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Systematic Review

Education-Based Mobile Apps Platform in Patients Undergoing Surgery: A Systematic Review

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ABSTRACT

Introduction: Providing sufficient information during a pre-operative helps patients understand their condition and plan of care, to identify and manage potential complications, and to reduce hospital readmission. New innovation mobile application platforms put education in the hands of patients and their families. The aim of study was to investigate the effect of mobile application education in patients undergoing surgery.

Methods: A systematic review study was based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyzes) with article sources using the Scopus, Science Direct, PubMed and ProQuest databases. Limited to the last 5 years (2015-2020) using English as well as full-text articles. This was done using a combination of keywords and Boolean operators (AND and OR). Keywords used in searching are "Education" "Pre-operative Education", "Perioperative", "Mobile Application", "Smartphone", "Multimedia" and "Surgery".

Results: Total article found were 438 articles and we just included 15 articles which related to topic. The design RCT was 10 articles, 2 quasi-experimental articles, 1 cohort study, and 2descriptive study. Mobile application platform has multiple benefit and challenges to effective delivery of health information to patients, new models of health care demand patient empowerment and so are fundamentally dependent on success with patient education. Patients indicated they understood of the content prior to discharge.

Conclusion: Additionally, patient demonstrated mobile application advances allow delivery of both individualized and "just-in-time" education. Our findings indicate that education based mobile application platform have a positive effect on patients undergoing surgery.

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INTRODUCTION

Surgical patients often experience pre-operative related problems such as anxiety and lack of knowledge (Lin et al., 2016)(Mundi et al., 2015). Patients undergoing surgery are often faced with complex treatment decisions without sufficient information regarding the association of these choices with outcomes that matter most to them (Panda et al., 2019).Perioperatively, patient education helps patients understand their condition and the plan of care, to identify and manage potential complications, and to reduce hospital re admission. This type of information reduces healthcare-associated costs through decreased length of stay and improved self-management after discharge. Effective patient education has multiple requirements; some relate to the form, content, and mode of delivery required for adults, whereas other contingencies are patient-sided challenges related to illness and hospitalization. Finally, there are multiple requirements of providers.

The format and delivery of education can impact a patient's ability to learn and act. Information acquisition is affected by the approach to education (type of setting, presenter), mode of delivery (written,

electronic, face-to-face, etc.), and how often information is presented (Tomaszek et al., 2019). Adult education is most effective when the content is individualized,

when multiple delivery means are utilized, and when delivery occurs in multiple sessions (Stamenkovic et al., 2018). Although perioperative education is critical, hospitalization creates patient-dependent education barriers. Surgery may result in pain, fatigue, and nausea; sleep deprivation, alteration of sleep wake cycles, medication effects, and cognitive impairment are also

common, particularly in older adults (Lee et al., 2014).There are also provider-dependent factors relevant to effective patient education. Post-operative patient education has traditionally been delivered through writing (e.g., pamphlets), verbal instruction by a nurse, or a combination of these. With verbal education, nurses are typically responsible for the selection of topics that they perceive as important

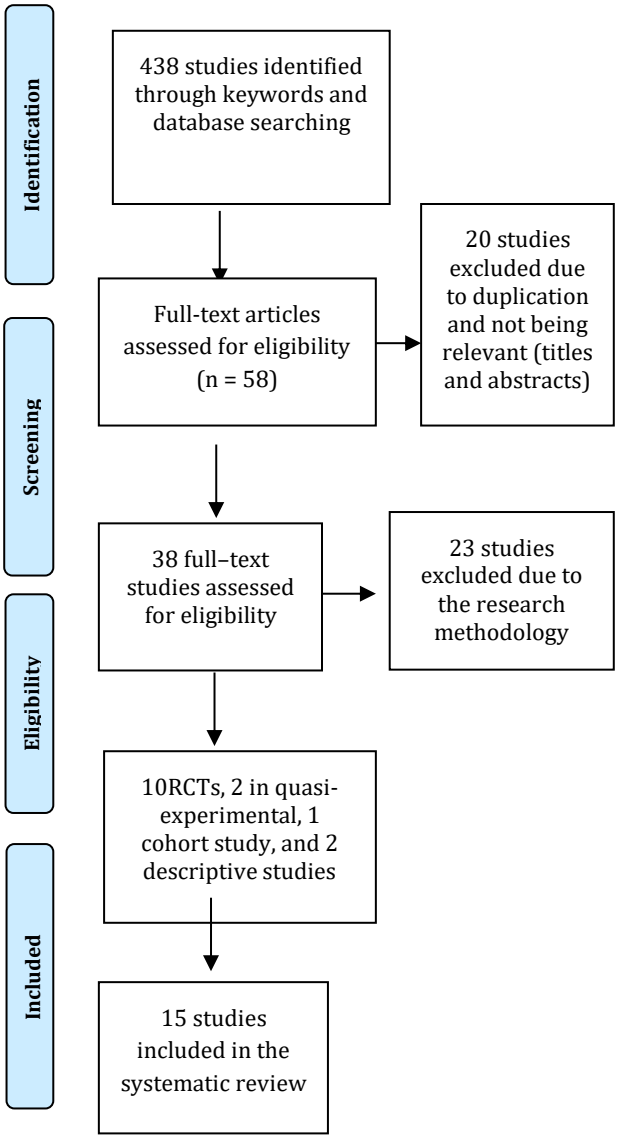

Figure 1. Flow diagram

(Cakmak et al., 2018).Limitations of this approach include provider-dependent inconsistencies, disconnection between patient needs and the provider's appraisal, providing too much information in written format, and information that may not correlate with patients' knowledge level(Hoon et al., 2013). Furthermore, verbal only instructions are frequently forgotten or remembered inaccurately, and timing dyssynchrony between nurse and patient availability/readiness is common. Educational topics may not be available, content inconsistencies are common, and keeping content up to date is difficult (Patel et al., 2016).

New approaches to patient education are required. There is a current growing movement in mobile technologies and applications that collaborate to build a new modality of healthcare (Sousa & Turrini, 2019).Advances in mobile telecommunication, improved mobile internet and affordability have led to a significant increase in smartphone use within medicine (Patel et al., 2016).Mobile applications on smartphones have played an increasingly significant role in patient-centered health and medicine (Panda et al., 2019). Smartphone mobile apps have been developed to target both consumers and healthcare professionals in myriad scenarios and settings, such as health, fitness and lifestyle education and management apps, ambient assisted living apps, continuing professional education tools, and apps for public health surveillance (Lalloo et al., 2017).E-learning on mobile applications is slowly becoming the standard of teaching in many fields because of multiple advantages, such as lack of physical barrier, flexibility, and options of asynchronous learning. Technological innovations will continue to bring new solutions, but also new challenges at the same time (Roy et al., 2019).The aim of this study was to identify the use of mobile application platforms in perioperative surgery.

MATERIALS AND METHODS

This paper reported on a complementary intervention in the nursing area since 2015-2020. The study adopted a systematic literature review methodology to clarify the advantages of mobile applications on perioperative care in surgery patients. By systematically reviewing the literature, we were able to synthesize the existing literature and empirical evidence in a transparent and replicable way in order to identify areas where the knowledge is still scarce and to point out future research questions to academics, practitioners and policymakers. From a range of 438 papers in total, we identified 38 papers that need to be thoroughly revised and, after we decided on the inclusion criteria, it limited the papers down to 15 focused on mobile application and related multimedia innovation for perioperative care on patient undergoing surgery.

Data Collection

The study uses a systematic review study based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyzes), in searching for article sources using the Scopus, Science Direct, PubMed and ProQuest databases. Article search is limited to the last 5 years (2015-2020), articles that use English as well as full-text articles. This was done using a combination of keywords and Boolean operators (AND and OR). Keywords used in searching are "Education" "Pre-operative Education" "Perioperative", "Mobile Application", "Smartphone", "Multimedia" and "Surgery".

Study Selection and Data Extraction

The inclusion criteria of the research were 1) experimental and non-experimental studies (including descriptive study), 2) research conducted from 2015 to 2020 and 3) research samples or respondents who were patients undergoing surgery or related point of view about surgery. There was no age limitation for the participants in the article, because the focus of the search was on the mobile application usefulness and implication. The articles were clarified if the results of the study did not explain the estimated effects of the intervention and studies focusing only on describing the use of mobile application in educating patients. The steps of the data selection and extraction are reported in Figure 1.

RESULTS

The results of the review of 15 journal articles used in this study are related to the benefits of mobile application and other kind multimedia innovation for surgery patient. The total number of respondents in this review was 1341 participants. The researcher found three articles that did not mention the number of participants.

DISCUSSION

The literature review showed that researchers have been analyzing mobile application benefit based on patient point of view. Only limited study showed both advantages for patient and surgeon or physician point of view (Patel et al., 2016)(Uesugi et al., 2013).New models of mobile apps platforms demand patient empowerment and so are fundamentally dependent on success with patient education. Remarkable advances in technology and information systems create previously unknown opportunities to achieve. In aging population having an average age over 60 years undergoing very major surgery, patients still utilize very aggressive education programs. Furthermore, patients indicated they understood the content prior to discharge(Roy et al., 2019).

Education tools and helping patient in making a decision

Mobile application can complement teaching techniques and educational tools in patient undergoing surgery (Roy et al., 2019). In addition, it can potentially be used as a platform for helping patient in making a decision regarding appropriate recovery or dietary programs. The approach to education (setting, educator), mode of delivery (written, electronic, face-to-face, etc.), and timing may affect patient's ability to retain information. Education is most effective when the content is personalized, when multiple delivery means are utilized, and when delivery occurs in multiple sessions, the addition of multimedia material is associated with greater patient satisfaction and maximizes information gain (Pecorelli et al., 2018).

Providing insight into the recovery of patients

Providing consultation may allow for considerable advances in shared decision-making, recovery monitoring, and patient engagement (Panda et al., 2019).There has been remarkable growth in smartphones use among surgeons. Apps are being developed for every conceivable use (Patel et al., 2016).

Favorable experience

Patients reported favorable experience with app usage, reporting that it fits easily into their existing life pattern, while helping them prepare for surgery. The app accomplished the primary intent of cost-effectively educating, assessing, and engaging patients (Mundi et al., 2015).Patients participating in the trial reported high usability and satisfaction with the app; most of them felt that the app was very helpful to understand and achieve their recovery goals and motivate them to recover from surgery (Pecorelli et al., 2018).

Decreased anxiety levels

The reduction in anxiety can be attributable to the audiovisual presentation, indicating that it might be easier to understand a video presentation than a purely verbal briefing (Lin et al., 2016)(Shao et al., 2019).Patient anxiety may result from lack of information in the pre-operative period. The 'fear of feeling ill' component of anxiety was assessed by measurements. The pre-operative video addressed these two dimensions and described the experience that patients should expect during the perioperative period. Previous studies of surgical patients indicate that pre-operative anxiety is reduced by having had positive experiences in previous surgery, feeling a sense of security and caring, being well-informed and having positive expectations.

Table 1. The studies included in the systematic review

Author	Type of Study	Participants	Intervention	Outcome
(Bouwsma et al., 2018)	RCTs	433 participants	An internet-based care program	Return to work (RTW) duration
(Lalloo et al., 2017)	Descriptive study	10 applications	Characterize, evaluate functionality of apps.	Character, content, and function of application
(Lin et al., 2016)	RCTs	100 participants	Educational anesthetic video	Anxiety, experimental effect, and satisfaction
(Mundi et al., 2015)	RCTs	30 participants	Algorithmic EMA text messages	Satisfaction, behavior
(Panda et al., 2019)	Cohort Study	139 participants	Application of accelerometer data	Post-operative physical activity
(Patel et al., 2016)	Descriptive study	Useful apps specifically helpful in the perioperative care of microsurgical reconstruction	Application on Smartphone	Communication, storage, educational, flap monitor
(Pereira et al., 2019)	RCTs	Patients who underwent upper or lower extremity microsurgical reconstruction	Augmentation of reality for microsurgical planning with a smartphone (ARM-PS)	Information regarding vascular anatomy
(Roy et al., 2019)	RCTs	271 participants	Smartphone application as an educational tool	Effectiveness for teaching method
(Shao et al., 2019)	RCTs	128 participants	Multimedia-based pre-operative nursing visit	STAI score, VAS scores and vital signs
(Pecorelli et al., 2018)	RCTs	45 participants	Mobile device application	Validity and usability
(Soh et al., 2019)	RCTs	44 patients	Mobile technology of incentive spirometer (IS) (Go-breath)	Performance rates of IS count, active coughing, and deep breathing
(Sousa & Turrini, 2019)	Quasi-experiment	30 participants	Educational mobile application	Usability and user satisfaction
(Rauwerdink et al., 2019)	RCTs	Patients undergoing elective colorectal surgery	patient-centered mobile application	Compliance, health-related quality of life, physical activity, and patient satisfaction
(Pulijala et al., 2015)	RCTs	50 participants	A mobile app with interactive 3D animations	efficacy of Sur-Face
(Yang et al., 2016)	Quasi-experiment	61 participants	Smartphone text messaging	Knowledge, anxiety

Supporting self-management of post-operative pain

Education was the most common self-management feature offered (Lalloo et al., 2017). Individually tailored pre-operative education and perioperative pain management planning, the use of validated pain assessment tools to track response to pain interventions and inform treatment adjustments as needed, as well as the use of evidence-based, non-pharmacological pain management (e.g., cognitive, behavioral strategies, physical modalities) in conjunction with indicated pharmacological modalities. A complex myriad of surgical, psychological, socio-environmental, and patient-related risk factors have been shown to influence postsurgical pain experience. Pre- and postsurgical psychological factors associated with increased pain include anxiety, depression, low self-efficacy, and the tendency to catastrophize about pain. Apps that are designed to pair psychological and physical pain self-management strategies with goal setting may be particularly effective for reducing pain and enhancing postsurgical outcomes.

Enhancing post-operative recovery

In the days after surgery, patients receiving the intervention returned to work faster (Bouwsma et al., 2018). Implementation of mobile application through internet-based care program targeting the patient's self-management leads to accelerated post-operative recovery following surgery. The majority of patients benefited greatly from the care program. Patients reported slightly better on the outcomes recovery-specific quality of life and pain (both intensity score and disability score) at two weeks following surgery. The differences disappeared with longer follow-up.

Issues of confidentiality, consent, storage and data retention

Although, the benefits of smartphone apps to a microsurgical breast reconstructive surgeon are evident, the issues of confidentiality, consent, storage and retention warrant attention. There must be some caution with regard to storing and transferring patient's sensitive data. There are both ethical and legal factors when processing this type of data, although guidance varies between countries. A clinical smartphone application, and collected data, used for patient care is likely to be considered part of a patient's medical record, even when stored electronically. Doctors should be aware of the applicable health records legislation within the country in which they practice. In addition, it is usual for local freedom of information legislation to give patients access their own clinical photographs if and when requested (Patel et al., 2016).

Although there are multiple challenges to effective delivery of health information to patients, new models of healthcare demand patient empowerment and so are fundamentally dependent on success with patient education. Additionally, we demonstrated that computing and technology advances allow delivery of both individualized and ''just-in-time'' education. Finally, we showed that patients can quickly learn and consume education delivered with new, but user-friendly, technology.

CONCLUSION

Mobile computing allows for highly effective delivery of customizable, and, therefore, relevant, patient education. Relevance is increased when the education is ''just-in-time'' and linked to the patients' daily care experience. The potential for extending this health education model and the implications are profound, as we move toward care models where patients are informed, empowered participants in their healthcare.

CONFLICT OF INTEREST

Author was an independent researcher and declared no conflict of interest on this study. This study was not supported by any part of institutions or organization. No third party of mobile application or smartphone vendor endorsed the author.

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