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Development and usability testing of a web-based smoking cessation treatment for smokers with schizophrenia

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ABSTRACT

Introduction: Over half of people with schizophrenia and other psychotic disorders smoke tobacco. Web-based approaches to cessation have been effective for the general population, but are not usable by many with schizophrenia disorders due to cognitive impairments and low computer experience. We developed a prototype smoking cessation treatment website for this group of smokers with features to reduce cognitive load. Here we report results from initial office-based usability testing and home-based field testing.

Method: Five people were observed using the prototype website in the office with think-aloud cognitive interviewing. The website was modified based on these data. Six people then used the website on a home laptop after a single training session, with further coaching if needed.

Results: Office-based testing showed that the website was usable, but required minor modifications. Further editing provided labels that were more explicit and concrete, limited the conceptual content on each page, and modified features of the support group forum. Home-based field-testing identified further functionality issues that were rapidly modified. Over half of users needed more than a single session of training to use the computer and website. Eighty three then used it independently and were very satisfied with the web-based program. Among the five smokers who field tested the prototype, 60% cut down and 20% had quit smoking after three weeks of home use.

Conclusion: The prototype website was usable and satisfactory. With training and support, home use of this cessation website appears to be feasible and promising for cessation among smokers with schizophrenia. Further research is needed to evaluate web-based cessation treatment in people with psychotic disorders.

1. Introduction

Although the prevalence of smoking has declined in the past 50 years (Escobedo and Peddicord, 1996; CDC, 2009), people with behavioral health disorders remain vulnerable to nicotine addiction. Nicotine dependence is particularly common among people with schizophrenia and other psychotic disorders (50–80% smoke) (de Leon et al., 1995, 2002; Vanable et al., 2003; Kotov et al., 2010; de Leon and Diaz, 2005; Forchuk et al., 2002; Lasser et al., 2000; Herran et al., 2000; Lawrence et al., 2009; Hughes et al., 1986; Etter et al., 2004; Annonymous, 2008). The high rate of smoking in this group contributes to their premature morbidity and mortality (Kelly et al., 2011; Colton and Manderscheid, 2006; Mauer et al., 2006; Brown et al., 2000; Hoang et al., 2011; Chwastiak and Tek, 2009; Tiihonen et al., 2009). Fortunately, quitting at any age reduces morbidity and increases life expectancy (Doll et al., 2004), and, like the general population, people with schizophrenia can use cessation treatment to increase their likelihood of quitting (Evins et al., 2001, 2005, 2007; George et al., 2002, 2008; Baker et al., 2006; Weiner et al., 2011; Tsoi et al., 2010; Ferron et al., 2009; Williams et al., 2012).

Interactive and tailored website cessation programs facilitate cessation for the general population (Myung et al., 2009; Shahab and McEwen, 2009; Civljak et al., 2013), and they dramatically extend the reach of cessation treatment (An et al., 2010). Human-centered design processes can facilitate high quality designs (IDEO.org, 2015), but websites may still may not be usable by important subpopulations. Along these lines, currently available cessation websites are not usable by people with psychotic disorders (Brunette et al., 2011), due to lack of accommodations for the cognitive impairments commonly present in this group (Keefe and Eesley, 2006).

In order to develop websites that can be usable by people with psychotic disorders, we have used principles of design for people with

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disabilities (Anonymous, 2010) and iterative usability testing (Rotondi et al., 2007; Ferron et al., 2011) to establish designs that reduce cognitive load, enabling people with schizophrenia to effectively use them (Ferron et al., 2012). With such a design, Rotondi's group developed a psychoeducation website for people with schizophrenia with an online discussion forum that provided peer support. After one training session for use of this particular website, 100% of subjects with schizophrenia used the site and support group independently for an average of 46 h (and almost 3000 page views) over a year, resulting in improved symptoms and functioning (Rotondi et al., 2010).

Using similar design principles, we sought to develop a prototype of a tailored, easy-to-use smoking cessation website that included behavioral therapy modules, an information resource library, and an online support group for smokers with psychotic disorders who want to quit smoking, called Let's Talk About Quitting Smoking. We started with a prototype, as prototypes are a cost effective strategy to enable rapid evaluation of new technology tools or to test tools in new populations (IDEO.org, 2015; Hall, 2001). Usability testing is a key component of website development that can ensure that the intended users are able to benefit from the website (Stoddard et al., 2006). This report describes the website design and usability testing of this prototype website among 11 people with psychotic disorders.

2. Materials and methods

2.1. Website development

2.1.1. Website content

We used the Theory of Planned Behavior to guide our overall approach, in which we attend to attitudes, social norms, and perceived behavioral control for smoking and cessation treatment (Ajzen, 1991, 2006). We developed the website prototype to contain a) standard evidence-based behavioral techniques for smoking cessation (Association, A.L., 2015) adapted for people with psychotic disorders (Cather et al., 2007) in eight brief, linear, interactive modules, b) an online forum support group, and c) a "library" of educational materials for people with psychotic disorders who are quitting smoking.

2.1.2. The behavioral therapy modules

In this prototype engaged users to list reasons for quitting, track the circumstances associated with their smoking, learn and practice simple coping strategies to use when trying not to smoke. Additionally, users learned about why medications can help with quitting and how to talk to a doctor about getting medications. The content helped users set a quit date and make a detailed plan for activities during that day. Additional content that was planned for the final version of the website included helping the user develop skills for: managing stress without smoking, maintaining use of cessation medication to prevent relapse; and dealing with a slip without relapsing to daily smoking. The content was also designed to help the user maintain his or her motivation to quit smoking.

The modules were interactive and included video demonstrations, practice exercises, and questions to engage the user and reinforce learning (Binder, 1996). Since engagement promotes abstinence (Richardson et al., 2013), and contingent reinforcement can improve engagement (Carey and Carey, 1990; Helmus et al., 2003; Cahill and Perera, 2011), the completion of each module resulted in an automated email to the coordinator, who could reinforce use. In this study, completion of each module was also reinforced with $5 that was electronically placed on a personal gift card. This feature can be adapted to automate reinforcing emails or texts to the user rather than cash reinforcers.

2.1.3. The online forum support group

Was intended to help users connect with peers who were also learning skills to quit smoking. The support group used a bulletin board format. This allowed for asynchronous communication between members, which is generally more convenient than requiring all users to be on line at the same time. This arrangement required messages to be text-based, and in this application users typed messages using a keyboard. A moderator, who was a tobacco treatment specialist, made posts to engage users into the forum and into conversation with each other.

2.1.4. The online 'library"

This feature consisted of a "library" of easy-to-read information sheets about smoking, quitting, and cessation treatment. We planned for the next version to contain a larger group of documents and videos presenting information relevant for smokers with psychotic disorders, including managing stress, relaxed breathing, etc.

2.1.5. Development and design considerations

The interface was designed to minimize reliance on cognitive functions (Mayer and Moreno, 2003) that are often impaired in schizophrenia, including working memory, spatial perception and abstraction (Keefe and Eesley, 2006). Key design features included a shallow hierarchy and explicit labels, which rendered a website with a flat, explicit, weak-modular design that has been shown to be highly usable for this group (see Table 1) (Rotondi et al., 2015). The eight linear modules, designed to be used in order, guided users to learn smoking cessation information and skills. This linear design guides the user to view the content from start to finish, increasing the likelihood of viewing all content and thus improving knowledge acquisition (Crutzen et al., 2012). To improve focus on and learning of the website content, pages were presented sequentially within each session rather than scrolling, which requires simultaneous assessment of need to scroll, physical implementation of scrolling, and continued refocusing on a new area to read. Further, the sequential page approach guides the user to complete the acquisition of one "chunk" of information before moving on to attend to the next "chunk" of information (Anonymous, 2010). We used large font, simple text or video, and large buttons to enhance user's ability to view, understand and interact with the content. Advertisements and moving content were not used, as they tend to distract learners. Text-to-speech software enabled audio presentation as the user reads the pages, a feature that also enhances learning and is preferred by this population (Ferron et al., 2012). Fig. 1 depicts an example of one of the program's simply designed pages that addresses triggers. In contrast, Fig. 2 is a screenshot of a currently available website page addressing the same issue. At the end of each module, the user was asked questions about the information and given feedback to reinforce learning.

Because computers have large screens and keyboards as well as a mouse (which improve viewing and interactive capacity for those with cognition, dexterity and vision problems that are common in this group), we chose the laptop computer over phones and tablets to deliver treatments to this population. However, the website was programmed to allow for future use on phones or tablets. We used the Java programming language to implement the interactive portions of the website, including the modules, support group, and the user's preference for audio. For the website's text-to-speech capabilities, the Festival software package was used to generate spoken text on our web server.

2.2. Overview of study design

The study protocol was approved by the Dartmouth Committee for the Protection of Human Subjects. After consenting, subjects completed baseline assessments. They were then randomly assigned to either a) use the prototype website with a usability cognitive interview protocol in the office during the first 4 weeks (Group 1), or b) use the further modified prototype website independently at home during the second 4 weeks (Group 2). We enrolled two groups of five or six participants,