Development of an online smoking cessation program for use in hospital and following discharge: Smoke-Free Recovery

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ABSTRACT

Background: Tobacco smoking can have negative health outcomes on recovery from surgery. Although it is recommended best practice to provide patients with advice to quit and follow-up support, provision of post-discharge support is rare. Developing an online smoking cessation program may help address this gap.

Objectives: This paper describes the development and pre-testing of an online smoking cessation program (Smoke-Free Recovery, SFR) tailored to the orthopaedic trauma population for use both while in hospital and post-discharge.

Methods: Drawing on the DoTTI framework for developing an online program, the following steps were followed for program development: 1) design and development; 2) testing early iteration; 3) testing for effectiveness; and 4) integration and implementation. This article describes the first two stages of SFR program development.

Results: SFR is a ten-module online smoking cessation program tailored for orthopaedic trauma patients. Of the participants who completed testing early iterations, none reported any difficulties orientating themselves to the program or understanding program content. The main themes were that it was 'helpful', provision of 'help to quit' was low and SFR increased thoughts of 'staying quit post-discharge'.

Conclusions: This study found that a theory and evidence based approach as the basis for an online smoking cessation program for orthopaedic trauma patients was acceptable to users. A randomised controlled trial will be conducted to examine whether the online smoking cessation program is effective in increasing smoking cessation and how it can be integrated and implemented into hospital practice (stages three and four of the DoTTI framework).

INTRODUCTION

As well as contributing to chronic diseases(1) tobacco smoking has a negative effect on surgical outcomes, including post-operative complications and an increased risk of mortality(2), often resulting in longer hospital stays, higher rates of hospital readmission, and a greater cost to the health care system(3). In addition, orthopaedic trauma patients who smoke have longer healing times as a result of increased wound infection(2), and an estimated 40% increase in time to bone union(4). The advantages of smoking cessation following surgery are clear, with cessation reducing the chance of developing some of the negative effects(2, 5-10). Hospital stays may represent an ideal time and location to intervene as they provide an opportunity when a tobacco user may feel vulnerable and more likely to heed health and behaviour change advice(11). Hospitalisation also provides individuals who smoke with a time away from their everyday triggers due to smoke-free policies. This provides patients with a chance to experience a smoke-free environment, likely to lead to a quit attempt(12). As a result of this smoke-free stay, many individuals who smoke tobacco often stop temporarily during their hospital admission(13, 14). Regardless, many relapse after hospital discharge likely due to a lack of post-discharge support(15, 16).

Despite the well-documented benefits of addressing tobacco use in hospitals and providing follow-up support, adherence to clinical practice guidelines by health providers is less than optimal(17, 18), with low levels of smoking cessation support provided if any(17, 19). High intensity hospital-based behavioural interventions which contain a post-discharge component of at least one month follow-up have been found to increase cessation rates by 37% at 6-12 months when compared with usual care(13). Similarly, programs with longer relapse prevention components post-

discharge are associated with higher rates of prolonged smoking cessation(20). However, health providers report that smoking cessation counselling can be expensive(21) and time consuming for the provider(22), making addressing patient tobacco use face-to-face during their hospitalisation difficult. As well, follow-up support for individuals who smoke tobacco post-discharge is rarely provided. This may be related to the lack in continuation of support as patients are transferred to the primary care setting, or the failure to include important information in discharge summaries(23). For this reason, finding a practical method for the provision of continuing smoking cessation support after hospital discharge is needed.

Online health programs are popular tools for health providers as they have a lower cost per user(24) and have the potential to reach individuals who may not have otherwise sought help(25). Systematic reviews report that online smoking cessation programs can be effective among adults, with rates of 9-17% still quit at six month follow-up(26-28). Other online smoking cessation programs are available to the Australian population, for example www.iCanQuit.com.au and www.quitnow.gov.au, however, no online smoking cessation program has yet been designed, developed and trialled specifically for orthopaedic trauma patients, for use while in hospital as well as following discharge from hospital. This population group may experience added difficulty stopping smoking as it consists predominantly of younger males(29), who may have co-occurring conditions such as anxiety or depression(30). The current SRF program has been designed to address this particular demographic and comorbid group of smokers. The online delivery of the program may appeal to younger males who tend to use health care services less than females, and the inclusion of motivational interviewing, cognitive behaviour therapy and a module to address mood may tackle some of the barriers for quitting smoking.

5

Descriptions of the health behaviour change interventions often do not identify all techniques used to change behaviour(31). Although, the CONSORT statement requires the accurate reporting of all intervention techniques used in published studies, behaviour change components are often complex, making them hard to describe and replicate(32). In order to facilitate the reporting and replication of behaviour change techniques (BCTs), Michie, Richardson, Johnston et al. have developed a taxonomy of BCTs(33). BCTs refer to components of interventions which can be quantified and replicated, otherwise known as 'active ingredients'. Michie et al. suggested that poor intervention description present barriers to building on the knowledge of effective intervention techniques as they fail to identify the 'active ingredients'(33). Unlike other studies, this study will use the BCT taxonomy to assist in the development of the intervention in order to comprehensively report all aspects of the program which are aimed at changing behaviour, as per CONSORT recommendations.

This paper aims to describe the development of an online smoking cessation program, Smoke-Free Recovery (SFR), for orthopaedic trauma patients to use during and following hospital admission.

METHODS

The development of SFR occurred two stages and was based on the DoTTI framework(34). The DoTTI framework involves four stages from which it has taken it's name: 1) design and development, 2) testing early iteration, 3) testing for effectiveness, and 4) integration and implementation. The article below describes the first two steps, with a randomised controlled trial (RCT) planned for SFR to test stages three and four of the framework. The process involved 1) the design and development of the online program including: basing it in theory; needs assessment;

the use of an evidence base; input from experts on content; BCT coding of the intervention content; software programming and development of resource materials; and 2) Testing early iteration with a convenience sample of orthopaedic trauma patients (Figure 1). Approval for this study was provided by the Hunter New England Health Human Ethics Committee (14/02/19/4.04).

<<Insert Figure 1 here>>

Figure 1. Flowchart of development of online program

1) Design and development

1.1 Theoretical basis of the intervention. To encourage smoking cessation, SFR adopted the Trans-Theoretical (Stage of Change) Model (TTM)(35), and behaviour and communication theory(36), as well as principles of web usability cited in other smoking cessation programs(37). The TTM is a useful framework for this online program as it guides smokers through six stages of quitting: pre-contemplation, contemplation, preparation, action, maintenance and relapse prevention allowing individuals to step back and forth according to their readiness to change(35). The TTM has been used previously in the development of effective smoking cessation programs(26, 38) and, was chosen as a model for the basis of SFR as it aligns with the hospital admission (pre-contemplation stage aligns with immediate post-surgery recovery, contemplation and action with thinking about quitting, action with the hospital admission, maintenance with staying quitting, and relapse prevention with heading home post-hospital discharge).

In addition, the web usability model was employed, with formative research, formative evaluation and process evaluation, for the development of the online intervention conducted. Counselling techniques were also included in the

7

development of the program content, with Motivational Interviewing(39) and Cognitive Behaviour Therapy (CBT)(40) techniques utilised.

1.2 Needs assessment. According to the DoTTI framework(34), the needs of the population must first to be understood in order to develop high quality, patient-centred care. Pilot research of hospitalised orthopaedic trauma patients who smoked found that only 60% reported receiving information about the effects of tobacco use on recovery during their admission to hospital(41). This study also found that after a hospital admission, patients who identified as current tobacco smokers expressed an increased interest in quitting.

1.3 Evidence-based smoking cessation treatments. The content for the online program was developed by drawing on information from evidence-based sources. Firstly, a literature review was conducted to identify published smoking cessation advice specific to hospitalised patients, and, more broadly the general public. Two Cochrane Reviews were of particular relevance including 'Interventions for smoking cessation in hospitalised patients (review)'(13) and 'Internet-based interventions for smoking cessation'(42). Additionally, current clinical guidelines were consulted for best practice regarding tobacco use cessation care(43). Secondly, a search of the literature conducted for online smoking cessation programs specific to hospitalised patients identified two trials(44, 45). A broader search was also conducted to identify other online smoking cessation programs designed for the general public. From this, the main recommendation of SFR includes: staying smoke-free during hospital admission; talking to your doctor with regards to tobacco use; seeking nicotine replacement therapy; as well as tips on how to remain smoke-free after hospital discharge.

1.4 Expert input into the content. A draft version of the program was sent to all program investigators (n=10) for review. Feedback regarding the perceived relevance of program content and information on the feasibility of applying it in a clinical environment was collected from the investigators who included: orthopaedic surgeons; behaviour change researchers; clinical psychologists; epidemiologists; nursing staff and pharmacists. The use of a multidisciplinary panel incorporates a wider set of views and expertise based on the individuals' experiences. As the panel has experience with identifying evidence-based strategies, and incorporating them into practice, their expertise was integral to developing an intervention which would be relevant with orthopaedic trauma patients(46, 47). Feedback from the panel included adding information to the program about the types of NRT and how to use them; the use of more appropriate wording regarding hospital admission; and adding links to information from other websites. Program information was updated based on feedback received and programed into the online platform.

1.5 BCT coding of the intervention content. SFR was coded using the BCT taxonomy to provide labels for BCTs included in the intervention. A full list of the BCTs used and examples from the program, can be found in Appendix A.

1.6 Software programming of SFR and development of resource materials.

Program modules. To guide patients through the quit process and improve flexibility, a number of separate but related modules were designed. When users initially access the online program they are presented with a loading module in which they are required to answer some simple questions to tailor the feedback they receive to their tobacco use profile. Modules remain available after loading so that users are able to go back and access information they find helpful as needed. Each section contains information specific to the stage of the quit process, asks questions which

are designed to increase motivation to quit, and provides information about the harms of tobacco use and the benefits of quitting. Answers provided by users guide their access to more tailored information. A description of each module can be found in Table 1.

Module	Description
Module 1 'Recovery from surgery'	Provides information about the benefits of quitting while in hospital, the effects of continuing to smoke on recovery from surgery and prompts to think about the reason why the user continues to smoke.
Module 2 'Thinking about quitting'	Provides information on reasons for quitting and helps the user identify their reasons for quitting. This module also contains information about what chemicals are in cigarettes, and prompts the user to set a quit date.
Module 3 'Quitting'	Describes information about what an addiction is, as well as what withdrawals, cravings and triggers are. This section also presents tips to avoid or overcome these triggers. This module also calculates the user's level of nicotine addiction using the Fagerstrom Test for Nicotine Dependence.
Module 4 'Staying quit'	Presents the reasons the user decided to quit and information about the benefits of staying cigarette free.
Module 5 'Heading home'	Contains more information about the benefits of staying smoke free as well as information about how to avoid relapse.
Module 6 'Having trouble staying quit'	Covers common difficulties faced when quitting smoking as well as tips on how to overcome setbacks.
Module 7 'Games and quizzes'	Contains quizzes and games that teach the user about the negative effects of smoking on the body and recovery from surgery, as well as common myths and facts surrounding smoking.

Module 8 'Smoke-free diary'	An interactive section in which the user can plan and track their quit smoking process, and receive graphic feedback of their progress.
Module 9 'Resources'	Contains links to more information as well as information on common problems and solutions.

Table 1. SFR module description

Tailoring and interactivity. SFR has been designed to be an interactive program which is easily navigated. Information provided is tailored to the user's circumstances (Figure 2). Tailoring is based on health behaviour and communication theory(36). Users are also asked a series of questions relevant to their stage of the quit process. Branching is used to allow the individuals to navigate to different sections of the program, skipping sections which are not relevant to them. Other tools included in this program include videos of surgeons, pharmacists and clinical psychologists providing the user with information about making a quit attempt (Figure 3). Graphics have been used along-side information where possible, and written text includes the use of language at a year six (age 12) reading level.

Patient-education materials. Along with access to SFR, users are provided with an A4 sheet of paper outlining each of the modules (Appendix B). This is to aid the user in their navigation of the program, in particular their access to modules.

<<Insert figure 2 here>>

Figure 2. Screenshot from SFR, feedback on progress

<<Insert figure 3 here>>

Figure 3. Screenshot from SFR, information delivered by video

Delivery of the online program. The QuON software(48) will be used to deploy SFR. QuON is a survey software suite which can be programed by research staff to collect both survey answers and timing statistics from participants.

Data collected using QuON to deploy SFR is securely stored on servers at the University of Newcastle, in line with ethics requirements.

As part of the SFR project, QuON was enhanced in a number of ways. The concept of a "modular" survey project was introduced that allows researchers to design surveys as a group of individual "modules". Each module is a survey in its own right. Users gain access to various modules that are initially 'hidden' and become available as they progress through the program. A researcher is able to define complex rules that determine if and when a particular module is enabled for a user. For example, a module on smoking while pregnant may only be displayed to survey participants who indicated their sex as female during the introductory questions.

A "user diary" feature was added to QuON to allow individuals to track their progress for example, number of cigarettes smoked per day. The "user diary" asks a user to provide a daily report of their cigarette intake. A graph is then presented to the user showing how they are progressing.

These enhancements enabled QuON to be used as an information dissemination tool

2) Testing early iterations: Process evaluation of the content by surgical orthopaedic trauma patients

Once a functional version of the online program was available, a sample of orthopaedic trauma patients at a large trauma surgery unit were approached to trial SFR.

Qualitative interviews were conducted with a convenience sample of five orthopaedic trauma patients (mean age = 48 years, range 20-75 years) who were daily smokers at the time of admission (three male, two female). These participants were approached on the ward by a research nurse (NL) and asked if they would be willing to anonymously trial an online program for the duration of their hospital admission and provide some feedback prior to discharge. Interviews lasted approximately ten minutes. The goal of trialling SFR with patients was to ensure that it was easy to use and understandable to a broad age group, and that the technology worked. Thematic analysis was also used to determine thoughts about the program and patterns of use. Participants were asked in face-to-face interviews by the research nurse (NL) "How did you find the program?" "Were there any section of the program which you found difficult to understand?" and "What other feedback would you like to provide us?". Participants were asked to rate on a scale of 1 to 5 (where 1=not at all and 5=extremely) "Was the program easy to use? Was it easy to navigate?", "Did you find the information contained in the program useful to you while you were in hospital?". Responses were transcribed by the research nurse on a structured interview form, and provided to the research team.

RESULTS

Timing results from the patient's use of SFR were exported to ensure that the data were able to be collated from the servers easily.

There was consensus in participant's positive views, therefore, only a few themes were extracted during the thematic analysis. All participants reported that the program was extremely easy to use and extremely easy to navigate. The main theme that arose from the interviews was that SFR was 'helpful' (n=4); it "helped… make the most of my hospital admission and being smoke-free". Other common

themes focussed on being provided 'help to quit' and 'staying quit post-discharge'. Participants often reported that they had not received any 'help to quit' (n=3) or thought about trying to 'stay quit post-discharge' until they used the program (n=3). One participant suggested adding a section to the program which went through instructions on how to use the program. As a result, simple instruction screens were added to the welcome module. No further comments with regards to the functioning of the program were identified.

3) Testing for effectiveness and 4) Integration and implementation

Following on the final steps in the DoTTI framework, the SFR program will be evaluated with an RCT. Feedback from testing will be integrated into the program so that it may be implemented into practice.

DISCUSSION

This paper describes the development of the SFR program, an online intervention designed for orthopaedic trauma patients to assist in remaining smoke-free after a hospital admission. Research indicates the benefits of remaining smoke-free while recovering from surgery, with hospital admission providing an opportune time to advise smoking cessation. Despite this, provision of smoking cessation care during hospital admission has been found to be low(13), (41), while smoking rates remain high(41). New methods to provide support to quit smoking are necessary, an online program provides a pragmatic, acceptable and low cost option for the provision of this care.

While it could be a concern that online programs may lead to staff ignoring the provision of any smoking cessation support, it is believed that the development of an online program will facilitate communication between patient and health care-provider regarding smoking cessation care. With prompts included in the program to

ask medical personal questions with regards to prescription medication and additional smoking cessation support, it is believed that the development of an online program may lead to a greater support to quit from staff.

As well as addressing this gap in support during the acute-care period, eHealth interventions have the potential to increase post-discharge care due to their extended reach. While hospitals provide immediate medical care as needed, post-discharge support is often lacking, with communication deficits between hospital staff and primary care physicians common, often to the detriment of the patient's care(23). The increased reach of the Internet therefore makes online programs a potential source of follow-up support, as it is available anywhere, anytime and can be used in the comfort of one's own home.

While the number of online smoking cessation programs are increasing, it is important that they are developed with rigour and the target population in mind. Little is known about the effective components of online interventions and developing them in a rigorous manner is essential for making them effective and being able to identify effective components of the program. This process assists also in describing exactly what is involved in an intervention and the components used to produce behaviour change. For this reason, our approach described above is important as it identifies exactly what was done in order to develop SFR and what theories and techniques were used.

Limitations

A limitation of this study is that SFR was usability tested with a small number of participants. As well, long term and post-discharge results from intervention use were not sought. While this was enough for the testing of the intervention to identify programming errors, few themes arose from thematic analysis, possibly due to the

short nature of the surveys. Testing with participants still needs to be conducted to determine effectiveness of the intervention among the target population, and is planned for this study.

Another possible limitation of this study is that SFR is based on the TTM, which has been criticised on such grounds as having no clear sense of where one stage ends and the other begins. Such criticisms were acknowledged by the research team and regarded as having little impact on the tailoring of the online program. Thus, the TTM in this context was deemed to provide a good basis for the logical flow and modularisation of the program.

Practice implications

By developing SFR using theories and techniques known to promote smoking cessation, this program hopes to address the gap in the provision of smoking cessation support for orthopaedic trauma inpatients. To further knowledge in this field, an RCT of SFR is planned for this population group. SFR, if found to help current tobacco smokers cut down or quit, could be widely implemented to change current practices surrounding the provision of support, and tailored to other hospital populations.

CONTRIBUTORSHIP

SMc assisted with the development of the intervention content, programed the intervention, conducted surveys with the participants who trialled the program and drafted the manuscript. BB, ZB, AB, IH, JA, NL, JN, CD, JG, LW, conceived the idea, assisted with the development of the intervention material and assisted with manuscript preparation. Further, NL assisted with conducting surveys of intervention users. ES assisted with the coding of the online program and assisted with manuscript preparation. MW, DP and FH developed the online platform as assisted with the coding of the intervention

COMPETING INTERESTS

None declared

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