



ANALYSIS OF PERIOPERATIVE PATIENT EDUCATION NEEDS AS THE BASIS FOR DEVELOPING A MOBILE PERIOPERATIVE COMPANION APPLICATION

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ABSTRACT

Effective perioperative patient education is essential to improve patient understanding, reduce anxiety, enhance adherence to perioperative instructions, and support patient safety. However, perioperative education remains challenged by limited consultation time, heavy workload of healthcare providers, and variations in patients' health literacy. Consequently, understanding patients' educational needs is necessary to support the development of digital educational media tailored to users' needs. This study aimed to explore perioperative patient education needs from the perspective of nurse anesthetists as a basis for developing a patient-centered mobile perioperative companion application. A qualitative study with a Focus Group Discussion (FGD) approach was conducted involving nine nurse anesthetists from hospitals in Bali, Indonesia. Participants were selected using purposive sampling. Data were collected through online FGD and analyzed using Reflexive Thematic Analysis following Braun and Clarke. The sample of this study was 9 anesthesiologists from various hospitals in Bali Province who participated in this study. Participants were selected using purposive sampling based on the criteria of having at least one year of work experience in anesthesiology services, having provided perioperative education to patients, and being willing to participate in the study. Four themes were identified: (1) patient readiness is established through comprehensive and continuous perioperative education; (2) the effectiveness of perioperative education is influenced by patient characteristics, healthcare system factors, and the consequences of non-adherence; (3) adaptive and collaborative educational approaches enhance patient engagement; and (4) a mobile application is perceived as an adaptive, sustainable, and patient-centered digital educational medium. Participants emphasized that the application should provide phase-specific educational content, audiovisual learning materials, reminders for important perioperative instructions, and features that accommodate patients' varying educational backgrounds and health literacy. Perioperative patient education should be continuous, adaptive, and patient-centered. The findings provide evidence to support the development of a mobile perioperative companion application as a complementary educational tool to improve patients' understanding, engagement, and readiness throughout the perioperative period.

Keywords: mHealth; mobile health; nurse anesthetist; patient education; perioperative education; qualitative research

INTRODUCTION

Surgery is one of the most commonly performed healthcare interventions worldwide, with over 300 million surgical procedures performed annually. The success of a surgical procedure is determined not only by the technical aspects during surgery but also by the patient's pre-operative readiness and post-operative recovery process. Therefore, patient education is an integral part of perioperative care to enhance understanding, support decision-making, increase adherence to medical instructions, and improve patient outcomes (Guo, 2015). Despite its importance, the implementation of perioperative education in various healthcare facilities still faces various obstacles, such as time constraints, high workloads for healthcare workers, differences in health literacy levels, and patients' psychological conditions prior to surgery. These obstacles result in patients not always optimally understanding the information provided (Atomsa et al., 2024). Furthermore, research shows that low health literacy is associated with patients' poor ability to understand medical information and follow perioperative instructions, potentially impacting healthcare outcomes (Roy et al., 2019). Advances in digital technology offer opportunities to improve the quality of patient education through the use of mobile health (mHealth). Mobile applications allow patients to access health information independently, flexibly, and repeatedly as needed. Various studies have reported that mHealth-based interventions have the potential to improve patient knowledge, engagement, and

adherence to their health management (Marcolino et al., 2018; Ng et al., 2022). However, the success of health application development depends heavily on its suitability to user needs.

Therefore, user needs analysis is a crucial step before application development. Most previous studies have focused on the effectiveness of educational media or education during the pre-anesthesia phase, while research comprehensively exploring patient educational needs throughout the perioperative period as a basis for mobile application development is limited. Furthermore, the perspective of anesthesiologists, as healthcare professionals directly involved in providing perioperative education, has not been widely reported. Therefore, this study aims to analyze patient educational needs during the perioperative phase, based on the anesthesiologists' perspective, as a basis for developing a perioperative mobile application. This study aims to analyze patient educational needs during the perioperative phase, based on the anesthesiologists' perspective, as a basis for developing a patient-centered perioperative mobile application.

METHOD

This study used a qualitative approach using a Focus Group Discussion (FGD) method to explore patient educational needs during the perioperative phase as the basis for developing a perioperative mobile application. The FGD method was chosen because it allows interaction between participants, resulting in a more in-depth exploration of experiences, perceptions, and needs than individual interviews (O. Nyumba et al., 2018). The study participants were anesthesiologists with experience providing perioperative patient education at hospitals in Bali Province. Participants were selected using purposive sampling based on the criteria of having at least one year of work experience in anesthesiology services, having provided perioperative education to patients, and being willing to participate in the study. A total of nine anesthesiologists from various hospitals in Bali Province participated in this study.

Data collection was conducted through an online Focus Group Discussion session using the Zoom Meeting platform in June 2026. The discussion lasted approximately 90 minutes and was guided by a semi-structured interview guide developed based on a literature review on perioperative education and the need for digital educational media. The entire discussion was recorded with the participants' consent and then transcribed verbatim for analysis. Data analysis was conducted using Reflexive Thematic Analysis (RTA) based on the six stages proposed by Braun and Clarke: (1) familiarizing yourself with the data, (2) generating initial codes, (3) constructing initial themes, (4) reviewing and developing themes, (5) defining and naming themes, and (6) writing up the research report (Braun & Clarke, 2021).

Data validity was maintained through the principles of credibility, dependability, confirmability, and transferability. Credibility was enhanced through reflective discussions between researchers during the analysis process (Nowell et al., 2017). Dependability and confirmability were maintained through documentation of the entire analysis process (audit trail), while transferability was supported by the presentation of participant characteristics and representative quotes illustrating each theme. This study has obtained ethical approval from the Health Research Ethics Committee of the Bali Institute of Technology and Health No: 04.315/KEPITEKES-BALI/V/2026. All participants provided written informed consent before participating in the study, and confidentiality of identity was maintained using a participant code during the analysis process and reporting of research results.

Table 1.
Data Analysis Process Using Reflexive Thematic Analysis (Braun & Clarke, 2021)

Analysis Stage	Researcher Activities
Data Familiarization	All FGD transcripts were read repeatedly to understand the context and content of the discussions, and to gain a comprehensive understanding of participants' experiences with perioperative education.
Identification of Meaning Units	Sections of the transcripts related to the research objectives were identified as meaning units, which are chunks of data containing a single meaning or main idea.
Initial Code Development	Each meaning unit was assigned an initial code that described the explicit meaning of the data without changing the original context of the participant's statement.
Code Consolidation	Initial codes with similar meanings were compared, grouped, and simplified into consolidated codes.
Master Code Development	The consolidated codes were then grouped into master codes based on conceptual similarities.
Subtheme Development	Each master code was accompanied by an operational definition and participant sources.
Theme Development	Relationships between master codes were analyzed to form subthemes representing clusters of interrelated meanings.
Theme Review and Refinement	Subthemes were then synthesized into main themes that described shared patterns of meaning regarding patient education needs as the basis for developing a perioperative mobile companion application.
	Themes were reviewed against all transcripts, participant quotes, and the research objectives to ensure congruence, internal coherence, and clear distinctions between themes.

RESULT

Participant Characteristics

Table 2.
Participant Characteristics

Participant	Length of service (years)	Hospital Area
1	20	Singaraja
2	22	Negare
3	17	Denpasar
4	22	Klungkung
5	16	Denpasar
6	24	Bangli
7	13	Badung
8	11	Karangasem
9	21	Gianyar

This study involved nine anesthesiologists from nine hospitals in Bali Province: Singaraja, Negara, Denpasar (two participants), Klungkung, Bangli, Badung, Karangasem, and Gianyar. All participants had extensive work experience in anesthesia, ranging from 11 to 24 years. The average length of service was 18.4 years, indicating that participants had sufficient professional experience to provide perioperative patient education and were able to provide in-depth information in line with the study's objectives.

Table 3.
Themes and Subthemes

Themes	Subthemes	Description of Findings
Theme 1. Perioperative patient readiness is built through the need for comprehensive and ongoing education	Basic understanding of anesthesia and surgery	Patients need to understand the role of the anesthesia provider, the types of anesthesia, the benefits, risks, and objectives of the procedure to build trust and prepare them for perioperative procedures.
	Patient preparation before anesthesia	Pre-anesthesia education covers physical preparation, fasting, the use and discontinuation of certain medications, and necessary supporting examinations to enhance patient safety during anesthesia.
Theme 2. The effectiveness of perioperative education is influenced by patient	Understanding the perioperative care process	Patients need to understand the service flow, the stages of anesthesia, the placement of monitoring equipment, and the operating room environment to understand the experience they

Themes	Subthemes	Description of Findings
characteristics, the care system, and the consequences of non-compliance		will undergo during the procedure.
	Understanding the postoperative recovery process	Education continues into the postoperative phase, providing information on the effects of anesthesia, pain management, early mobilization, breathing exercises, and permitted activities during recovery.
Theme 3. Adaptive and collaborative educational approaches enhance patient engagement in the perioperative period	Information supporting patient decision-making	Patients and families require information about surgical procedures, expected outcomes, costs, and various aspects of care to support decision-making before the procedure.
	Barriers arising from patient characteristics	The effectiveness of education is influenced by patient characteristics, such as age, education level, psychological condition, communication skills, and the special needs of geriatric patients, children, and those with communication disabilities.
Theme 4. Mobile applications are seen as a digital solution to expand access and sustainability of perioperative education	Barriers in the care system	Time constraints, the number of healthcare workers, the high workload, and the dynamic nature of the service environment mean that the education process cannot be implemented optimally.
Theme 1. Perioperative patient readiness is built through the need for comprehensive and ongoing education	Consequences of non-compliance with education	Lack of understanding of education leads to non-compliance with perioperative instructions, potentially increasing the risk of anesthetic complications and delaying surgery.
	Professional limitations in providing education	Healthcare workers adapt communication strategies through the use of simple language, family involvement, and interprofessional collaboration to ensure information is easily understood and tailored to the patient's characteristics.
Theme 2. The effectiveness of perioperative education is influenced by patient characteristics, the care system, and the consequences of non-compliance	Adjusting educational methods to patient characteristics	Participants emphasized that educational methods need to be tailored to the patient's age, education level, communication skills, physical condition, and special needs to ensure optimal understanding.
	Pelibatan keluarga sebagai mitra edukasi	Keluarga dipandang memiliki peran penting dalam membantu pasien memahami informasi, mengingat kembali instruksi perioperatif, serta mendukung kepatuhan terhadap persiapan dan pemulihan pascaoperasi.
Theme 3. Adaptive and collaborative educational approaches enhance patient engagement in the perioperative period	Kolaborasi antarprofesi dalam pemberian edukasi	Edukasi perioperatif dipandang sebagai tanggung jawab bersama antara penata anestesi, dokter anestesi, dokter bedah, perawat ruangan, dan profesi kesehatan lainnya.
	Komunikasi terapeutik untuk meningkatkan kepercayaan pasien	Pendekatan yang ramah, penggunaan bahasa sederhana, pemberian kesempatan bertanya, serta pengenalan tenaga kesehatan membantu membangun hubungan saling percaya.
Theme 4. Mobile applications are seen as a digital solution to expand access and sustainability of perioperative education	Media digital sebagai pelengkap edukasi tatap muka	Aplikasi mobile tidak dimaksudkan menggantikan edukasi yang diberikan tenaga kesehatan, tetapi berfungsi sebagai media pendamping yang dapat diakses kembali oleh pasien dan keluarga setelah memperoleh penjelasan verbal, serta menyediakan sumber informasi yang lebih terpercaya dibandingkan informasi dari media sosial atau internet.
Theme 1. Perioperative patient readiness is built through the need for	Media audiovisual meningkatkan	Video dipandang sebagai media edukasi yang paling efektif karena mampu menjelaskan prosedur, tahapan anestesi, efek yang mungkin dialami pasien, serta proses perioperatif secara lebih

Themes	Subthemes	Description of Findings
comprehensive and ongoing education	efektivitas edukasi perioperatif	mudah dipahami pada berbagai kelompok pasien, termasuk anak-anak, lanjut usia, maupun pasien dengan hambatan komunikasi tertentu.
	Aplikasi mendukung edukasi yang berkelanjutan dan berorientasi pada kebutuhan pasien	Partisipan mengharapkan aplikasi tidak hanya menyajikan materi edukasi yang dapat dipelajari berulang, tetapi juga mampu mengidentifikasi kebutuhan informasi pasien melalui fitur skrining sehingga materi yang diberikan lebih sesuai dengan kondisi dan tingkat kecemasan masing-masing pasien.
Theme 2. The effectiveness of perioperative education is influenced by patient characteristics, the care system, and the consequences of non-compliance	Implementasi aplikasi memerlukan dukungan sistem dan perlindungan data pasien	Meskipun aplikasi dipandang bermanfaat dalam meningkatkan kualitas edukasi, implementasinya dipengaruhi oleh kesiapan sumber daya, dukungan anggaran, kebijakan institusi, serta keamanan data pasien. Partisipan menekankan pentingnya pembatasan akses terhadap data kesehatan agar hanya dapat diakses oleh pihak yang berwenang sehingga kerahasiaan informasi pasien tetap terjaga.

Theme 1. Perioperative patient readiness is built through the need for comprehensive and ongoing education

Analysis showed that participants viewed patient readiness as being determined not only by clinical conditions but also by an adequate understanding of the entire perioperative care chain. Educational needs include a basic understanding of anesthesia and surgery, pre-procedure preparation, perioperative care processes, post-operative recovery, and information that supports patient and family decision-making. Overall, participants emphasized that education needs to be provided in a gradual, ongoing manner, and tailored to patient needs to enhance readiness and reduce uncertainty before undergoing the procedure.

Basic understanding of anesthesia and surgery

Participants perceived that education begins with providing information about the role of the anesthesiologist, the type of anesthesia to be used, the purpose of the procedure, the benefits, and the risks of anesthesia. This information is perceived as fundamental to establishing a therapeutic relationship, increasing patient trust, and providing an overview of the procedure to be undertaken. One participant explained:

"What we as anesthesiologists need to convey is, of course, first we introduce ourselves... we explain the technique or type of anesthesia that will be used for the patient's surgery. Then, of course, an initial assessment has been conducted before the surgery... That's what we must explain to the patient." (P1)

Furthermore, another participant added that education should also include the diagnosis, reason for surgery, benefits, risks, and possible complications of anesthesia so that patients gain a more comprehensive understanding of the procedure they will undergo. These findings indicate that a basic understanding of anesthesia and surgery is the initial foundation for building patient readiness before undergoing perioperative procedures.

Patient Preparation Before Anesthesia

Participants explained that pre-anesthesia education needs to prepare patients comprehensively, providing information about fasting rules, the use and discontinuation of certain medications, supporting examinations, and various physical preparations before surgery. This education is considered crucial for improving patient safety during anesthesia.

"Equally important in perioperative care is the preoperative preparation. This may include perioperative fasting, the use or discontinuation of certain medications, and any necessary supporting examinations." (P2)

In addition to medical aspects, participants also emphasized the importance of explaining physical preparation such as bathing, shaving, and removing accessories as part of surgical preparation.

These findings indicate that pre-anesthesia education helps patients understand all the necessary preparations for a safe anesthetic procedure.

Understanding the Perioperative Care Process

Participants assessed that patients need to understand the entire care process from entering the operating room to the completion of the procedure. Information about the operating room environment, the personnel involved, the installation of monitoring equipment, and the stages of the procedure is seen as reducing uncertainty and improving patient psychological readiness.

"In the intraoperative setting, we need to inform patients about the process the patient will experience in the operating room. Then, regarding the installation of monitoring equipment... we shouldn't tie them up without providing information." (P2)

Another participant added that patients also need to understand the process of care they will undergo from the ward to the operating room to have a clearer picture of the experience they will face. These findings indicate that education regarding the care process not only provides procedural information but also helps build patient psychological preparedness.

Understanding the postoperative recovery process

Participants assessed that education should continue into the postoperative phase. Material provided included potential side effects of anesthesia, pain management, meal and drink times, early mobilization, and exercises to support the recovery process.

"You might experience pain from the surgery, but we usually give you analgesics or painkillers for 24 hours after surgery." (P3)

In addition to pain management, participants also emphasized the importance of education regarding deep breathing exercises, effective coughing, and permitted activities during the recovery period. These findings indicate that postoperative education helps patients have realistic expectations about the recovery process while encouraging active involvement in rehabilitation.

Information Supports Patient Decision-Making

In addition to clinical information, participants identified that patients and families need information regarding surgical procedures, expected outcomes, costs, and administrative aspects of care. This information is considered essential to help patients prepare for the procedure and support the decision-making process.

"Patients usually struggle with the certainty of recovery... and then the certainty of insurance coverage. Is it covered by BPJS, and so on?" (P6)

Participants also explained that questions about surgical procedures often require collaboration with surgeons to ensure the information provided remains within the scope of each profession. These findings indicate that patient information needs are not solely focused on anesthesia procedures, but also encompass various aspects that support more comprehensive decision-making.

Theme 2. The Effectiveness of Perioperative Education is Influenced by Patient Characteristics, the Service System, and the Consequences of Non-Compliance

The analysis shows that the effectiveness of perioperative education depends not only on the quality of the material provided, but also on patient characteristics, the condition of the service system, and the ability of healthcare professionals to convey information. Participants identified differences in age, education level, psychological condition, communication skills, time constraints, and service load as key challenges in the education process. These barriers can reduce patient compliance with perioperative instructions and impact patient safety and the smoothness of care.

Patient Barriers to Receiving Education

Participants described that patients' ability to receive education is influenced by individual characteristics, such as age, education level, psychological condition, and communication skills.

Geriatric patients, children, and patients with communication difficulties require a more adaptive educational approach to ensure optimal understanding of information.

"Of course, these things present challenges for us... the varying levels of patient education. Of course, there's also the anxiety of patients and their families... and the language we use must be understandable to the patients." (P2)

Furthermore, participants emphasized that patients with special needs, such as those with communication disorders, children, and the elderly, require different attention and communication strategies than adult patients in general. These findings indicate that the effectiveness of education is greatly influenced by patient characteristics, so information delivery needs to be tailored to each individual's needs.

Barriers to the Service System

In addition to patient factors, participants identified that limitations in the service system also impact the effectiveness of education. The high service load, limited number of healthcare workers, and available time mean that education cannot be provided optimally to all patients.

"Of course, from my experience, that's a common challenge... limited time. This is common knowledge... with our limited human resources and more operators." (P2)

Another participant described how the high number of patients per day further limits the opportunity for healthcare workers to provide comprehensive education.

These findings indicate that the effectiveness of education is determined not only by the competence of healthcare workers, but also by the support of service organizations that provide adequate time and resources.

Consequences of Non-Compliance with Perioperative Education

Participants explained that a lack of understanding of education can lead to non-compliance with perioperative instructions, particularly regarding fasting regulations before surgery.

This non-compliance is perceived as increasing the risk of anesthetic complications, causing delays in procedures, and prolonging anxiety for patients and families.

"Once anesthesia is administered... sometimes vomiting... even desaturation, there may be slight aspiration." (P4)

In addition to increasing patient safety risks, participants also perceived that violations of perioperative instructions can lead to surgical delays, which increases the patient's economic and psychological burden. These findings indicate that successful education has direct implications for patient safety, service efficiency, and the patient's experience during the perioperative process.

Professional Limitations in Delivering Education

Participants revealed that the provision of education is also influenced by the limits of authority of each profession. Information that falls outside the anesthesiologist's competence, such as explanations of surgical procedures, needs to be delivered through collaboration with other professionals to ensure the information received by patients remains accurate and consistent.

"Usually, if the patient tends to ask more questions about the operation... we pass them on to the DPJP." (P3)

In addition to interprofessional collaboration, participants emphasized the importance of using simple language and involving families when patients have difficulty understanding information.

These findings indicate that the effectiveness of education depends not only on the communication skills of healthcare workers, but also on interprofessional collaboration and the delivery of information within professional boundaries.

Theme 3. An Adaptive and Collaborative Educational Approach Increases Patient Engagement

The analysis shows that the effectiveness of perioperative education is influenced not only by the material presented, but also by the healthcare worker's ability to adapt the educational approach to

the patient's characteristics and build collaboration with the family and other healthcare professionals. Participants viewed that an adaptive, communicative, and collaborative approach can improve patient understanding, engagement, and compliance during the perioperative process.

Adjusting Educational Methods to Patient Characteristics

Participants explained that educational methods need to be tailored to the age, education level, communication skills, and specific needs of each patient. The use of simple language, appropriate delivery methods, and the selection of educational media are considered crucial to ensure optimal understanding of information by various patient groups.

"...when we encounter patients with mental retardation, then mute, deaf-mute... then children and the elderly..." (P1)

Furthermore, participants emphasized the importance of using easily understood language so that education can be received according to each patient's individual abilities. These findings suggest that an adaptive educational approach allows for more effective information delivery tailored to individual patient characteristics.

Involving families as educational partners

Participants viewed families as a vital part of the perioperative education process. Families play a role in helping patients understand information, recall instructions, and support adherence to postoperative preparation and care.

"...if the patient doesn't understand... maybe we can involve the family." (P2)

In addition to helping patients understand information, families were also perceived as playing a role in ensuring compliance with important instructions, such as fasting rules and pre-operative preparation. These findings indicate that family involvement strengthens the education process and supports the success of perioperative care.

Interprofessional Collaboration in Providing Education

Participants explained that perioperative education is a shared responsibility of various healthcare professionals, according to their respective competencies and authorities. Collaboration is seen as crucial to ensure patients receive complete, consistent, and accurate information without overlapping or misinformation.

"...usually, if patients tend to ask more questions about the surgery... we pass them on to the surgeon." (P3)

Participants assessed that the division of roles between professionals helps ensure that all information is delivered by healthcare professionals who are competent in their respective fields.

These findings indicate that interprofessional collaboration is a crucial component in providing comprehensive perioperative education.

Therapeutic communication to enhance patient trust

Participants viewed therapeutic communication as fundamental to building a trusting relationship between healthcare professionals and patients. Self-introduction, the use of simple language, an empathetic attitude, and providing opportunities for patients to ask questions were perceived as enhancing trust and patient engagement during the education process.

"...first, we introduce ourselves... then we explain the technique or type of anesthesia..." (P1)

Through open communication, patients have the opportunity to clarify any unclear information, thus better preparing for anesthesia and surgery. These findings demonstrate that therapeutic communication plays a role in building a trusting relationship while increasing patient active participation in the perioperative process.

Theme 4. Mobile applications are viewed as a digital solution to improve the quality of perioperative education

The analysis showed that participants viewed mobile applications as an innovation with the potential to strengthen perioperative education by providing easily accessible, sustainable, and personalized information. Applications were not perceived as a substitute for direct communication with healthcare professionals, but rather as a supporting medium that expands access to information, improves patient understanding, and helps overcome the limitations of conventional education. In addition to supporting independent learning, participants also emphasized that application implementation needs to be supported by a prepared service system and patient data protection.

Digital media complements face-to-face education. Participants perceived that verbal education provided during consultations is often difficult to remember after patients leave the hospital. Therefore, mobile applications are perceived as a complementary medium that allows patients and families to re-access educational information, reducing reliance on unreliable sources.

"It would be nice if, after listening to the explanation, the family and patient had media they could read." (P9)

This finding indicates that digital media is viewed as a complement to face-to-face communication, supporting the continuity of perioperative education.

Audiovisual media enhances the effectiveness of perioperative education

Participants consistently rated audiovisual media, especially videos, as more effective than verbal or printed media in explaining anesthesia procedures, the stages of the procedure, and the recovery process. These media were perceived as improving understanding, reducing anxiety, and reaching patients with diverse characteristics.

"Before the procedure, I played the video, and it was very effective." (P4)

This finding indicates that audiovisual media is a more engaging and easily understood form of education, supporting patients' psychological readiness before undergoing perioperative procedures.

The application supports ongoing, patient-centered education. Participants expected the application to not only serve as a repository for educational materials but also be able to tailor the information to each patient's characteristics and needs. The initial screening feature was deemed essential for identifying information needs, thus making the educational materials more personalized. Furthermore, presenting the material in various formats, such as text, video, and a question-and-answer feature, allows patients to review the information repeatedly according to their needs.

"So, during the screening, we can use the application to determine the patient's or the patient's family's needs from the beginning." (P9)

These findings indicate that the application is expected to be an adaptive, personalized, and ongoing educational tool throughout the perioperative process.

Application implementation requires system support and patient data protection

Although participants responded positively to the development of the mobile application, they emphasized that its implementation requires institutional policy support, resources, and a security system capable of protecting patient data confidentiality. Protection of health information was seen as a crucial prerequisite for the application to be safely implemented in perioperative care.

"The most important thing to remember is patient data protection." (P2)

These findings indicate that the success of application implementation is determined not only by the completeness of educational features, but also by organizational readiness and a security system that ensures patient data confidentiality.

DISCUSSION

Perioperative patient readiness is built through comprehensive and continuous education.

Research results indicate that patient readiness for perioperative care is built through comprehensive education provided from the pre-anesthesia, intraoperative, and post-operative phases. Participants emphasized that patients require information not only regarding anesthetic procedures, but also

regarding pre-operative preparation, the operating room, post-operative recovery, and information to support decision-making. These findings demonstrate that perioperative education is a continuous process and plays a role in improving patient readiness before undergoing procedures. These findings align with previous research showing that structured preoperative educational interventions can improve patient knowledge, reduce preoperative anxiety, and contribute to better recovery outcomes (Guo, 2015). Previous research also reported that providing good information can influence perioperative anxiety, knowledge, and outcomes (Ng et al., 2022). Unlike most studies that focus on pre-anesthesia education, this study demonstrates that patient information needs encompass the entire perioperative journey. Therefore, educational materials in mobile applications should be structured according to the stages of care, from pre-anesthesia, intraoperative, to post-operative, so that patients receive relevant information according to the phase of care they are undergoing (Machado et al., 2020).

The effectiveness of perioperative education is influenced by patient characteristics, the care system, and the consequences of non-compliance

Research results indicate that the effectiveness of perioperative education is influenced by patient characteristics, particularly age, education level, psychological condition, communication skills, and special needs. These variations impact patients' ability to understand and apply the information provided. This finding aligns with studies in surgical patients that demonstrate that health literacy plays a crucial role in understanding the benefits and risks of procedures, following perioperative instructions, and making decisions regarding care (Roy et al., 2019). The effectiveness of education is also limited by conditions within the care system, such as high workloads, limited healthcare personnel, and limited communication time. Research on pre-operative education practices has found that time constraints, understaffing, language barriers, the complexity of the patient's condition, and patient and family anxiety are associated with suboptimal education delivery (Atomsa et al., 2024). Patient education is one of the nursing activities that often goes uncompleted when healthcare workers face time constraints and high patient-to-patient ratios. This situation suggests that self-accessible educational media are needed to complement, not replace, direct communication with healthcare workers.

Lack of understanding of perioperative instructions can impact patient non-compliance, particularly with fasting regulations before anesthesia. Non-compliance with fasting requirements can increase the risk of aspiration and lead to delays or cancellations of surgical procedures. Therefore, perioperative assistance mobile applications need to use simple language, easy-to-understand visual materials, and reminder features for important instructions, such as fasting start times, medication use or discontinuation, and procedure schedules. Adaptive and accessible information presentation repeated access has the potential to reduce gaps in understanding due to limitations in patients and service systems (Pang et al., 2025).

An adaptive and collaborative educational approach enhances patient engagement.

Research results indicate that the effectiveness of perioperative education is determined not only by the content but also by the delivery method, tailored to the patient's characteristics. Participants emphasized the importance of using simple language, visual media, repetition of information, and adapting educational methods based on the patient's age, education level, psychological condition, and communication skills. These findings align with the concept of patient-centered care, which emphasizes that education centered on the patient's needs, preferences, and abilities can improve patient understanding, engagement, and participation in the clinical decision-making process. Furthermore, communication tailored to individual needs has been shown to increase the effectiveness of health information delivery and patient satisfaction (Doyle et al., 2013). This study also demonstrates that families play a crucial role in the success of education, particularly for geriatric patients, children, and patients with communication limitations. Family involvement helps strengthen patients' understanding of the information provided and improves compliance with

perioperative instructions. These findings are consistent with the family-centered care approach, which positions families as partners in the healthcare process, thereby improving communication, decision-making, and service outcomes (Kokorelias et al., 2019).

In addition to an individualized approach and family involvement, participants emphasized the importance of collaboration between anesthesiologists, nurses, and other healthcare professionals to ensure consistent information is received by patients. Aligned communication between professionals can reduce patient confusion, increase trust in healthcare professionals, and support continuity of education throughout the perioperative process. Therefore, mobile application development should not only function as a medium for delivering information but also as a tool that supports consistent, adaptive, and patient-centered communication (Stauber et al., 2020).

Mobile applications are viewed as adaptive, sustainable, and patient-centered digital educational tools.

The study's results indicate that mobile applications are viewed as a tool that can complement face-to-face education during the perioperative period. Participants assessed that limited service time, the high workload of healthcare professionals, and patients' ability to retain information mean that conventional education does not fully meet patient needs. Therefore, mobile applications are expected to provide educational materials that can be independently accessed as needed by patients. These findings align with the growing use of digital technology in healthcare, which aims to improve access to information, patient engagement, and continuity of care through a mobile health approach (Global Strategy on Digital Health 2020-2025, 2021).

Participants emphasized the importance of presenting material through audiovisual media, using simple language, and features tailored to patient characteristics. Several studies have shown that mobile app-based interventions can improve patient knowledge, adherence to therapy, and patient engagement in health management compared to conventional education alone (Hung et al., 2018). Thus, apps serve not only as a medium for delivering information but also as a learning tool that can be accessed repeatedly as needed by patients. Based on the findings of this study, mobile application development should integrate educational materials appropriate to the perioperative stage, easy-to-understand audiovisual media, automatic reminders for important instructions, and features that allow patients to access information at any time. With this approach, the application has the potential to complement face-to-face education, supporting continuity of education and improving patient preparedness during perioperative care (Morte et al., 2021).

Implications for Developing a Perioperative Companion Mobile Application

The findings of this study provide a conceptual basis for developing a patient-centered perioperative companion mobile application. Unlike conventional educational media, which are generally provided verbally or through leaflets for a limited time, mobile applications allow patients to obtain information independently, repeatedly, and appropriately according to the stage of care they are undergoing. This approach has the potential to improve educational continuity while complementing face-to-face communication between healthcare professionals and patients (Kondylakis et al., 2022).

Based on the four themes identified, application development should integrate educational materials appropriate to the perioperative phase, covering pre-anesthetic preparation, the anesthesia and surgical process, and post-operative recovery. Material should be presented in simple language, supported by illustrations, educational videos, and reminder features for important instructions, such as fasting times, medication use, and procedure schedules. Furthermore, the application needs to be designed adaptively to be usable by patients of varying education levels, ages, and health literacy levels, while also allowing for family involvement as patient advocates (El-Hadi et al., 2025).

The results of this study also indicate that mobile applications are not intended to replace education provided by healthcare professionals, but rather as supporting tools that strengthen the educational process during the perioperative period. By providing consistent and easily accessible information, applications have the potential to improve patient understanding, engagement, and preparedness for anesthesia and surgery. Therefore, further research should focus on developing application prototypes, conducting usability testing, and evaluating the application's effectiveness on patient outcomes, such as increased knowledge, adherence to perioperative instructions, anxiety levels, and patient satisfaction.

Table 4. Implications of Application Development

Research Findings	System Requirements	Recommended Features
Patients need information according to the perioperative stage	Education structured according to service flow	Pre-anesthesia, intra-anesthesia, and post-anesthesia modules
Verbal information is easily forgotten	Materials accessible again	Educational videos, infographics, e-books
Patient characteristics vary	Adaptive education	Simple language, visual icons, subtitles, and audio
Patients need information according to their condition	Personalized education	Initial screening and material recommendations
Families play a role in education	Supporting caregivers	Family account or companion mode
Patients need preparation reminders	Automatic reminders	Notifications for fasting, medication, and surgery schedules
Patients seek information online	Official information sources	Evidence-based information center
Families are anxious about awaiting surgery	Patient progress information	Service stage status (integrated with hospital systems if possible)
Data security is a concern	Privacy protection	User login, authentication, and data access restrictions

CONCLUSION

This study identified four main themes that describe patient education needs during the perioperative period: (1) patient readiness is built through comprehensive and continuous education; (2) the effectiveness of education is influenced by patient characteristics, the care system, and the consequences of non-compliance; (3) an adaptive and collaborative educational approach increases patient engagement; and (4) mobile applications are viewed as adaptive, continuous, and patient-centered digital educational media. These findings indicate that patient education needs are not limited to the pre-anesthesia phase but encompass the entire perioperative journey. Therefore, the development of a perioperative mobile application has the potential to be an educational support medium that complements face-to-face communication, improves access to information, and supports patient readiness and engagement in perioperative care.

The results of this study can serve as a basis for the development of perioperative mobile applications tailored to the actual needs of patients and healthcare professionals. Future research is recommended to develop an application prototype based on the findings of this study, then conduct usability testing and evaluate its effectiveness for patient-centered outcomes, such as increased knowledge, adherence to perioperative instructions, reduced anxiety, and patient satisfaction.

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