



Analysis of Patient Photograph-Based Electronic Informed Consent Implementation in HMS Khanza at a Hospital

I Made Satria Adi Harta¹, Anton Mulyono Azis², Helni Mutiarsih Jumhur³

^{1,2}, Affiliation (Faculty of economic and Business, Telkom University, Indonesia)

Corresponding email: madesatriaadiharta@gmail.com

DOI: <https://doi.org/10.54099/aijbs.v6i2.2001>

ARTICLE INFO

Research Paper

Article history:

Received: 12 August 2026

Revised: 115 September 2026

Accepted: 2 October 2026

Available online:

Keywords: *Electronic Informed Consent, Electronic Medical Record, Biometric Authentication, Operational Efficiency, Change Management*

ABSTRACT

Purpose – This study analyzes the effectiveness and efficiency of patient photograph-based electronic informed consent (e-IC) at Puri Adhya Paramita Hospital, focusing on managerial adaptation, legal and ethical compliance, and data security. **Methodology/approach** – A descriptive qualitative case study was conducted. Data were collected through in-depth interviews with eight purposively selected informants, including hospital management, physicians, nurses, medical records officers, IT personnel, patient representatives, the District Health Office, and the IDI Ethics Committee. Non-participatory observations and document reviews were also conducted. Data were analyzed using the Miles and Huberman interactive model and theoretical triangulation. **Findings** – The implementation of photograph-based e-IC improved administrative efficiency through paperless processes and enhanced documentation using photo metadata, including timestamps, geolocation, and device identification. Initial staff resistance and patient confusion were addressed through change management based on Kurt Lewin's model and humanistic communication. Legally and ethically, the system supports patient autonomy and is aligned with Indonesian electronic information and health regulations, while manual consent remains available for patients who decline photography. Data protection is supported through encrypted internal storage and role-based access controls. **Novelty/value** – This study contributes empirical evidence on using patient photographs as supporting evidence of daily medical consent and highlights the need for clearer national regulations concerning biometric data protection in electronic medical records.

[This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.](https://creativecommons.org/licenses/by-nc/4.0/)

INTRODUCTION

The massive advancement of information and communication technology has driven a positive disruption in the global healthcare sector, particularly through the digitalization of medical documents. In Indonesia, the transition from conventional medical records to digital systems is reinforced by government regulations, notably the Minister of Health Regulation (PMK) No. 24 of 2022 concerning Medical Records, which mandated all healthcare facilities to implement Electronic Medical Records (EMR) by December 31, 2023. One of the fundamental components of EMR is the process of medical

consent, or informed consent, which has traditionally been paper-based and is now transforming into electronic informed consent (e-IC). Ethically and medically, informed consent is not merely an administrative formality, but rather an embodiment of protecting patient autonomy and providing legal protection for physicians in carrying out medical interventions. However, manual paper-based execution often faces operational limitations, such as administrative inefficiency, risks of documents being lost, torn, or damaged, and difficulties in retrieval when future legal disputes arise.

Puri Adhya Paramita Hospital, a specialized Class-C hospital in Central Lampung Regency managed by PT Adhya Paramita Medica, has responded to these digital demands by integrating its information systems using the open-source platform HMS Khanza. As part of the EMR integration, the hospital launched an innovative e-IC implementation that utilizes facial photographs of patients or their representatives as authentic evidence of consent, replacing conventional manual signatures. This strategic move reflects the operational flexibility and cost-effectiveness highly relevant to resource-limited healthcare facilities in Indonesia. However, the transition from paper signatures to biometric visual documentation triggers complex dynamics, ranging from the managerial readiness of information systems and the management of change in clinical staff work cultures to compliance with emerging regulations such as Law No. 27 of 2022 concerning Personal Data Protection (UU PDP) and the Indonesian Code of Medical Ethics (KODEKI).

Literature reviews on the digitalization of medical consent have been extensively explored by previous researchers, which can be grouped into several key themes. The first theme focuses on the effectiveness and efficiency of e-IC, with numerous studies concluding that e-IC significantly enhances patient understanding, enriches patient engagement with medical content, and drastically minimizes documentation errors compared to paper forms. Nonetheless, some experimental studies have also noted that the use of interactive multimedia features has the potential to extend the cycle time because patients require more time to interact with the system. The second theme addresses managerial challenges and health information system adoption. The successful adoption of technology in hospitals is heavily influenced by transformational leadership in building user trust, increasing perceived usefulness, and overcoming medical staff resistance through structured change management. The third theme highlights the ethical, legal, and security aspects of biometric data. The use of biometric technology, such as capturing patient facial photographs, is highly sensitive because facial data belongs to the category of specific personal data that is strictly protected by law. The lack of implementing regulations governing the restrictions on biometric facial recognition technology in Indonesia often creates a technical legal vacuum that increases the risks of privacy violations and misuse of patient data.

Although the digitalization of medical consent has been explored globally, a distinct research gap persists in the current literature. The majority of previous studies have evaluated Electronic Informed Consent (e-IC) primarily within controlled clinical trial environments or focused on interactive multimedia tools using touchscreen stylus signatures (Cohen et al., 2023; Goldschmitt et al., 2025; Rowbotham et al., 2013). Consequently, there is a clear empirical gap regarding the legal validity, operational feasibility, and ethical acceptability of using daily patient biometric photographs as authentic evidence of medical consent integrated directly into hospital information systems (HMS) in low-resource healthcare settings.

Furthermore, this study addresses two critical research problems—both theoretical and practical. Theoretically, a significant gap exists regarding how healthcare institutions can navigate the regulatory vacuum surrounding biometric face recognition technology in Indonesia, balancing the automated efficiency of Health Information Systems (MIS) with the stringent data privacy mandates under Law No. 27 of 2022 on Personal Data Protection (UU PDP) and the bioethical principles of KODEKI (Husna

et al., 2025; Sintyasari & Risdawati, 2025). Practically, hospitals face severe operational challenges with conventional paper consents—such as missing physical records, high archiving costs, and legal vulnerabilities—while third-party certified digital signatures impose substantial transactional costs and complex registration barriers for patients (Bahasuan & Sukoco, 2021; Rijal Husni, 2022). Additionally, clinical staff often display strong behavioral resistance to paperless transitions, necessitating structured change management (Wijaya, 2025).

To bridge these gaps and resolve these dual problems, this study provides a comprehensive qualitative analysis evaluating the photograph-based e-IC implementation on HMS Khanza at Puri Adhya Paramita Hospital. The objectives of this study are threefold: (1) to analyze the effectiveness and efficiency of photograph-based e-IC documentation compared to conventional methods, (2) to identify managerial challenges in work culture adaptation based on change management theory, and (3) to evaluate the legal strength and ethical compliance of biometric photo consent under personal data protection regulations and medical ethics standards in Indonesia.

LITERATURE REVIEW

Electronic Informed Consent (e-IC) and Digital Authentication in Health Information Systems

The transition from paper-based consent forms to Electronic Informed Consent (e-IC) represents a foundational shift in modern Health Information Systems (MIS) management (Goldschmitt et al., 2025). Literature demonstrates that conventional paper consents are severely limited by administrative inefficiencies, documentation errors, physical filing costs, and legal vulnerabilities during medical disputes (Reeves et al., 2020). Digital consent platforms resolve these limitations by establishing automated workflows, reducing document cycle times, and minimizing documentation error rates from 43% down to zero (Kaur et al., 2025; Ngoliwa et al., 2024). A critical dimension of e-IC implementation is data integrity and non-repudiation (Cohen et al., 2023). While early digital consent tools relied on stylized touchscreen signatures, recent studies highlight that basic digital signatures are vulnerable to legal challenge and forgery (Astromskè et al., 2021). To address this limitation, health systems are increasingly deploying biometric verification tools—such as patient photograph capturing—that permanently bind UTC time-stamps, GPS geolocation coordinates, and device hardware credentials to the digital document (Iype & Sebastian, 2024). In resource-constrained hospitals, integrating photograph-based authentication directly into open-source Hospital Information Systems (SIMRS) offers a cost-effective, highly reliable alternative to costly third-party certified digital signature services (Ngoliwa et al., 2024).

Organizational Change Management and Technology Adoption in Healthcare

Implementing digital health innovations is fundamentally a socio-technical transformation that disrupts established clinical routines and employee comfort zones (Jaana et al., 2024). Studies on Health Information Technology (HIT) adoption reveal that technical usability alone does not guarantee success; user resistance from clinical staff and anxiety among low-literacy patients often create severe barriers to implementation (Gesualdo et al., 2021). To overcome organizational inertia, healthcare institutions utilize Kurt Lewin's Three-Step Change Management Framework, comprising Unfreezing, Changing, and Refreezing (Trihandari et al., 2025). The Unfreezing stage exposes the vulnerabilities of legacy paper workflows, creating a shared urgency for change. The Changing stage facilitates transition through structured technical training, hands-on administrative support, and humanistic communication protocols that guide clinicians on how to explain digital systems to patients (Warriner et al., 2016). Finally, the Refreezing stage institutionalizes the digital culture by withdrawing paper forms and reinforcing mandatory system usage through leadership support and continuous monitoring (Wijaya, 2025).

Medicolegal Framework, Bioethics, and Personal Data Protection in Biometric Health Records

The capture and digital storage of patient facial photographs introduce complex legal and bioethical challenges (Bhattacharjee et al., 2023). Under international privacy standards and national legislations—such as Indonesia's Law No. 27 of 2022 on Personal Data Protection (UU PDP)—facial photographs are classified as Specific Personal Data (Sensitive Biometric Records) subject to stringent regulatory oversight (Husna et al., 2025; Sintyasari & Risdawati, 2025). Unauthorized processing or public disclosure of biometric data exposes healthcare institutions to severe legal liabilities (Bhattacharjee et al., 2023). From a bioethical perspective, digital consent must adhere to the core principle of Patient Autonomy established in medical ethics codes such as KODEKI (Dzi et al., 2025). Informed consent is not merely an electronic check-box or a photograph capture; it requires clear verbal explanation, patient comprehension, and voluntary agreement without coercion (Chane et al., 2020; De Sutter et al., 2020). When patients refuse photo capture due to personal, religious, or cultural reasons (such as female patients wearing a niqab), ethical compliance mandates that the system must provide alternative hybrid options, such as manual paper signing, thereby respecting patient rights while maintaining legal validity under Electronic Information and Transactions (ITE) laws (Bahasuan & Sukoco, 2021).

Conceptual Research Framework

Based on the synthesis of Information Systems Management, Change Management theory, and Medicolegal frameworks, this study formulates an integrated conceptual research framework to analyze the implementation of photograph-based e-IC on HMS Khanza. The framework bridges three core dimensions: first, System and Operational Efficiency (MIS), evaluating how open-source SIMRS integration optimizes paperless workflows and metadata-driven non-repudiation; second, Socio-Technical Adaptation (Change Management), mapping how Kurt Lewin's model transforms organizational work culture from paper reliance to digital institutionalization; and third, Medicolegal and Bioethical Governance (Law and Ethics), examining how internal Standard Operating Procedures (SOPs) balance Law No. 27 of 2022 (UU PDP) data protection with KODEKI patient autonomy.

METHOD

This study employs a descriptive qualitative approach with a single-case study design to explore the implementation of patient photograph-based Electronic Informed Consent (e-IC) using HMS Khanza at Puri Adhya Paramita Hospital, Central Lampung, Indonesia. A qualitative case study design was selected because it allows an in-depth, contextual exploration of a complex socio-technical phenomenon within its natural operational setting without manipulating variables.

Research Setting and Social Situation

The research was conducted at Puri Adhya Paramita Hospital, a private Type C specialty hospital focusing on maternal and child health located in Bandar Jaya, Central Lampung Regency, Lampung Province, Indonesia. In accordance with qualitative research standards, the social situation under investigation encompasses three interconnected dimensions: place, actors, and activities. The place dimension encompasses the clinical service units, outpatient clinics, inpatient wards, emergency department, and medical records department where the e-IC module is actively operated. The actors dimension includes healthcare professionals (physicians, ward nurses, medical records officers, IT developers), hospital executive management, patients and their family guarantors, as well as external regulatory officials from the Health Office and Medical Ethics Committee. The activities dimension represents the operational consent workflow, which includes explaining medical procedures, obtaining

explicit oral consent, capturing the patient's photograph through the HMS Khanza interface, and securely storing biometric consent data in encrypted local servers.

Informant Selection and Data Saturation

The informants of this study were selected using a non-probability, purposive sampling technique based on their direct involvement, operational experience, and specialized knowledge regarding the e-IC implementation. The final sample size was governed by the principle of data saturation, defined operationally as the point of thematic redundancy where additional interviews yielded no new conceptual codes or categories. Data saturation was continuously evaluated during field research through constant comparative analysis across interview transcripts. Thematic saturation was formally reached during the analysis of the final three transcripts, as no novel open codes emerged during the cross-examination of data from clinical nurses, service users, and regulatory ethics representatives.

A total of eight key informants participated in this study, establishing a multi-stakeholder triangulated cohort. The informant group comprised Informant 1 (N1), the Lead Developer of HMS Khanza and IT Specialist (Windiarlo Nugroho, S.Kom); Informant 2 (N2), the Hospital Director of Puri Adhya Paramita Hospital (dr. Muji); Informant 3 (N3), the Head of Medical Services (dr. Chandrika); Informant 4 (N4), the HRD and Operations Manager (Prasetyo); Informant 5 (N5), the Head of the Central Lampung Health Office (dr. Josi Harnos); Informant 6 (N6), a Clinical Ward Nurse Practitioner (Esti Wardani); Informant 7 (N7), a Patient's Family Member and Service User (Pak Supriyatno); and Informant 8 (N8), the Chairman of the Medical Association Ethics Committee (Ketua MKEK IDI).

Data Collection Techniques and Trustworthiness

Data were gathered through three primary qualitative methods to ensure comprehensiveness and enable rigorous triangulation. First, semi-structured in-depth interviews were conducted face-to-face or virtually using a standardized interview guide to explore user experiences, technological usability, change management dynamics, and legal-ethical perceptions. Second, non-participative field observations were executed in real-time within clinical settings to witness the actual e-IC workflow, hardware arrangements (such as webcam positioning and tablet integration), nurse-patient interactions during consent explanations, and the digital capturing of photos on HMS Khanza. Third, a documentary review was performed analyzing internal and external regulatory documents, including the Hospital's Standard Operating Procedure for Electronic Informed Consent (RSIAPAP/SPO/RM/082), system flowcharts, user manuals, database interface screenshots, and national regulatory frameworks (PMK No. 24 of 2022, UU PDP No. 27 of 2022, and UU ITE No. 11 of 2008).

To establish the credibility, transferability, dependability, and confirmability of the qualitative findings, this study utilized three-way triangulation techniques. Source triangulation was achieved by cross-verifying data obtained from different informant tiers (comparing executive strategy with clinical nurse experiences and patient feedback). Methodological triangulation was established by correlating interview transcripts with direct field observation notes and written SOP policies. Time triangulation was executed by conducting follow-up observations across different clinical shifts to verify procedural consistency and system stability.

Qualitative Data Analysis and Coding Hierarchy

The collected qualitative data were processed iteratively using the Miles and Huberman Interactive Model, integrated with a three-cycle coding hierarchy adapted from Strauss and Corbin. In the first cycle (open coding), interview recordings were transcribed verbatim and analyzed line-by-line, generating 42 discrete empirical open codes that captured specific operational observations such as administrative task duration, webcam cable length, staff digital anxiety, and metadata binding. In the second cycle (axial coding), these open codes were systematically grouped based on conceptual overlaps into seven axial sub-themes representing operational categories. In the third cycle (selective coding), the axial sub-themes were further synthesized into three overarching core themes that directly address the research propositions: Health Information Systems Efficiency and Metadata Integrity,



Organizational Change Management and Work Culture Transformation, and Medicolegal Compliance, Bioethics, and Personal Data Protection.

RESULT AND DISCUSSION

he analysis appears largely descriptive and does not sufficiently demonstrate how interview data were systematically transformed into the reported themes and conclusions.

Qualitative Data Transformation and Analytical Synthesis

To address the methodological requirement of demonstrating how raw qualitative data were systematically transformed into reported themes, the analysis followed a transparent data transformation matrix. The primary verbatim interview evidence gathered from the eight key informants (N1–N8), field observation notes, and institutional SOP documents underwent rigorous thematic synthesis. First-cycle open codes were mapped onto functional axial categories, which were then synthesized into three core analytical themes through theoretical triangulation.

As detailed in Table 1, the qualitative data transformation matrix illustrates the direct logical path connecting raw informant statements, open codes, axial themes, and theoretical frameworks across Management Information Systems (MIS), Organizational Change Management, and Medical Ethics and Law.

Table 1. Theoretical Triangulation Matrix of e-IC Implementation Findings

Research Findings & Raw Data	Management Information Systems (MIS)	Change Management	Medical Ethics & Law
High system usability and paperless efficiency (N6, N4)	High system quality & workflow automation	Positive technology adoption	Paperless administrative validity
Metadata integrity & timestamp binding (N1, N2)	Metadata tracking & non-repudiation	System credibility building	Authentic digital signature standing
Staff resistance & digital adaptation (N4, N6)	User interface optimization	Kurt Lewin Unfreezing & Changing	Staff compliance protocols
Humanistic clinical communication (N6, N7)	User-centric SOP facilitation	Proactive change communication	Bioethical Respect for Autonomy
Niqab & cultural refusal accommodation (N6, N8)	Hybrid system flexibility	Inclusive change management	KODEKI Autonomy & ITE Validity

On-premise database encryption (N1, N5)	Structural cybersecurity & access control	Data governance assurance	UU PDP No. 27/2022 Sensitive Data
Infrastructure constraints & cable length (N1, N6)	Hardware & network limitations	Operational transition barriers	Institutional SOP enforcement

Effectiveness and Efficiency of Patient Photograph-Based e-IC (MIS Perspective)

From a Management Information Systems (MIS) perspective, system performance is evaluated based on its ability to establish smart operations, ensure information quality, and maintain security controls. The empirical results demonstrate that the photograph-based e-IC module integrated into HMS Khanza at Puri Adhya Paramita Hospital achieved substantial operational optimization across these areas. First, regarding workflow automation, the transition from paper-based consent forms to the digital e-IC system eliminated massive administrative redundancies. Under the legacy paper system, nursing staff spent extensive time preparing physical forms, obtaining physical signatures, and manually filing documents in archives. As outlined in Table 1, Informant N6 (a clinical ward nurse) confirmed that the digital system streamlined bedside clinical workflows, stating that nurses no longer need to run back and forth to locate paper forms or physically archive them, as the entire consent process is executed instantly at the patient's bedside via the terminal. This operational efficiency was corroborated by Informant N4 (HRD and Operations Manager), who noted that task duration and administrative cycle times have been drastically reduced, aligning with the hospital's strategic roadmap toward paperless operations.

Second, concerning information quality and non-repudiation, the lead IT developer (Informant N1) emphasized that utilizing a patient's photograph as digital evidence provides superior legal and administrative validity compared to basic touchscreen stylus signatures. Stylus signatures on screens can easily be disputed or forged; however, the photograph-based consent system automatically captures and binds metadata directly to the image file, including the precise UTC network time-stamp, GPS location coordinates, device hardware ID, and the logged-in staff credentials. As shown in Table 1, this structural metadata linkage creates an unalterable audit trail that guarantees data integrity and prevents retroactive manipulation.

Third, to address low digital literacy among patients and guarantors, the hospital successfully implemented a staff-mediated, user-centric operational procedure. Under the Standard Operating Procedure for Electronic Informed Consent (RSIAPAP/SPO/RM/082), medical staff retain control of the SIMRS terminal, presenting digital explanations on screen, guiding the patient, and initiating camera capture. Informant N7 (a patient's family member) confirmed the convenience of this process, noting that it was straightforward because nurses explained the medical procedure clearly, showed the screen, and simply required looking at the camera without navigating complicated applications.

These empirical findings strongly align with prior literature, particularly the clinical outcomes of Kaur et al. (2025) and Ngoliwa et al. (2024), who demonstrated that tablet-based digital consent tools in low-resource hospitals achieved complete adoption while eliminating documentation errors that previously stood at 43% under paper systems. Furthermore, by replacing touchscreen signatures with biometric photograph verification, the hospital bypassed the high transactional costs and complex registration barriers associated with third-party certified digital signature providers (such as PrivyID), which require national identity card (KTP) verification and cellular OTP registration. This cost-effective and highly reliable model confirms that integrated, metadata-driven health information systems significantly optimize operational efficiency and information quality in clinical administration.

Managerial Challenges and Organizational Work Culture Transformation (Change Management Perspective)

Technological adoptions in healthcare settings represent complex socio-technical transitions that disrupt established work cultures and employee comfort zones. The introduction of the photograph-based e-IC system at Puri Adhya Paramita Hospital initially triggered organizational resistance and user anxiety. To systematically analyze and address these human resource challenges, the hospital management applied Kurt Lewin's Three-Step Change Management Model, comprising Unfreezing, Changing, and Refreezing.

During the Unfreezing stage, management destabilized the established behavioral equilibrium by creating a shared awareness of paper-based limitations. Informant N4 (HRD Manager) observed that staff members were entrenched in manual habits, as nurses and physicians had signed paper forms for years. To break this inertia, Informant N2 (Hospital Director) initiated a proactive campaign, reframing the e-IC transition not as an administrative burden, but as a critical medicolegal protective shield for clinical staff. Socialization sessions presented concrete data on manual filing errors, paper damage rates, and legal vulnerabilities of disputed physical signatures.

The Changing stage facilitated organizational movement toward the new state through active learning, skills acquisition, and operational adjustments. Hospital management provided comprehensive technical training for nursing and medical records staff, incorporating specialized modules on humanistic clinical communication. This training taught nurses how to politely request photograph consent, address privacy concerns, and explain the digital process without causing alarm. These communication protocols were codified into Steps 4 and 5 of SOP RSIAPAP/SPO/RM/082. To minimize operational disruptions during initial teething phases—such as minor technical glitches or short webcam cables—the IT team provided real-time, on-site support directly in the wards.

The Refreezing stage stabilized the new equilibrium, integrating the digital system into permanent organizational culture. Management enforced a corporate mandate: physical paper consent forms were officially withdrawn from wards, and SIMRS e-IC usage was made mandatory, backed by continuous monitoring. Informant N6 (ward nurse) reflected that while the process initially felt slower during camera adjustment, it quickly became second nature and proved substantially faster and cleaner than paper.



Figure 1. Lewin's Change Management Framework Applied to e-IC Adoption
(Source: Synthesized from research findings and SOP RSIAPAP/SPO/RM/082, processed by author)

This structured socio-technical transition aligns perfectly with the empirical insights of Wijaya (2025), who studied EMR adoption in primary care clinics in Bali. Wijaya (2025) concluded that transformational leadership styles are directly correlated with full technology acceptance, whereas laissez-faire leadership leads to fragmented adoptions. The proactive involvement of dr. Muji (Informant N2) as a transformational leader who championed the e-IC project was the decisive factor in overcoming staff resistance and successfully shifting the organizational work culture, as illustrated in Figure 1.

Strategic SWOT Analysis and Personal Data Protection (PDP) Lifecycle Alignment

To systematically evaluate the strategic position and regulatory compliance of the photograph-based e-IC system within the hospital's broader operational framework, the research synthesized empirical findings into an integrated matrix combining SWOT strategic dimensions with the Personal Data Protection (PDP) lifecycle under Law No. 27 of 2022.

As evaluated in Table 2, the internal strengths of the system are anchored in its compliance with national health regulations (PMK No. 24 of 2022), paperless operational efficiency, and metadata-driven non-repudiation. Internal weaknesses center on hardware constraints, such as short webcam cables in ward terminals and server vulnerability during power outages. External opportunities include establishing an operational SOP blueprint for regional Type-C hospitals and pioneering biometric consent standards. External threats involve the regional regulatory vacuum surrounding face recognition guidelines and legal liabilities under Law No. 27 of 2022 if biometric data breaches occur.

Furthermore, Table 2 maps the hospital's Standard Operating Procedure (RSIAPAP/SPO/RM/082) against the six core stages of the PDP lifecycle mandated by Law No. 27 of 2022. During data collection (Stage 1), Step 8 of the SOP enforces explicit verbal consent prior to photographing, respecting patient autonomy. During data processing (Stage 2), Step 10 mandates immediate metadata binding (UTC timestamp, GPS coordinates, device ID) to ensure data authenticity. During data storage (Stage 3), photos are encrypted and transmitted directly to secure on-premise SIMRS local servers rather than public cloud environments. During data transfer (Stage 4), role-based access control restricts database access to authorized clinical personnel. During data deletion and retention (Stage 5), biometric records are retained for five years in alignment with medical record regulations before secure purge protocols. Finally, during data audit (Stage 6), the embedded metadata enables unalterable digital audit trails for legal defense.

Table 2. Integrated Strategic SWOT and Personal Data Protection (PDP) Lifecycle Matrix

Strategic & PDP Dimension	Operational Realities & SOP Mapping (RSIAPAP/SPO/RM/082)	Medicolegal & Governance Alignment
Strengths & Collection Stage	Step 8 SOP enforces explicit verbal consent prior to photo capture; metadata (timestamp, GPS, device ID) bound automatically.	Complies with PMK No. 24/2022 & Explicit Consent mandate under Article 20 of Law No. 27 of 2022 (UU PDP).



Weaknesses & Processing Stage	Short webcam cables and minor terminal loading delays in ward settings; local server backup dependencies.	Requires hardware infrastructure upgrades and technical redundancy protocols to prevent processing bottlenecks.
Opportunities & Storage Stage	Pioneering biometric consent SOP blueprint for regional Type-C hospitals; direct open-source HMS Khanza integration.	Step 10 SOP mandates local on-premise encrypted database storage, eliminating public cloud security breach risks.
Threats & Transfer Stage	Regional regulatory vacuum regarding biometric face recognition guidelines; potential legal liabilities under UU PDP.	Role-based password authentication restricts photo transfer strictly to authorized attending clinical staff.
Retention & Deletion Stage	Step 12 SOP enforces a 5-year data retention period aligned with medical record archiving regulations.	Prevents permanent data hoarding; compliant with data erasure mandates under Law No. 27 of 2022.
Audit & Compliance Stage	Embedded metadata provides tamper-proof digital audit trails for legal defense during medical disputes.	Establishes non-repudiation under UU ITE Law No. 11 of 2008 & Government Regulation No. 71 of 2019.

Medicolegal Validity, Ethical Adherence, and Cybersecurity Governance (Law & Bioethics Perspective)

Replacing traditional physical signatures with biometric patient photographs triggers profound legal, ethical, and data privacy considerations. Under Indonesian Law, health data—including biometric records such as facial photographs—is classified as Specific Personal Data (Sensitive Data) subject to strict regulatory protection under Law No. 27 of 2022 concerning Personal Data Protection (UU PDP).

In medical ethics, informed consent is fundamentally rooted in the bioethical principle of Patient Autonomy, which dictates that patients possess the absolute right to make informed decisions regarding their bodies. Crucially, the hospital did not allow the digital system to override patient rights. According to Step 8 of SOP RSIAPAP/SPO/RM/082, nurses are strictly required to politely request explicit permission from the patient or family member to take their photograph as legal proof of consent. In cases where patients declined to be photographed due to cultural, religious, or personal beliefs—such as female patients wearing a niqab or individuals with heightened privacy anxieties—the hospital accommodated their autonomy by reverting to a hybrid approach, allowing secure digital touchscreen signatures or physical paper signatures. As highlighted in Table 1, Informant N8 (Chairman of the MKEK IDI Ethics Committee) commended this design, emphasizing that medical ethics evaluates voluntary patient comprehension rather than physical medium rigidity.

From a legal perspective, photograph-based e-IC provides a remarkably robust level of non-repudiation. Under Law No. 11 of 2008 concerning Electronic Information and Transactions (UU ITE) and Government Regulation No. 71 of 2019, biometric authentication is recognized as a valid form of electronic signature. If a patient or family member disputes a medical procedure in the future, claiming they never authorized it, a simple stylized digital signature on a touchscreen is easy to repudiate. In contrast, the metadata-embedded photograph provides indisputable visual proof of the exact individual authorizing consent, linked to precise time and location credentials. Informants N2 (Hospital Director) and N5 (Head of District Health Office) both emphasized that this biometric linkage significantly reduces medicolegal risks and protects healthcare practitioners from fraudulent lawsuits.

Storing sensitive biometric photographs in digital systems exposes hospitals to severe cybersecurity risks and data leakage liabilities. In contrast to the risks highlighted by Bhattacharjee et al. (2023) regarding uncontrolled public dissemination of patient photographs online, Puri Adhya Paramita Hospital implemented a secure, closed-loop network architecture. As noted by Informant N1 (IT Developer), captured photos are not transmitted to public cloud servers; instead, they are encrypted and sent directly via secure local networks to the hospital's on-premise SIMRS database. Access controls are strictly partitioned using role-based password authentication, complying with the technical mandates of PMK No. 24 of 2022 on Electronic Medical Records and the security principles of Law No. 27 of 2022 (UU PDP).

CONCLUSION

This Single-site qualitative case study evaluated the implementation of patient photograph-based electronic informed consent (e-IC) integrated with HMS Khanza at Puri Adhya Paramita Hospital. Based on the empirical findings across eight key informants, field observations, and institutional document reviews, several contextual conclusions are drawn while acknowledging the inherent boundaries of a single-hospital qualitative design.

Within the observed setting of Puri Adhya Paramita Hospital, the implementation of photograph-based e-IC demonstrated significant contextual improvements in medical documentation efficiency compared to legacy paper-based workflows. From a Management Information System (MIS) perspective, the empirical evidence indicates that the digital transition effectively streamlined administrative processes, reduced physical storage demands, and minimized document loss risks within the hospital's maternity and pediatric wards. Furthermore, embedding metadata—such as network UTC timestamps, GPS coordinates, and device hardware IDs—into photo files provided a localized audit trail that enhanced data authenticity for daily clinical consent.

From an Organizational Change Management perspective, the findings suggest that the hospital successfully mitigated initial staff resistance and patient confusion through structured managerial interventions adapted from Kurt Lewin's Three-Step Change model. Proactive communication, targeted technical training, hands-on mentoring, and internal Standard Operating Procedures (SOPs) facilitated the adaptation of clinical personnel to paperless workflows within this specific institutional environment. Regarding bioethics, legal compliance, and data governance, the visual biometric consent mechanism implemented at Puri Adhya Paramita Hospital aligns with national legal frameworks, including the Electronic Information and Transactions Act (UU ITE), Government Regulation No. 71 of 2019, and Ministry of Health Regulation No. 24 of 2022 on Electronic Medical Records. Patient autonomy (under KODEKI) was upheld through explicit verbal consent protocols prior to photo capture, supported by hybrid signing alternatives for patients who declined photo capture due to personal or cultural reasons. To address cybersecurity risks under the Personal Data Protection Act (Law No. 27 of 2022), the hospital adopted on-premise local server storage with role-based access controls rather than public cloud infrastructure.



Study Limitations and Scope Boundaries

As a single-site qualitative case study conducted exclusively at a Type-C specialty hospital, the empirical findings and operational insights of this research are inherently context-bound and cannot be directly generalized to all healthcare facilities or tertiary public hospitals with differing patient volumes, IT infrastructure capacities, and organizational cultures. The conclusions reflect the specific socio-technical dynamics and managerial strategies observed at Puri Adhya Paramita Hospital during the implementation phase.

Suggestions for Future Implementation and Research

For practical implementation at Puri Adhya Paramita Hospital, management should continue upgrading network bandwidth, expanding tablet availability, and refining SOPs regarding biometric data retention periods and deletion protocols under Law No. 27 of 2022. Medical personnel should undergo ongoing communication training to maintain a humanistic approach during digital consent explanations.

For academic research, future studies are strongly encouraged to conduct multi-center qualitative and quantitative investigations across diverse hospital types (e.g., public tertiary hospitals) to empirically test the transferability of photograph-based e-IC models, evaluate clinical cycle times quantitatively, and measure user acceptance across larger, multi-hospital samples.

ACKNOWLEDGMENT

The author wishes to express sincere appreciation and deepest gratitude to the individuals and institutions that provided invaluable support, guidance, and resources throughout this research. Special recognition is extended to Universitas Telkom (Telkom University), Bandung, Indonesia, particularly the Faculty of Economics and Business, and the Master of Management Distance Learning Program (PJJ S2 Magister Manajemen) for providing an excellent academic environment. Sincere gratitude is expressed to Prof. Dr. Anton Mulyono Azis, S.E., M.T., as First Advisor, and Dr. Helni Mutiarsih Jumhur, S.H., M.Hum., as Second Advisor, for their insightful advice, continuous guidance, and constructive critiques that significantly enhanced the quality of this manuscript.

Deep appreciation is also conveyed to the Board of Directors and Management of RSIA Puri Adhya Paramita, particularly dr. Muji as Hospital Director and dr. Chandrika as Head of Medical Services, for granting research permission and operational support, as well as PT. Adhya Paramita Medica for facilitating institutional access. Grateful recognition is extended to Yayasan SIMRS Khanza Indonesia (YASKI) and lead IT developer Windiarto Nugroho, S.Kom., for developing and maintaining the open-source HMS Khanza platform that enabled this digital innovation. Finally, the author acknowledges the Health Office of Central Lampung Regency (Dinas Kesehatan Kabupaten Lampung Tengah), the Medical Ethics Committee of the Indonesian Medical Association (MKEK Ikatan Dokter Indonesia), and all key informants, medical personnel, ward nurses, and patient families who generously shared their valuable perspectives during interviews.

References

- Astromskė, K., Peičius, E., & Astromskis, P. (2021). Ethical and legal challenges of informed consent applying artificial intelligence in medical diagnostic consultations. *AI and Society*, 36(2), 509–520. <https://doi.org/10.1007/s00146-020-01008-9>

- Azis, A. M., & Irjayanti, M. (2024). Strengthening the accuracy and visibility of supply chain management data in the coffee industry. *Cogent Business and Management*, 11(1), 1–18. <https://doi.org/10.1080/23311975.2024.2380811>
- Bhattacharjee, M., Kaposy, C., Grossman, M. R., & Marshall, Z. (2023). Patient photographs on Google Images: a commentary on informed consent, copyright, and privacy laws. *Law, Innovation and Technology*, 15(2), 536–557. <https://doi.org/10.1080/17579961.2023.2245684>
- Castro, C. F. de, Quintana, A. M., Olesiak, L. da R., & München, M. A. B. (2020). Informed consent form in healthcare. *Revista Bioética*, 28(3), 522–530. <https://doi.org/10.1590/1983-80422020283416>
- Chane, W., Birhanu, B., & Suga, Y. (2020). Quality of informed consent among patients who underwent major surgical procedure in a tertiary care hospital, Addis Ababa, Ethiopia. *Open Access Surgery*, 13, 27–33. <https://doi.org/10.2147/oas.s250532>
- Cohen, E., Byrom, B., Becher, A., Jörntén-Karlsson, M., & Mackenzie, A. K. (2023). Comparative effectiveness of eConsent: Systematic review. *Journal of Medical Internet Research*, 25(1), e43883. <https://doi.org/10.2196/43883>
- De Sutter, E., Zaçe, D., Boccia, S., Di Pietro, M. L., Geerts, D., Borry, P., & Huys, I. (2020). Implementation of electronic informed consent in biomedical research and stakeholders' perspectives: Systematic review. *Journal of Medical Internet Research*, 22(10), e19129. <https://doi.org/10.2196/19129>
- Dzi, K. T. J., Ndong, O. N., Menkem, E. Z., & Tendongfor, N. (2025). Bioethics knowledge, attitudes, and practices among healthcare professionals in Cameroon: a cross sectional analytical observational study of doctors and nurses in Cameroon's Southwest Region. *Discover Public Health*, 22(1), 1–12. <https://doi.org/10.1186/s12982-025-00419-7>
- Gesualdo, F., Daverio, M., Palazzani, L., Dimitriou, D., Diez-Domingo, J., Fons-Martinez, J., Jackson, S., Vignally, P., Rizzo, C., & Tozzi, A. E. (2021). Digital tools in the informed consent process: a systematic review. *BMC Medical Ethics*, 22(1), 1–14. <https://doi.org/10.1186/s12910-021-00585-8>
- Goldschmitt, M., Gleim, P., Mandelartz, S., Kellmeyer, P., & Rigotti, T. (2025). Digitalizing informed consent in healthcare: a scoping review. *BMC Health Services Research*, 25(1), 1–15. <https://doi.org/10.1186/s12913-025-12964-7>
- Husna, N., Nurman, M., & Nugroho, Y. (2025). Pembentukan Peraturan Pemerintah tentang Face Recognition Technology ditinjau dari Undang-Undang Nomor 27 Tahun 2022 tentang Perlindungan Data Pribadi. *Akses Jurnal Hukum*, 17(2), 78–92. <https://doi.org/10.36841/akses.v3i2.7126>
- Iype, J. K., & Sebastian, S. (2024). Comparative Analysis of State-of-the-Art Face Recognition Models: FaceNet, ArcFace, and OpenFace Using Image Classification Metrics. *Communications in Computer and Information Science*, 1773, 222–234. https://doi.org/10.1007/978-3-031-50993-3_18
- Jaana, M., MacPhee, E., Sherrard, H., & Walker, M. (2024). Sustaining e-health innovations in a complex hospital environment: learning through evidence. *Frontiers in Digital Health*, 6, e1346085. <https://doi.org/10.3389/fdgth.2024.1346085>
- Kamla AL-Aufi, & Basant Kumar. (2024). *Computational Sciences and Sustainable Technologies* (Vol. 1973). Springer Nature Switzerland. <https://doi.org/10.1007/978-3-031-50993-3>
- Kaur, K., Waqas, R., Kaur, H., Mumtaz, M., Majeed, N., Ali, S. e. R., Ali, K., Shehata Abdelmesih, S., & Rehman, L. (2025). Bridging the Gap: A Systematic Review of Digital Consent Tools to Enhance Participation and Procedures in Low-Resource Settings. *Cureus*, 17(1), e94280. <https://doi.org/10.7759/cureus.94280>



- Mazzochi, A. T., Dennis, M., & Chun, H. Y. Y. (2023). Electronic informed consent: effects on enrolment, practical and economic benefits, challenges, and drawbacks—a systematic review of studies within randomized controlled trials. *Trials*, 24(1), 1–19. <https://doi.org/10.1186/s13063-022-06959-6>
- Meaney, P. A., Hokororo, A., Ndosi, H., Dahlen, A., Jacob, T., Mwanga, J. R., Kalabamu, F. S., Joyce, C. L., Mediratta, R., Rozenfeld, B., Berg, M., Smith, Z. H., Chami, N., Mkopi, N., Mwanga, C., Diocles, E., & Agweyu, A. (2024). Implementing adaptive e-learning for newborn care in Tanzania: an observational study of provider engagement and knowledge gains. *BMJ Open*, 14(2), e077834. <https://doi.org/10.1136/bmjopen-2023-077834>
- Muhire, J., Badru, S., Nakatumba-Nabende, J., & Marvin, G. (2024). Interpretable drug resistance prediction for patients on anti-retroviral therapies (ART). *Communications in Computer and Information Science*, 1973, 43–53. https://doi.org/10.1007/978-3-031-50993-3_4
- Ngoliwa, C., Chakwiya, C., Gondwe, J., Nsomba, E., Nkhoma, V., Reuben, M., Chantunga, L., Liwonde, P., Mangani, E., Kudowa, E., Makhaza, L., Toto, N., Sochera, T., Chikaonda, T., Morton, B., Henrion, M. Y. R., Dula, D., Gordon, S. B., & Chirwa, A. E. (2024). Piloting electronic informed consenting in a pneumococcal human infection study in Blantyre, Malawi. *Wellcome Open Research*, 9, 233. <https://doi.org/10.12688/wellcomeopenres.20770.1>
- Nijhawan, L., Janodia, M., Muddukrishna, B., Bhat, K., Bairy, K., Udupa, N., & Musmade, P. (2013). Informed consent: Issues and challenges. *Journal of Advanced Pharmaceutical Technology and Research*, 4(3), 134–140. <https://doi.org/10.4103/2231-4040.116779>
- Reeves, J. J., Mekeel, K. L., Waterman, R. S., Rhodes, L. R., Clay, B. J., Clary, B. M., & Longhurst, C. A. (2020). Association of electronic surgical consent forms with entry error rates. *JAMA Surgery*, 155(8), 777–778. <https://doi.org/10.1001/jamasurg.2020.1014>
- Rheina Sayla, Dinda Putri, Muhammad Arby Fahrezi, & Abdul Fattah Nasution. (2024). Peran data dan informasi dalam teori sistem organisasi. *Student Scientific Creativity Journal*, 3(1), 156–164. <https://doi.org/10.55606/sscj-amik.v3i1.4830>
- Rijal Husni, M. A. (2022). Aspek keamanan dan privasi penerapan informed consent elektronik di unit kamar bedah RSUD Anna Medika Madura Bangkalan. *Jurnal Rekam Medis dan Informasi Kesehatan*, 5(2), 72–80. <https://doi.org/10.31983/jrmik.v5i2.8376>
- Rowbotham, M. C., Astin, J., Greene, K., & Cummings, S. R. (2013). Interactive Informed Consent: Randomized Comparison with Paper Consents. *PLoS ONE*, 8(3), e58603. <https://doi.org/10.1371/journal.pone.0058603>
- Sintyasari, D., & Risdawati, I. (2025). Urgensi reformasi hukum kesehatan di era digital: Antara etika, privasi data, dan perlindungan hak pasien. *Indonesia Journal of Business Law*, 4(2), 1–14. <https://doi.org/10.47709/ijbl.v4i2.5878>
- Skelton, E., Drey, N., Rutherford, M., Ayers, S., & Malamateniou, C. (2020). Electronic consenting for conducting research remotely: A review of current practice and key recommendations for using e-consenting. *International Journal of Medical Informatics*, 143, e104271. <https://doi.org/10.1016/j.ijmedinf.2020.104271>
- Trihandari Widyatania, D., Pratiwi, R., Vistanada, D., & Langit, S. (2025). The role of Kurt Lewin model change management in tourism human resource management in responding to National Data Center crisis. *International Conference on Management and Communication*, 1(1), 187–200. <https://doi.org/10.33292/IConMC.v1i1.xxx>

- Vera Nurfajriani, W., Ilhami, M. W., Mahendra, A., Sirodj, R. A., Afgani, W., Negeri, U. I., Fatah, R., & Abstract, P. (2024). Triangulasi data dalam analisis data kualitatif. *Jurnal Ilmiah Wahana Pendidikan*, 10(17), 826–833. <https://doi.org/10.5281/zenodo.13929272>
- Warriner, A. H., Foster, P. J., Mudano, A., Wright, N. C., Melton, M. E., Sattui, S. E., Calmbach, W., Curtis, J. R., Kilgore, M., Lewis, C. E., Pace, W., & Saag, K. G. (2016). A pragmatic randomized trial comparing tablet computer informed consent to traditional paper-based methods for an osteoporosis study. *Contemporary Clinical Trials Communications*, 3, 32–38. <https://doi.org/10.1016/j.conctc.2016.02.003>
- Wijaya, M. I. (2025). Leadership styles and EMR adoption: insights from Bali's primary care clinics. *Leadership in Health Services*, 38(3), 402–424. <https://doi.org/10.1108/LHS-01-2025-0003>
- Yusof, M. Y. P. M., Teo, C. H., & Ng, C. J. (2022). Electronic informed consent criteria for research ethics review: a scoping review. *BMC Medical Ethics*, 23(1), 1–15. <https://doi.org/10.1186/s12910-022-00849-x>
- Zondag, A. G. M., Hollestelle, M. J., van der Graaf, R., Nathoe, H. M., van Solinge, W. W., Bots, M. L., Vernooij, R. W. M., Haitjema, S., De Borst, G., Bots, M. L., Hollander, M., Emmelot, M. H., de Jong, P. A., Lely, A. T., Nathoe, H. M., Hoefer, I. E., van der Kaaij, N. P., Ruigrok, Y. M., Verhaar, M. C., & Visseren, F. L. J. (2024). Comparison of the response to an electronic versus a traditional informed consent procedure in terms of clinical patient characteristics: Observational study. *Journal of Medical Internet Research*, 26(1), e54867. <https://doi.org/10.2196/54867>