

# Nurses' Perception of a Tailored Web-Based Intervention for the Self-Management of Pain After Cardiac Surgery

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## Abstract

**Background:** Cardiac surgeries rank among the most frequent surgical procedures and present a risk of chronic post-surgical pain (CPSP). A continuum approach is required to prevent the development of CPSP. As a first step, a tailored web-based intervention was developed and successfully tested to tackle pain management during hospitalization. Before proceeding to further development, preliminary acceptability of the intervention including the postdischarge phase must be evaluated.

**Purpose:** The purpose of this study was to examine nurses' perception of a tailored Web-based intervention for pain management in the early recovery phase. The objectives were to evaluate intervention's acceptability and to identify ways to enhance its acceptability.

**Methods:** A parallel mixed methods approach was used to assess the acceptability of the intervention in the early recovery phase (first month after surgery).

**Results:** In total, 249 participants completed the online survey and 10 participants were individually interviewed. Overall, the intervention was rated as acceptable. No difference was found in acceptability ratings by demographics. The intervention was rated as appropriate to very much appropriate by 79% of participants. Although nurses seemingly would recommend it to their patients, they did not perceive that their patients would be as highly willing to use it. Interviews highlighted several strengths of the intervention, such as postoperative pain awareness, customization of content, and flexible dosage and schedule. However, the main weakness was related to patient adherence. Opting for a hybrid format and integrating individual preferences could enhance the coaching experience.

**Conclusion:** The innovative intervention was judged as acceptable for pain management in the early recovery phase. Considering that the intervention has demonstrated positive effects on the pain experience in the first week after cardiac surgery, it seems logical to explore its potential impact after discharge on the transition to CPSP.

## Keywords

medical/surgical, practice, telenursing, cardiology, health promotion

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## Introduction

Death rate caused by cardiovascular diseases has decreased because of progress in cardiac surgery (Mozaffarian et al., 2015). However, about two thirds of patients suffer from moderate to severe pain in the 7 days after surgery, which predicts the presence and severity of pain after discharge and is a risk factor for

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the development of chronic postsurgical pain (CPSP) (Choiniere et al., 2014; Guimaraes-Pereira, Reis, Abelha, Azevedo, & Castro-Lopes, 2017; Kamalipour, Vafaei, Parviz Kazemi, & Khademi, 2014). Indeed, a recent meta-analysis found that CPSP affects 37% of patients in the first 6 months and is present for more than 2 years in 17% of adults following cardiac surgery, with 50% reporting moderate to severe pain intensity (Guimaraes-Pereira et al., 2017), potentially compromising their recovery and daily functioning (Choiniere et al., 2014; Guimaraes-Pereira et al., 2017; Kamalipour et al., 2014).

Sex and gender differences are individual risk factors that have gained great interest in pain-related research in general. These differences are currently an important concern in the context of postoperative pain after cardiac surgery where women have been underrepresented (Bjornnes, Parry, et al., 2016; Bjornnes, Parry, Leegaard, et al., 2018; Bjornnes, Parry, Lie, et al., 2018; Parry et al., 2018). Previous studies on pain after cardiac surgery indicate that sex is an independent predictor of CPSP with more women experiencing relatively high levels of pain up to 2 years postoperatively (Choiniere et al., 2014; Van Gulik et al., 2011). Women also report more pain interference with daily activities than men at 1 month and 12 months after surgery (Bjornnes, Parry, et al., 2016; Parry et al., 2010).

Various other risk factors have been highlighted and considerable advances have been made in understanding the transition from acute to CPSP (Katz & Seltzer, 2009; Katz et al., 2015; Kehlet, Jensen, & Woolf, 2006). These factors include perioperative pain and use of opioids, and negative affect reflected in pain-related attitudes (Choiniere et al., 2014; Fletcher et al., 2015; Van Gulik et al., 2011). Patients' attitudes regarding pain and its relief partially explain inadequate levels of analgesia in the immediate postoperative phase, but also 12 months after surgery (Bjornnes, Parry, et al., 2016; Bjornnes, Rustoen, Lie, Watt-Watson, & Leegaard, 2016; Cogan et al., 2013; Martorella, Cote, Racine, & Choiniere, 2012; Watt-Watson et al., 2004). Moreover, it has been shown that pain cognitions, such as pain catastrophizing, influence postoperative pain intensity and activity levels contributing to the development of CPSP (Burns et al., 2015; Khan et al., 2011, 2012; Theunissen, Peters, Bruce, Gramke, & Marcus, 2012).

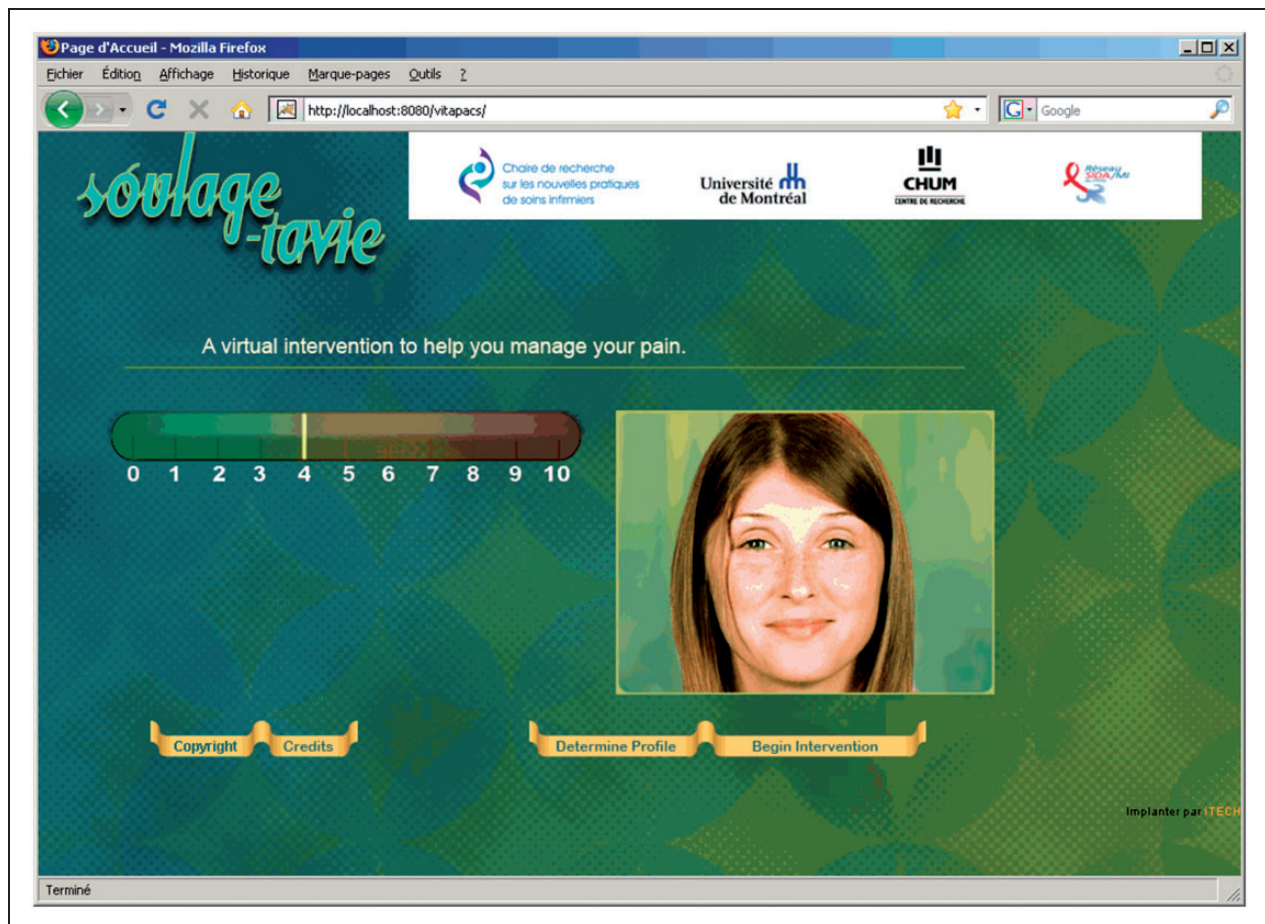
In an effort to address postoperative pain and its potential transition to CPSP, risk factors need to be targeted in the different perioperative phases (Katz & Seltzer, 2009; Katz et al., 2015). Hence, findings suggest that postcardiac surgery patients could benefit from a pain management intervention, not only during the perioperative period, but also after discharge from the hospital (Bjornnes et al., 2017; Fredericks & Yau,

2013; J. Lapum, Angus, Peter, & Watt-Watson, 2011; J. L. Lapum et al., 2016; Martorella, Gelinias, & Purden, 2014). However, very few interventions for this population include both of these phases, and of those which have, they are usually not tailored to CPSP risk factors (Guo, 2015; Koranyi, Barth, Trelle, Strauss, & Rosendahl, 2014; Ramesh et al., 2017). Information technologies can support patients and clinicians in a busy care setting and contribute to improving clinical outcomes in the perioperative setting (Van Der Meij, Anema, Otten, Huirne, & Schaafsma, 2016). Tailored Web-based interventions have multiplied over the past decade to address pain management. Albeit, they mainly target chronic pain, allowing opportunities for the development of interventions aimed at acute pain and its transition to chronic pain (Martorella et al., 2017).

## Background

A tailored Web-based intervention for the self-management of pain after cardiac surgery was developed to tackle pain in the immediate postoperative phase (Martorella, Cote, & Choiniere, 2013). This intervention consists of a brief assessment of two risk factors, that is, patients' pain-related attitudes and pain catastrophizing, and a 30-minute tailored preoperative session on a laptop computer coached by a virtual nurse (see Figure 1). Based on this assessment, information and strategies are then specifically tailored to the participants' profile according to an algorithm. Two tailored reinforcements of 5 to 10 minutes are also provided in person after surgery. A pilot randomized controlled trial ( $N=60$ ) was conducted (Martorella et al., 2012). Findings provided evidence that the intervention was feasible and helpful in minimizing pain interference with several postoperative activities, especially breathing and coughing in the first few days after surgery. The intervention also influenced the way people coped with pain in modulating some individual barriers toward pain relief and opioid analgesic consumption. One month after discharge, patients' perception of the intervention were quite positive and similar between women and men, although they differed in their reasons for its acceptability (Martorella et al., 2014).

These results substantiate the need for the development of an updated version of the current intervention (Martorella et al., 2013) that encompasses the post-discharge phase (first month). Although the required dose of intervention in this phase is still unclear (Veronovici, Lasiuk, Rempel, & Norris, 2014), a qualitative study underlined that providing support in the first few weeks after discharge is important for patients after cardiac surgery (J. L. Lapum et al., 2016). It is then proposed to add two sessions in the early recovery phase (first



**Figure 1.** Tailored web-based intervention's home page.

month postdischarge), which would require additional content. However, before proceeding to further refinement, as it was done with patients, it is essential to evaluate nurses' perceptions of the intervention and its possible expansion. Health-care professionals who judge an intervention as unacceptable to patients may avoid it and not recommend it or use it (Sidani & Braden, 2011). Acceptability, the extent to which people delivering or receiving a health-care intervention consider it to be appropriate (Sekhon, Cartwright, & Francis, 2017), must be examined for interventions that are in the process of being refined in terms of content, mode of delivery or dose, or being implemented in a newly selected setting (Sidani & Braden, 2011).

Therefore, the purpose of this study was to examine nurses' perceptions of a tailored Web-based intervention aimed at improving pain control in the early recovery phase of cardiac surgery. The objectives were two-fold: (a) to evaluate intervention's acceptability (perceived effectiveness, appropriateness, suitability, and willingness to adhere) from the perspective of nurses caring for patients undergoing cardiac surgery and (b) to identify ways to modify aspects of the intervention to

enhance its acceptability for the hospitalization and post-discharge phases.

## Methods

### Design

A parallel or convergent mixed methods design (QUAN + QUAL; Creswell & Plano Clark, 2017) was used to assess the acceptability of the preliminary version of the intervention for pain management after cardiac surgery including both the hospitalization and the post-discharge phases (i.e., early recovery). This design allowed us to describe to which extent the intervention is acceptable and in what ways. Quantitative and qualitative data were collected concurrently, compared and combined to offer a more comprehensive understanding of nurses' perception. A mixed methods convergent study design combines the strengths of both quantitative and qualitative approaches and have been recognized as a relevant approach for addressing contemporary and complex issues in health services research (Fetters, Curry, & Creswell, 2013).

## Sample and Data Collection

After obtaining approval from the Florida State University institutional review board, quantitative data were collected between May and June 2017 through an online survey (Qualtrics©). Based upon an a priori sample size calculation using GPower for a one-way analysis of variance Main Effects *F* test, an  $\alpha = 0.05$ , medium standardized effect (0.25), three groups (clinical setting: inpatient, outpatient, other), and power = 0.8, 159 participants were needed for this study. Participants were included in the study if they had at least 2 years of experience working with the cardiovascular surgical population.

An introductory email inviting potential participants was sent to the Florida Board of Nursing Board of Nursing database and included a link to the survey. The study also was advertised through the Preventive Cardiovascular Nursing Association newsletter and Facebook page and included a link to the survey. As suggested by Sidani and Braden (2011), a basic description of the intervention (i.e., objectives, content, and schedule of sessions) along with screenshots were presented to the participants. An acceptability questionnaire was then administered to rate the different components

of the intervention (i.e., content, dosage, format). Table 1 details the proposed outline for the intervention provided to participants.

In order to complement quantitative data and identify the intervention's refinement possibilities, qualitative data were collected through individual face-to-face interviews with a convenience sample of 10 nurses (Guest, Bunce, & Johnson, 2006; Hennink, Kaiser, & Marconi, 2016) working with cardiovascular surgical patients for at least 2 years. Participation in individual interviews was advertised through the Florida State University, College of Nursing's Facebook page. Anyone interested was invited to contact the Principal investigator (PI). During the 45-minute interview conducted by a trained research assistant, participants read a description of the intervention supported by screenshots of Web pages. Interview participants were asked to rate the intervention prior to initiation of the semistructured individual interview. A semistructured interview guide was used to facilitate discussion.

## Instruments

**Sociodemographic questionnaire.** A researcher-developed survey was used to gather the following

**Table 1.** Outline of the Proposed Intervention Presented During the Survey and Interviews.

Overview	<p>Research results have led to the development of interventions to prevent the development of CPSP. Empowering patients regarding pain management seems to be an interesting avenue to prevent its negative consequences. We are working on the development of a transitional Web-based intervention to promote pain self-management after cardiac surgery. Our approach relies on an individualized content and strategies to engage patients in a learning process. The Web format allows the intervention to be easily accessible from any phase of the peri-operative continuum.</p> <p>A prototype was developed for the preoperative period. We need your opinion before we proceed to the development of additional content for the postdischarge phase. Here is a brief description of the intervention's components.</p>
Schedule	<ul style="list-style-type: none"> <li>● One session of 30 minutes in the preoperative phase</li> <li>● One session of 30 minutes in the first week after discharge</li> <li>● One session of 30 minutes in the third week after discharge</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>● To assess pain intensity on a numerical scale from 0 (<i>no pain</i>) to 10 (<i>worst possible pain</i>)</li> <li>● To communicate the level of pain intensity to health-care professionals</li> <li>● To take adequate pain medication according to the level of pain intensity and planned activities</li> <li>● To use other nonpharmacological strategies, such as distraction, relaxation, guided imagery, positioning, ice pack, surgical bra, etc.</li> </ul>
Themes	<ul style="list-style-type: none"> <li>● Pain representation</li> <li>● Individual reaction to pain</li> <li>● Pain management strategies</li> </ul>
Content	<ul style="list-style-type: none"> <li>● Screening questionnaire to tailor content according to CPSP risk factors, that is, pain-related attitudes and catastrophizing</li> <li>● Introductory video of the nurse</li> <li>● Activities, such as multiple choice questions to promote reflection on pain attitudes and behaviors</li> <li>● Feedback videos of a nurse</li> <li>● Animations including other patients' stories to promote integration of the content and the elaboration of an action plan</li> </ul>

Note. CPSP = chronic postsurgical pain.



sociodemographic data: age, sex, level of education, clinical role, clinical practice setting, years of experience with the cardiovascular surgical population, specific pain management training (y/n), and experience working in a pain clinic (y/n). A questionnaire also was developed by two of the investigators (GM, CG) to assess knowledge about CPSP. This CPSP questionnaire included 10 Likert-type items on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The questionnaire was not validated but the specific items can be found in the Results section.

**Treatment Acceptability and Preference questionnaire.** The Treatment Acceptability and Preference (TAP) questionnaire is a valid and reliable instrument used to measure an intervention's acceptability (Sidani, Epstein, Bootzin, Moritz, & Miranda, 2009). The specific intervention acceptability attributes included in this questionnaire are: (a) effectiveness in managing the problem, (b) intervention appropriateness, (c) suitability of the intervention to individual reality, and (d) convenience or willingness to apply and adhere to the intervention. The intervention acceptability questionnaire in this study included: (a) effectiveness in promoting pain self-management (4 items), (b) appropriateness in helping patients manage pain (2 items), (c) suitability (4 items), and (d) willingness to adhere (2 items). The specific items can be found in the Results section. The ratings refer to a 5-point scale ranging from *not at all* (0) to *very much* (4). A total scale score between 0 and 4 is obtained based on a mean of the four attributes' subscales to reflect perceived intervention acceptability. The four items previously demonstrated internal consistency reliability in a

population receiving behavioral interventions for insomnia ( $\alpha > .80$ ; Sidani, Epstein, et al., 2009). Validity was confirmed through factor analysis and discriminant validation as well (Sidani, Epstein, et al., 2009).

**Semistructured interview guide.** A researcher-developed semistructured interview guide was composed based upon the four attributes of the TAP questionnaire (see Table 2).

### Data Analysis

**Quantitative data.** Sociodemographic characteristics (i.e., years of experience, clinical setting, role, CPSP knowledge) and TAP questionnaire scores were analyzed descriptively. Frequency tables, means, and standard deviations (*SDs*) were used to summarize data for each item and the total score on the TAP measure. One-way analysis of variance was conducted to determine differences in acceptability ratings among sociodemographic variables.

**Qualitative data.** Individual interviews were digitally recorded and transcribed verbatim, with concurrent data collection and analysis. NVivo<sup>TM</sup> software was used to analyze the transcripts and to generate themes derived from clinicians' perceptions of the intervention and its acceptability (Miles & Huberman, 1994). A preliminary generation of codes was based on the attributes of acceptability highlighted by Sidani et al. (Sidani & Braden, 2011; Sidani, Epstein, et al., 2009): appropriateness, effectiveness, suitability, and willingness to adhere. Additional codes (subcategories) were created when

**Table 2.** SemiStructured Interview Guide.

Themes	Questions
Effectiveness	<ul style="list-style-type: none"> <li>• What do you find the most/least helpful about the intervention?</li> <li>• In what way do you think the intervention would/would not help your patients manage their pain after surgery?</li> <li>• In what way do you think the intervention would/would not help your patients decrease the impact of pain on their recovery?</li> <li>• In what way do you think the intervention would/would not help your patients improve their ability to do their postoperative exercises?</li> </ul>
Appropriateness	<ul style="list-style-type: none"> <li>• What do you find appropriate/not appropriate about the intervention?</li> <li>• What strategies seem appropriate/inappropriate to manage post-operative pain?</li> <li>• In what way are the strategies appropriate/not appropriate to pain management after surgery?</li> <li>• What additional information (if any) you would like covered by the intervention?</li> </ul>
Suitability	<ul style="list-style-type: none"> <li>• What pain management strategies in the intervention do you find suitable/not suitable?</li> <li>• What do you think of the timing of the intervention?</li> <li>• What do you think of the length of the intervention?</li> <li>• What do you think of the virtual nurse?</li> </ul>
Willingness to adhere	<ul style="list-style-type: none"> <li>• What is easy/not easy about the intervention?</li> <li>• What (if anything) could be done to make the intervention more convenient?</li> </ul>

necessary. To ensure reliability, double coding was conducted by the primary investigator (GM) and the research assistant. Discrepancies were discussed until a consensus was reached. Frequency counts were conducted to validate the emergence of a theme and participants were contacted when necessary to validate findings.

Results from the two data sets were then merged and synthesized in order to discuss how they converge or diverge. Examination of qualitative and quantitative data assisted understanding of the intervention's acceptability (Creswell & Plano Clark, 2017).

## Results

### *Sociodemographic and Clinical Characteristics*

A total of 249 participants completed the online survey. Table 3 summarizes sociodemographic characteristics of the participants. The majority were advanced registered nurse practitioners and practiced exclusively in an inpatient clinical setting. Most participants had more than 6 years of experience. Almost half of the participants reported having received some type of pain management training other than that received for their degree, but the vast majority had never worked in a pain clinic.

**CPSP knowledge.** Overall, the pain knowledge questionnaire reflected a mean of 3.56 ( $SD = 0.48$ ) for the mean total score (10 items) with a median score of 3.6 (ranging from 1 to 4.6). Table 4 shows results for each CPSP knowledge item. Of note, participants reporting that they had received a pain management training had significantly higher scores on the CPSP knowledge questionnaire ( $p < .05$ ).

### *Acceptability of the Intervention*

A Cronbach's alpha of 0.946 was calculated for the TAP questionnaire in this study. Overall, the intervention was rated as acceptable with a mean score on the TAP of 2.26 ( $SD = 0.76$ ). The intervention was rated as effective for both hospitalization and postdischarge phases with 77.4% and 76.9%, respectively. The intervention was rated as appropriate for pain management after cardiac surgery by 79% of participants, including the proposed schedule (77.7%). Although the length of sessions were reportedly suitable (78.1%), in addition to using videos of a nurse (80.5%) and patients' stories (87.7%), nurses seemed more unsure regarding its ease of use by their patients with 57.5% rating it as easy. Although nurses seemingly would recommend it to their patients (86% willing to do so), they did not perceive that their patients would be as highly willing to use it (66.3% thinking their

**Table 3.** Sociodemographic Profile of Participants.

Variables	N	%
Age		
18–34	34	13.7
35–54	89	35.7
55–74	126	50.6
Sex		
Male	31	12.5
Female	217	87.5
Education level		
Professional degree	26	10.4
Bachelor	62	24.9
Master	135	54.2
Doctorate	26	10.4
Professional title		
Registered Nurse	104	41.8
Advanced Registered Nurse Practitioner	136	54.6
Other	9	3.6
Clinical setting of practice		
Inpatient	101	40.6
Outpatient	59	23.7
Inpatient and outpatient	22	8.8
Other	67	26.9
Years of experience with cardiovascular surgical patients		
0–5	54	21.7
6–20	111	44.6
21+	84	33.7
Training in pain management		
Yes	112	45.0
No	137	55.0
Pain clinic (has worked, currently working)		
Yes	33	13.3
No	215	86.7

Note.  $N = 249$ .

patients would be willing). No difference was found in acceptability ratings of the intervention by demographics (i.e., age, gender, education level, professional title, clinical setting of practice, years of experience, training in pain management and pain clinic practice). Table 5 reports the TAP mean scores and frequencies.

### *Strengths and Weaknesses of the Intervention*

A total of 10 nurses participated in individual interviews (2 advanced registered nurse practitioners and 8 registered nurses). Two of them were working in outpatient settings and eight in in-patient settings. They rated the intervention as very acceptable with a median score on the TAP questionnaire of 3.33 (minimum: 2.33; maximum: 4.42). Table 6 summarizes the content analysis of these interviews.

**Table 4.** Mean (SD) for Each Item Related to CPSP Knowledge.

Items	Mean (SD)
Pain after surgery can become chronic in a very small proportion of patients	2.23 (1.03)
There are numerous physiological risk factors for the development of chronic postoperative pain	4.12 (.87)
There are numerous psychosocial risk factors for the development of chronic postoperative pain	4.25 (.81)
The most important predictor of chronic postoperative pain is pain intensity in the first postoperative days	3.17 (1.16)
Pain after surgery is a normal phenomenon and it will not last more than 6 weeks	3.17 (1.31)
Some people will develop chronic postoperative pain and there is nothing we can do about it	3.71 (1.18)
Interventions before surgery can influence the development of chronic postoperative pain	4.05 (.95)
Acute pain management after surgery can influence the development of chronic postoperative pain	3.93 (1.02)
It is impossible to know which patients are at risk of chronic postoperative pain	3.12 (1.16)
Patients rarely experience postoperative pain after their discharge	4.21 (1.01)
Total	3.56 (.48)

Note. SD= standard deviation.

**Effectiveness.** When questioned about the effectiveness of the intervention, strengths were noted. Most of the time nurses found that the intervention provided patients an opportunity for increased awareness about postoperative pain and its management. This awareness included both postoperative pain representation as a mental preparation and also expectations regarding postoperative recovery and how the team will work with them. The intervention was perceived as a tool that equips patients with a better mindset and will help them cope with pain both during hospitalization and postdischarge. By equipping them, nurses thought that it would decrease some fears, engage them in their recovery, and allow better outcomes.

**Appropriateness.** When asked about appropriateness of the intervention, again several strengths were discussed. The main theme that emerged was customization both in terms of content and dosage of messages. Nurses appreciated the fact that patients' individual experience and needs are acknowledged by tailoring the content of messages based on their on-screen answers and choices. Customization also addressed individual needs in terms

of reinforcements or repetitions and learning pace. Repetition of information seemed to be an important aspect of education in this clinical setting. Hence, nurses saw some benefit in the flexibility of the Web application, allowing patients to pause, repeat, or go back at their convenience.

**Suitability.** When asked about suitability, the length of sessions was not an issue. Nurses also agreed on the benefits of using other patients' stories to normalize the experience. The main theme that emerged in regard to format preferences was the provision of guidance and technology usability. Both strengths and weaknesses were identified. When asked about using videos of a nurse, most nurses appreciated that the application creates an individual nursing consultation and that the information is not just a text to read. According to the nurses interviewed, the presence of a nurse also added some credibility to the educational content. However, one nurse remained reserved mentioning that she preferred human contact. The Web-based format also generated some concerns about the usability in elderly patients, while others thought it was a great idea as many patients are now using smartphones or tablet computers.

**Willingness.** Both willingness of patients to comply with the intervention and willingness of nurses to recommend the intervention to their patients were discussed as a supplement to usual care. Some weaknesses were identified. The willingness of patients to comply with the intervention after discharge was the main concern. Different reasons were mentioned, such as living alone, being exhausted or depressed after surgery, and lack of motivation in general. Hence, the Web-based intervention seemed to be more acceptable if combined with guidance and monitoring from nurses (e.g., telephone or face-to-face). The willingness of nurses to recommend the intervention to their patients seemed to be influenced by their involvement in the success of the intervention. According to those interviewed, the Web-based intervention should be integrated and complementary to nursing care.

## Discussion

This mixed methods convergent study sought to examine nurses' perception of a tailored Web-based intervention for pain management after cardiac surgery (i.e., hospitalization and postdischarge phase). This approach is innovative by targeting CPSP risk factors before surgery, immediately after and in the first month postdischarge. The intervention was reported as acceptable by nurses and appropriate for pain management after cardiac surgery by the majority of respondents. Moreover, more than 80% of nurses would be willing to recommend it to their patients.

**Table 5.** TAP Mean Scores and Frequencies.

Intervention attributes	Mean (SD)	N (%)	
<i>Effectiveness</i>			
How effective do you think this intervention would be in helping your patients manage postoperative pain in the first days after cardiac surgery?	2.32 (0.993)	Not effective at all	3 (1.3)
		Somewhat effective	49 (21.3)
		Effective	80 (34.8)
		Very effective	68 (29.6)
		Very much effective	30 (13.0)
How effective do you think this intervention would be in helping your patients manage postoperative pain after discharge?	2.35 (0.982)	Not effective at all	1 (0.4)
		Somewhat effective	52 (22.7)
		Effective	71 (31.0)
		Very effective	76 (33.2)
		Very much effective	29 (12.7)
How effective do you think this intervention would be in decreasing the impact of pain on recovery after cardiac surgery?	2.24 (0.976)	Not effective at all	1 (0.4)
		Somewhat effective	59 (25.8)
		Effective	80 (34.9)
		Very effective	63 (27.5)
		Very much effective	26 (11.3)
How effective do you think this intervention would be in helping your patients perform their daily activities?	2.31 (1.001)	Not effective at all	1 (0.4)
		Somewhat effective	56 (24.4)
		Effective	75 (32.7)
		Very effective	66 (28.8)
		Very much effective	31 (13.5)
<i>Appropriateness</i>			
How acceptable does this intervention seem to be for pain management after cardiac surgery?	2.38 (1.004)	Not acceptable at all	2 (0.9)
		Somewhat acceptable	46 (20.1)
		Acceptable	80 (34.9)
		Very acceptable	65 (28.4)
		Very much acceptable	36 (15.7)
How logical does the schedule of the intervention seem to you?	2.20 (0.984)	Not logical at all	7 (3.1)
		Somewhat logical	44 (19.2)
		Logical	101 (44.1)
		Very logical	50 (21.8)
		Very much logical	27 (11.8)
<i>Suitability</i>			
How suitable does the length of sessions seem to you?	2.14 (0.902)	Not suitable at all	6 (2.6)
		Somewhat suitable	44 (19.3)
		Suitable	108 (47.4)
		Very suitable	53 (23.2)
		Very much suitable	17 (7.5)
How easy do you think it would be for your patients to use this intervention?	1.89 (0.967)	Not easy at all	4 (1.8)
		Somewhat easy	92 (40.7)
		Easy	70 (31.0)
		Very easy	45 (19.9)
		Very much easy	15 (6.6)
How suitable does the use of videos of a nurse seem to you?	2.27 (0.947)	Not suitable at all	7 (3.1)
		Somewhat suitable	37 (16.3)
		Suitable	92 (40.5)
		Very suitable	70 (30.8)
		Very much suitable	21 (9.2)

(continued)



**Table 5.** Continued.

Intervention attributes	Mean (SD)		N (%)
How suitable does the use of other patients' stories seem to you?	2.56 (0.930)	Not suitable at all	1 (0.4)
		Somewhat suitable	27 (11.8)
		Suitable	83 (36.4)
		Very suitable	77 (33.8)
		Very much suitable	40 (17.5)
<i>Willingness</i>			
How willing do you think your patients would be to comply with this intervention?	1.95 (0.862)	Not willing at all	0 (0)
		Somewhat willing	76 (33.6)
		Willing	100 (44.2)
		Very willing	36 (15.9)
		Very much willing	14 (6.2)
How willing are you to recommend this intervention to your patients?	2.55 (0.981)	Not willing at all	2 (0.9)
		Somewhat willing	30 (13.2)
		Willing	82 (36.0)
		Very willing	69 (30.3)
		Very much willing	45 (19.7)
Total	2.26 (0.758)		

Note. SD= standard deviation; TAP= Treatment Acceptability and Preference.

**Table 6.** Content Analysis Summary of Individual Interviews With Nurses.

Acceptability attributes	Category	Subcategory	Verbatim
Effectiveness	Awareness	Representation	"It discretely allows you to realize that you will have pain" "... investigate their opinion of pain"
		Expectation	"That you can do something about it [ . . . ] you need to get moving for your recovery" "These guys are actually going to be working with me and my pain"
Appropriateness	Customization	Patient-centeredness	"I like the fact that the intervention is patient-driven and not nurse-at-the-bedside-driven"
		Reinforcement	"... making it available to them multiple times" "... move through it at their own pace"
Suitability	Preference	Guidance	"It creates a face-to-face nursing consultation" "I just like real people"
		Technology usability	"Technology is really beneficial to the large majority but some people can struggle with using a computer" "They are on their smartphone anyway"
Willingness to adhere	Supplement	Staff involvement	"Only if staff is engaged" "... encouraged to work with the intervention"
		Self-motivation	"I'm not sure that patients that live by themselves would be motivated" "Compliance seems challenging once people are out of the hospital"

Note. n= 10.

### Acceptable Intervention Components

The intervention was rated as being effective for both the hospitalization and postdischarge phases mainly because of its potential to increase patients' awareness of

postoperative pain. This finding supports the perception of patients (Martorella et al., 2014). A recent study found that 80% of patients (n=1,481) were unaware of the risk of persistent postoperative pain underlining

the need for clinicians to discuss this significant risk with patients (Oliver, Kashef, Bader, & Correll, 2016). This finding is even more concerning considering that beliefs and attitudes toward pain and its treatment are common in this population and impede proper pain management (Cogan et al., 2013; Martorella et al., 2012). The intervention, not only provides information on pain management, but responds to the current needs of clinicians and patients in terms of CPSP prevention.

The intervention was rated as appropriate for pain management after cardiac surgery, with customization in terms of content and dosage being the most important feature. Tailoring has been previously acknowledged by nurses as an important component of interventions for this population (Fredericks, 2011; J. L. Lapum et al., 2016). Previous findings have specifically identified that standardized delivery of information, as opposed to tailored, affected the application of strategies by patients in their own lives (J. L. Lapum et al., 2016). Moreover, tailoring strategies allow targeting specific health determinants, such as risk factors for CPSP (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008).

The schedule of the intervention (i.e., preoperatively and first month postdischarge) was also rated as appropriate. The preoperative period is a traditional timeframe for education in this population (Koranyi et al., 2014; Ramesh et al., 2017). However, when targeting the postdischarge phase, traditional interventions usually take place postoperatively at discharge while in the hospital, which has been recognized by both nurses and patients as not allowing an adequate amount of time for education (J. L. Lapum et al., 2016). Previous findings support the need for interventions during the early recovery phase at home (Bjornnes et al., 2017; Fredericks, 2009; Fredericks, Sidani, & Shugurensky, 2008; J. L. Lapum et al., 2016). The possibility to receive information reinforcements according to needs, and individual pace and convenience was clearly perceived as an advantage by nurses similarly to patients' perceptions (Martorella et al., 2014). Web-based interventions offer this flexibility and have the potential to facilitate the delivery of perioperative interventions during the postdischarge phase (Van Der Meij et al., 2016).

### *Avenues for Improvement*

Nurses identified two aspects of the intervention's format that could be improved to optimize patient's adherence to the intervention. Although the use of patients' stories and videos of a nurse were rated as suitable, ease of use by patients, in terms of computer literacy, seemed to be more of a concern for nurses. Individual interviews corroborated this result. Moreover, in a previous study examining patients' acceptability, the Web-based format was also identified as a potential barrier in the home setting

(Martorella et al., 2014). Although participants had come to the conclusion that it was easier after a few minutes of use, this finding should be taken into consideration for further development. Nevertheless, patients' age seems to be less and less of an issue. A recent report from the Pew Research Center highlighted that seniors have similar use of technologies than adults under 65 of age. Demographic variables such as education and income levels are more determining (Anderson & Perrin, 2017). Moreover, undergoing a cardiac surgery is a stressful experience that can impede the use of technology. Evidence-based guidelines, such as those from the Office of Disease Prevention and Health Promotion of the U.S. Department of Health and Human Services (2016) can easily help improve and promote e-Health literacy.

Also, while nurses would recommend the intervention to their patients, they rated their patients' willingness to comply with the intervention lower, with the interviews illustrating that patients may not comply with the intervention during the postdischarge phase if it relies solely on technology. This finding is similar to previous studies with this population highlighting the need for supportive follow-up in the home setting where patients could be coached in their daily life, as well as share their concerns (Bjornnes et al., 2017; J. L. Lapum et al., 2016; Parry et al., 2018; Veronovici et al., 2014). Some participants discussed the possibility of including contacts with clinicians in the postdischarge phase. This could not only increase adherence, but also provide technical support if needed. Interestingly, frequent contacts with health-care providers have been recognized as a significant ingredient to improve adherence to Web-based interventions by providing additional support through presence (Baumeister, 2014; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012; Mohr, Cuijpers, & Lehman, 2011). Of note, hybrid formats, (e.g., addition of face-to-face or telephone contacts), are predominant in Web-based interventions for chronic pain, including tailored approaches (Buhrman, 2016; Martorella et al., 2017). Moreover, this alternative has also been recently used and successful in a trauma population also at risk of developing chronic pain after experiencing acute pain during their hospitalization (Berube et al., 2018; Bérubé et al., 2018). Besides, adding contacts with clinicians raises the question of dosage (how frequent and how long). This aspect of the intervention could be tailored as patients with moderate to severe levels of pain intensity or pain interference with activities could necessitate more contacts (Bérubé et al., 2018).

Last, enhancing patient engagement could be reached by making the intervention more relevant to specific subgroups and according to their preferences. Treatment preferences are determined by sociodemographic factors and they can influence adherence and clinical outcomes (Mills et al., 2006; Sidani, Epstein, & Miranda, 2006;

Sidani, Fox, & Epstein, 2017; Sidani et al., 2015; Sidani, Miranda, Epstein, & Fox, 2009). For instance, the acceptability study with patients underlined that women felt that the most important aspect of the intervention was the awareness-raising content, while men focused on the convenience of the support provided (Martorella et al., 2014). It was also found that promoting hope, particularly for women living alone, could improve outcomes after cardiac surgery (Bjornnes, Parry, Lie, et al., 2018). Another study with patients suffering from chronic musculoskeletal pain illustrated the importance of sociodemographic factors in showing that women had better levels of pain acceptance while men experienced more fear of movement (Rovner et al., 2017). These gender differences in the pain management individual experience are determinant factors of the intervention's success as they generate different therapeutic strategies.

Integrating these improvements could require a series of iterative cycles of formative and evaluative research (Whittaker, Merry, Dorey, & Maddison, 2012). Hence, incorporating iterative cycles involving end users will also serve as a means to enhance patient engagement, especially in the context of a chronic condition (Whitehead & Seaton, 2016). Moreover, the same way it was done for the development of the first version of the intervention (Martorella et al., 2013), this process will also involve clinical and policy decision-makers to ensure the future implementation of the intervention (Sidani & Braden, 2011; Whittaker et al., 2012).

### **Limitations**

A few limitations can be outlined. Although the sample size is large, response rate could not be calculated, which keeps us from evaluating the risk of a nonresponse bias. In addition, participants in the sample were self-selected which could lead to bias in the results. Of note, a majority of respondents had a graduate level of studies (64.6%) which could have influenced their responses. For instance, they could be more willing to suggest the intervention through their practice being more influenced by evidence-based standards. Also, many respondents (40.6%) were practicing in an in-patient clinical setting. Acute care settings leave little opportunities for patients' empowerment and autonomy which could hinder nurses' acceptability for an intervention of this type. Last, the level of technology acceptance by nurses determined by various individual, contextual, and organizational factors could have influenced their acceptability perceptions of the intervention but were not assessed (Gagnon et al., 2012; Gagnon, Ngangue, Payne-Gagnon, & Desmartis, 2016). For instance, perceived usefulness, perceived ease of use, and attitudes toward technology are variables influencing the successful implementation of technology-based health interventions (Strudwick, 2015).

### **Conclusion**

This mixed methods study described nurses' perception of a tailored Web-based intervention for pain management in order to prevent CPSP. The results of the interviews and survey were merged and integrated to inform and guide further development of the intervention.

Nurses perceived the intervention as acceptable and appropriate for the early recovery phase and would recommend it. They highlighted the importance of several components, such as postoperative pain awareness, customization of content, and flexible dosage and schedule. One of the concerns was related to patients' capability of using a Web-based format. Opting for a hybrid format seems to be a promising avenue to improve patients' adherence, especially after discharge. This would allow to combine the flexibility of the Web-based format with an enhanced coaching experience through human contact. Moreover, integrating gender preferences in the intervention content seems to be a key ingredient for success.

Prior work has demonstrated the potential to influence postoperative pain experience with a brief intervention if educative messages are tailored and personally relevant for the individual. Considering that the intervention has demonstrated positive effects on the pain experience in the first week after cardiac surgery, a logical extension of this research is to explore its potential impact on pain after discharge and on the transition to chronic pain. After further refinement and large-scale evaluation, if results are positive among the cardiac surgery patients, the intervention could easily be adapted and offered to different patient populations experiencing postoperative pain and at risk of developing CPSP. Nurses are ideally situated to intervene in the prevention of pain at all levels of the perioperative continuum of care and this type of intervention can support them in fulfilling that mission.

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## References

- Anderson, M., & Perrin, A. (2017). *Tech adoption climbs among older adults*. Retrieved from <http://www.pewinternet.org/2017/05/17/technology-use-among-seniors/>.
- Baumeister, H., Reichler, L., Munzinger, M., & Lin, J. (2014). The impact of guidance on Internet-based mental health interventions: A systematic review. *Internet Interventions, 1*(4), 205–215.
- Berube, M., Gélinas, C., Martorella, G., Feeley, N., Cote, J., Laflamme, G. Y., ... Choiniere, M. (2018). Development and acceptability assessment of a self-management intervention to prevent acute to chronic pain transition after major lower extremity trauma. *Pain Management Nursing*. Advance online publication. doi:10.1016/j.pmn.2018.04.010.
- Bérubé, M., Gélinas, C., Feeley, N., Martorella, G., Côté, J., Laflamme, G. Y., ... Choinière, M. (2018). A hybrid web-based and in-person self-management intervention aimed at preventing acute to chronic pain transition after major lower extremity trauma: Feasibility and acceptability of iPACT-E-Trauma. *JMIR Formative Research, 2*(1), e10323.
- Bjornnes, A. K., Parry, M., Leegaard, M., Ayala, A. P., Lenton, E., Harvey, P., ... Watt-Watson, J. (2018). Self-management of cardiac pain in women: A meta-summary of the qualitative literature. *Qualitative Health Research, 28*(11), 1769–1787. doi: 10.1177/1049732318780683
- Bjornnes, A. K., Parry, M., Lie, I., Fagerland, M. W., Watt-Watson, J., Rustoen, T., ... Leegaard, M. (2016). Pain experiences of men and women after cardiac surgery. *Journal of Clinical Nursing, 25*(19–20), 3058–3068. doi:10.1111/jocn.13329
- Bjornnes, A. K., Parry, M., Lie, I., Fagerland, M. W., Watt-Watson, J., Rustoen, T., ... Leegaard, M. (2017). The impact of an educational pain management booklet intervention on postoperative pain control after cardiac surgery. *European Journal of Cardiovascular Nursing, 16*(1), 18–27. doi:10.1177/1474515116631680
- Bjornnes, A. K., Parry, M., Lie, I., Falk, R., Leegaard, M., & Rustoen, T. (2018). The association between hope, marital status, depression and persistent pain in men and women following cardiac surgery. *BMC Womens Health, 18*(1), 2. doi:10.1186/s12905-017-0501-0
- Bjornnes, A. K., Rustoen, T., Lie, I., Watt-Watson, J., & Leegaard, M. (2016). Pain characteristics and analgesic intake before and following cardiac surgery. *European Journal of Cardiovascular Nursing, 15*(1), 47–54. doi:10.1177/1474515114550441
- Buhrman, M., Gordh, T., & Andersson, G. (2016). Internet interventions for chronic pain including headache: A systematic review. *Internet Interventions, 4*(1), 17–34.
- Burns, L. C., Ritvo, S. E., Ferguson, M. K., Clarke, H., Seltzer, Z., & Katz, J. (2015). Pain catastrophizing as a risk factor for chronic pain after total knee arthroplasty: A systematic review. *Journal of Pain Research, 8*, 21–32. doi:10.2147/JPR.S64730
- Choiniere, M., Watt-Watson, J., Victor, J. C., Baskett, R. J., Bussieres, J. S., Carrier, M., ... Taillefer, M. C. (2014). Prevalence of and risk factors for persistent postoperative nonanginal pain after cardiac surgery: A 2-year prospective multicentre study. *CMAJ, 186*(7), E213–E223. doi:c-maj.131012 [pii];10.1503/cmaj.131012 [doi]
- Cogan, J., Ouimette, M. F., Vargas-Schaffer, G., Yegin, Z., Deschamps, A., & Denault, A. (2014). Patient attitudes and beliefs regarding pain medication after cardiac surgery: Barriers to adequate pain management. *Pain Management Nursing, 15*(3), 574–579. doi: S1524-9042(13)00019-2 [pii];10.1016/j.pmn.2013.01.003 [doi]
- Creswell, J., & Plano Clark, V. L. (2017). Core mixed methods designs. In J. Creswell & V. L. Plano Clark (Eds.), *Designing and conducting mixed methods research* (3rd ed., pp. 51–99). Thousand Oaks, CA: Sage.
- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs-principles and practices. *Health Services Research, 48*(6 Pt 2), 2134–2156. doi:10.1111/1475-6773.12117
- Fletcher, D., Stamer, U. M., Pogatzki-Zahn, E., Zaslansky, R., Tanase, N. V., Perruchoud, C., ... Meissner, W.; euCPSP Group for the Clinical Trial Network Group of the European Society of Anaesthesiology. (2015). Chronic post-surgical pain in Europe: An observational study. *European Journal of Anaesthesiology, 32*(10), 725734. doi:10.1097/EJA.0000000000000319
- Fredericks, S. (2009). Timing for delivering individualized patient education intervention to Coronary Artery Bypass Graft patients: An RCT. *European Journal of Cardiovascular Nursing, 8*(2), 144–150. doi:10.1016/j.ejcnurse.2008.10.007
- Fredericks, S. (2011). Coaching in the cardiovascular surgical population. *Canadian Journal of Cardiovascular Nursing, 21*(3), 30–33.
- Fredericks, S., Sidani, S., & Shugurensky, D. (2008). The effect of anxiety on learning outcomes post-CABG. *Canadian Journal of Nursing Research, 40*(1), 127–140.
- Fredericks, S., & Yau, T. (2013). Educational intervention reduces complications and rehospitalizations after heart surgery. *Western Journal of Nursing Research, 35*(10), 1251–1265. doi:10.1177/0193945913490081
- Gagnon, M. P., Desmartis, M., Labrecque, M., Car, J., Pagliari, C., Pluye, P., ... Legare, F. (2012). Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. *Journal of Medical Systems, 36*(1), 241–277. doi:10.1007/s10916-010-9473-4
- Gagnon, M. P., Ngangue, P., Payne-Gagnon, J., & Desmartis, M. (2016). m-Health adoption by healthcare professionals: A systematic review. *Journal of the American Medical Informatics Association, 23*(1), 212–220. doi:10.1093/jamia/ocv052
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods, 18*, 59–82.
- Guimaraes-Pereira, L., Reis, P., Abelha, F., Azevedo, L. F., & Castro-Lopes, J. M. (2017). Persistent postoperative pain after cardiac surgery: A systematic review with



- meta-analysis regarding incidence and pain intensity. *Pain*, 158(10), 1869–1885. doi:10.1097/j.pain.0000000000000997
- Guo, P. (2015). Preoperative education interventions to reduce anxiety and improve recovery among cardiac surgery patients: A review of randomised controlled trials. *Journal of Clinical Nursing*, 24(1–2), 34–46. doi:10.1111/jocn.12618
- Hawkins, R. P., Kreuter, M., Resnicow, K., Fishbein, M., & Dijkstra, A. (2008). Understanding tailoring in communicating about health. *Health Education Research*, 23(3), 454–466. doi:cyn004 [pii];10.1093/her/cyn004 [doi]
- Hennink, M. M., Kaiser, B. N., & Marconi, V. C. (2016). Code saturation versus meaning saturation: How many interviews are enough? *Qualitative Health Research*, 27(4), 591–608. doi:10.1177/1049732316665344
- Kamalipour, H., Vafaei, A., Parviz Kazemi, A., & Khademi, S. (2014). Comparing the prevalence of chronic pain after sternotomy in patients undergoing coronary artery bypass grafting using the internal mammary artery and other open heart surgeries. *Anesthesiology and Pain Medicine*, 4(3), e17969. doi:10.5812/aapm.17969
- Katz, J., & Seltzer, Z. (2009). Transition from acute to chronic postsurgical pain: Risk factors and protective factors. *Expert Review of Neurotherapeutics*, 9(5), 723–744. doi:10.1586/ern.09.20 [doi]
- Katz, J., Weinrib, A., Fashler, S. R., Katznelson, R., Shah, B. R., Ladak, S. S., . . . Clarke, H. (2015). The Toronto General Hospital transitional pain service: Development and implementation of a multidisciplinary program to prevent chronic postsurgical pain. *Journal of Pain Research*, 8, 695–702. doi:10.2147/JPR.S91924
- Kehlet, H., Jensen, T. S., & Woolf, C. J. (2006). Persistent postsurgical pain: Risk factors and prevention. *Lancet*, 367(9522), 1618–1625. doi:S0140-6736(06)68700-X [pii];10.1016/S0140-6736(06)68700-X [doi]
- Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: A systematic review of adherence to web-based interventions. *Journal of Medical Internet Research*, 14(6), e152. doi:10.2196/jmir.2104
- Khan, R. S., Ahmed, K., Blakeway, E., Skapinakis, P., Nihoyannopoulos, L., Macleod, K., . . . Athanasiou, T. (2011). Catastrophizing: A predictive factor for postoperative pain. *American Journal of Surgery*, 201(1), 122–131. doi:10.1016/j.amjsurg.2010.02.007
- Khan, R. S., Skapinakis, P., Ahmed, K., Stefanou, D. C., Ashrafian, H., Darzi, A., & Athanasiou, T. (2012). The association between preoperative pain catastrophizing and postoperative pain intensity in cardiac surgery patients. *Pain Medicine*, 13(6), 820–827. doi:10.1111/j.1526-4637.2012.01386.x
- Koranyi, S., Barth, J., Trelle, S., Strauss, B. M., & Rosendahl, J. (2014). Psychological interventions for acute pain after open heart surgery. *Cochrane Database of Systematic Reviews*, (5), CD009984. doi:10.1002/14651858.CD009984.pub2
- Lapum, J., Angus, J. E., Peter, E., & Watt-Watson, J. (2011). Patients' discharge experiences: Returning home after open-heart surgery. *Heart & Lung*, 40(3), 226–235. doi:S0147-9563(10)00011-7 [pii];10.1016/j.hrtlng.2010.01.001 [doi]
- Lapum, J. L., Fredericks, S., Liu, L., Yau, T. M., Retta, B., Jones, V. M., & Hume, S. (2016). Facilitators and barriers of heart surgery discharge: Patients' and nurses' narrative accounts. *Journal of Cardiovascular Nursing*, 31(4), 350–356. doi:10.1097/JCN.0000000000000253
- Martorella, G., Boitor, M., Berube, M., Fredericks, S., Le May, S., & Gelinac, C. (2017). Tailored web-based interventions for pain: Systematic review and meta-analysis. *Journal of Medical Internet Research*, 19(11), e385. doi:10.2196/jmir.8826
- Martorella, G., Cote, J., & Choiniere, M. (2013). SOULAGETAVIE: Development and validation of a virtual nursing intervention to promote self-management of postoperative pain after cardiac surgery. *Computers, Informatics, Nursing*, 31(4), 189–197. doi:10.1097/NXN.0b013e3182812d69 [doi]
- Martorella, G., Cote, J., Racine, M., & Choiniere, M. (2012). Web-based nursing intervention for self-management of pain after cardiac surgery: Pilot randomized controlled trial. *Journal of Medical Internet Research*, 14(6), e177. doi:v14i6e177 [pii];10.2196/jmir.2070 [doi]
- Martorella, G., Gelinac, C., & Purden, M. (2014). Acceptability of a web-based and tailored intervention for the self-management of pain after cardiac surgery: The perception of women and men. *JMIR Research Protocols*, 3(4), e63. doi:10.2196/resprot.3175
- Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.
- Mills, N., Metcalfe, C., Ronsmans, C., Davis, M., Lane, J. A., Sterne, J. A., . . . Donovan, J. L. (2006). A comparison of socio-demographic and psychological factors between patients consenting to randomisation and those selecting treatment (the ProtecT study). *Contemporary Clinical Trials*, 27(5), 413–419. doi:10.1016/j.cct.2006.04.008
- Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: A model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research*, 13(1), e30. doi:10.2196/jmir.1602
- Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Stroke Statistics, S. (2015). Heart disease and stroke statistics—2015 update: A report from the American Heart Association. *Circulation*, 131(4), e29–322. doi:10.1161/CIR.0000000000000152
- Office of Disease Prevention and Health Promotion of the U.S. Department of Health and Human Services. (2016). *Health Literacy Online: A guide for symplifying the user experience* (2nd ed.). Retrieved from <https://health.gov/healthliteracyonline/>.
- Oliver, J. B., Kashef, K., Bader, A. M., & Correll, D. J. (2016). A survey of patients' understanding and expectations of persistent postsurgical pain in a preoperative testing center. *Journal of Clinical Anesthesia*, 34, 494–501. doi:10.1016/j.jclinane.2016.06.008
- Parry, M., Bjornnes, A. K., Victor, J. C., Ayala, A. P., Lenton, E., Clarke, H., . . . Watt-Watson, J. (2018). Self-management interventions for women with cardiac pain: A systematic review and meta-analysis. *Canadian Journal of Cardiology*, 34(4), 458–467. doi:10.1016/j.cjca.2017.12.011
- Parry, M., Watt-Watson, J., Hodnett, E., Tranmer, J., Dennis, C. L., & Brooks, D. (2010). Pain experiences of men and

- women after coronary artery bypass graft surgery. *Journal of Cardiovascular Nursing*, 25(3), E9–E15. doi:10.1097/JCN.0b013e3181cd66be [doi];00005082-201005000-00017 [pii]
- Ramesh, C., Nayak, B. S., Pai, V. B., Patil, N. T., George, A., George, L. S., & Devi, E. S. (2017). Effect of preoperative education on postoperative outcomes among patients undergoing cardiac surgery: A systematic review and meta-analysis. *Journal of Perianesthesia Nursing*, 32(6), 518–529. doi:10.1016/j.jopan.2016.11.011
- Rovner, G. S., Sunnerhagen, K. S., Bjorkdahl, A., Gerdle, B., Borsbo, B., Johansson, F., & Gillanders, D. (2017). Chronic pain and sex-differences: Women accept and move, while men feel blue. *PLoS One*, 12(4), e0175737. doi:10.1371/journal.pone.0175737
- Sekhon, M., Cartwright, M., & Francis, J. J. (2017). Acceptability of healthcare interventions: An overview of reviews and development of a theoretical framework. *BMC Health Services Research*, 17(1), 88. doi:10.1186/s12913-017-2031-8
- Sidani, S., & Braden, C. J. (2011). *Design, evaluation and translation of nursing interventions*. Ames, IA: Wiley-Blackwell.
- Sidani, S., Epstein, D., & Miranda, J. (2006). Eliciting patient treatment preferences: A strategy to integrate evidence-based and patient-centered care. *Worldviews on Evidence Based Nursing*, 3(3), 116–123. doi:10.1111/j.1741-6787.2006.00060.x
- Sidani, S., Epstein, D. R., Bootzin, R. R., Moritz, P., & Miranda, J. (2009). Assessment of preferences for treatment: Validation of a measure. *Researching in Nursing and Health*, 32(4), 419–431. doi:10.1002/nur.20329 [doi]
- Sidani, S., Fox, M., & Epstein, D. R. (2017). Contribution of treatment acceptability to acceptance of randomization: An exploration. *Journal of Evaluation in Clinical Practice*, 23(1), 14–20. doi:10.1111/jep.12423
- Sidani, S., Fox, M., Streiner, D. L., Miranda, J., Fredericks, S., & Epstein, D. R. (2015). Examining the influence of treatment preferences on attrition, adherence and outcomes: A protocol for a two-stage partially randomized trial. *BMC Nursing*, 14, 57. doi:10.1186/s12912-015-0108-4
- Sidani, S., Miranda, J., Epstein, D., & Fox, M. (2009). Influence of treatment preferences on validity: A review. *Canadian Journal of Nursing Research*, 41(4), 52–67.
- Strudwick, G. (2015). Predicting nurses' use of healthcare technology using the technology acceptance model: An integrative review. *Computers, Informatics, Nursing*, 33(5), 189–198; quiz E181. doi:10.1097/CIN.0000000000000142
- Theunissen, M., Peters, M. L., Bruce, J., Gramke, H. F., & Marcus, M. A. (2012). Preoperative anxiety and catastrophizing: A systematic review and meta-analysis of the association with chronic postsurgical pain. *Clinical Journal of Pain*, 28(9), 819–841. doi:10.1097/AJP.0b013e31824549d6
- van der Meij, E., Anema, J. R., Otten, R. H., Huirne, J. A., & Schaafsma, F. G. (2016). The effect of perioperative e-health interventions on the postoperative course: A systematic review of randomised and non-randomised controlled trials. *PLoS One*, 11(7), e0158612. doi:10.1371/journal.pone.0158612
- van Gulik, L., Janssen, L. I., Ahlers, S. J., Bruins, P., Driessen, A. H., van Boven, W. J., ... Knibbe, C. A. (2011). Risk factors for chronic thoracic pain after cardiac surgery via sternotomy. *European Journal of Cardiothoracic Surgery*, 40(6), 1309–1313. doi:10.1016/j.ejcts.2011.03.039 [doi]
- Veronovici, N. R., Lasiuk, G. C., Rempel, G. R., & Norris, C. M. (2014). Discharge education to promote self-management following cardiovascular surgery: An integrative review. *European Journal of Cardiovascular Nursing*, 13(1), 22–31. doi:10.1177/1474515113504863
- Watt-Watson, J., Stevens, B., Katz, J., Costello, J., Reid, G. J., & David, T. (2004). Impact of preoperative education on pain outcomes after coronary artery bypass graft surgery. *Pain*, 109(1–2), 73–85. doi:10.1016/j.pain.2004.01.012 [doi];S030439590400034X [pii]
- Whitehead, L., & Seaton, P. (2016). The effectiveness of self-management mobile phone and tablet apps in long-term condition management: A systematic review. *Journal of Medical Internet Research*, 18(5), e97. doi:10.2196/jmir.4883
- Whittaker, R., Merry, S., Dorey, E., & Maddison, R. (2012). A development and evaluation process for mHealth interventions: Examples from New Zealand. *Journal of Health Communication*, 17(Suppl 1): 11–21. doi:10.1080/10810730.2011.649103