research method used was still descriptive qualitative and had not been supported by in-depth statistical analysis. The study was also conducted in only one hospital, making the results difficult to generalize to other facilities with different systems. In addition, the article did not comprehensively discuss data security aspects and SIMRS governance, nor did it evaluate the effectiveness of the recommended solutions. Discussion comparing previous studies was also limited, making the comparison of research findings less comprehensive.	The strength of this journal lies in the relevance of the research topic to the development of healthcare digitalization, particularly regarding duplication of Electronic Medical Records (EMR) in the Hospital Management Information System (SIMRS). The study used a 5M analysis approach (man, machine, method, material, money), allowing the causal factors to be systematically identified from various aspects. Research data were obtained directly through observation, interviews, and document review, enabling a realistic description of field conditions. In addition, the journal provides applicable solutions such as data validation using NIK, optimization of the merge record feature, and improvement of staff and patient education. The use of simple and systematic language makes the journal easy to understand for both students and medical record practitioners.
11	Factors Causing Duplication of Patient Medical Record Numbers (Rosita & Apriyani, 2023)	The use of a cross-sectional survey design only captures problems at a single point in time without assessing the frequency of incidents based on daily workload. In addition, the study recommendations were still very general, without providing clear technical priorities for improvement measures that should be implemented first.	The sharpness of the observational findings successfully revealed two sides of the numbering issue. The finding regarding the use of the same number by more than one patient (overlap) is a point that is rarely discussed but highly dangerous for patient safety. Furthermore, the researchers accurately linked the risk of failure in the numbering system with the potential for medical malpractice, thus providing a strong sense of urgency for management to take immediate action.

The final sample consisted of 11 Indonesian-language scientific articles published between 2022 and 2026. Eight articles directly examined medical-record duplication or duplicate numbering, while three contextual studies were retained because they addressed staff training, dual-record workflows, or EMR data-risk mechanisms relevant to duplication prevention. The settings included public and private hospitals and community health centers in several regions of Indonesia. Study designs included descriptive qualitative research, observational studies, fishbone or 5M analyses, literature synthesis, and quality-improvement reports.

Across the included evidence, medical-record duplication appeared in multiple types of healthcare facilities and was associated with interactions among people, technology, registration procedures, governance, and infrastructure. Facilities using EMR and those operating manual or dual systems reported similar categories of problems, although the severity and local circumstances varied.

Human-resource factors were reported in seven studies, system-and-technology factors in three, process-and-SOP factors in three, policy-and-governance factors in two, and infrastructure factors in two. Because a study could contribute to more than one theme, these frequencies are not mutually exclusive and should be interpreted as reporting patterns rather than a causal ranking.

DISCUSSION

Factors Causing Medical Record Duplication

1. Human Resource Factors

Human-resource (HR) factors were the most frequently reported dimension in the included evidence. Rizkhika et al. (2022), using a 5M analysis at Muhammadiyah Hospital Lamongan, found that registration officers did not always have appropriate educational qualifications and had not received sufficient medical-record training. Frequent HMIS errors also complicated the registration process. These findings were supported by Aini et al. (2022), who reported limited understanding of the numbering system, qualifications that did not consistently meet standards, and inadequate SOP implementation and evaluation.

Aini et al. (2022) also found that weak organizational support, such as lack of supervision, absence of SOPs, and no reward or punishment system, contributed to duplication. Wahyuningsih (2025) identified high workload, inappropriate educational qualifications, and limited management supervision as additional contributing factors. Rosita and Apriyani (2023) highlighted low patient compliance in bringing patient identity cards (KIB), which was often poorly anticipated by officers.

2. System and Technology Factors

Rahma Nisaa Ramadhani Kusetiono (2024) found that the hospital information system lacked adequate duplication prevention mechanisms. The absence of automatic alerts when creating new medical record numbers for already registered patients became a major gap enabling repeated duplication. Similarly, Putra, Hunna, and Fadhila (2022) found that HMIS components in many medical record units were inadequate to support accurate services, indirectly increasing duplication risks.

Rahmawati and Ulfah (2024) found that duplicate medical records occurred because the HMIS lacked effective data merging features, making systematic management of duplicate numbers difficult. This condition indicates that technology investment without proper system design cannot solve duplication problems.

3. Process and Standard Operating Procedure Factors

The absence or weak implementation of SOPs during patient registration was consistently identified as a structural factor. Luh Gede Asri Martania Dhansunu and Bambang Hadi Kartiko (2024) revealed that duplication caused delays in medical record file provision and BPJS claim

processes due to weak control at registration points and inconsistent identity verification procedures.

Chresia Ericha et al. (2023) found that more than half of the studied institutions still experienced duplication despite having SOPs, indicating that SOP availability alone is insufficient without implementation, supervision, and enforcement.

4. Policy and Governance Factors

Aini et al. (2022) found that the absence of formal policies regarding Master Patient Index (MPI) management, lack of periodic data audits, and weak management accountability systems contributed to ongoing duplication problems in healthcare facilities.

5. Infrastructure Factors

Limited technological infrastructure also worsened duplication problems. When HMIS servers experienced disruptions or internet connections became unstable, registration officers tended to switch to manual procedures, increasing the likelihood of duplicate entries. Rosita and Apriyani (2023) identified inadequate information technology infrastructure as a structural contributor to duplication.

Evidence-Informed Continuous Improvement Recommendations

Based on the synthesis of the 11 analyzed articles, this study developed an evidence-informed continuous-improvement framework integrating the PDCA cycle, Kaizen principles, data cleansing, and Master Patient Index (MPI) implementation. This framework represents a practical mapping of reported causes to potential actions and was not independently tested as an intervention in this review.

Implementation of the PDCA Cycle in Managing Medical Record Duplication:

- a) Plan
Establish measurable duplication reduction targets (e.g., zero new cases per month), revise patient identity verification SOPs, and redesign technology-based registration workflows integrating automatic identity verification.
- b) Do
Implement automatic alert systems within HMIS to prevent duplicate medical record numbers, provide periodic intensive training for registration officers, and gradually enforce new SOPs across all service units.
- c) Check
Conduct routine data audits (at least monthly) to detect duplication cases, monitor staff compliance with SOPs, and evaluate the effectiveness of implemented alert systems.
- d) Act
Improve SOPs and systems based on audit findings, strengthen ineffective mechanisms, and standardize best practices across all service units continuously.

Implementation of Data Cleansing and Master Patient Index (MPI)

Rahmawati and Ulfah (2024) and Rokhman et al. (2020) reported that identifying duplicate numbers, verifying patient identity, merging records into a valid primary number, and deactivating confirmed duplicate records could support systematic data cleansing. After cleansing, MPI can provide a single reference for patient identity across service units and may reduce future duplication. Implementation should include safeguards such as authorized access, identity verification using more than one identifier, audit logs, review before merging or deactivation, and a recovery procedure when an incorrect merge is detected.

Table 1. Summary of Root Causes and Continuous Improvement Recommendations

Dimension	Specific Factors	CI Recommendations	References
Human Factors	Lack of accuracy, low digital literacy, high workload, limited training	Continuous training (Kaizen), strict SOP implementation, registration supervisors, adequate staffing quotas	(Rizkhika et al. 2022; Aini et al. 2022; Desi Wahyuningsih 2025; Rosita & Apriyani 2023; Rahmadanti & Yunengsih 2023; Laila et al. 2023; Erawantini et al. 2022)
Systems & Technology	No duplication alert system, suboptimal SIMRS, absence of MPI features	SIMRS upgrades, MPI implementation, automatic alerts, audit trails, inter-unit integration	(Kusetiono & Sari 2024; Heri Irawan 2026; Marsyahada et al. 2026)
Processes & SOPs	SOPs unavailable or not enforced, unstandardized registration workflows	SOP standardization, Gemba walk, periodic PDCA implementation, mandatory identity verification	(Luh Gede Asri Martania Dhansunu, Bambang Hadi Kartiko 2024; Erawantini et al. 2022; Rahmadanti & Yunengsih 2023)
Policies & Governance	No formal MPI policy, absence of data audits, weak accountability	Formal MPI policies, monthly audits, data quality KPIs, managerial accountability	(Aini et al. 2022; Wahyuningsih & Licia 2025)
Infrastructure	Unstable internet connection, limited hardware, inadequate backup systems	Infrastructure investment, backup systems, redundant connections, emergency manual procedures	(Rosita & Apriyani 2023; Marsyahada et al. 2026)

LIMITATIONS

This review has several limitations. The search was limited to Google Scholar and Indonesian-language evidence, the included studies used heterogeneous designs, and no meta-analysis was appropriate. Several contextual studies were retained to inform prevention strategies, while supplementary sources outside the 11-study sample were used only for implementation context. In addition, the proposed PDCA, Kaizen, data-cleansing, and MPI actions were synthesized from the literature and were not evaluated as a single intervention. Future studies should test the framework prospectively and report standardized duplication indicators.

CONCLUSION

Based on the Systematic Literature Review of 11 articles identified through Google Scholar, the evidence indicates that medical-record data duplication in Indonesia is a multidimensional problem involving five interrelated dimensions:

1. Human Resource Factors: Limited accuracy, digital competency, training, and staffing capacity were the most frequently reported contributors.
2. System and Technology Factors: Lack of automatic alert features in HMIS, limited real-time identity validation capabilities, and absence of integrated MPI implementation.
3. Process and SOP Factors: Inconsistent implementation of registration SOPs, weak patient identity verification at registration points, and absence of standard procedures for patients without identity cards.
4. Policy and Governance Factors: Lack of formal MPI policies, absence of periodic data audit mechanisms, and weak managerial accountability regarding data quality.

5. Infrastructure Factors: Unstable internet connections, limited hardware availability, and weak backup systems encouraging manual procedures.

Addressing medical-record duplication requires a coordinated approach rather than an isolated technical correction. A continuous-improvement framework involving PDCA, Kaizen, MPI, and structured data cleansing may support earlier detection, safer resolution, and prevention of new duplicate numbers. Its implementation should be adapted to local workflows and supported by management commitment, adequate infrastructure, staff development, identity-verification safeguards, and routine evaluation.

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Ethical Approval Statement: This study was a systematic literature review based exclusively on publicly available scientific publications and did not involve human participants, animals, biological specimens, or identifiable private information. Therefore, institutional ethical approval was not required.

Informed Consent Statement: Not applicable because this study did not directly involve human participants.

Data Availability Statement: The data supporting the findings of this review were obtained from the publicly available articles cited in the reference list. The extracted and synthesized information is presented within this article.

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Conflict of Interest: The authors declare no conflict of interest.

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