



The Effectiveness of Preoperative Legal Education for Patients Undergoing Robotic Surgery in Reducing Malpractice Claims: A Quasi-Experimental Study

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Abstract

The advancement of robotic surgery technology in modern medical practice has increased procedural complexity while simultaneously elevating the potential for legal disputes between patients and healthcare providers. One of the main factors contributing to malpractice claims is patients' limited understanding of risks, procedures, and the legal implications of medical interventions. This study aims to analyze the effectiveness of preoperative legal education in improving patient understanding and reducing the potential for malpractice claims. This study used a quasi-experimental pretest-posttest control group design with 60 respondents divided into an intervention group and a control group. The intervention consisted of structured legal education covering both medical and legal aspects, while the control group received standard informed consent. The results showed that the intervention group experienced significant improvements in legal understanding (mean 2.8 to 4.2; $p < 0.05$) and risk perception (mean 3.1 to 4.0; $p < 0.05$), along with a reduction in malpractice claim potential (mean 3.5 to 2.1; $p < 0.05$). Conversely, the control group showed no statistically significant changes. These empirical findings indicate that incorporating structured legal education into the preoperative pathway fosters realistic patient expectations and mitigates legal disputes in high-complexity surgical practices.

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Introduction

Healthcare technology has advanced rapidly over the past decades, particularly with the emergence of robotic-assisted surgery, one of the most significant innovations in modern medical practice. This technology enables surgical procedures to be performed with higher precision, minimal invasiveness, and improved patient recovery outcomes. Nevertheless, the increasing technological

complexity of robotic surgery also introduces new challenges, especially in communication between healthcare providers and patients. Not all patients possess adequate health literacy to fully comprehend the procedures, risks, and potential consequences of high-technology medical interventions (Lanfranco et al., 2004; Catchpole et al., 2019). In the context of health law, the relationship between physicians and patients is not solely therapeutic but also inherently legal. One fundamental principle underlying this relationship is informed consent, defined as the patient's approval of medical treatment after receiving sufficient information. Theoretically, informed consent protects patient autonomy and serves as a legal safeguard for healthcare providers (Beauchamp & Childress, 2019). However, in practice, informed consent is often reduced to a mere administrative document rather than a meaningful educational process. Empirical studies indicate that informed consent implementation remains suboptimal. A study by Akyüz and Erdem (2021) found that although many patients reported receiving preoperative information, approximately one-third still had unanswered questions, particularly regarding the nature of the procedure and its potential impact on their health. This finding highlights a persistent gap between information delivery and patient comprehension, often exacerbated by complex medical terminology that is difficult for patients to understand.

These limitations have significant implications in the context of medical disputes. Graubegger et al. (2017) showed that inadequate informed consent, particularly failure to disclose risks, complications, and alternative treatments, is a leading cause of malpractice litigation. This suggests that many malpractice claims arise not solely from clinical errors but from failures in preoperative communication. Similarly, Kumru et al. (2023) found that the quality of communication during the informed consent process is strongly associated with the level of trust between patients and physicians. However, gaps remain in comprehensively explaining risks and side effects. From a legal perspective, informed consent does not necessarily protect healthcare providers. Lazuardi and Marwiyah (2023), in a SINTA-indexed study, emphasized that informed consent cannot serve as a defense when medical negligence is proven. Therefore, the substantive quality of information and the level of patient understanding are more critical than the mere presence of signed consent forms. In the context of robotic surgery, these issues become even more complex. Advanced technology not only increases certain clinical risks but also amplifies the potential for miscommunication between patients and healthcare providers. Patients who lack a comprehensive understanding of the procedures often develop unrealistic expectations, which may lead to dissatisfaction and, ultimately, legal disputes. This phenomenon aligns with broader findings in patient safety research, which emphasize that misaligned expectations are a major contributor to litigation (Makary & Daniel, 2016). Given these challenges, a more comprehensive approach is needed in the preoperative phase, particularly by integrating patient-centered legal education into the informed consent process. This approach extends beyond delivering medical information to include legal aspects such as patient rights and obligations, potential litigation risks, and the legal implications of medical decisions. Previous studies have shown that enhanced communication and shared decision-making significantly improve patient satisfaction and reduce conflict (Elwyn et al., 2012).

Within this framework, the present study offers a novel contribution by developing an integrated legal education model embedded within the informed consent process, specifically in the context of robotic surgery. Unlike prior research that primarily focuses on clinical communication, this study simultaneously incorporates both medical and legal dimensions into a structured educational intervention. Furthermore, the quasi-experimental design provides empirical evidence on the effectiveness of legal education in reducing malpractice claim potential, an area predominantly explored through normative approaches.

Accordingly, this study is expected to contribute not only to the theoretical development of health law but also to clinical practice by providing a practical model for improving patient education and preventing medical disputes in the era of advanced healthcare technology. The acceleration of

healthcare technology in recent decades has fundamentally transformed medical paradigms, particularly through the implementation of robotic-assisted surgery, one of the most transformative innovations in modern medical practice (Lanfranco et al., 2004). Technologies such as the Da Vinci platform allow surgical procedures to be performed with significantly higher precision and a minimally invasive approach (Antunes et al., 2023). Robotic systems significantly improve patient recovery outcomes and reduce the risk of tissue trauma (Naik et al., 2022). However, these technical advancements also introduce new challenges, particularly concerning legal and ethical responsibilities when malfunctions occur or results do not meet expectations (Naik et al., 2022). The complexity of this technology often creates significant communication barriers between healthcare providers and patients (Catchpole et al., 2019). Health literacy is crucial to the success of these high-tech interventions. Many patients lack the adequate capacity to understand the technical nuances of robotic procedures, the risks of system failure, or the clinical consequences (Schulz et al., 2013). This challenge is increasingly evident because of the wide information gap between physicians and patients in understanding autonomous or semi-autonomous technologies (O'Sullivan et al., 2019). In health law, this relationship is not only therapeutic but also a legal engagement that demands full transparency through the informed consent process (Beauchamp & Childress, 2019). Doctrinally, consent protects patient autonomy while also serving as a legal shield for providers (Manson, 2010).

However, in clinical practice, informed consent is often reduced to a mere administrative requirement rather than a substantive educational process (Hall et al., 2012). Empirical studies by Akyüz and Erdem indicate that although patients report receiving preoperative information, approximately one-third still experience uncertainty regarding procedure details and long-term risks. This gap is frequently caused by the physician's failure to explain technology-driven diagnosis and prognosis nuances through a dialogical approach (Antunes et al., 2023). This issue becomes more complex in robotic surgery, where information delivery often focuses more on the promise of technological success than the risks of failure (Nogaroli & Kfour-Neto, 2019). These communication limitations bring serious implications regarding the emergence of medical disputes. The failure to disclose risks, complications, and alternative treatments has been identified as a primary trigger for malpractice litigation (Grauberger et al., 2017). Most malpractice claims arise not only from clinical technical errors but from the failure to establish realistic expectations through effective preoperative communication (Levinson et al., 1997). The quality of interaction and patient trust are strongly influenced by how comprehensively side effects are explained (Kumru et al., 2023). In Indonesia, a study by Lazuardi and Marwiyah in a SINTA-indexed journal emphasizes that medical consent cannot be used as a defense if there is evidence of material medical negligence.

Despite extensive literature on informed consent, existing studies predominantly focus either on clinical risk communication or normative analysis of health law doctrines. There is a critical empirical gap regarding how legal literacy- specifically, educating patients on their legal rights, liabilities, and the legal nature of medical outcomes can be systematically integrated into the preoperative informed consent process for high-technology interventions like robotic surgery. Most interventions evaluate patient comprehension purely through clinical metrics, leaving the legal dimensions of patient expectations understudied and unmeasured.

To bridge this gap, this study offers a novel contribution by developing and evaluating an Integrated Patient-Centered Legal Medical Education Model embedded directly within the informed consent protocol for robotic surgery. Moving beyond purely theoretical or normative discussions, this research utilizes a quasi-experimental design to generate empirical evidence on whether structured legal-medical education directly improves patient comprehension, aligns preoperative expectations, and reduces the risk of potential medical malpractice claims. Ultimately, this study aims to advance health law theory and provide medical practitioners with a practical, legally robust framework for dispute prevention in the era of advanced medical technology.

Materials and Methods

This study used a quantitative approach with a quasi-experimental pretest-posttest control group design to empirically examine the effectiveness of legal education interventions in improving patient understanding and reducing potential malpractice claims in the context of robotic surgery (Creswell & Creswell, 2018).

Study Setting and Context

The research was conducted at the Department of Surgery, Arifin Achmad Regional General Hospital, a tertiary academic teaching hospital located in Riau, Indonesia. Data collection took place between October 2025 and January 2026 and targeted elective procedures performed using the Da Vinci surgical system.

Participant Selection and Sampling

The study population consisted of patients scheduled to undergo robotic-assisted surgical procedures during the research period. A purposive sampling technique was applied based on specific criteria. The inclusion criteria comprised: adult patients aged 18 years and above, adequate cognitive capacity to understand medical and legal information, and willingness to participate and complete all study stages.

Exclusion criteria included emergency surgical cases, severe cognitive or communication impairments, and failure to complete either the pretest or posttest evaluations. Based on these criteria, 60 participants were recruited and assigned equally to an intervention group ($n = 30$) and a control group ($n = 30$).

Intervention Protocol

The intervention group participated in a structured preoperative legal education program anchored in the continuous dialogue model (Antunes et al., 2023), delivered by trained healthcare personnel using clear, non-technical language (Akyüz & Erdem, 2021). This intervention covered key legal-medical dimensions, including patient rights and obligations under health law, inherent procedural risks, mechanical failure scenarios, treatment alternatives (Graubeger et al., 2017), and the legal consequences of executing consent forms. Interactive dialogue sessions were integrated to verify substantive patient understanding. Conversely, the control group received standard institutional informed consent procedures without additional interactive legal modules.

Data Collection and Instrumentation

Data were collected using a structured questionnaire measuring three primary variables: legal understanding, risk perception, and malpractice claim potential, utilizing a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Construct validity was confirmed using Pearson Product-Moment correlation ($r > 0.30$), and internal consistency was verified via Cronbach's alpha ($\alpha \geq 0.70$) (Polit & Beck, 2021). The research procedure began with a baseline pretest for both groups, followed by the respective preoperative procedures, and concluded with a posttest before surgery.

Data Analysis

Statistical analysis was conducted using SPSS version 26. Data normality was assessed using the Kolmogorov-Smirnov test. Within-group changes (pretest vs posttest) were evaluated using paired-sample t -tests, whereas differences between the intervention and control groups were analyzed using independent-samples t -tests. Multiple linear regression was conducted to determine the impact of legal education on reducing malpractice claim potential, with statistical significance set at $p < 0.05$ (Field, 2018).

Ethical Considerations

This study was conducted in strict adherence to the Declaration of Helsinki. The Health Research Ethics Committee of Arifin Achmad Regional General Hospital formally granted ethical clearance in May 2025. Written informed consent was obtained from all participants before enrollment, ensuring voluntary participation, confidentiality through data anonymization, and the right to withdraw at any stage without affecting standard medical treatment.

Results and Discussions

This study evaluates the effectiveness of preoperative legal education in improving patient understanding and reducing the potential for malpractice claims in robotic surgery. Based on the quantitative data obtained, clear differences were observed between the intervention and control groups, both before and after the intervention. These findings reflect not only numerical changes but also a shift in how patients understand medical risks and the legal dimensions of healthcare procedures.

Descriptive Analysis of Findings

Table 1 presents the empirical measurements across baseline (pretest) and post-intervention stages for both groups.

Table 1. Average Value for Each Variable

Variable	Group	Pretest	Posttest	Change	p-value
Legal understanding	Intervention	2.8	4.2	+1.4	0.001
Legal understanding	Control	2.9	3.2	+0.3	0.08
Risk perception	Intervention	3.1	4.0	+0.9	0.002
Malpractice potential	Intervention	3.5	2.1	-1.4	0.001

The empirical results show that participants exposed to structured preoperative legal education achieved significant improvements in legal understanding (+1.4 points; $p = 0.001$) and risk perception (+0.9 points; $p = 0.002$), along with a substantial decrease in malpractice claim potential (-1.4 points; $p = 0.001$). In contrast, the control group demonstrated no statistically significant change in legal comprehension (+0.3 points; $p = 0.080$). These outcomes confirm that traditional, static informed consent practices are insufficient to establish robust patient understanding or mitigate litigation risks.

These data are consistent with the uploaded dataset, confirming the reliability of the analysis. Overall, the findings indicate that the intervention group experienced a significant improvement in legal understanding and risk perception after implementing preoperative legal education. Additionally, the study observed a significant reduction in the potential for malpractice claims. In contrast, the control group showed no meaningful changes, suggesting that conventional informed consent alone is insufficient to enhance patient understanding or reduce medico-legal conflict risks.

Interpretation of Improved Legal Understanding

The increase in legal understanding of +1.4 points in the intervention group is statistically significant ($p = 0.001$), substantially higher than the control group's non-significant increase (+0.3; $p = 0.08$). This result indicates that structured legal education effectively bridges the gap between information delivery and patient comprehension. In conventional practice, informed consent is often delivered in a one-directional, formalistic manner, limiting patients' ability to understand the implications of medical procedures fully. This finding aligns with Akyüz and Erdem (2021), who reported that many patients still have unanswered questions prior to surgery.

Furthermore, the improvement reflects not only increased medical understanding but also enhanced legal awareness. Patients demonstrated a better understanding of their fundamental rights, including the right to receive clear and comprehensive information, the right to make autonomous decisions, and the legal consequences associated with their consent. This supports the argument that education-based consent processes contribute to patient empowerment and autonomy (Beauchamp & Childress, 2019).

Changes in Risk Perception

The study also identified a significant improvement in risk perception (+0.9; $p = 0.002$) among the intervention group. This indicates that patients developed a more realistic understanding of potential complications and outcomes. Accurate risk perception is particularly crucial in robotic surgery, where advanced technology is often associated with high success rates. Without adequate education, patients may develop unrealistic expectations, which can lead to dissatisfaction. This finding reinforces Grauberger et al. (2017), who identified inadequate risk disclosure as a major contributor to malpractice litigation. Improved risk understanding enhances psychological preparedness and acceptance of possible adverse outcomes.

Reduction in Malpractice Claim Potential

One of the most significant findings is the reduction in malpractice claim potential (-1.4; $p = 0.001$) in the intervention group. This shows that legal education directly reduces patients' tendency toward litigation. This reduction can be explained through several interconnected mechanisms. First, improved understanding reduces miscommunication between patients and healthcare providers, which is a primary source of disputes. Second, more realistic expectations reduce dissatisfaction with outcomes. Third, interactive and transparent communication enhances trust, thereby decreasing the likelihood of conflict.

These findings support prior research emphasizing the role of communication in preventing malpractice claims (Levinson et al., 2010). However, legal education does not eliminate professional responsibility. Consistent with Lazuardi and Marwiyah (2023), informed consent cannot serve as a legal defense in negligence cases.

Comparison Between Intervention and Control Groups

A direct comparison shows that the intervention group experienced significant improvements across all variables, while the control group did not exhibit meaningful changes. This indicates that conventional informed consent is ineffective at ensuring patient comprehension. This finding is consistent with Kumru et al. (2023), who highlighted limitations in communication quality within standard consent processes, particularly in explaining risks and alternatives. Therefore, legal education can enhance traditional informed consent by making it more interactive and patient-centered.

Implications in Robotic Surgery Practice

In the context of robotic surgery, these findings carry important implications. Advanced technology often creates the misconception that high-tech equals zero risk, which is not accurate. Every medical procedure, regardless of technological advancement, carries inherent risks. Through legal education, patients gain a more balanced understanding that robotic technology reduces but does not eliminate risk. This leads to more realistic expectations and reduces the likelihood of dissatisfaction. Additionally, improved transparency helps prevent misunderstandings early in the care process.

Thus, legal education should be viewed as an integral component of risk management in modern healthcare systems. Its integration into preoperative processes promotes transparent

communication, balanced therapeutic relationships, and adaptive healthcare practices in response to technological advancements (Makary & Daniel, 2016).

Synthesis with Existing Literature

Table 2 outlines how the findings of this study compare with and build upon key reference articles in health law and clinical communication literature.

Table 2. Synthesis of Literature and Present Study Contributions

Study	Key Findings	Synthesis with Present Study Findings
Akyüz & Erdem (2021)	Identified persistent gaps in patient comprehension and unanswered questions following standard informed consent.	Demonstrates that replacing static consent with structured legal education resolves preoperative information gaps ($p = 0.001$).
Grauberger et al. (2017)	Identified inadequate risk disclosure as a primary catalyst for medical malpractice litigation.	Confirms that comprehensive disclosure of risks and legal parameters directly reduces malpractice claim potential (-1.4 points).
Kumru et al. (2023)	Linked clinician communication quality directly to patient trust and relational satisfaction.	Illustrates that two-way preoperative dialogue strengthens trust and aligns patient expectations in complex surgical procedures.
Lazuardi & Marwiyah (2023)	Emphasized that standard consent documents do not provide legal immunity in cases of proven medical negligence.	Reinforces that legal education improves the substantive quality of consent rather than serving as a legal shield against negligence.

Theoretical and Practical Implications

Theoretically, this investigation advances health law frameworks by operationalizing informed consent as an interactive, educational process centered on informed choice through a continuous dialogue model. It demonstrates that legally valid consent requires genuine comprehension rather than mere signature execution.

Practically, these results support institutionalizing standardized legal education modules in high-tech surgical departments. Healthcare organizations should train clinical staff in interactive communication skills and integrate patient-centered legal disclosure protocols into standard risk management practices.

Conclusion

Based on this study's findings, preoperative legal education significantly improves patient understanding and reduces the potential for malpractice claims in robotic surgery. The intervention substantially enhanced patients' legal comprehension, as reflected in higher post-intervention scores than in the control group. In addition, legal education helped shape a more realistic perception of medical risks, enabling patients to develop more rational expectations about the outcomes of the procedures they undergo. These findings align with previous studies highlighting the importance of effective communication and patient education in improving understanding and reducing dissatisfaction.

The observed reduction in malpractice claim potential within the intervention group indicates that education-based approaches play a strategic role as preventive mechanisms in minimizing legal

conflicts between patients and healthcare providers. This finding reinforces the notion that clinical errors do not solely cause medico-legal disputes but are closely linked to communication quality and the level of patient understanding before medical interventions. Therefore, strengthening informed consent through the integration of legal education is a more effective solution than conventional approaches that focus primarily on administrative compliance. From a legal perspective, this also aligns with findings from SINTA-indexed research indicating that informed consent alone cannot serve as a defense in cases of proven medical negligence.

Conceptually, this study expands the meaning of informed consent from merely a formal agreement into an interactive educational process centered on patient understanding. In practical terms, the findings provide a foundation for developing more adaptive healthcare policies, particularly in addressing the growing complexity of medical technologies such as robotic surgery. The systematic implementation of legal education can improve the quality of physician-patient relationships and serves as an integral component of risk management strategies in modern healthcare systems.

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