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CONSTRUCTING A VIRTUAL BEHAVIOR CHANGE SUPPORT SYSTEM: A MOBILE INTERNET HEALTHCARE SOLUTION FOR PROBLEM DRINKERS

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ABSTRACT

Currently there is no effective pharmacological method for treating problem drinkers without having negative side effects. Although previous studies indicate that brief office technique has positive effects on decreasing drinking. Problem drinkers' behavior change is still the most effective "cure". With Wireless Application Protocol (WAP) enabled, cellular phones with access to Internet provide a great opportunity to adopt mobile Internet as a means to support behavior change. This paper presents an innovative approach to target this issue and provide a solution based on interdisciplinary cooperation between health and information technology professionals. There are three phases in this study. The first phase is to implement a preliminary assessment to explore problem drinkers' physical and psychological needs. Then in the second phase a WAP Web site will be constructed to provide alcohol related information tailored to their needs and also trying to use other functions such as on-screen icons, chat etc. to support behavior change. Finally a feasibility study will be implemented to evaluate the effectiveness of applying mobile Internet to addictive behavior change in comparison with traditional brief office techniques.

1. INTRODUCTION AND RESEARCH OBJECTIVES

As of February 2001, there are 5.6 million people (79%) in Hong Kong are cellular phone subscribers (Business2.0, 2001), if properly used, cellular phone could be an innovative and powerful tool for behavior change, information delivery, or providing social support to problem drinkers. The cellular phone is compact and is usually with the user 24 hours per day. For young people, especially, the cellular phone is a symbol of personality and communication freedom. By using wireless Internet technologies such as the Wireless Application Protocol (WAP cellular phone) or General Packet Radio Service (GPRS) the target group will be able to search information or look for social support anytime and anywhere without the obstacles of digital divide. Unlike a normal Web site, which requires a user to have a well-equipped personal computer, a Web browser, and an Internet connection, a WAP Internet Web site can be reached through cellular phones or other handheld computing devices such as WAP enabled cellular phones. The only requirement is that the user has to subscribe to a mobile Internet service with a wireless Internet service provider to connect to the Internet.

Use of alcohol among young people is a growing concern. Problem drinkers are at high risk for alcohol morbidity and mortality. Effective interventions are needed to help problem drinkers to stop or decrease alcohol abuse. It is suggested that nurses working in general hospitals are confronted with up to 40% of their clients who drink at hazardous or harmful levels, yet are admitted to the service for other reasons. Similarly studies show that up to 25% of the adult population consumes alcohol at hazardous or harmful levels.

1617

Behavioral treatments tailored to problem drinkers at high risk offer the possibility of more effective intervention. Because problem drinkers are mainly competent and productive members of society with no 'obvious' problem they desire autonomy and independence and want to be involved in decisions related to their treatment and well being. They also often prefer not to attend alcohol clinics or to be labeled as someone with a problem. Some success in the past has been demonstrated with offering such people 'distance learning' treatment anonymously by mail. Recently e-health interventions have focused on in-home use of computer-based systems as a tool for social support or behavior change. For example, in the US, an interactive, in home, computer-based system, CHESS project in the University of Wisconsin at Madison (Comprehensive Health Enhancement Support System) has demonstrated positive health outcomes in a number of adult populations (Gustafson et al., 1999).

Is there a better way to deliver health-related information and promote health more effectively? Problem drinkers are unlikely to stay at home and sit in front of computers to look for health related information and avoid their usually social activities, and unlikely to modify their environment to avoid the social triggers to consume alcohol. Furthermore problem drinkers are unlikely to call for help when they are socializing and involved in drinking, and it is this proposed intervention which will help them to reach the Internet without exposing their identities and intentions. Thus, mobile Internet might be the convenient channel to provide information or support when problem drinkers need it, for unlike conventional treatments it is feasible to implement this treatment when the subject is participating in social intercourse and in the midst of the environment which strongly contributes to the drinking behavior, for example being in a bar with friends.

In this study, a prototype of a mobile Internet information module for problem drinkers will be developed and evaluated for used in wireless cellular phone in adult problem drinkers. We chose to study the efficacy of mobile Internet information module for problem drinkers because it offers a number of advantages over traditional ways of health promotion. The advantages include real-time peer-based social support, instant feedback or advice, periodical reminding messages, direct connection to professional support and other content which will be based on the needs identified by problem drinkers. It also has the potential for widespread dissemination through a large group of wireless communication subscribers in Asia Pacific and to be used in other addictive behaviors, such as smoking, and drugs of addiction. It may also have applications for adherence to therapeutic medications such as antibiotics or psychiatric medication.

The main aim of this study is to explore and develop an innovative way to deliver health related information, and provide social support to problem drinkers by using wireless Internet technologies, and evaluate its feasibility.

1.1 Primary Aims

The first primary aim is to assess the needs of problem drinkers through a comprehensive preliminary assessment conducted among 20 current and former problem drinkers. Secondly, based on the needs identified by problem drinkers, a mobile Internet information and support system for drinking cessation will be developed, designed and subsequently constructed. The Alcohol Use Disorders Identification Test (AUDIT) will be used as an instrument to screen problem drinkers to be recruited in the clinic trial. Then a randomized clinic trial will be implemented to evaluate the efficacy and effectiveness of providing wireless Internet connections with the MIM (n=60) compared to brief office intervention (n=60) on the week 24 intention to consume alcohol rates in problem drinkers.

1.2 Secondary Aims

The effectiveness of MIM compared to brief office intervention on safe alcohol consumption will be evaluated. Mechanisms and processes of change associated with MIM including perceived social support, negative affect, and use of coping skills will be assessed. Finally, the duration, frequency,

1618

patterns and specific components of MIM use and differences in mobile Internet use between different socio-demographic groups will also be determined.

2. THEORETICAL FOUNDATIONS

2.1 Problem drinking in Hong Kong

The Psychiatric Epidemiology Research Unit at the Chinese University reported a community study of alcoholism in Hong Kong during late eighties. Findings suggested that the life-time prevalence of alcohol abuse/ dependence was about 9% in men and less than 1% in women, with alcohol dependence in one-tenth of the total (Donnan, 1989 cited in Leung, 1992).

Alcohol is a growing problem in Hong Kong, especially for young people with more lounges and karaoke bars opening up in the community. Local young people tend to spend their leisure time in these drinking centred places instead of tea or coffee houses (Green, 1991). They may underestimate the health hazard of beer - the most common beverage among young people. There is a fear that many of them may develop alcohol related problems unknowingly (Green, 1991). A survey conducted by the Narcotics Division of the Security Branch in 110,000 teenagers has found that as high as 73.1% of Chinese-speaking secondary school students have consumed beer and wine, with 15% having their first drink aged six or under (Fraser, 1993).

Recent research in Mainland China has demonstrated that the patterns of alcohol consumption are similar to those of other western countries (Shen et al, 1990) and social changes may be increasing the magnitude of the problem (Leung and Arthur, 1999). There is a further suggestion that alcohol consumption and related problems are on the increase in China as foreign brewers move into the country and the expansion of beer markets take place (Leung, 1992; South China Morning Post, 1995).

2.2 Effect of Brief Intervention Techniques

Controlled clinical trials have produced convincing evidence that early intervention using a screening instrument and an intervention of up to 20 minutes duration conducted by 'generalists' in hospitals can have a significant effect on the mortality and hospitalisation in a group of problem drinkers (Bien et al 1993, Elvy et al ,1988; Kristenson et al 1983; Chick et al , 1985; Watson, 1999). Problem drinkers are people whose alcohol consumption is at a level that if it continues it may lead to physical, psychological or social problems in the future.

Saunders (1988a and b), as part of the World Health Organisation (WHO) collaborative study on early-intervention conducted with 551 subjects, was able to demonstrate that "structured advice of one to five minutes duration resulted in a statistically significant and clinically relevant improvement in outcome" (Saunders and Foulds, 1992) and that 20 minutes intervention has more therapeutic benefit than 5 minutes of intervention. The WHO supported an early-intervention study of 1,661 problem drinkers in 10 countries, results of which were released in 1992, and recommended that brief intervention techniques receive widespread dissemination for use with problem drinkers in primary care settings (Babor, Grant, Acuda, Burns *et al,* 1994).

2.3 Benefits of Adopting Wireless Technologies in Health Care

When wireless phones first came into use, they were mainly limited to voice communication which functioned as wire phones. As time passed, the technology rapidly advanced, thus increasing the range and amount that could be done with the hand-held devices. Today, with Wireless Application Protocol (WAP) enabled, cellular phones are used for anything from emailing, web browsing, and writing memos to sending graphic messages directly to the recipients (Singhal et al., 2001). One potentially beneficial use of mobile Internet is decision support in the form of information delivery, connection to

1619

social support, and automated reminders. This can be done through the use of a mobile Internet that allow users directly register into sophisticated, dynamic, and integrated information systems using WAP enabled cellular phones. These systems can offer the ability to check the harmful level of drinking, provide access to disease-based information, communicate among patients, doctors, and social support groups, automate requests for tests and consultations, assist with decision making, avoid embarrassing interactions, and offer advice. Dietary guidelines on alcohol consumption can be loaded on to WAP enabled cellular phones for reference as well. WAP enabled cellular phones also allow for retrieval of information through web browsing on a site developed by Wireless Markup Language.

Mobile Internet can also be used to enter in and track information. Patient tracking systems can be used to look up and enter information as it is collected about each problem drinker. While without the need to appear in the same room, a health care provider can write text-based messages using their WAP enabled cellular phones, which is then transmitted to the problem drinker immediately. An attractive icon can be designed to appear on the screen of the cellular phone to provide reinforcement about safe drinking. If properly designed WAP cellular phone could be the most effective tool for addictive behavior change.

2.4 Difficulties in Adopting Information Technology

Though the benefits to adopting new technology are many, there will always be barriers to overcome. New technology can lead to fear, anxiety, and resistance (Turnage, 1994). Although many related studies indicate that information systems can benefit patients in many ways (Gustafson et al., 1999), actual implementation of computer systems, especially for inpatient care, has met negative attitudes and considerable resistance from both patients, and health care staff (Dawson, 1998). Studies have been performed to look at the factors of acceptance of information systems on an individual level. There are three well known theories include Technology Acceptance Model (Davis, 1993), Theory of Planned Behavior (Ajzen, 1980), and Theory of Motivation (Triandis, 1980). Specifically, in the Theory of Motivation there are three factors 1) habits, 2) relevant arousal, and 3) facilitating conditions are relevant to this study. Habits are defined as automatic behavior that is influenced by past experience. Traditional brief office techniques may be habitual for patients who usually being sent in hospitals due to problem drinking. However, because of the popularity of using mobile phone as a communication tool in Hong Kong, use mobile phones as a behavior change tool could have a positive relationship with mobile Internet adoption as well. Relevant arousal is a physiological factor defined as excitement surrounding a new technology. It is expected to have a positive relationship with mobile Internet adoption. Facilitating conditions prevents as act from being performed. Accessibility and security are two major factors considered and expected to have a negative relationship with mobile Internet adoption. Other studies have shown that initial acceptance has required extensive training of users, vigorous encouragement from administrators and active support of family and friends.

2.5 Screening Instrument

The AUDIT instrument, which has demonstrated reliability and validity in numerous international studies (Allen et al, 1997) will be administered to all eligible patients in the study to assess the level of alcohol consumption. The instrument was developed as part of an international WHO project where data were collected by means of 150 questions, comprehensive interview, clinical examination and various biochemical and hematological tests. Inferential statistical procedures reduced the instrument to 10 items, which reflected the domains: 'the amount and frequency of alcohol consumption' (three items), 'alcohol dependence' (three items) 'alcohol related problems' (three items) and 'psychological reactions to alcohol' (one item). This instrument became known as the Alcohol Use Disorders Identification Test (AUDIT). The instrument has been shown to possess the necessary discrimination to be used as a screening tool in an alcohol early intervention strategy, by health care professionals in primary and secondary health care settings (Arthur et al 1995). The instrument was translated into

Chinese and proved reliable and valid in a pilot study conducted in Hong Kong (Leung and Arthur, 2000). Following norms developed in overseas countries and confirmed in Hong Kong (Leung and Arthur, 2000; Arthur et al, 1999) a score of 0-7 will identify low risk drinkers; 8-19 hazardous drinkers (those whose pattern of drinking poses a risk for the future); 20 or more harmful drinkers (those whose drinking is already resulting in problems). Dependence can also be flagged.

2.6 Transtheoretical Model of Behavior Change

Prochaska and DiClemente (1984) proposed a theoretical model of behavior change, the Transtheoretical Model of Behavior Change, which describes how people modify a problem behavior or acquire a positive behavior. Different from other approaches that have focused on social influences on behavior or biological influences on behavior, this model is focus on the decision making of the individual. Figure 1 illustrates the five stages of the transtheoretical model of change. This model will be used to examine the effect of mobile Internet support system.

Figure 1: Transtheoretical Model of Behavior Change
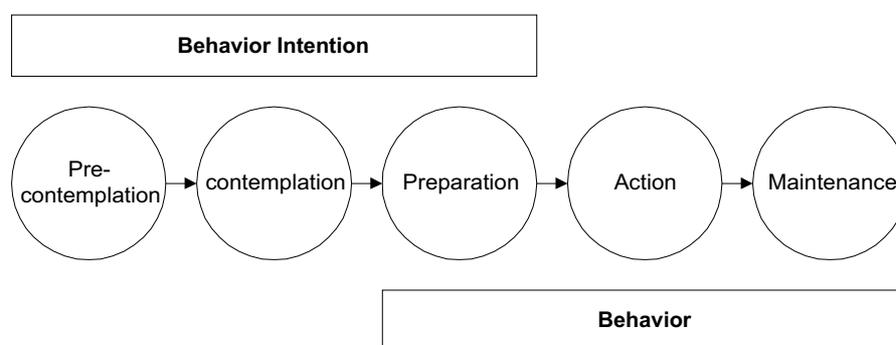
2.7 Measuring Behavior Change of Problem Drinkers

Problem drinkers are estimated to comprise around 20% of the population and in the early stages of their drinking career do not come into contact with the health care system. They are not considered dependent drinkers and are usually productive members of society and will be the targeted users of MIM, therefore it is important to determine the progress of what stages in the behavior change model they have been moving to after MIM has been used as an intervention. Prior to participating in the study all subjects will be appraised, by questionnaire regarding what they know about WAP cellular phones, their current level of experience with the devices, what aspects of WAP cellular phones and the associated systems are most valuable to them, and provide the predicted future use of the devices. This will aid in the requirement analysis of WAP cellular phones, taking into consideration the varying needs and probable concerns of the system's intended users. These human aspects of computer-system design often have been overlooked and the results can be devastating. Failure of a system to address the needs of the users, forced changes in work practices or workflow, and failure of early versions of new technology/systems can lead to failure in implementation. By identifying and addressing these barriers, the chance of successful implementation of a new system will increase.

3. RESEARCH DESIGN AND METHODS

3.1 Overview

The project will be conducted in three phases. The first phase will be to conduct a preliminary assessment of current and former problem drinkers alcohol abusers ages 18 to 50. This phase will consist of focus groups involving 20 problem drinkers. Subjects for this phase will be recruited from three geographically site HK island, Kowloon, and the New Territories. The preliminary assessment

1621

phase will provide us with an understanding of the information and support needs of problem drinkers, and how they would be best served to become safe drinkers. In the second phase, the results of the preliminary assessment will be used to develop the content, design and subsequently construct an Internet-based WAP cellular phone module, the MIM for problem drinkers. The key components of the module will be peer-based social support, motivational interviewing and information. The third phase of the study will be a randomized trial to assess the impact of MIM on reducing problem drinking. The primary hypothesis to be tested is: WAP cellular phone module will decrease the week 24 intention to consume alcohol in problem drinkers compared to a brief office-based intervention. We propose to test this hypothesis by providing 60 problem drinkers with brief office intervention for 4 weeks (n=30) WAP cellular phone for 24 weeks (n=30) in a randomized, two-group design. The assessment visits will occur at weeks 0, 4, 8, 12, 16, 20, 24, 36, and 52. The primary outcome will be measurements including alcohol consumption as measured by the AUDIT, the learning effect of alcohol related information, and perceived social support. Problem drinkers will be recruited for the evaluation phase from three geographically sites HK Island, Kowloon, and New Territories.

3.2 Phase 1: Preliminary Assessment

Development of the WAP module on problem drinking cessation will begin with a preliminary assessment of current and former problem drinkers. During the first month of the grant, we will hold a series of two focus groups at the Hong Kong Polytechnic University. Each focus group will have from 3-5 participants. Because different issues may be faced by problem drinkers of different ages, we will hold a series of two focus groups consisting of current problem drinkers ages 18-35 and 36-50 and former problem drinkers ages 18-35 and 36-50. Thus a total of four focus groups will be conducted with a projected average of 5 problem drinkers per group, resulting in a total of 20 problem drinkers. Safe drinking is defined as not exceeding four standard drinks (or units of 10 grams of alcohol) per day for men, two for women. Problem drinking is in excess of safe drinking and is further defined as: hazardous drinking, four to six units per day for men, two to four for women; and harmful drinking, more than six units per day for men and four for woman (Conigrave, Burns, Reznik and Saunders, 1991, p.801; NHandMRC, 1992). By including former problem drinkers as well as current problem drinkers in the focus groups we will gain a better understanding of the experience of quitting, from both those who want to try to stop and those who have succeeded. We will also gain an understanding of how to prevent recidivism in former problem drinkers. Participants for these groups will be recruited from clinics in Hong Kong. Informed consent from the problem drinkers will be obtained prior to conducting the focus group. Each focus group will take one to two hours and subjects will be provided with a meal vouchure and refunded their public transport costs for attending. A critical incident technique in a nominal group setting will be used to develop straw models of the problem drinkers' needs. Based on experience, we anticipate a 2-month period for recruitment and completion of the focus groups. Data from the focus groups will be combined with the findings in the literature and with review and input from the investigators to develop the content of MIM.

3.3 Phase II: Mobile Internet Problem Drinking Support System Content Development

While the exact nature of the content to be included in the problem drinkers module will be determined in large part by phase 1, the broad outlines of the content can be projected based on literature outlined in the literature review section, project investigator's experience with problem drinkers, and experience with the design of Internet health information systems. Following the preliminary assessment, during year I of this project, the investigators will meet to discuss specific intervention components to address the identified needs of problem drinkers. We will also involve a female and male problem drinkers to assist in the content development. The problem drinker assistants will be former problem drinkers who will be recruited from our previous studies or clinical program at the general hospital. The problem drinkers will also assist the adult expert in monitoring certain WAP functions during the randomized trial. The projected content areas are:

1622

1. Alcohol Knowledge Base. Problem drinkers desire information and wish to be participants in their drinking cessation treatment. This section will consist of key questions with brief, easy-to-understand answers related to all aspects of problem drinking cessation, options for treatment including behavioral interventions, emotional, social, financial and medical information.

2. Screen Icons. A set of attractive screen icons will be designed to show on the cellular LCD screen every time a subject trying to use the cellular phone. A cellular phone capable of downloading and changing screen icons will be used in this project.

3. Virtual Support Group. Based on the literature, one area that traditional drinking cessation programs have failed to address is the influence of peers in problem drinking. Problem drinkers will be linked to other problem drinkers in the same cohort forming an Internet support group. The problem drinkers will be identified by code name only. Messages will be posted and problem drinkers can choose to reply or send messages to the group. Within 48 hours, messages will be reviewed for content by the adult expert monitor and the problem drinker assistants at the general hospital and responses will be made as appropriate to posted messages (i.e., when misinformation is being promulgated). Under certain circumstances, such as report of suicidal intent, more aggressive responses will be initiated.

4. Ask an Expert. This option allows problem drinkers to type and send questions addressed to an adult expert that is not addressed in the alcohol knowledge section. Messages will be sent directly and answered by the adult expert within 48 hours. The adult expert will be a research counselor who has substantial experience in drinking cessation treatment of problem drinkers. The problem drinker assistants will assist the adult expert in tailoring the answers to the language and needs of problem drinkers.

5. Getting Help/Referral. Contact numbers will be supplied for on-going telephone counseling support and professional support facilities available in the community, both non-government and government services.

3.4 Phase III: Randomized Clinical Trial of mobile Internet module

This application employs a randomized, two-group design to evaluate the efficacy of mobile Internet compared to brief office intervention for problem drinkers aiming to reduce their alcohol consumption. Figure 2 shows the study design. Participants will include 60 problem drinkers randomized to one of two treatment conditions: 1) Brief Office Intervention (BOI) (n=30) for 4 weeks or 2) Mobile Internet (MIM) (n=30) for 24 weeks. The brief office intervention is delivered in a medical setting and includes 4 clinic visits with a research counselor. In contrast, MIM is carried by subjects and does not include any scheduled clinic visits as part of the treatment. Following the baseline assessment (week 0), problem drinkers in both conditions will be assessed at weeks 4, 8, 12, 16, 36 and 52 by completing the AUDIT. Those in the BOI groups will complete the AUDIT in the clinic and those in the MIM by their phone. At each of these assessment points each subject will complete the Motivation Questionnaire (Bell, 1995) which contains 20 items and provides data on the subject's stage of development in terms of the behavior change model, and barriers to change. Subjects will be recruited from outreach services operated by Caritas, the HK Christian Service, the Salvation Army and the YMCA. Social workers will be asked to provide referrals to the researchers. Another source of subjects will come from an advertisement placed in the local press (English and Chinese) inviting people who are concerned about their drinking to enroll. This method of sampling, although of convenience is preferable because problem drinkers are not often found in conventional health care services until late in their 'drinking careers' when social, psychological and physical damage has occurred, rather than early in their careers before damage occurs, which is precisely why we are conducting this study.

The focus of this study is on enhancing drinking treatment outcome in problem drinkers. We are interested in determining whether mobile Internet improves drinking outcomes beyond that provided

by brief office intervention. If mobile Internet provides benefit, the findings would impact the treatment community by providing a new treatment alternative.

CURRENT STATUS

We have completed all relevant background studies, and are currently developing the WAP Web site. Development of content for other services will begin as soon as the straw model from focus groups is completed. Refinements will be made based on problem drinker feedback. Content will be refined based on the additional information received from survey responses. A brief pilot test will be performed with 10 problem drinkers once refinement is completed. Testing will consist of using mobile Internet module by problem drinkers for 2 weeks and observation of mobile Internet use on-site. We will use a standard questionnaire which will inquire about problem drinkers' reactions to the system and areas of difficulty encountered. A prototype of the mobile Internet module will be demonstrated in the conference.

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1624

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1625