

A Mobile-computing centric approach to tobacco cessation

Problem Statement

Despite several decades of efforts in tobacco control, smoking and tobacco dependence remains the leading preventable cause of death, disease, and disability in Canada and the U.S. In Canada, tobacco kills 45,000 people each year, while the U.S. sees 440,000 deaths per year (and \$150 *billion* in health care costs and lost productivity). In the developing world, the outlook is even worse; by 2030, 70% of the deaths from tobacco (seven million *dead each year*) will occur in developing nations, according to the WHO. This *entirely preventable* burden will fall on Third World health care systems already struggling to cope with natural disease (such as AIDS). Quitting smoking requires significant behavioral and cognitive change for the patient, in addition to overcoming the physical addiction to nicotine. We have identified evidence-based behavioral and cognitive treatment components for tobacco dependence that appear amenable to IT support and enhancement, particularly via mobile computing. We intend to deploy this support on cell phones, which are becoming ubiquitous in Western society and Asia. By providing appropriate support to patients at the time and place where they most need it, we hope to improve the patient's success in quitting smoking. Targeting mobile platforms also opens up the chance to aid patients in the developing world. Many Third World countries are foregoing landline telephony in favor of nationwide cellular networks. This means that the penetration of cell phones in Third World nations is high, and tobacco-cessation applications targeted at that platform can be widely disseminated.

Evidence-based clinical treatment guidelines identify a range of interventions that have been empirically shown to be effective, and are widely endorsed and used by professionals and institutions working in the field of tobacco control. These include both psychosocial interventions as well as pharmacologic and some somatic interventions. Clinical management of tobacco dependence requires the clinician and patient to select those interventions that seem most promising for the individual patient. Both psychosocial and pharmacologic interventions have been shown to significantly increase the success rate for a quit attempt, and the combination of both forms of treatment further increases the chances of success. However, few smokers are willing to attend cessation clinics limiting the impact of such approaches, and the need for cessation services to be institutionalized on a wider base is pressing. Also, none of these guidelines offers any direction for incorporating the use of Information Technology resources for tobacco cessation. There exists a significant challenge in establishing cessation support and counselling for all those who are interested in quitting smoking, and currently no effective means exists by which large numbers of patients can be engaged in effective broad-reach smoking cessation interventions. Web-based interventions have been proposed as a means of delivering individually tailored interventions to a broad population of smokers. Although the evidence for its effectiveness is only starting to emerge, this modality may have the potential to move far

beyond the traditional information-based health promotion interventions, reaching vast numbers of Internet users if presented appropriately. However, traditional web-based solutions have significant limitations within this domain: (1) they are by definition passive – they require the patient to interact with them rather than the system initiating the interaction. This active or response mode is critical to assist the patient in high-risk situations; (2) they lack context information. Patients face a significant battle to break many smoking and smoking related behaviors. These behaviors are triggered by many contextual situations; and assisting the patient in modifying their behavior in these situations is an essential component in any cessation program. It is believed that these contextual triggers can be encoded as chronological and geographical statements; and their integration into a cessation program that initiates program protocols upon recognizing this contextual information must be the cornerstone of any successful I.T. controlled cessation program. It is believed that mobile computing offers facilities to overcome both of these limitations.

Solution

We propose to provide IT support for behavioral treatment components for smokers. The behavioral therapies we are targeting are firstly stimulus control (and especially its antecedent, stimulus identification), and then relapse prevention and skills training. The initial IT support we can provide for stimulus identification is an “electronic smoking journal”. Usually, patients record their smoking habits (time, location, and activities associated with smoking) for a period of (usually) one month prior to a quit attempt. Then the patient and clinician review the smoking journal, and identify contextual cues (times, places, activities) that induce a craving for tobacco. They then create strategies to (initially) avoid or manage these cues (stimulus control). Gathering this information in an electronic form allows the personalization of the remainder of the proposed system, in particular the computer game and interaction elements described below. In addition, this stand-alone component of the system can be utilized to improve current stimulus control approaches. By creating a cell-phone based smoking journal, we decrease the effort required for the entire journaling exercise. Time and location information are automatically available when using a cell-phone, and activity information can be captured from a simple menu-based interface. These are very simple tasks, performed on a cell phone that many smokers are already carrying upon their person. Psychological research has shown that the provision of convenient tools that support an activity increases the likelihood that people will perform that activity. Our electronic smoking journal will then be able to upload the complete journal to the physician’s computer, where it can be conveniently analyzed. The electronic smoking journal thus fits into current best-practice clinical treatment of tobacco dependence, as well as being a springboard into the core system we will develop in future years.

The core of our proposed system is a skills training and relapse-prevention approach using a computer game-based interaction system; this type of approach has been shown at MIT to increase adherence rates across a range of treatment regimes. The system will be designed to assist patients in developing and practicing coping skills for use when a smoking cue is encountered. This will involve the actual development of coping strategies, and exploration of strategies best suited to the patient, using their own personal smoking cues. Our mobile environment will be a medium for exploring new, healthy behaviors in a virtual world, where the patient has the freedom to fail, without endangering their larger goal of quitting smoking. For maximum effectiveness, we intend this system to be a Massively Multiplayer Online Game, thus creating an educational and supportive group of recovering smokers in a virtual world. This approach also lends itself well to deployment in disadvantaged and developing regions, by allowing a single physician to reach a massive number of geographically dispersed patients through the game, while still having the option of providing one-on-one counseling as warranted. Such economies of scale will be vital in extending our system to the severely overloaded and understaffed health-care systems in Third World countries.

Interactive self-help materials in an electronic context can offer vastly superior capabilities than (passive) hardcopy pamphlets. Using the techniques of context-aware computing, a cell-phone based application can use an individual's smoking cues (imported from the electronic smoking journal) to automatically detect situations where an individual is likely to encounter a smoking cue, and then proactively offer an intervention. For example, calling up an instant-messaging system (for group reinforcement), cueing the patient to utilize behavioural or cognitive coping strategies, and inviting the patient to play a game element (behavioural substitution) are all possibilities. The system will also provide a "panic button" capability, allowing the smoker to call for an intervention when they sense a craving that the system did not automatically detect.

Our system is initially targeted at the pre-18 and 18-24 age brackets, a difficult population to reach with traditional interventions. This is a critical period in the evolution of tobacco addiction, as the uptake of smoking behaviours usually occurs prior to or during this period. This population is also intimately familiar with cell phones and computer games, and so the "learning curve" for our system will be small. The MMOG-based approach of our larger system will be particularly appropriate for this population. Youths are most responsive to genuine experiences from other "ordinary" youth, rather than declarations from authority figures or celebrities. Our MMOG approach will involve young, recovering smokers with an on-line community of their peers who are also attempting to quit smoking. Psychologists have shown that providing such a rich communications medium for a community also has a powerful persuasive effect.