

Regulating AI in Nursing Education: Legal and Ethical Challenges of Clinical Decision Support Systems in Indonesia and Malaysia

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ABSTRACT: The rapid integration of artificial intelligence (AI), particularly Clinical Decision Support Systems (CDSS), into healthcare education raises important concerns regarding legal adequacy, ethical governance, and institutional accountability. This study compares the regulatory and institutional readiness of Indonesia and Malaysia in governing AI-based CDSS in nursing education through normative legal research examining legislation, policy frameworks, ethical codes, and institutional documents. The findings reveal substantial differences. Malaysia demonstrates stronger preparedness through national AI strategies, ethical guidelines, and structured institutional mechanisms supporting responsible integration into nursing curricula. Indonesia, by contrast, lacks sector-specific regulations and institutional protocols, resulting in fragmented practices and legal uncertainty. The study also identifies differences in approaches to algorithmic accountability, professional responsibility, and the preservation of human-centered care values in AI-supported learning. It recommends sector-specific regulation, interdisciplinary oversight bodies, and standardized ethical protocols to ensure that AI adoption strengthens professional integrity, accountability, and ethical nursing education in both national contexts.

KEYWORDS: Artificial Intelligence, Clinical Decision Support Systems, Ethical Frameworks, Legal Governance, Nursing Education.

INTRODUCTION

Artificial intelligence has significantly transformed the healthcare sector through its capacity to enhance efficiency, accuracy, and quality of services. One prominent application of artificial intelligence is the Clinical Decision Support System, which provides data-driven recommendations to assist healthcare professionals in clinical decision-making. The use of Clinical Decision Support Systems has expanded beyond hospital settings into academic environments, particularly in nursing education (Skuban-Eiseler et al., 2023). Educational institutions employ these systems to simulate real clinical scenarios and support the

development of students' critical thinking skills. Nursing students interact with AI-based tools to analyze patient data and determine appropriate interventions. The integration of such technologies reflects the growing reliance on digital innovation in health education (Tun et al., 2025). This development introduces new legal and ethical considerations that require careful examination.

Legal governance plays a central role in regulating the deployment of Clinical Decision Support Systems in nursing education. The involvement of personal and clinical data requires strict compliance with data protection laws and privacy regulations. Educational institutions must ensure that the use of AI-based tools does not violate patient confidentiality or student rights. Legal accountability becomes complex when automated systems influence learning outcomes or clinical judgments. Clear legal frameworks are needed to define responsibility among developers, institutions, and users (El Arab et al., 2025). Regulatory clarity supports the secure and lawful use of artificial intelligence in academic settings. Legal certainty also provides protection for institutions and learners against potential misuse of technology.

Ethical considerations are equally critical in the use of Clinical Decision Support Systems within nursing education. The nursing profession is founded on ethical principles such as responsibility, fairness, compassion, and respect for human dignity. The application of artificial intelligence must reinforce these values rather than diminish the human dimension of care. Nursing students must understand the limitations of AI and the importance of human judgment in clinical practice. Algorithmic transparency and fairness are essential to maintain trust in AI-assisted learning. Ethical governance requires clear boundaries regarding the role of technology in decision-making processes (Abbas et al., 2025). The preservation of professional integrity remains a fundamental objective in technology-enhanced education.

Indonesia and Malaysia represent two Southeast Asian countries that are actively developing artificial intelligence ecosystems across various sectors. Both countries recognize the importance of legal and ethical governance in the implementation of AI in healthcare and education. Malaysia has introduced a structured national AI framework that incorporates ethical guidelines and digital governance strategies. Indonesia is advancing regulatory reforms through the enactment of the Personal Data Protection Act and national digital transformation policies. These different regulatory approaches provide an opportunity for comparative legal analysis. The examination of both jurisdictions offers insights into national readiness for AI adoption in education. The context of nursing education provides a focused lens for understanding how legal systems respond to technological innovation.

Universities and nursing institutions serve as primary actors in implementing Clinical Decision Support Systems in educational practice. Institutional policies must align with national laws and ethical standards to ensure responsible use of AI technologies. Academic regulations, standard operating procedures, and codes of conduct guide the integration of digital tools in teaching and learning activities (Čartolovni et al., 2022). Institutional governance structures must address issues of accountability, supervision, and system evaluation. Collaboration among legal experts, educators, and technology specialists strengthens institutional capacity. Engagement with professional associations and accreditation bodies supports consistent standards (Gerke et al., 2020). Effective institutional governance determines the sustainability of AI integration in nursing education.

The rapid expansion of artificial intelligence in education and healthcare creates an urgent need for adaptive legal and ethical frameworks. Regulatory systems must be capable of responding to technological change without compromising fundamental rights and professional values. Weak governance structures may expose students and institutions to legal risks and ethical dilemmas. Comparative legal studies contribute to understanding how different

jurisdictions manage similar challenges. The Southeast Asian region presents a dynamic environment for examining AI governance in education. Clinical Decision Support Systems in nursing education offer a relevant case for studying responsible innovation (Joo et al., 2025). Governance mechanisms must balance technological advancement with legal compliance and ethical responsibility.

Several previous studies have examined the use of Clinical Decision Support Systems in clinical and educational contexts. Saoudi CE Nouis (Nouis et al., 2025) in 2020 analyzed the impact of AI-based decision support tools on diagnostic accuracy and emphasized the importance of human oversight and algorithmic transparency. Pouyan Esmailzadeh (Esmailzadeh et al., 2012) investigated the integration of Clinical Decision Support Systems in Malaysian nursing education and reported improvements in students' clinical reasoning skills without addressing regulatory or ethical governance. Andi Subhan (Andi Subhan Amir & Deddy Mulyana, 2024) examined data privacy challenges related to the use of digital clinical tools among nursing students in Indonesia and identified gaps in institutional policy. These studies contributed valuable technical and pedagogical insights into CDSS implementation. The absence of comparative legal and ethical analysis between countries remains evident. This limitation highlights the need for cross-national research focused on governance frameworks.

This study aims to analyze the legal and ethical governance of AI-based Clinical Decision Support Systems in nursing education in Indonesia and Malaysia. The research focuses on comparing regulatory frameworks, institutional practices, and ethical considerations in both countries. The objectives include identifying legal provisions, assessing ethical challenges, and evaluating institutional readiness. The study seeks to provide policy recommendations for responsible AI integration in nursing education. The findings are expected to support policymakers, educators, and regulatory bodies in developing adaptive governance models. The research contributes to the regional discourse on AI regulation in education. The ultimate goal is to promote a legally sound and ethically grounded approach to technology-enhanced nursing education.

RESEARCH METHOD

This study applied a normative legal research method to examine the legal and ethical governance of AI-based Clinical Decision Support Systems (CDSS) in nursing education (Andi Subhan Amir & Deddy Mulyana, 2024). The research focused on analyzing written legal norms, statutory regulations, ethical codes, and policy instruments relevant to the integration of AI technologies in higher education and healthcare. Legal materials were classified into primary legal sources, including national constitutions, laws, government regulations, and ministerial decrees from both Indonesia and Malaysia. Secondary legal sources included academic literature, legal commentaries, expert opinions, and publications issued by professional bodies such as nursing councils and data protection authorities. This approach aimed to identify the normative framework regulating CDSS and assess its alignment with ethical principles in professional nursing education.

A comparative legal approach was employed to analyze the similarities and differences between the Indonesian and Malaysian legal systems in regulating AI governance in nursing education. The comparison focused on four key aspects: data protection and privacy laws, AI governance frameworks, health education regulations, and ethical codes of conduct for nursing students and institutions. The research also utilized a conceptual approach to evaluate the legal principles underpinning responsibility, accountability, and transparency in AI-assisted learning environments (Irwansyah, 2022). Through systematic interpretation of legal texts and comparative analysis, this study sought to provide a structured understanding of how each jurisdiction governs the intersection of law, ethics, and artificial intelligence in nursing education.

HASIL & PEMBAHASAN

Divergence in Regulatory Readiness and Institutional Compliance: A Comparative Study between Indonesia and Malaysia

Regulatory readiness for the integration of artificial intelligence–based Clinical Decision Support Systems (CDSS) in nursing education demonstrates substantial divergence between Indonesia and Malaysia. Malaysia has established a structured national policy architecture that explicitly positions artificial intelligence as a strategic component of healthcare and higher education development. Policy instruments such as the *Malaysia National AI Roadmap* and the *National Policy on Industry 4.0* provide clear regulatory direction for the responsible adoption of AI technologies. These frameworks articulate governance principles, ethical safeguards, and implementation pathways that are directly applicable to educational institutions (Shazwin Mat Taib et al., 2025). Regulatory clarity enables universities and nursing schools to operationalize CDSS within defined legal boundaries. The Malaysian regulatory environment thus exhibits a high degree of preparedness for institutional AI integration.

Indonesia presents a markedly different regulatory profile. The enactment of the Personal Data Protection Act in 2022 represents a significant milestone in data governance, yet the statute does not specifically address the educational use of artificial intelligence or clinical decision technologies. No sector-specific regulations currently delineate the legal parameters for CDSS deployment in nursing education. Ministerial regulations remain fragmented and largely silent on AI governance in academic contexts. This regulatory absence produces normative uncertainty for educational institutions. Institutional actors lack authoritative guidance on compliance obligations, accountability structures, and ethical safeguards. The regulatory framework in Indonesia therefore remains underdeveloped for governing AI in nursing education.

Institutional compliance in Malaysia reflects the maturity of its regulatory environment. Nursing faculties have incorporated CDSS into simulation-based learning and clinical case training through formally approved curricular frameworks. Internal policies align closely with national regulations and professional ethical codes. Faculty-level ethics committees and academic governance boards oversee the pedagogical and ethical dimensions of AI utilization. Regular monitoring and evaluation mechanisms assess both educational effectiveness and

normative compliance. Staff development programs enhance institutional capacity to manage technological and ethical complexity (Shazwin Mat Taib et al., 2025). Institutional practices in Malaysia thus demonstrate coherence between regulatory intent and operational execution.

Institutional practices in Indonesia reveal significant variability and structural limitations. Several universities have initiated experimental applications of AI in clinical teaching modules, yet these initiatives are rarely embedded within formal institutional policy. Implementation is predominantly driven by individual departments or academic staff without centralized governance oversight. Institutional regulations do not systematically address issues of data protection, algorithmic accountability, or ethical responsibility in AI-assisted learning. Divergent interpretations of legal risk impede the formulation of standardized protocols. Institutional compliance therefore remains contingent, informal, and uneven (Alhosani & Alhashmi, 2024). The absence of binding internal governance frameworks constrains the scalability and sustainability of CDSS adoption.

The relationship between national regulatory architecture and institutional compliance is particularly salient in the Malaysian case. Clear statutory direction and policy coherence enable institutions to develop robust internal governance structures. Universities are empowered to establish standard operating procedures, ethical review mechanisms, and accountability pathways for AI use. Regulatory certainty reduces institutional risk exposure and facilitates proactive innovation. Legal clarity functions not only as a control mechanism but also as an enabling condition for technological integration (Mahusin et al., 2024). The Malaysian experience illustrates how regulatory preparedness translates into institutional confidence and compliance capacity.

Indonesia has not yet achieved comparable alignment between regulatory direction and institutional governance. The absence of a dedicated AI governance framework for education limits the ability of institutions to translate general legal principles into operational policies. Inter-ministerial coordination remains insufficient to support the education sector in managing AI-related risks. Institutional leaders face structural barriers in accessing legal guidance, technical standards, and ethical benchmarks. Fragmented policy development contributes to institutional hesitation and regulatory conservatism. This condition weakens institutional readiness and delays systematic digital transformation in nursing education.

Divergent policy approaches further explain the contrast between the two countries. Malaysia employs a centralized and coordinated model of technology governance that promotes policy synchronization across sectors. Regulatory agencies, education authorities, and professional bodies operate within an integrated framework (Lu & Tie, 2025). Indonesia relies on sectoral and decentralized policy initiatives that lack horizontal coordination. The absence of a unified national implementation roadmap for AI in education exacerbates institutional fragmentation. Institutions are left to navigate complex regulatory terrain without strategic direction (Jubaidi & Khoirunnisa, 2024). Policy incoherence thus translates into uneven institutional governance capacity.

The preceding analysis reveals substantial divergence in the legal and institutional governance of artificial intelligence in nursing education between Indonesia and Malaysia. While Malaysia demonstrates a structured and policy-aligned approach supported by national strategies, ethical guidelines, and institutional mechanisms, Indonesia remains in a nascent stage marked by the absence of sector-specific regulation and fragmented institutional practices. These contrasts affect regulatory readiness and compliance, particularly in the integration of AI-based clinical decision support systems within nursing curricula. To clearly present these

differences, the following table provides a comparative overview of key legal instruments, governance structures, and institutional responses in both jurisdictions.

Tabel 1.

Regulatory Readiness and Institutional Compliance in Indonesia and Malaysia

Aspects	Indonesia	Malaysia
Regulatory Framework	No specific legal framework for AI in nursing education	Comprehensive national AI policy documents (e.g., National AI Roadmap)
Sector-Specific Regulation	Absent; general education and health laws apply	Present; includes health, data, and education-related AI provisions
AI Ethics Guidelines	Not yet developed or formally adopted	Available via Ministry-level ethical frameworks for AI use
Data Protection Legislation	Personal Data Protection Law enacted in 2022; implementation remains limited	Personal Data Protection Act 2010 well established and integrated
Institutional AI Policy	Fragmented and ad hoc across universities	Structured and aligned with national strategies
Ethical Oversight in Institutions	Minimal; often informal or delegated to departments	Formalised via ethics committees and academic governance boards
Faculty Preparedness and Training	Limited; mostly individual initiatives	Regular training programs and centralized capacity building
Curriculum Integration of CDSS	Experimental and isolated implementations	Integrated into clinical simulation and case-based learning
Accountability and Supervision Models	Unclear roles in AI-supported environments	Clear allocation of responsibilities and oversight mechanisms
Professional and Ethical Guidance	Based on general nursing ethics, not adapted to AI contexts	Adapted professional codes and internal ethical review procedures

Source: Author's data processing

These findings demonstrate that the effectiveness of CDSS integration in nursing education is fundamentally conditioned by the strength and coherence of regulatory governance. Jurisdictions with comprehensive and coordinated legal frameworks are better positioned to ensure institutional compliance, ethical integrity, and accountability. Regulatory preparedness provides the normative foundation for sustainable innovation. Institutional governance capacity develops in direct response to regulatory clarity. The comparative evidence from Indonesia and Malaysia underscores the centrality of law and policy in shaping the trajectory of AI adoption in higher education. Effective governance emerges from the alignment of national regulation and institutional practice.

Reframing Ethical Responsibility and Professional Boundaries in AI-Assisted Nursing Education: Institutional Gaps and Jurisdictional Contrasts

The integration of artificial intelligence based Clinical Decision Support Systems in nursing education introduces ethical complexities that fundamentally challenge traditional conceptions of responsibility, agency, and professional boundaries. Unlike conventional learning tools, AI driven systems generate algorithmic recommendations that directly shape students' clinical reasoning processes. These recommendations influence judgment formation and decision prioritisation. The involvement of non-human agents in pedagogical settings raises critical questions regarding the attribution of responsibility when decisions lead to adverse or ethically problematic outcomes. Ethical accountability becomes distributed among students, educators, institutions, and technology providers (Stroud et al., 2025). This redistribution of responsibility necessitates a systematic reconfiguration of ethical governance in nursing education.

Malaysia has developed a partial ethical infrastructure for artificial intelligence through national guidelines and policy instruments. Documents issued by the Ministry of Science, Technology and Innovation establish principles of fairness, accountability, and transparency for AI deployment. Educational institutions are expected to operationalise these principles within their academic governance structures (Jamaluddin et al., 2025). Several nursing faculties have incorporated AI ethics into institutional codes of conduct and professional development programmes. Ethics committees review digital tools prior to implementation to ensure alignment with professional standards. Institutional monitoring mechanisms oversee student engagement with CDSS platforms. These practices reflect a structured approach to ethical responsibility at the institutional level.

Indonesia does not yet possess a comparable national ethical framework specifically addressing artificial intelligence in education. Existing ethical codes in nursing education were formulated before the emergence of AI technologies and therefore lack provisions on algorithmic bias, interpretability, and automated decision influence. Institutional policies rarely address AI specific ethical risks (Ardina Khoirun Nisa, 2024). Oversight mechanisms for CDSS usage remain informal and inconsistently applied. Ethical review boards seldom evaluate digital learning tools (Romadhona, M. K., & Oktafenanda, 2025). This absence of structured ethical governance exposes institutions to normative uncertainty. Ethical responsibility is consequently diffused without clear institutional anchoring.

Professional boundaries in nursing education are particularly vulnerable in AI mediated learning environments. Traditional pedagogical models emphasise human interaction, moral sensitivity, and empathetic engagement. CDSS usage introduces a technological intermediary that may reshape these professional norms. Malaysian institutions have sought to preserve human centred care by positioning AI as a supportive instrument rather than a determinant of clinical judgment (Tung & Dong, 2023). Faculty supervision reinforces critical reflection on system outputs. Reflective learning sessions encourage students to evaluate AI recommendations within ethical and professional frameworks. These strategies maintain the primacy of human judgment in clinical education.

Indonesian institutions have not yet established comparable boundary safeguarding mechanisms. The absence of explicit policies often leads students to place disproportionate reliance on system generated outputs. Faculty members face uncertainty regarding their supervisory role in AI assisted learning. Pedagogical authority becomes diluted when technology mediates decision processes without clear normative guidance. Professional identity formation is consequently affected (B et al., 2024). The lack of institutional direction weakens ethical reflexivity among students. Educational objectives centred on moral reasoning and professional accountability become difficult to sustain.

Institutional culture significantly influences ethical governance capacity. Malaysian universities demonstrate higher levels of procedural formalisation and ethical institutionalisation. Regular policy reviews, structured training programmes, and stakeholder consultations support ethical adaptation to technological change. These practices cultivate collective responsibility and institutional learning (Saman et al., 2024). Indonesian institutions frequently depend on individual discretion rather than institutionalised governance mechanisms. Ethical issues are addressed on a situational basis without systemic policy support. This approach produces inconsistency and limits organisational accountability. Ethical governance remains fragmented and reactive.

Transparency and interpretability constitute essential dimensions of ethical AI governance. Malaysian institutions increasingly incorporate principles of algorithmic transparency and comprehensible system logic into the procurement and implementation of AI technologies. System interpretability enables students and educators to scrutinise decision pathways. Transparency strengthens trust and reinforces human agency. Ethical oversight bodies in some institutions assess algorithmic design features prior to adoption (Razak et al., 2025). Indonesian institutions rarely integrate such criteria into procurement processes. Limited awareness of algorithmic functioning restricts critical engagement with technology. Ethical scrutiny is therefore constrained by informational asymmetry.

Ethical responsibility and professional boundaries within AI-assisted nursing education are shaped by institutional mandates and regulatory orientations across different jurisdictions. Both Indonesia and Malaysia acknowledge the ethical implications of digital transformation in healthcare education, yet their frameworks differ significantly. The scope of institutional oversight, clarity of faculty roles, integration of ethical principles, and mechanisms of accountability reflect varying degrees of preparedness. Regulatory gaps in Indonesia reveal an absence of structured ethical guidance and institutional protocols, whereas Malaysia demonstrates more coherent integration of ethical standards aligned with national AI strategies. The following table presents a comparative overview of ethical dimensions and institutional responses in both countries, highlighting key contrasts and areas for policy development.

Table 2.
Ethical Responsibility and Professional Boundaries in AI-Assisted Nursing Education

Dimension	Indonesia	Malaysia
Ethical Framework for AI Use	No specific ethical framework for AI in nursing education	National-level ethical principles incorporated into health and education AI policies
Integration of Professional Codes	Based on general nursing ethics; lacks adaptation for AI contexts	Nursing ethics adapted to include digital technologies and AI-assisted learning
Institutional Ethical Oversight	Limited; often informal or handled at faculty level	Formal ethics committees and review boards oversee digital education practices
Faculty Guidance and Responsibility	No structured protocols for AI-based instruction	Institutional policies assign clear faculty responsibilities in AI implementation
Student Ethical Training	Ethical instruction not tailored to AI usage	AI ethics embedded in curriculum and simulation-based learning practices

AI-Driven Decision Autonomy Boundaries	Unclear boundaries between AI support and professional judgment	Defined boundaries; AI seen as assistive, not authoritative
Accountability in AI Misuse Scenarios	No legal or ethical guidelines in place	Institutional and legal accountability procedures partially established
Institutional Policy Documents	Scarce or nonexistent in most institutions	Available and aligned with national digital education and AI strategies
Role of Regulatory Bodies	Passive; limited enforcement or guidance on AI use in education	Active involvement of nursing boards and educational regulators
Compliance with International Standards	Not aligned with global AI ethics frameworks	Partial alignment with UNESCO and WHO AI ethics principles

Source: Author’s data processing

The comparative table reveals substantial differences in how Indonesia and Malaysia address ethical responsibility and professional role boundaries in AI-assisted nursing education. Malaysia has adopted a more structured approach, with national ethical guidelines, institutional oversight mechanisms, and partially adapted professional codes that reflect the realities of AI-supported clinical learning. Faculty responsibilities and student exposure to AI ethics are clearly defined, supported by institutional policies and active involvement from regulatory bodies. In contrast, Indonesia shows limited progress, with ethical considerations largely absent from institutional practice and national regulation. Professional roles in AI-based learning environments remain undefined, and mechanisms for accountability in cases of misuse are lacking. These disparities underscore the urgency of developing coherent ethical frameworks and institutional protocols to support responsible AI integration in nursing education, particularly within the Indonesian context.

The contrasting ethical governance trajectories between Indonesia and Malaysia demonstrate the decisive influence of institutional capacity and regulatory direction. Malaysia illustrates how national ethical guidance can be translated into operational institutional practices. Indonesia reflects the consequences of ethical under specification in rapidly evolving technological environments. Ethical responsibility in AI assisted nursing education cannot rely solely on individual moral judgment. Institutional frameworks must define boundaries, allocate responsibility, and provide normative clarity. Sustainable ethical governance emerges from the alignment of legal norms, institutional policy, and professional values.

CONCLUSION

The comparative findings from Indonesia and Malaysia underscore the critical role of regulatory coherence and institutional capacity in shaping the ethical and legal governance of AI-based Clinical Decision Support Systems in nursing education. Malaysia demonstrates a relatively advanced stage of regulatory readiness, with structured national strategies, ethical guidance, and institutional mechanisms that collectively support responsible implementation. Ethical oversight, professional boundaries, and accountability structures are clearly delineated and operationalised through formal procedures. In contrast, Indonesia's regulatory landscape remains fragmented and underdeveloped, with limited sector-specific policies and insufficient institutional infrastructure. This regulatory vacuum hinders the formation of consistent ethical practices, undermines institutional confidence, and weakens governance frameworks for AI-assisted pedagogical tools. The divergence in national policy orientation, administrative coordination, and ethical standard-setting explains the significant gaps in institutional adoption, compliance, and educational integrity across both jurisdictions.

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