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Derleme/Review

Current Technological Methods Used in Education of Surgical Patients: A Literature Review /

Cerrahi Hastalarının Eğitiminde Güncel Teknolojik Yaklaşımlar: Literatür Taraması

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Özet:

Perioperatif dönemde cerrahi hastaların etkili ve doğru eğitimi, iyileşmenin hızlandırılması, komplikasyonların azaltılması ve hasta memnuniyetinin artırılması açısından kritik öneme sahiptir. Günümüzde sağlık alanındaki teknolojik gelişmeler, mobil uygulamalar, artırılmış gerçeklik, sanal gerçeklik, yapay zekâ, giyilebilir teknolojiler, tele-sağlık ve web tabanlı eğitim materyalleri gibi çeşitli yenilikçi araçların hasta eğitiminde kullanılmasına olanak sağlamıştır. Bu derleme, cerrahi hemşireliği bağlamında kullanılan güncel teknolojik hasta eğitimi uygulamalarını ve yöntemlerini kapsamlı biçimde incelemektedir. Söz konusu teknolojik yaklaşımların hasta sonuçları üzerindeki etkileri, uygulama alanları, avantajları ve sınırlılıkları ile cerrahi hemşirelik uygulamalarına yansımaları ele alınmaktadır. Bulgular, teknolojik eğitim araçlarının perioperatif hasta eğitiminde katılımı ve öğrenmeye yönelik motivasyonu artırarak hasta uyumunu ve bakım kalitesini olumlu yönde etkilediğini göstermektedir. Ancak erişim engelleri, maliyet, teknik bilgi eksikliği ve bireysel farklılıklar gibi çeşitli zorluklar da göz önünde bulundurulmalıdır. Sonuç olarak, cerrahi hasta eğitimine teknolojik uygulamaların entegrasyonu hem hastalar hem de sağlık profesyonelleri açısından önemli fırsatlar sunmaktadır. Bu faydaların en üst düzeye çıkarılabilmesi için hemşirelerin bilgi ve becerilerinin güçlendirilmesi, disiplinler arası iş birliğinin teşvik edilmesi ve teknolojik altyapının iyileştirilmesi gerekmektedir.

Anahtar Kelimeler: Perioperatif bakım, Cerrahi hemşireliği, Hasta eğitimi, Sağlık eğitimi teknolojisi.

Abstract:

Effective and accurate education of surgical patients during the perioperative period is critically important for accelerating recovery, reducing complications, and increasing patient satisfaction. Today, the rapid advancement of technology in healthcare has enabled the use of various innovative tools in patient education, including mobile applications, augmented reality, virtual reality, artificial intelligence, wearable technologies, telehealth, and web-based educational materials. This review provides a comprehensive examination of current technological patient education practices and methods used within the context of surgical nursing. The effects of these technological approaches on patient outcomes, their areas of application, advantages, and limitations are discussed, along with their implications for surgical nursing practice. The findings indicate that technological educational tools positively influence patient compliance and the quality of care by enhancing engagement and motivation to learn during perioperative patient education. However, challenges such as access barriers, cost, lack of technical knowledge, and individual differences must also be considered. In conclusion, integrating technological applications into surgical patient education presents significant opportunities for both patients and healthcare professionals. To maximize these benefits, it is essential to strengthen nurses' knowledge and skills, foster interdisciplinary collaboration, and improve technological infrastructure.

Keywords: Perioperative care, Surgical nursing, Patient education, Health education technology.

1. Introduction

Surgical interventions have significant physical and psychological effects on patients, often manifesting as depressive emotions such as fear and anxiety. Educational interventions play a critical role in patients coping with these negative emotions (Candaş Altınbaş & Gürsoy, 2023; Kamau-Mitchell, 2025; Reger, 2023). Patient education, one of the primary responsibilities of nurses, helps reduce anxiety levels, strengthens patients' coping skills, facilitates their adherence to the treatment process, shortens hospital stays, and enhances both overall satisfaction and the quality of care (Görücü et al., 2024). Traditional patient education is typically conducted through face-to-face consultations, printed brochures, or instructional videos (Güzel & Yava, 2024). However, in recent years, the comprehensive and dynamic development of digital applications -and their integration into various clinical domains including patient education and counseling within healthcare systems- has led to significant transformations in the providing patient education (Schooley et al., 2020; Zhitomirsky & Aharony, 2023; Patel et al., 2025). In this review, the current technological applications and methods used in the education of surgical patients are reviewed within the context of surgical nursing, focusing on their effects on patient outcomes, areas of implementation, advantages and disadvantages, and implications for nursing practice.

2. General Information

Today, digital technologies have transformed the way patients access health-related information and interact with healthcare providers. Innovative approaches such as mobile health applications, wearable technologies, telehealth systems, personalized health tools, and artificial intelligence (AI)-based systems offer effective solutions that eliminate temporal and spatial barriers in patient education while promoting individual awareness, engagement, and behavioral change (Kuwabara et al., 2020). Cutting-edge methods such as mobile health applications, virtual reality (VR), augmented reality (AR), and telehealth are increasingly being utilized in the education of surgical patients. Mobile health applications help surgical patients adhere to post-discharge care by facilitating nurse-patient communication in areas such as medication adherence, wound care, and monitoring of physical activity levels (Nietsche et al., 2024). Surgical nurses can use such tools to provide personalized and culturally sensitive education (Reger, 2023).

2.1. The Importance of Patient Education in the Perioperative Periods

Surgical interventions represent a major turning point in an individual's life and serve as a significant source of both physiological and psychological stress for patients. The complexity and uncertainty of the surgical process can trigger feelings of fear, anxiety, and loss of control (Atomsa et al., 2024; Candaş Altınbaş & Gürsoy, 2023; Güzel & Yava, 2024; Kamau-Mitchell, 2025). The preoperative period, in particular, is one of the most critical phases in which patients have heightened informational needs and require substantial support to make informed health-related decisions. In this context, patient education emerges as a vital nursing intervention that not only aims to enhance patients' knowledge but also supports the development of health-promoting behaviors, improves adherence to treatment, and encourages active participation in their own care processes (Ali et al., 2024; Atomsa et al., 2024; Candaş Altınbaş & Gürsoy, 2023).

Perioperative patient education not only addresses knowledge deficits but also reduces anxiety levels and hospital length of stay, fosters a sense of safety, enhances patient satisfaction, and enables more informed participation in the treatment process (Ali et al., 2024; Görücü et al., 2024; Grab et al., 2023). Surgical nurses play a coordinating role during perioperative care by assessing all of the patient's needs and planning patient education (Akaltun et al., 2025; Görücü et al., 2024). The content of education for surgical patients typically includes the purpose of the surgery, procedural steps, anesthesia practices, postoperative pain management, wound care, mobilization, nutrition, medication use, and important considerations for the post-discharge period (Akaltun et al., 2025; Ali et al., 2024; Atomsa et al., 2024).

Today, the shortening of hospital stays in healthcare systems requires patients to take on greater responsibility in the surgical care process (Pulkkinen et al., 2020; Fatani et al., 2025). Therefore, patient education should not only aim to provide information but also focus on developing skills and promoting behavioral change (Çeçen Çamlı, 2024). Patients and their families must be equipped with the necessary knowledge and competencies to manage their care safely and effectively at every stage of the surgical process. An effective patient education process facilitates adherence to pre- and postoperative treatments, reduces postoperative complications and healthcare costs, and supports a quicker return to normal daily life (Atomsa et al., 2024; Zhitomirsky & Aharony, 2023).

2.2. Classification of Current Technological Methods in the Education of Surgical Patients

2.2.1. Mobile applications

Mobile health applications (mHealth) are digital tools designed for use via smartphones and tablets to provide patients with education and guidance, deliver health-related information, monitor health status, and promote active participation in their care processes (Williams & Duff, 2024). Numerous mobile applications developed for surgical patients offer a wide range of content such as preoperative preparation instructions, information about the surgical procedure, recommended exercises, and postoperative care guidelines. These tools allow for the customization of patient education and follow-up processes according to individual needs (Sayar, 2025; Williams & Duff, 2024).

Mobile applications enable patients to access information independently of time and place, and their continuously updatable features allow for the delivery of individualized educational content (Kuwabara et al., 2020). Furthermore, integrated notification systems within these apps support the regular follow-up of postoperative practices such as medication adherence, exercise tracking, and wound care (Sayar, 2025). Recent studies have shown that such applications may positively influence patients' anxiety levels and treatment adherence (Salman Saraç et al., 2024; El-Hadi et al., 2025; Pan et al., 2025; Çakmak et al., 2018). In one study involving patients scheduled for breast cancer surgery, an educational mobile application introduced one week prior to surgery significantly reduced postoperative anxiety and distress levels during the early recovery period. The study concluded that digital patient education may serve as an effective tool for providing psychological support (Salman Saraç et al., 2024). Similarly, in a study involving hip and knee arthroplasty patients, a mobile app was used to deliver postoperative care instructions and follow-up surveys. The results showed high patient satisfaction, with a compliance rate of 78% for completing follow-up questionnaires. Most participants expressed willingness to use the app again and preferred it over traditional paper forms. However, the study also noted that 82% of patients still required at least one phone reminder despite the app's automated notifications, highlighting that not all patients may adapt equally well to digital follow-up methods (Suzuki et al., 2024).

2.2.2. Virtual reality

Virtual reality (VR) is a technology that immerses users in a completely artificial, computer-generated environment through visual interaction. Today's widely used VR systems operate via devices such as smartphones, televisions, headsets, and goggles. These software- or hardware-based applications allow individuals to navigate and interact with virtual environments in a manner that closely mimics real-time experiences (Kuwabara et al., 2020; Sayar, 2025; Zhao et al., 2019). In patient education, VR technologies enable surgical patients to experience simulated procedures, providing a more tangible understanding of the surgical process. This approach is particularly effective for patients with high anxiety levels, as it enhances their sense of safety and reduces preoperative stress (Grab et al., 2023; Kuwabara et al., 2020; Zhao et al., 2019).

In a study examining the impact of preoperative VR experiences on patient-reported outcomes, participants were educated through 360° videos delivered via VR headsets covering both preoperative and postoperative phases. The findings indicated increased patient knowledge and satisfaction, along with decreased anxiety and pain levels (Bekelis et al., 2017). Another study investigated the effects of

VR videos on the quality of bowel preparation, patient compliance, satisfaction, and anxiety reduction before colonoscopy. Patients received step-by-step instructions on bowel cleansing via VR videos, which led to improved satisfaction, adherence, preparation quality, and lower pre-procedural anxiety (Zhao et al., 2019). A different study that addressed the use of VR in education from both nurse and patient perspectives found that novice nurses who used VR technology to educate patients reported significantly lower levels of burnout compared to those employing conventional methods. Furthermore, patients who received VR-based education reported significantly higher satisfaction levels (Kim et al., 2024). These findings suggest that VR-enhanced education can actively engage patients in treatment, care, and decision-making processes, while also reducing anxiety and pain, and increasing satisfaction and knowledge. For surgical patients, VR technology can be particularly effective among individuals with learning difficulties, making complex health information more understandable and supporting informed decision-making (Görücü et al., 2024).

2.2.3. Augmented reality

Augmented reality (AR) is an interactive technology that overlays virtual objects onto the real-world environment. In the context of patient education, AR applications allow individuals to visualize their own body or the surgical setting through smart devices enhanced with graphics and/or animations (Boz Yüksekdağ, 2021; Kuwabara et al., 2020). Although the use of AR in surgical patient education is relatively new, recent studies have presented evidence suggesting that AR may be effective in reducing preoperative anxiety and postoperative acute pain (Esteban-Sopeña et al., 2024; García-Sánchez et al., 2023; Rizzo et al., 2023). In a randomized controlled trial involving surgical patients, participants were divided into two groups during the preoperative period. One group received conventional education (verbal information+printed brochures), while the other experienced an interactive AR-based simulation of the day of surgery. The results showed that the AR group had significantly lower preoperative anxiety scores compared to the standard education group. However, there were no significant differences between the groups in terms of postoperative pain, anxiety levels, or opioid consumption (Rizzo et al., 2023). These findings suggest that AR-based education may be effective in reducing anxiety during the preoperative period. Nonetheless, further research is needed to better understand the broader impact of AR applications in the education of surgical patients (Evans et al., 2025).

In light of the literature findings, the following concrete steps are recommended for the effective use of VR/AR technologies in a clinical setting:

- Patient selection and preliminary assessment: Nurses should carefully assess the patient's cognitive status, visual acuity, and digital literacy level before technological intervention (Grab et al., 2023; Knudsen et al., 2024; Zhao et al., 2019). These technologies may be prioritized, particularly in pediatric burn patients, to reduce pain and fear during dressing changes or to improve rehabilitation compliance in patients undergoing complex surgery such as total joint replacement (Akaltun et al., 2025; Evans et al., 2025; García-Sánchez et al., 2023).

- Application conditions and safety: VR/AR sessions should be conducted under the direct supervision of a nurse and in a familiar environment where the patient feels most comfortable (Pena et al., 2023; Schooley et al., 2020). Physical discomfort symptoms such as dizziness, nausea, or "virtual reality sickness" that may occur during the procedure should be closely monitored by the nurse, and the procedure should be terminated immediately if symptoms are observed (Grab et al., 2023; Zhao et al., 2019).

- Personalization and visualization of training: Nurses should actively involve the patient in the processes using 3D interactive models, especially in areas such as cardiac or neurosurgery where traditional 2D images are difficult for patients to understand (Grab et al., 2023; Evans et al., 2025; Görücü et al., 2024). In this process, technology should not replace the nurse's professional advisory role, but rather be positioned

as a complement that strengthens the "human touch" (Knudsen et al.,2024; Erdoğan & Bulut, 2017).

- Managing limitations: For patients with limited access to technology or barriers such as claustrophobia, nurses should offer alternative channels such as less invasive tablet-based digital materials or videos accessible via QR codes (Pena et al., 2023; Wang et al., 2024; Zhao et al., 2019).

Consequently, nurses should provide technical pre-training to the patient before using digital tools and utilize the distraction effect created by technology as a strategic tool in pain and anxiety management (Akaltun et al., 2025; Knudsen et al., 2024; Sadeghi et al., 2025).

2.2.4. Web-based educational programs

Nowadays, the internet has become a vital resource for seeking health-related information, enhancing opportunities for information sharing and interaction among patients, family members, and healthcare professionals. The increasing use of web-based patient education applications is driven by factors such as adults' limited time to attend face-to-face health education sessions, the ability to replay online educational content, and its cost-effectiveness (Kuwabara et al., 2020; Sayar, 2025). Online education models developed for individuals seeking information in surgical fields prioritize a patient-centered approach and facilitate access to education outside clinical settings through videos and audiovisual materials. These resources support users in engaging independently in learning processes alongside their caregivers. Additionally, the repetitive nature of these programs helps reinforce knowledge and facilitate the translation of information into practice (Erdoğan & Bulut, 2017; Kuwabara et al., 2020; Sayar, 2025).

Compared to traditional written or verbal education methods, multimedia-supported or video-based education offers greater accessibility, flexibility, and interactive opportunities, enhancing individuals' motivation to learn and leading to more effective outcomes in patient education (Sadeghi et al., 2025; Türkdoğan et al., 2022). A randomized controlled trial examining the effects of multimedia-based education in patients scheduled for gallbladder surgery found that the intervention group, which received multimedia education about the preoperative period, showed a significant reduction in preoperative state anxiety compared to the control group receiving traditional education (Sadeghi et al., 2025). In another study involving patients scheduled for endoscopic sinus surgery, individuals invited to participate in preoperative education via a digital platform and reminded through personalized messages sent via an electronic health record system demonstrated increased participation rates. This finding highlights the critical role of the human factor within digital health systems for enhancing patient engagement (Reger, 2023).

2.2.5. Telehealth applications

Telehealth refers to the delivery of healthcare services remotely through the use of information and communication technologies. Telehealth applications are utilized in a multifaceted manner for surgical patients, ranging from preoperative assessments and education conducted online to postoperative home monitoring and follow-up processes (Köstekli et al., 2020; Waterland et al., 2021). With the onset of the COVID-19 pandemic, telehealth experienced significant global acceleration and became increasingly integrated into the care pathways of surgical patients (Segal et al., 2021). Studies on this topic have reported varied outcomes. In a study involving gynecological surgery patients, teleconference and face-to-face options were offered for preoperative evaluation, education, and surgery appointment scheduling. The comprehension rates of preoperative education were found to be similar between the telehealth and face-to-face groups, and patient satisfaction was high in both groups (Wang et al., 2024). Another study providing telehealth education to patients undergoing abdominal cancer surgery reported that 77% of participants preferred online education over face-to-face sessions and found the information more memorable when delivered virtually. The study concluded that telehealth education increased accessibility and patient satisfaction (Waterland et al., 2021).

2.2.6. Artificial intelligence-supported systems

Artificial intelligence (AI) technologies are systems capable of learning from large datasets to provide intelligent predictions and personalized recommendations (Zhang et al., 2021). In recent years, AI-based applications such as chatbots, virtual assistants, and decision support systems have become increasingly prevalent in healthcare and have begun to be integrated into the education process for surgical patients (Çeçen Çamlı, 2024). Particularly, AI-powered chatbots facilitate access to information by answering patients' frequently asked questions 24/7 through natural language processing. As technological advances become more widely embedded in everyday life, patients increasingly turn to online resources to obtain information about their health status, treatment options, and expected outcomes. Large language models (LLMs) like ChatGPT have emerged as new tools with the potential to transform healthcare delivery in this context (Ferrari-Light et al., 2025; Kuwabara et al., 2020; Thia & Saluja, 2024). In a study within vascular surgery, ChatGPT's responses regarding abdominal aortic aneurysm were compared with those of an official health platform and evaluated by experts for medical accuracy, clarity, and actionable recommendations. All responses were deemed clinically appropriate, and some even met high-quality criteria for patient education materials. However, it was noted that the responses often required advanced reading skills and were limited in providing clear, actionable instructions (Collin et al., 2025). Another study investigating ChatGPT's potential in patient education emphasized the need for improvement in response quality and accuracy. While some information was correct, clear, and patient-friendly, other responses were overly general, lacked technical details, or were presented without proper sourcing. Therefore, caution is advised when using ChatGPT directly as a patient education tool (Ferrari-Light et al., 2025).

Despite concerns regarding ethical considerations, reliability, and limitations, LLMs remain promising tools for delivering useful and up-to-date medical information to patients and improving access to health knowledge. However, structuring questions appropriately is essential to make the responses more accessible and comprehensible to the general public (Thia & Saluja, 2024). AI systems can offer personalized guidance for surgical patients on topics such as preoperative preparation, postoperative care, and medication management. Nevertheless, it should be noted that AI systems currently have limited capacity to provide detailed, individualized recommendations based on personal health histories (Ferrari-Light et al., 2025; Thia & Saluja, 2024). While artificial intelligence and LLMs have the potential to present complex medical information in a language patients can understand, their use in a clinical setting carries significant risks of misinformation (Collin et al., 2025). In this context, the role of surgical team members is to use technology not as a substitute, but as a complement that strengthens their professional advisory role (Kuwabara et al., 2020; Çeçen Çamlı, 2024). Before guiding patients to use AI-generated content, nurses should assess their individual health literacy levels and establish a relationship of trust by maintaining a "human touch" in this interaction with technology (Knudsen et al., 2024; Kuwabara et al., 2020). Organizational policies and management frameworks are also crucial for the security of the process (Pena et al., 2023; Williams & Duff, 2024). The use of AI tools should be aligned with the organization's strategic plans. Data security should be supported by clear guidelines and training programs that include ethical standards and implementation protocols (Pena et al., 2023; Knudsen et al., 2024; Patel et al., 2025). Cross-checking with reliable sources is essential to ensure the accuracy of AI outputs (Thia & Saluja, 2024). The information generated by LLMs must be compared with current evidence-based clinical guidelines, valid databases, or content provided by official health organizations (Walker et al., 2020; Thia & Saluja, 2024). Adding reliable external links (reputed sources) to the end of digital training packages will create a critical security layer to prevent patients from being misled and to verify the accuracy of the training (Walker et al., 2020).

2.2.7. Wearable devices

Wearable technologies encompass various electronic devices worn on the body through personal equipment or other means. These devices consist of hardware, software, and core components such as a mobile phone or computer application, enabling them to process and present collected data either in real time or retrospectively (Kolovos, 2020). Wearable technologies represent innovative

applications used in healthcare following patient discharge, capable of monitoring patients' postoperative physical activity levels, assessing whether exercises are performed correctly, and providing alerts when necessary (Sayar, 2025). These technologies have the potential to improve patient care in surgical settings and, when effectively utilized, can positively influence the experiences of both patients and healthcare professionals (Shantz & Veillette, 2014).

Typically, wearable devices and sensors monitor heart rate and physical activity. They may track sleep patterns, mood, or stress levels, or offer guided exercises. These smart devices are used to monitor patient lifestyles and deliver personalized education and feedback to promote healthier behaviors (Kuwabara et al., 2020). The use of wearable technologies in surgery allows for real-time information acquisition about patient status, facilitates early detection and intervention for possible complications, and promotes patients' awareness of their own health and active participation in treatment processes. However, to achieve broader and more effective use of wearable technologies in surgical care, certain challenges must be overcome. These include technological, ethical, and educational barriers such as data security, device integration, and user training (Shantz & Veillette, 2014).

2.3. Advantages and Disadvantages of Using Current Technological Methods in the Education of Surgical Patients

The integration of technological methods into education processes for surgical patients has enhanced the quality of patient education and reshaped the educational roles of nurses (Kim et al., 2024). Mobile health applications, telehealth systems, web-based training, AI, VR, and AR applications support patients' educational processes and positively influence outcomes (Erdoğan & Bulut, 2017; Guo et al., 2023). Contemporary technological and digital tools can offer tailored educational materials according to patients' levels of knowledge, learning preferences, and communication styles. This customization enables patients to receive education that better meets their individual needs. Digital education tools promote active patient engagement; for example, through feedback mechanisms, patients can follow the educational content at their own pace and comprehension level. Information can be presented in a layered manner, starting from basic concepts and progressing to more detailed and theoretical knowledge. This approach facilitates easier access for patients to the information they require at their specific level (Guo et al., 2023; Knudsen et al., 2024; Walker et al., 2020). Telehealth applications provide a safe alternative for remote monitoring, education, and counseling of patients, especially in situations where face-to-face access is limited and during the post-discharge period (Al et al., 2024; Knudsen et al., 2024; Köstekli et al., 2020). AI-supported systems reduce nurses' workload and support the patient education process by providing rapid responses to patients' questions (Ferrari-Light et al., 2025; Konukbay et al., 2020; Thia & Saluja, 2024). VR and AR applications strengthen patient-nurse communication and enable experiential learning (Görücü et al., 2024; Sayar, 2025).

Alongside these benefits, there are also some drawbacks associated with these technologies (Erdoğan & Bulut, 2017; Guo et al., 2023). While digital technologies offer revolutionary opportunities in surgical patient education, implementing these processes brings with it a number of complex risks and limitations (Konukbay et al., 2020; Williams & Duff, 2024). The success of these technologies depends not only on the benefits they offer but also on how digital inequality, data security, low literacy, and ethical concerns are managed (Williams & Duff, 2024; Patel et al., 2025). One of the biggest obstacles facing digital education platforms is the lack of equal access to these technologies for all segments of society (digital exclusion). Low income levels, inadequate education, and limited access to appropriate equipment can make digital education a health inequality factor (Walker et al., 2020). For example, the lack of access to devices such as smartphones or computers for some patients, or instability in internet connectivity, are concrete problems that hinder the continuity of education (Köstekli et al., 2020; Segal et al., 2021; Wang et al., 2024). Furthermore, systems that are not optimized for smartphones or complex login processes (such as username/password errors) can lead patients to stop using the application (Knudsen et al., 2024). The language of educational content may not be appropriate to the patient's literacy level, leading to misunderstandings or inability to recall concepts (Reger, 2023; Suzuki

et al., 2024; Thia & Saluja, 2024; Walker et al., 2020). Studies show that digital information on complex medical topics, such as urological cancer or sinus surgery, is far beyond the average patients' reading level (Thia & Saluja, 2024). The lack of exact equivalents for medical terms in some languages (e.g., Urdu) can lead to cultural and linguistic confusion in translation processes (Walker et al., 2020). This can weaken the patient's ability to manage their own condition (Zhitomirsky & Aharony, 2023). In VR-based training, in particular, patients' physical comfort is at serious risk (García-Sánchez et al., 2023). Symptoms of "virtual reality sickness," such as dizziness, nausea, headaches, and blurred vision, are frequently reported among users (García-Sánchez et al., 2023; Evans et al., 2025; Grab et al., 2023; Zhao et al., 2019). Such physical discomforts can hinder the patient's ability to focus on the training and may even lead to resistance to the training method (García-Sánchez et al., 2023; Grab et al., 2023). In digital health applications, the privacy and security of personal data is one of the most critical ethical issues. Storing patients' health records, test results, or pre-operative images on digital platforms carries the risk of unauthorized access and cyberattacks (Williams & Duff, 2024; Patel et al., 2025). Furthermore, the accuracy of information provided by AI bots used in training cannot be verified, and legal uncertainties persist regarding who is responsible (the manufacturer or the software?) in cases of erroneous medical guidance (Thia & Saluja, 2024; Çeçen Çamlı, 2024). Digitalization is also raising concerns about the decrease in the "human touch" between healthcare professionals and patients. Patients feel that education is less personal in the absence of face-to-face interaction and express that their need for emotional support is not being met (Segal et al., 2021; Knudsen et al., 2024). Especially in processes where anxiety is high, such as surgery, relying solely on screen-based information risks making the patient feel isolated and reducing the quality of care (Zhitomirsky & Aharony, 2023; Kim et al., 2024). Table 1 provides a summary of the advantages and disadvantages of current technological methods and approaches used in the education of surgical patients.

Table 1. Advantages and Disadvantages of Current Technological Approaches in Surgical Patient Education

Technology	Advantages	Disadvantages and Limitations
Mobile Applications	Access independent of time and place; individualized content and increased adherence through instant notifications (medication, exercise tracking); reduction in patient anxiety.	Risk of digital exclusion for patients without smartphones; discontinuation of use due to complex login processes; potential need for additional phone reminders despite automation.
Virtual Reality (VR)	Experiential learning and procedural simulation; creates a sense of safety for high-anxiety patients; significant reduction in reported pain and stress levels.	Risk of "virtual reality sickness" (dizziness, nausea, blurred vision); high equipment costs and requirement for technical knowledge.
Augmented Reality (AR)	Interactive visualization of the patient's own body or the surgical setting; effective in reducing preoperative anxiety.	Limited impact on postoperative pain and opioid consumption; relatively new technology requiring further research for broader impact.
Web-Based Education	Cost-effectiveness and the ability to replay educational content; increased motivation through multimedia support; ease of access outside clinical settings.	Internet connectivity issues; content often exceeds the general public's reading level; lack of "human touch" and perceived insufficient emotional support.

Table 1. Continued

Telehealth	Remote monitoring and counseling capabilities; safe alternative when physical access is restricted (e.g., post-discharge or pandemic conditions).	Requirement for stable internet infrastructure; education may feel less personal due to the absence of face-to-face interaction.
Artificial Intelligence (AI) and Chatbots	24/7 rapid response and reduction in nursing workload; ability to provide personalized recommendations using large datasets.	Risk of medical misinformation and accuracy issues; ethical and legal liability uncertainties regarding erroneous guidance; requirement for high health literacy.
Wearable Technologies	Real-time vital sign and activity monitoring; early detection of complications; promotion of healthy lifestyle behaviors and active patient participation.	Data security and privacy risks (potential for cyber-attacks); challenges regarding device integration and the need for user training.

2.4. Impact of Current Technological Methods on Surgical Nursing in the Education of Surgical Patients

The rapid advancement of digital health technologies in recent years has initiated a multidimensional transformation in surgical nursing (Erdoğan & Bulut, 2017). This transformation has changed the form of the education of surgical patients not only in terms of content but also regarding accessibility, interaction, and learning processes. At the center of this change are surgical nurses who enhance learning opportunities through digital tools, facilitate access, and provide individualized learning experiences (Evans et al., 2025).

Thanks to these technologies, surgical patients can be informed throughout the perioperative period without constraints of time and place. Interactive content, video-based explanations, and audiovisual simulations offered by digital platforms enable patients to better understand the surgical process, adhere to instructions, improve self-care skills, and increase motivation (Grab et al., 2023; Schooley et al., 2020). Nurses also report that integrating digital education systems into patient teaching processes is beneficial (Kim et al., 2024; Schooley et al., 2020). In this process, nurses evolve from being mere conveyors of information to becoming healthcare professionals who monitor, manage, and support the patient's educational journey through technological methods. The development of education modules tailored to patient characteristics via digital tools facilitates the practical implementation of personalized education approaches (Machado et al., 2020).

The multidimensional nature of digital technologies has driven a transformation in nursing roles. In addition to traditional face-to-face education methods, nurses now provide remote consultation services, analyze digital data for patient monitoring, and verify the accuracy of AI-supported content. Technology has thus become not only a tool that facilitates nursing duties but also a defining element shaping professional nursing practice (Akaltun et al., 2025). In this context, patient education in surgical nursing has evolved into a practice area requiring competencies beyond clinical knowledge, encompassing digital ethics, data security, and user experience (Erdoğan & Bulut, 2017). Surgical nurses should not only be implementers of digital technologies but also coordinators and supervisors of this process (Akaltun et al., 2025; Williams & Duff, 2024).

3. Conclusion and Recommendations

Meeting the informational needs of patients undergoing surgical procedures during the perioperative

period is crucial for the effectiveness of treatment and ensuring patient safety. Surgical patients often face multidimensional challenges, including uncertainty, the risk of complications, and potential functional losses. In this context, effective patient education plays a fundamental role in maintaining both physical and psychosocial well-being (Atomsa et al., 2024; Candaş Altınbaş & Gürsoy, 2023; Kamau-Mitchell, 2025; Pena et al., 2023). Surgical nursing occupies an indispensable position in patient education, aiming to facilitate access to information, enhance patient engagement, and support healthy lifestyle behaviors. In recent years, with the rapid advancement of digital health technologies, the education of surgical patients has evolved beyond traditional methods, incorporating innovative and diverse approaches. These technological applications allow nurses to make patient education more personalized, accessible, and effective (Candaş Altınbaş & Gürsoy, 2023; Kim et al., 2024; Reger, 2023).

In conclusion, while digital patient education offers significant potential benefits, its successful implementation requires addressing digital inequities, ensuring the reliability of information, and developing solutions that facilitate access for all patients (Walker et al., 2020). For the effective integration of current technological methods into patient education, technical accessibility must be supported by organizational infrastructure, individualized patient assessments, and the commitment of healthcare professionals to adopt these programs (Knudsen et al., 2024). However, limitations such as infrastructure challenges and data security risks associated with digital technologies must also be taken into account (Williams & Duff, 2024). To this end, nurses' competence in using digital tools and their ability to develop appropriate educational strategies are essential for integrating these methods as indispensable components of high-quality surgical care. Surgical nurses should be able to design personalized and holistic education plans by applying appropriate technological approaches to the appropriate patient. Furthermore, future research especially studies that are comprehensive, long-term, and comparative in nature will enable surgical nurses to evaluate the most effective digital and technological applications and successfully incorporate current methods into patient education practices.

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References

Akaltun, H., Azizoğlu, H., & Güner, Ş. İ. (2025). Cerrahi hemşireliğinde teknoloji kullanımı: sistematik derleme. *Journal of Nursology, 28*(1), 64-75. https://doi.org/10.17049/jnursology.1429679

Al, B., Alturki, S., Yalçıntaş, E., & Torun, E. (2024). A telemedicine model to improve and facilitate access to healthcare: online polyclinic. *Eurasian J Emerg Med, 23*(4), 213-223. https://doi.org/10.4274/eajem.galenos.2024.59862

Ali, Z., Ahsan, Z., Liaqat, N., & Din, I. U. (2024). Bridging the gap: evaluation of preoperative patients' education by comparing expectations and real-perioperative surgical experiences: a mixed-methods descriptive cross-sectional study. *BMC Health Serv Res, 24*(964), 1-8. https://doi.org/10.1186/s12913-024-11388-z

Candaş Altınbaş, B., & Gürsoy, A. (2023). Nurse-led web-based patient education reduces anxiety in thyroidectomy patients: a randomized controlled study. *Int J Nurs Pract, 29*(1), e13131. https://doi.org/10.1111/ijn.13131

Atomsa, L., Temesgen, S., Dechasa, A., Ayana, M., Amena, N., Teklehymanot, D., & Regea, F. (2024).

Preoperative patient teaching practices and associated factors among nurses working at hospitals in West Shoa Zone, Ethiopia, 2022: a cross-sectional study. *Front Public Health, 12*, 1498406. https://doi.org/10.3389/fpubh.2024.1498406

Bekelis, K., Calnan, D., Simmons, N., MacKenzie, T. A., & Kakoulides, G. (2017). Effect of an immersive preoperative virtual reality experience on patient-reported outcomes: a randomized controlled trial. *Ann Surg, 265*(6), 1068-1073 https://doi.org/10.1097/SLA.0000000000002094

Boz Yüksekdağ, B. (2021). Sağlık profesyonellerinin eğitiminde artırılmış gerçeklik uygulamaları. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi, 7*(2), 130-148. https://doi.org/10.51948/auad.887267

Collin, H., Tong, C., Srinivas, A., Pegler, A., Allan, P., & Hagley, D. (2025). Evaluating the role of AI chatbots in patient education for abdominal aortic aneurysms: a comparison of ChatGPT and conventional resources. *ANZ J Surg, 95*(5), 784-788. https://doi.org/10.1111/ans.70053

Çakmak, M., Kose, I., Zinzircioglu, C., Karaman, Y., Tekgul, Z. T., Pektas, S., Balik, Y., Gonullu, M., & Bozkurt, P. S. (2018). Effect of video-based education on anxiety and satisfaction of patients undergoing spinal anesthesia. *Rev Bras Anestesiol, 68*(3), 274-279. https://doi.org/10.1016/j.bjane.2018.01.004

Çeçen Çamlı, D. (2024). Cerrahi hemşireliğinde yapay zekâ teknolojilerinin kullanımı: etik ikilem. *Euroasia Journal of Mathematics, Engineering, Natural & Medical Sciences, 11*(34), 26-34. https://doi.org/10.5281/zenodo.13848063

El-Hadi, H., Chan, B. L.-H., Siu, B. W.-H., Ko, I. C.-H., Leung, D. K.-W., Teoh, J. Y.-C., Chiu, P. K.-F., Ng, C.-F., & Liu, A. Q. (2025). A systematic review of smartphone applications that address patient care in the peri-operative period. *Healthcare (Basel), 13*(21), 2775. https://doi.org/10.3390/healthcare13212775

Erdoğan, Z., & Bulut, H. (2017). Bilgisayar destekli hasta eğitimi. *Gazi Üniversitesi Sağlık Bilimleri Dergisi*, *2*(3), 13-18.

Esteban-Sopeña, J., Beltran-Alacreu, H., Terradas-Monllor, M., Avendaño-Coy, J., & García-Magro, N. (2024). Effectiveness of virtual reality on postoperative pain, disability and range of movement after knee replacement: a systematic review and meta-analysis. *Life, 14*(3), 289. https://doi.org/10.3390/life14030289

Evans, T., Turna, A., Stringfellow, T. D., & Jones, G. G. (2025). Uses of augmented reality in surgical consent and patient education - a systematic review. *PLOS Digit Health, 4*(4), e0000777. https://doi.org/10.1371/journal.pdig.0000777

Fatani, A., Alzebaidi, S., Alghaythee, H. K., Alharbi, S., Bogari, M. H., Salamatullah, H. K., Alghamdi, S., & Makkawi, S. (2025). The role of the discharge planning team on the length of hospital stay and readmission in patients with neurological conditions: a single-center retrospective study. *Healthcare (Basel), 13*(2), 143. https://doi.org/10.3390/healthcare13020143

Ferrari-Light, D., Merritt, R. E., D'Souza, D., Ferguson, M. K., Harrison, S., Madariaga, M. L., Lee, B. E., Moffatt-Bruce, S. D., & Kneuertz, P. J. (2025). Evaluating ChatGPT as a patient resource for frequently asked questions about lung cancer surgery-a pilot study. *J Thorac and Cardiovasc Surg, 169*(4), 1174-1180. https://doi.org/10.1016/j.jtcvs.2024.09.030

García-Sánchez, M., García-Robles, P., Osuna-Pérez, M. C., Lomas-Vega, R., Obrero-Gaitán, E., & Cortés-Pérez, I. (2023). Effectiveness of virtual reality-based early postoperative rehabilitation after total knee arthroplasty: a systematic review with meta-analysis of randomized controlled trials. *Appl Sci, 13*(7), 4597. https://doi.org/10.3390/app13074597

Görücü, R., Şengör, K., & Ayoğlu, T. (2024). Cerrahi işlemler öncesinde hasta eğitiminde sanal gerçeklik: kapsam derlemesi. *Selçuk Sağlık Dergisi, 5*(3), 380-392. https://doi.org/10.70813/ssd.1328017

Grab, M., Hundertmark, F., Thierfelder, N., Fairchild, M., Mela, P., Hagl, C., & Grefen, L. (2023). New perspectives in patient education for cardiac surgery using 3D-printing and virtual reality. *Front Cardiovasc*

Med, 10, 1092007. https://doi.org/10.3389/fcvm.2023.1092007

Guo, F., Zhang, X., & Lee, P. (2023). Editorial: digital information for patient education. *Front Public Health, 11*, 1211285. https://doi.org/10.3389/fpubh.2023.1211285

Güzel, A., & Yava, A. (2024). Cerrahi servislerde çalışan hemşirelerin preoperatif hasta eğitimi uygulamaları ve yaklaşımlarının belirlenmesi. *Bingöl Üniversitesi Sağlık Dergisi, 5*(2), 492-503. https://doi.org/10.58605/bingolsaglik.1481592

Kamau-Mitchell, C. (2025). Benefits of patient education in surgery. *The Surgeon, 23*, 162-166. https://doi.org/10.1016/j.surge.2025.02.002

Kim, J., Kim, D., Oh, S. H., & Kwon, H. (2024). Virtual reality for preoperative patient education: impact on satisfaction, usability, and burnout from the perspective of new nurses. *World J Clin Cases, 12*(28), 6204-6216. https://doi.org/10.12998/wjcc.v12.i28.6204

Knudsen, L. R., Lomborg, K., Hauge, E.-M., Zangi, H. A., & de Thurah, A. (2023). The WebRA study: opportunities and challenges in digital patient education from the perspective of patients with rheumatoid arthritis: a qualitative study. *Patient Educ Couns, 116*, 107969. https://doi.org/10.1016/j.pec.2023.107969

Knudsen, L. R., Lomborg, K., Hauge, E.-M., & de Thurah, A. (2024). Facilitators and challenges of implementing a digital patient education programme for rheumatoid arthritis into clinical practice. *BMC Health Serv Res, 24*, 1104. https://doi.org/10.1186/s12913-024-11597-6

Kolovos, P. (2020). Wearable technologies in post-operative recovery: clinical applications and positive impacts. *International Journal of Caring Sciences, 13*(2), 1474-1479.

Konukbay, D., Efe, M., & Yıldız, D. (2020). Teknolojinin hemşirelik mesleğine yansıması: sistematik derleme. *SBÜ Hemşirelik Dergisi, 2*(3), 175-182. https://doi.org/10.48071/sbuhemsirelik.70087

Köstekli, S., Çelik, S., & Karahan, E. (2020). Cerrahi hastasının taburculuk sonrası tele-sağlık yöntemi ile hemşirelik bakımının önemi. *Cerrahi Ameliyathane Sterilizasyon Enfeksiyon Kontrol Hemşireliği Dergisi, 1*(1), 30-38.

Kuwabara, A., Su, S., & Krauss, J. (2020). Utilizing digital health technologies for patient education in lifestyle medicine. *Am J Lifestyle Med, 14*(2), 137-142. https://doi.org/10.1177/1559827619892547

Machado, R. C. G., Turrini, R. N. T., & Sousa, C. S. (2020). Mobile applications in surgical patient health education: an integrative review. *Rev Esc Enferm USP, 54*, e03555. https://doi.org/10.1590/S1980-220X2018032803555

Nietsche, E. A., Colussi, G., Salbego, C., Cogo, S. B., Ramos, T. K., Girardon-Perlini, N. M. O., & Sehnem, G. D. (2024). Guide for the preparation of the surgical patient for hospital discharge: validation of care-educational technology. *Cogitare Enferm, 29*, e96217. https://doi.org/10.1590/ce.v29i0.96217

Pan, Y., Wan, L., Xue, Q., Ran, G., Chen, K., & Shen, X. (2025). Evaluating the efficacy of a smartphone application in reducing preoperative anxiety in children: a randomised controlled trial. *Indian J Anaesth, 69*, 308-314. https://doi.org/10.4103/ija.ija_526_24

Patel, S.B., Iqbal, F.M., Lam, K., Acharya, A., Ashrafian, H., & Darzi, A (2025). Characterizing behaviors that influence the implementation of digital-based interventions in health care: systematic review. *J Med Internet Res, 27*, e56711. https://doi.org/10.2196/56711

Pena, H., Engel, J., Kester, K., Ellis, M., & Alexander, A. (2023). Implementing digital health technology to facilitate patient education for cardiac surgery patients. *J Nurs Care Qual, 38*(2), 97-99. https://doi.org/10.1097/NCQ.0000000000000673

Pulkkinen, M., Jousela, I., Engblom, J., Salanterä, S., & Junttila, K. (2020). The effect of a new perioperative

practice model on length of hospital stay and on the surgical care process in patients undergoing hip and knee arthroplasty under spinal anesthesia: a randomized clinical trial. *BMC Nurs, 19*, 73. https://doi.org/10.1186/s12912-020-00465-3

Reger, C. (2023). The effect of patient reminders on patient engagement with digital preoperative education [Unpublished doctoral dissertation]. West Chester University. https://digitalcommons.wcupa.edu/all_doctoral/209

Rizzo, M. G., Jr., Costello, J. P., II, Luxenburg, D., Cohen, J. L., Alberti, N., & Kaplan, L. D. (2023). Augmented reality for perioperative anxiety in patients undergoing surgery: a randomized clinical trial. *JAMA Netw Open, 6*(8), e2329310. https://doi.org/10.1001/jamanetworkopen.2023.29310

Sadeghi, N., Salari, N., & Jalali, R. (2025). Effect of multimedia education on anxiety and pain in patients undergoing laparoscopic cholecystectomy: a Solomon four-group randomized controlled trial. *Sci Rep, 15*(1), 9357. https://doi.org/10.1038/s41598-024-77207-x

Salman Saraç, F., Erkal İlhan, S., Kutun, S., & Kutlutürkan, S. (2024). The effect of informative mobile app use on anxiety, distress, and quality of life of women with breast cancer. *Eur J Breast Health, 20*(3), 207-214. https://doi.org/10.4274/ejbh.galenos.2024.2024-3-9

Sayar, S. (2025). Ortopedi hastalarında taburculuk eğitimi ve yenilikçi uygulamalar. *TOTBİD Dergisi, 24*, 129-135. https://doi.org/10.5578/totbid.dergisi.2025.20

Schooley, B., Singh, A., Hikmet, N., & Brookshire, R. (2020). Integrated digital patient education at the bedside for patients with chronic conditions: observational study. *JMIR mHealth and uHealth, 8*(12), e22947, 1-11. https://doi.org/10.2196/22947

Segal, R. M., Matson, J., Moshtaghi, O., Vaidya, E., Kari, E., Friedman, R., Ramamoorthy, S., & Harris, J. P. (2021). Surgical patient experience with a novel telemedicine program in the COVID-19 era. *Telehealth and Medicine Today, 6*(1), 1-16. https://doi.org/10.30953/tmt.v6.237

Shantz, J. A. S., & Veillette, C. J. (2014). The application of wearable technology in surgery: ensuring the positive impact of the wearable revolution on surgical patients. *Front Surg, 1*, 39. https://doi.org/10.3389/fsurg.2014.00039

Suzuki, L., Connon, F., Munir, S., Piplica, S., Pandit, H., & Rodda, D. (2024). Evaluation of a mobile app to assist patient education and research in arthroplasty. *Arthroplasty Today, 30*, 101549. https://doi.org/10.1016/j.artd.2024.101549

Thia, I., & Saluja, M. (2024). ChatGPT: is this patient education tool for urological malignancies readable for the general population? *Res Rep Urol, 16*, 31-37. https://doi.org/10.2147/RRU.S440633

Turkdogan, S., Roy, C. F., Chartier, G., Payne, R., Mlynarek, A., Forest, V.-I., & Hier, M. (2022). Effect of perioperative patient education via animated videos in patients undergoing head and neck surgery: a randomized clinical trial. *JAMA Otolaryngol Head Neck Surg, 148*(2), 173-179. https://doi.org/10.1001/jamaoto.2021.3765

Walker, D., Adebajo, A., & Bukhari, M. (2020). The benefits and challenges of providing patient education digitally. *Rheumatology, 59*(12), 3591-3592. https://doi.org/10.1093/rheumatology/keaa642

Wang, Y., Xu, G., Yan, C., Wang, F., Yang, M., & Wang, Y. (2024). Telemedicine for preoperative assessment, surgical appointments, and preoperative education in gynecological day surgery: a prospective observational analysis. *Int J Womens Health, 16*, 1533-1540. https://doi.org/10.2147/IJWH.S467963

Waterland, J. L., Chahal, R., Ismail, H., Sinton, C., Riedel, B., Francis, J. J., & Denehy, L. (2021). Implementing a telehealth prehabilitation education session for patients preparing for major cancer surgery. *BMC Health Serv Res, 21*, 443. https://doi.org/10.1186/s12913-021-06437

Williams, C. J., & Duff, J. (2024). The roadblocks to success - identifying challenges in implementing a surgery

support e-health solution: a qualitative interview study. *Perioperative Care and Operating Room Management, 37*, 100427. https://doi.org/10.1016/j.pcorm.2024.100427

Zhang, Q., Lu, J., & Jin, Y. (2021). Artificial intelligence in recommender systems. *Complex Intell Syst, 7*, 439-457. https://doi.org/10.1007/s40747-020-00212-w

Zhao, Y., Xie, F., Bai, X., Yang, A., & Wu, D. (2019). Educational virtual reality videos in improving bowel preparation quality and satisfaction of outpatients undergoing colonoscopy: protocol of a randomized controlled trial. *BMJ Open, 9*(8), e029483. http://dx.doi.org/10.1136/bmjopen-2019-029483

Zhitomirsky, Y., & Aharony, N. (2023). The effect of a patient education multimodal digital platform on knowledge acquisition, self-efficacy, and patient satisfaction. *CIN: Computers, Informatics, Nursing, 41*(5), 356-364. https://doi.org/10.1097/CIN.0000000000000939