

Cardiovascular surgical settings encompass shared spaces that are accessible to patients, physicians, nurses, residents, and other members of the healthcare team.¹ Dynamic, fluid interactions are constantly occurring between various members of the team at any one point in time.¹ Each member has their own unique needs. For example, patients require information and support for learning and application of new self-care behaviour skills, residents and students require mentorship to guide practice, while, nurses and physicians need access to up-to-date empirical and theoretical information to revise and evaluate existing care endeavors.

Traditionally, separate interventions have been designed and administered for each member of the healthcare team, however a single intervention, that addresses the needs of each member of a multi-disciplinary team have not been designed or evaluated.^{2,3} This paper will present a specific interactive multi-disciplinary collaborative online intervention that is designed to address the needs of post-operative patients, cardiovascular medical residents, nursing students, and other trainees, as well as nurses and physicians. The interactive multi-disciplinary collaborative online intervention mimics the collective functioning within a shared space of the existing healthcare teams across various cardiovascular surgical settings to enhance the quality of care being delivered. The intervention is defined as a website that can be accessed anywhere there is a wireless connection, by different members of the healthcare team. Furthermore, it allows for interactive discussion through online chat rooms and open forums. Through the use of this interactive multi-disciplinary collaborative online intervention, it is anticipated that there will be an increase in the quality of patient care that is delivered within the cardiovascular surgical setting. A more thorough discussion of this interactive multi-disciplinary collaborative online intervention will be presented, along with a brief overview of the implications for its clinical testing. However, a brief description of the cardiovascular surgical experience will first be

presented to exemplify the notion of various members of a single healthcare team working in a shared environment to address each of their respective learning and practice needs.

Cardiovascular surgical experience

Across the health care setting, an average of 134, 900 individuals undergo a cardiovascular surgical procedure every year ⁴ to repair diseased heart tissue and/or surrounding structures of the circulatory system.⁵ Specifically, procedures that include replacement of damaged valves, rewiring of cardiac electrical impulses, rerouting of blood throughout the circulatory system, and heart transplantation are commonly performed.⁶ Following these procedures, patients typically experience a number of symptoms that include: shortness of breath, fluid retention, pain, lack of appetite, difficulty sleeping, constipation, mood swings, and swelling in extremities.⁷ As a result, patients are required to engage in a number of self-care behaviours, as well as be familiar with the signs and symptoms of complications that may arise during their recovery.⁸ For most patients, immediate contact with a healthcare provider is significantly reduced following hospital discharge, as many do not meet the requirements for receiving nursing care at home. This can result in inadequate performance of self-care behaviours and failure to recognize key signs and symptoms of infection and other complications, resulting in exacerbation of existing health condition, delayed recovery, increased visits to family physician clinics and emergency rooms, and even rehospitallisation.⁶

Resources in the form of discharge educational booklets provided to patients' during their hospitalization have been shown to be effective in producing short-term (24-48 hours post-hospital discharge) self-care behavioural changes.⁸ However, inconsistent findings were reported in relation to the effectiveness of these interventions in producing changes over a longer period of time (up to 3 months following hospital discharge).⁹ Furthermore, additional findings⁶

suggest not all of the information contained with the educational booklets may be of interest and/or relevant to patients' recovery experience at a particular point in time, as an individual's learning needs is constantly changing to reflect their overall health situation.⁹ Thus, educational interventions that are reflective of patient's learning needs at a particular point in time, is needed.

In addition to patients, nursing students and medical residents co-exist within the CVS setting, and their ability to engage in the clinical environment can influence patients' in-hospital recovery, as well as home discharge experience. Nursing students and medical residents' experiences however, are quite different from those of patients, as their main objective is that of acquisition and application of scholarly and clinical based information. Students and residents actively seek out and engage in learning opportunities to advance knowledge of practice, as well as research endeavors, with the aim of refining their clinical skills, while enhancing their research knowledge to enact change. Mentorship from senior members of the health care team are often times used to facilitate this learning process.¹⁰ Resources in the form of up-to-date clinical and research materials, opportunities for research involvement, and provision of experiential learning endeavors are characteristic of various tools used to enhance the teaching and learning experience of students and residents.¹⁰

Clinical staff, that includes: staff nurses, nurse practitioners, surgeons, and staff physicians, encompass the largest group of health care workers who have the most contact with patients within the first week following surgery. These healthcare team members not only provide direct patient care in the form of surgical or nursing interventions, but also continuously seek out and integrate empirical evidence into their practice with the aim of enhancing the quality of care provided to patients. Resources in the form of self-study practice guides and

access to online databases are the most common tools that are used to access, critique, and integrate empirical evidence into clinical practice.

Cardiovascular surgical website for patients, students, and clinical personnel

In an effort to reduce the number of resources that are designed, evaluated, and supported within a CVS setting, a website is being created with the goal of educating patients, training students, and providing current clinical practice and research information to medical and nursing staff. Relevant sections of this website are intended to be used by specific members of the multi-disciplinary team to enhance knowledge, change practice, and ultimately reduce the overall rate of post-discharge complications and hospital readmissions. The following is a brief overview of this interactive multi-disciplinary collaborative online intervention.

The interactive multi-disciplinary collaborative intervention is in the form of a website that can be access by members of the CVS team. The homepage contains several tabs that include the following titles: *Research*, *Patient Information*, *Opportunities*, and *Clinical Application*. The content contained within each of these tabs are oriented towards the needs of the specific audience and is designed using appropriate language and information. The tab titled *Research* provides direct access to current research studies that address up-to-date nursing, medical, rehabilitative, occupational therapy, and physiotherapy studies. The layout of this page includes the upload of each article's abstract, followed by hyperlinks to published manuscripts, for ease of access. A university-based librarian is responsible for the maintenance of this page. On average, the page is updated on a weekly basis. It is anticipated the *Research* tab will be beneficial to clinical staff, students, residents, and patients.

In addition to a *Research* screen, a *Patient Information* tab has also been designed with the intention of providing information to patients who have had coronary artery bypass graft,

valvular replacement, or heart transplant. These individuals have open access to this tab to obtain information which will guide them in their performance of self-care behaviours during their first year of recovery. It contains content related to specific behaviours (i.e. activity performance, management of complications and medication, nutrition, and symptom management) patients are expected to engage in during the first year of recovery following heart surgery. The information contained within this link has been described and evaluated extensively in various randomized controlled trial (RCT) based studies ^{6,8,11} and have demonstrated effectiveness in promoting self-care behaviour performance, while reducing the rate of symptoms, complications, and hospital readmissions. The *Patient Information* screen allows patients to review and select from a list of topic areas, the specific content that they deem to be relevant for their recovery, at any specific point time during the home discharge period. The screening and identifying of specific content provides patients with the opportunity to select specific content that is reflective of their individual learning needs each time they access the website (see Figure 1 for screenshots of pre-operative and post-operative patient education screens).

Typically, when the patient accesses the Patient Information screen, a list of topic areas will populate the screen. The patient will be prompted to rate each topic area using a five point Likert scale in which one end is labelled *not important to learn about* while the other end will be labelled as *extremely important to learn about*. Based on the patient's rating, information relating to any topic identified by the patient as being important or very important for learning will be generate. If all topics are identified by the patient as being important or very important to learn, then information relevant to all content areas will be generated (see Table 1 for a detailed breakdown of list of topics and relevant content areas).

A tab titled *Opportunities* has also been created to provide an overview of the various opportunities that are available for patients, students, clinicians, researchers, and knowledge users. Specifically, opportunities in the form of: 1) study participation which may be of relevance to patients, 2) research assistant positions that can be applicable to undergraduate and graduate students, as well as medical residents and clinicians, 3) graduate student thesis supervision, 4) research mentorship for scientists, and 5) patient, clinician, and/or knowledge user collaboration.

Finally, a *Clinical application* tab presents innovative approaches and strategies for promoting the uptake and integration of new and existing research evidence. Integrative knowledge translation activities that include: methods for integrating technology into patient care activities, approaches for engaging the healthcare provider as a catalyst for change, and strategies for involving patients in the design and implementation of care activities, are identified within this section of the webpage. Clinicians, students, and clinicians, may benefit from accessing this tab on a routine basis.

Implementing a single intervention in the form of a website, to be used by different members of a multi-disciplinary team, is not only cost-effective, but it provides an extension of the healthcare setting in which the website functions as a shared space. The specific elements of this “shared space” are used differently by different members of the healthcare team. Additionally, having a website that is used by the multi-disciplinary team allows for continued interactions between patients and health care providers. This is possible through the use of discussion boards and blogs embedded within this interactive multi-disciplinary collaborative online intervention. The website in and of itself, can also be used as a helpful tool for engaging patients in clinical trials and other studies, and/or providing them with the opportunity to function as knowledge users on knowledge utilization projects.

Additionally, to ensure that the website is communicated effectively and is providing useful information to patients following hospital discharge, feedback will be solicited from the academic and non-academic community on an ongoing basis and will be incorporated into feasibility and pilot study results. Specifically, the website's content has to be concise and clearly structured to allow for ease of navigation. Every attempt has been made to ensure that it is visually attractive, with primarily new and/or compelling information being presented. As well, simple language that is clear and easy to understand, use of headings, colour, photos and images, readable font, and adequate use of white space were used to enhance readability and website navigation.

Future revisions to this website will be made based on study results obtained. As multiple perspectives and feedback is instrumental in ensuring that the website is easy to understand and navigate, is comprehensive, and reflects the needs of all users, a number of versions of the website should be shared with collaborators that include: students, residents, physicians, and nurses. These individuals will be asked to evaluate the different versions of the website in relation to its relevance and feasibility. Thus, a pilot study will be conducted to examine number of times the website was used, which section of the website was used most frequently, and ease of navigating throughout different areas of website in order to refine the process in which the interactive multi-disciplinary collaborative online intervention is delivered. Additionally, data related to the effectiveness of the sampling and recruitment strategy, determining an estimate of participation rate, evaluating the utility and feasibility of the screening procedure, and assessing the appropriateness of data analysis and management plans will be collected to enhance the methodological conduct of the main study. Data related to reasons for attrition rate will also be collected to enhance study participant retention rates. Furthermore, perception of factors that

facilitated or interfered with participation and adherence to the intervention, factors that affected the delivery of this intervention will be collected to quantify and refine the intervention delivery process. Finally, the effect of the website on enhancing patient care during both the in-patient and out-patient hospitalization period will be examined. Once deemed relevant and feasible, a large scale study will be conducted to determine the effectiveness of this intervention in meeting the needs of CVS patients, students, and clinicians, resulting in enhanced patient outcomes.

Challenges

A challenge that has become evident as this interactive multi-disciplinary collaborative online intervention is being designed relates to the posting of published empirical and theoretical articles. This online intervention is being designed based on the principal of green open access publishing, which is also called self-archiving.¹² This type of open access publishing is a means through which authors/researchers can make their materials publicly available.¹² However, in order to post articles on a research website, the article has to be in the form of the author's pre-print, so as to not violate copyright. Thus, the publisher's PDF version cannot be posted. This has resulted in seeking out alternative means through which an author's pre-print of a manuscript can be accessed that include: contacting the corresponding author directly for a pre-print version or creating a link to a manuscript that may already exist on an institution's open access repository.

In summary, alternative means for supporting members of the CVS health care team is needed. Presently, a number of interventions have been designed to attend to the needs of specific members of the health care team that include: patient education interventions designed to support patient recovery, mentorship and training opportunities for residents and students, and the provision and access to up-to-date empirical and theoretical information to support the practice of nurses and physicians. An interactive multi-disciplinary collaborative online

intervention is currently being designed with the goal of educating patients, training students, and providing current clinical practice and research information to medical and nursing staff.

Once implemented, this website will be evaluated for its effectiveness in reducing CVS patient readmission rates and post-operative complications.

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