

ORIGINAL ARTICLE

Effects of a web-based preoperative education program for patients undergoing ambulatory surgery: a preliminary study

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Abstract

Increasing numbers of surgical procedures that were once done in hospitals are now being performed in ambulatory care settings. Provision of quality preoperative education in those settings has become a challenge. This article reports findings from a practice-based study where the nurses in a preoperative preparation center implemented a supplemental, web-based educational program for same-day surgery patients and assessed its outcomes (N = 69). The patients who used the web-based program in addition to usual care achieved significantly higher scores for anesthesia knowledge ($t = 2.15$, $p = 0.04$) and teaching satisfaction ($t = 2.13$, $p = 0.04$) than those who received usual care only. The findings demonstrate a great potential for use of web-based programs to improve patient education in busy preoperative care areas. A convenience sample with a small sample size was a major limitation. Further studies with large samples are needed to demonstrate tangible clinical outcomes.

Key words

Web-based education, Preoperative education, Same day surgery, Patient teaching

1 Introduction

In the United States, the number of surgical and nonsurgical procedures performed in the ambulatory setting has increased rapidly^[1]. By 2006, a total of 53.3 million procedures were performed in ambulatory care settings, as compared to 46 million procedures performed in in-patient settings^[2]. As medical technology advances and health care insurance changes, an increasing number of surgeries previously done in hospitals will be performed in the ambulatory setting^[1].

Patients who undergo surgical procedures experience a high level of stress and anxiety, which could have negative consequences on post-operative outcomes^[3]. Preoperative patient teaching can mitigate these potential problems through provision of anticipatory knowledge on necessary preparations (e.g., nothing per oral before surgery) and the procedures. It directly impacts patient safety and became part of the standard care emphasized by the Joint Commission^[4]. Many prior studies have reported important benefits of preoperative education^[5-7]. For example, findings from a systematic review of 11 studies (N=1044 orthopedic patients) supported a positive association between preoperative education and the

reduction of anxiety and improvement of knowledge regarding surgery^[7]. Other studies also have shown the impact of effective preoperative education on increased overall patient satisfaction^[8-10].

Patient preoperative education has been a particular concern for nurses^[11, 12]. Although patients who undergo same day surgery have a great deal of educational needs, they spend a very limited amount of time at the hospital, resulting in a lack of time allocated for patient teaching^[11, 13]. Patient preparation and education are often done during a scheduled visit for preoperative assessment. During this visit, patients complete preoperative laboratory tests and physical examinations, as well as preoperative education. This is a very busy time for patients, who tend to be overwhelmed by various activities performed in preparation for the surgery. In addition, the time allocated for preoperative education is only 10 to 15 minutes. This short time frame in such a hectic environment is not conducive for effective teaching. Insufficient preoperative education may negatively affect clinical outcomes and patient satisfaction^[8, 10].

With the advancement and popularity of information communication technology, innovative technology-based education programs may alleviate some of the constraints of preoperative teaching in the ambulatory care setting. Currently, 79% of American adults are using the Internet^[14], and 80% of them gather health information online^[15]. As the number of online users grows, a great deal of health education is being done online^[16, 17]. Web-based interactive programs have been used to provide information about specific surgical procedures in health care settings, such as laparoscopic cholecystectomy^[18] and breast reconstruction^[19, 20]. Patients using these programs can receive necessary information at their convenience and think about specific questions to ask health care providers during their visit for preoperative assessment.

Web-based programs can be particularly helpful for individuals scheduled for elective surgery because they can receive a sufficient amount of information about the procedure (e.g., anesthesia and recovery process) at their convenience. Prior findings have demonstrated some positive effects from the web-based educational program. For example, Hering and his associates^[10] investigated the impact of a web-based educational intervention on knowledge, anxiety level, and overall satisfaction with anesthesia care (N=64). Participants who received web-based education in addition to the usual verbal preoperative care had a significantly higher gain in posttest learning scores ($p = .004$). They also showed significantly higher satisfaction with teaching than the usual care group ($p = .019$). Both groups showed no significant change in posttest anxiety. Further studies, however, are needed to develop more effective web-based education programs for patients who undergo ambulatory surgery and to demonstrate their impact on patient outcomes.

In an effort to improve the quality of patient preoperative education, the University of Maryland Medical Center (UMMC) started offering a supplementary Web-based educational program (Expectation Management and Medical Information [Emmi[®]] program)^[21] to its patients who undergo elective surgical procedures. The program is accessible via the Internet at the patient's convenience and provides patients and their families with information about preoperative anesthesia care. Information about the Emmi[®] program was available at the physicians' outpatient clinics and the Preoperative Readiness Evaluation and Preparation (PREP) Center, and patients are encouraged to review the program at their convenience. The purpose of our study was to assess the preliminary effects of the supplemental web-based preoperative education program. We hypothesized that participants who used a web-based education program with the usual preoperative care (Emmi_Plus group) would exhibit better outcomes on preoperative anesthesia knowledge, less preoperative anxiety, and more satisfaction with teaching than those who received traditional care (Usual Care group).

The entire research project was guided by the evidence-based practice model used by UMMC (the Johns Hopkins Nursing Evidence-Based Practice [EBP] Model)^[22]. The nursing staff at the PREP center identified the opportunity to improve the quality of patient education. After the completion of extensive product evaluations, UMMC selected the innovative web-based program to supplement patient education. During the implementation process, in collaboration with other clinical staff (e.g., physicians), the nursing staff developed policies on the use of the program and made the program available on the computers at the Patient Resource Center next to the PREP center. The present study was conducted to

seek evidence showing the effects of changed practice. In particular, the study was conducted as a demonstration project between UMMC and the University of Maryland School of Nursing (UMSON) to further instill EBP in nursing practice.

2 Methods

2.1 Design/Setting/Sample

This preliminary study used a prospective two-group (self-selected; Emmi_Plus vs. Usual Care) comparison design with two data-collection points (end-of-intervention [EOI] and post-discharge follow-up).

Upon approval from the Institutional Review Board, participants were recruited from the PREP Center of UMMC, a teaching hospital located in the Baltimore metropolitan region, between March 2009 and August 2009. A participant was eligible if he/she was an adult aged 21 years or older and was scheduled for a same-day surgery with general anesthesia. The person must have signed the consent form for the surgical procedure on his/her own. Participants were excluded if they had more than three prior surgical procedures with general anesthesia in the past five years.

2.2 Intervention

Emmi_Plus program. The Emmi[®] program is an interactive web-based program designed to allow patients to complete the content at their convenience ^[21].

The program, written at a seventh-grade level, could be accessed via the Internet at any time. The program used at UMMC included three components: a learning module, a self-assessment questionnaire, and an electronic mail function. The content of the module included preoperative care information about anesthesia, specific health information the patient needed to relay to the anesthesiologist, and expectations for the post-operative period. At the end of the program, the patient completed a self-assessment questionnaire. The program also allowed patients to send questions directly to their healthcare provider (at UMMC, a PREP Center nurse managed those questions). Preliminary observations of five patients (mean age, 50 years) who used the program at the UMMC PREP Center showed that the program was user friendly and took about 15 minutes to complete.

Usual preoperative care at the PREP Center. Prior to surgery (from 1 to 30 days), the PREP center nurse provided the patient with approximately 10 to 15 minutes of preoperative education about the surgery either on the phone or face-to-face. When face-to-face education was provided, the patient-education booklet "*Preparing for Surgery*" was also offered to the patient.

2.3 Procedures

The trained research nurse visited the PREP Center twice a week during the days appointments were allocated for same-day surgeries. Upon the completion of a history and physical examination, clinicians asked potential candidates whether the research nurse could explain the study to them. If the patients gave permission, the nurse explained the study to them and reminded them of the availability of the web-based program (some patients were already aware of the program through the UMMC brochures and instructions from their care providers in the clinic or surgeon's office). If the patient agreed to participate in the study, he/she met with the research nurse upon the completion of the scheduled preoperative evaluation.

The interview was conducted in a private room in the PREP center. Depending on the timing of the patient's PREP Center visit, most participants were enrolled one to seven days prior to surgery. Once the participant signed the consent forms, he/she completed the end-of-intervention (EOI) survey. At the end of the survey, the participant was reminded that he/she would receive a mailed survey with a stamped, self-addressed envelope. Participants were instructed to return the survey

within one week from the date they received it. Upon the completion of the first survey, the participant received a \$20 gift certificate as a token of appreciation. The follow-up survey was mailed within 72 hours after the surgery, after the confirmation of the patient's discharge.

2.4 Instruments

Outcomes were assessed at the end of the intervention and after discharge. Selected demographical information (e.g., age, sex, education, and years of Internet use) was assessed in the EOI survey.

Anesthesia knowledge was evaluated using a modified version of the Standard Anesthesia Learning Test (mSALT). The original 30-item SALT was developed to assess the preoperative anesthesia knowledge of parents whose children underwent surgical procedures, and its modified version has been successfully used for 64 adults who underwent scheduled surgery^[23]. The SALT^[23] was modified for this study (20-item mSALT) by the PREP Center educator based on the Center's teaching material, and two registered nurses in the PREP center validated the tool (calculated Content Validity Index = 1.0). Face validity was assessed through five patients who underwent a same-day surgical procedure at UMMC. The calculated alpha coefficient for the mSALT in this study was .54. (The knowledge variables, which use dichotomous scoring, were expected to be less reliable than the Likert-scale variables.)

Preoperative anxiety was assessed using the 20-item Preoperative Intrusive Thoughts Inventory (PITI) measured on a 4-point Likert scale. Prior findings showed some evidence of the internal consistency of the scale ($\alpha = .91$) and the construct validity through a confirmatory factor analysis^[24]. The calculated alpha coefficient of the measure was .61.

Satisfaction with preoperative teaching was assessed by selected 8-items from the Pre-Admission Test Center Satisfaction Questionnaire (PATCSQ). The original PARCSQ included 18 items that assessed the patient's satisfaction with the staff and the process in the preoperative center, the anesthesia care providers, the nursing staff, and the lab technician using a 5-point scale^[9]. Reliability of the measure was evidenced by a calculated alpha coefficient of .96, and validity of the measure was accrued by a factor analysis. Among those, only 8 items that were relevant to satisfaction with preoperative teaching were used in this study. The alpha coefficient of the revised was .95.

Usability of the Emmi[®] program was evaluated using the Perceived Health Web Site Usability Questionnaire (PHWSUQ)^[25], which included 12 items on a 7-point Likert scale. The PHWSUQ assessed three usability dimensions: satisfaction, ease of use, and usefulness. The measure was internally consistent ($\alpha = .95$). Some evidence of the validity was indicated by comparing the results measured by the PHWSUQ with those from the evaluation by usability experts^[25].

2.5 Data analysis

Descriptive statistics (e.g., mean, range, frequency distributions) were computed for demographic data, Internet usage, and usability scores. None of the demographical variables emerged as covariates, and the outcomes of the Emmi_Plus intervention and Usual Care were compared using paired *t*-test. Although we attempted to conduct a repeated-measures analysis of variance (ANOVA), this analysis raised some concerns due to changes in sample sizes from EOI to follow-up in the Emmi_Plus and Usual Care groups, from 28 to 18 (64.3%) and 40 to 16 (40%), respectively. The findings using both analysis methods were almost identical. The findings reported in this paper were based on paired *t*-test.

3 Results

A total of 69 participants with a mean age of 47.5 ± 13.39 years were enrolled, and one participant withdrew from the study. Among those who completed the baseline survey, 28 (40.6%) completed the web-based program with the usual care and 41 received only usual care. Table 1 summarizes selected sample characteristics of each group. The majority of participants were female ($n = 47$, 68.1%) and African-American ($n = 46$, 66.7%). Participants tended to be general surgery

patients (n = 28, 41%), followed by gynecological surgery patients (n = 13, 19%). More than half of the participants (n = 40, 57.8%) completed at least some college education.

Table 1. Selected Sample Characteristics

	Total	Emmi_Plus (n=28)	Usual Care (n=40)	p-value
Gender				.63
Male	22 (31.9%)	8 (28.6%)	14 (34.1%)	
Female	47 (68.1%)	20 (71.4%)	27 (65.9%)	
Race				.62
American Indian	1 (1.4%)	1 (3.6%)	0	
Asian	1 (1.4%)	0	1 (2.4%)	
Black	46 (66.7%)	20 (71.4%)	26 (63.4%)	
White	18 (26.1%)	5 (17.9%)	13(31.7%)	
Mixed	3 (4.3%)	2 (7.1%)	1 (2.4%)	
Education				.54
Less than High School	2 (2.9%)	2 (7.1%)	0	
Some High school (HS) or HS Diploma	27 (39.1%)	10 (35.7%)	17 (41.5%)	
Some College or College graduate	33 (47.8%)	14 (50.0%)	19 (46.3%)	
Graduate Degree	7 (10.1%)	2 (7.1%)	5 (12.2%)	

Among 68 participants (28 in Emmi_Plus group) who completed the baseline survey, 34 participants (50%) returned the follow-up survey. A significantly higher proportion of Emmi_Plus group participants (n = 18; 64.3%) returned the survey compared to the Usual Care group (n = 16, 40.0%) ($p = .039$). There was no significant difference in sex, race, or education between the two groups (Table 1).

3.1 Internet experience and usability of the intervention

Table 2. Computer/Internet Usage Information

	Total (N=69)	Emmi_Plus (n=28)	Usual Care (n=41)	p-value
Computer Access (Y/N)				.40
Yes	56 (81.2%)	24 (85.7%)	32 (78%)	
Use Internet				.04*
Yes	53 (76.8%)	25 (89.3%)	28 (68.3%)	
Years Used Internet				.39
≤ 5	13 (26.0%)	5 (21.7%)	8 (29.6%)	
6-10	18 (36.0%)	7 (30.4%)	11 (40.7%)	
≥11	19 (38.0%)	11 (47.8%)	8 (29.6%)	
Internet Use Hrs /Week				.78
≤ 7	27 (51.9%)	13 (52.0%)	14 (51.9%)	
≥7	25 (48.1%)	12 (48.0%)	13 (48.1%)	
Mean Internet Use Hrs. (SD) /Week	10.98 (11.75)	10.5 (11.94)	11.42 (11.8)	

The majority of participants had access to computers (n = 56, 81.2%) and were online users (n = 53, 76.8%) (Table 2). More than half of the online users (n = 31, 58%) felt that they were competent or proficient in using the Internet. There was no significant difference in having computer access between the Emmi_Plus and Usual Care groups. Significantly higher

proportion of participants (89.3%) in the Emmi_Plus group was online users than that in the Usual Care group (68.3%). Overall, participants were using the web approximately 11 ± 11.6 hours per week, and there was no significant difference between the two groups. The web-based education program (Emmi[®]) was reported to be highly user friendly, as evidenced by a mean score of 62.7 ± 13.7 (range, 7-77). Usability of the web intervention was significantly related to satisfaction with teaching ($r = .55, p = .02$).

3.2 Comparison of outcomes between two groups

Emmi_Plus group participants achieved significantly higher scores for anesthesia knowledge ($t = 2.15, p = .04$) and were more satisfied with the teaching experience ($t = 2.13, p = .04$) at the end of the intervention (Table 3). There was no significant difference in anxiety between the two groups. Emmi_Plus group participants also achieved better scores in both knowledge and satisfaction with teaching in the follow-up survey. Those differences, however, were no longer statistically significant.

Table 3. Outcome Comparison between Two Groups

			N	Mean (SD)	Range	p
Anesthesia Knowledge	EOI	Emmi_Plus	28	10.21 (1.52)	0-12 (+)	.04
		Usual	40	9.35 (1.78)		
	FU	Emmi_Plus	18	10.66 (1.33)	0-12 (+)	.52
		Usual	15*	10.33 (1.63)		
Satisfaction with Teaching	EOI	Emmi_Plus	28	35.62 (4.38)	8-40 (+)	.04
		Usual	40	32.60 (7.30)		
	FU	Emmi_Plus	18	36.27 (4.17)	8-40 (+)	.09
		Usual	16	15.17 (11.64)		
Anxiety	EOI	Emmi_Plus	28	15.87 (12.42)	(+) 0-60	.81
		Usual	40	15.17 (11.64)		

* One participant did not complete the questions

4 Discussion

4.1 Innovative patient education approaches in a busy clinic

Currently, only a limited time (10-15 minutes) is allocated for preoperative teaching in the ambulatory care settings. Based on the current health care trend, patients will likely spend less time in the hospital in the future, which will result in less time for preoperative education. Thus, clinicians need innovative methods to deliver effective preoperative education.

The findings from this study suggest an excellent potential for using technology-based educational interventions to improve patient education in ambulatory care settings. The participants who used the web-based education program achieved significantly higher scores for preoperative care knowledge and were more satisfied with preoperative teaching. These findings were consistent with other prior findings, such as in the study by Hering et al. [10]. Another study that tested the effects of a video-based educational intervention for patients (N = 141) who underwent a cataract procedure also showed the significant impact of the intervention on the improvement of the patients' understanding of and satisfaction with the surgery [26]. Patients' understanding of preoperative preparations is vital as it directly influences safety, and patients' satisfaction with care is one of the most important indicators for the quality of care [4]. Using effective technology-based educational interventions, healthcare organizations can empower and engage their patients with their own care, resulting in more satisfied patients.

Although prior findings have shown the important role of anticipatory information in reducing anxiety, our study did not demonstrate its significant impact on the reduction of patient anxiety. These findings are consistent with those in the study by Hering et al.^[10]. Several factors could have affected these inconsistent findings, such as types of study designs (e.g., experimental vs. non-experimental), interventions (e.g., types, dose), and instruments^[5-7]. Patients' anxiety levels can also be influenced by various factors, including the individual's personality or his/her coping skills. In general, current preoperative education tends to focus on physiological and factual aspects of patient preparation overlooking the psychosocial components. Appropriate information about anticipatory anxiety and the strategies to overcome negative emotions should be incorporated into the education. Web-based educational methods may be particularly well-suited for implementing this component as they can incorporate various audio-visual programs.

4.2 Usability of technology-based interventions

Usability of the intervention was significantly related to satisfaction with teaching ($r = .55$, $p = .02$). This finding demonstrates that technology-based interventions are only helpful when they can be used easily and when users are satisfied with the programs. In our study, participants found the web-based educational program to be user friendly, as evidenced by the high perceived usability score (mean score, 62.7; range, 7-77). When healthcare providers select a technology-based intervention for their patients, they must consider the users' needs, technology competence, and the availability of the technology to the patients. In the selected hospital, patients and their family members could use the computers and the Internet at the Patient Resource Center, which was adjacent to the PREP Center. A support person was present in the Resource Center during business hours to provide technical assistance. Other settings may not have such resources, and the providers must consider these aspects.

Additionally, technology-based education can augment clinicians' ability to educate patients and their family members; however, it cannot replace clinicians. For instance, upon review of the web-based content, patients often develop questions that are specific to their health conditions. The web-based program used in this study included an e-mail function. When the patients had specific questions, they had the option to use the e-mail function to correspond with nursing staff or to ask those questions face to face. Regardless of whether patients chose the electronic or face-to-face method, completion of the web-based educational program provided them with time to reflect on their learning and to apply it to their own health conditions.

4.3 Limitations

This preliminary, practice-based study has several methodological limitations. The major limitation was related to the nature of the sample, which was a small convenience sample recruited from one hospital. Participants were not randomized to each intervention. One of the limitations often considered in online studies is that computer users tend to be more educated individuals with a higher socioeconomical background. In this study there was no significant difference in computer use in both groups; however, more Emmi_Plus group members were regular online users. In the follow-up, a different proportion of participants in each group returned the survey, which resulted in some analytical concerns. Finally, some outcomes (e.g., preoperative anxiety) could have been better assessed right before surgery and not at the PREP center. This, however, was not feasible for this preliminary study due to certain logistical aspects (i.e., patients were busy with being prepared for surgery) during the time of the study.

Upon completion of the study, the PREP Center clinicians conducted an analysis of benefits and limitations for use of the selected Emmi[®] program. Limitations included the cost of the product and buy-in from physicians. The program used by the hospital was a commercial product that required a yearly contract, which was evaluated as high. In addition, the clinical nurses in the PREP Center wished to incorporate some of their own educational materials and simplify some functions of the program. Although it would have been more effective if patients learned about the program from the outpatient clinics, most patients learned about the program when they contacted the PREP center to schedule their preoperative check-ups. (PREP center nurses were the main sources of information about the program for the majority of patients scheduled for elective surgical procedures.)

5 Conclusion

The provision of effective preoperative patient education is vital to the quality of preoperative nursing care. Although this study was limited by the small sample size, the findings showed beneficial effects of the web-based preoperative educational program on the selected health outcomes. These benefits, in particular, have a great potential to empower patients to be in charge of managing their own care. To generalize the findings, more studies using larger and more diverse samples are needed. Additionally, further studies should include more direct clinical outcomes, such as patients' adherence to the postoperative care protocols and their recovery outcomes.

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