EVALUATION OF A WEB-PHONE INTERVENTION SYSTEM ON PREVENTING SMOKING RELAPSE

by

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ABSTRACT

EVALUATION OF A WEB-PHONE INTERVENTION SYSTEM

ON PREVENTING SMOKING RELAPSE

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This randomized-controlled-trial aimed to evaluate the effectiveness of a web-phone intervention system in preventing smoking relapse. The intervention was based on the Transtheoretical Model (TTM), incorporated with Motivational Interviewing strategies, and the Two-phase Model. One hundred and sixteen volunteer subjects were recruited from the student smokers name list of a university located in southern Taiwan. They were randomly assigned to three groups with a double-blind principle.

The findings are listed as below. After receiving a one-month intensive intervention, the subjects in the experimental group significantly improved on self-efficacy and stage of change toward smoking cessation. After receiving a one-month intensive and a one-month tapering schedule of intervention, the subjects significantly improved on self-efficacy but not on stage of change toward smoking cessation. After receiving one-month intensive check-ups, subjects in control group A significantly improved on self-efficacy and stage of change toward smoking

cessation. After receiving a two-month check-up, subjects in control group A significantly improved on self-efficacy but not on stage of change toward smoking cessation. Without receiving any intervention or check-up calls (other than receiving observation calls at weeks 1 and 9), subjects in control group B were not improved either on self-efficacy or on stage of change toward smoking cessation. The subjects' improvement between weeks 1 and 5 can be predicted by the group and school type as a set with 76.2% correctness rate. The subjects' improvement between weeks 1 and 9 can be predicted by age with 82.7% correctness rate. Three figures were drawn in terms of the proportion of each stage of change illustrating that the experimental group improved, the monitoring control group A stayed the same, while the control group B got worse during the 9-week process. Four types of effect size were identified and calculated using the subject's improvement on 5 stages of change scale as the outcome measure.

In conclusion, the results on evaluating the WPI system on preventing smoking relapse lent support to the application of IT to the human services. The research results were discussed and the limitations and implications were provided.

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CHAPTER 1

INTRODUCTION

1.1 Background

Information technology (IT) has been utilized to support practitioner-client interaction to perform functions such as assessment, testing, consultation, analysis, structuring, and treatment (Schoech, 1999, p. 126). The latest meta-analysis, in which 64 papers containing 92 web-based interventions were reviewed (Barak, Hen, Boniel-Nissim, & Shapira, 2008), provides strong support for the adoption of online psychological interventions as a legitimate therapeutic activity. Barak et al. found that the overall mean weighted effect size (0.53, medium effect), is quite similar to the average effect size of traditional face-to-face therapy. As the Internet has expanded tremendously throughout the world, web-based client services are attracting both service providers and their clientele. Web-based services are capable of delivering information via the internet in many types of media including text, pictures, videos, games, voice, etc. With the help of software programs, multimedia, and access to the internet, subjects or users may receive a service that is similar to or even better than the traditional one. In fact, web-based prevention or intervention programs have been designed for many problematic human behaviors and have obtained certain positive effects, for example, in helping people alleviate depression syndromes (Christensen & Griffiths, 2002), in behavioral weight loss programs (Tate, Wing, & Winett, 2001), or in smoking cessation services (Strecher, Shiffman, & West, 2005). In order to improve IT application in the human services, this study intends to select a practical problem, i.e., smoking cessation, to investigate whether a web-phone based IT system can help.

1.2 The Need

The needs of application in practice serve as the dynamic for designing an IT program. After reviewing the literature and discussing intentions with several agencies, telephone counseling service for smoking cessation has been selected as the field of this study. Telephone counseling has its strengths and weaknesses while being utilized as one of the primary methods in the smoking cessation field. Research has shown it to be efficient to some degree to the callers using the helpline in either proactive or reactive ways (Aveyard & West, 2007; D.-T. Chang, Pang, & Chang, 2006; Mallin, 2002; Martin-Diener, Thuring, Melges, & Martin, 2004; Walker, Roffman, Picciano, & Stephens, 2007). In the Cochrane database system, a review of forty-eight randomized controlled trials has concluded that "among smokers who contacted helplines, quit rates were higher for groups randomized to receive multiple sessions of call-back counseling (eight studies, >18,000 participants, odds ratio (OR) for long term cessation 1.41, 95% confidence interval (CI) 1.27 to 1.57)" (Stead, Perera, & Lancaster, 2006). Another meta-analysis of 10 trials of telephone support for people stopping smoking similarly gave an odds ratio of 1.64 (95% confidence interval = 1.41 to 1.92) (Aveyard & West, 2007).

In the study of Zhu and his colleague (1996), smokers (N = 3,030) were randomized to receive one of three interventions. For those who made a quit attempt, the two-month continuous abstinence rates were 14.7% for the self-help group (receiving a self-help quit kit), 19.8% for the single session counseling group (receiving the self-help quit kit plus one counseling session), and 26.7% for the multiple session counseling group (receiving the self-help quit kit plus at least 6 counseling sessions). In addition, the observation of dose response relationship indicates that multiple sessions produced significantly higher abstinence rates than

did the single session. Similar results were also found in Chang's (2006) study based on the data of "Taiwan Smokers' Helpline" (TSH). In that study, the multiple-session group showed significantly better results than the single-session group on their cessation rates, self-efficacy, days of cessation, and continuous one-, three- and six-monthly abstinence rates. TSH's advantages include accessibility, convenience, and privacy, which may encourage smokers to use this service (S. Zhu et al., 1996). These studies indicate that the number of proactive calls is an important predictor for smoking cessation.

Although telephone counseling has been reported with certain positive results in smoking cessation practice, it is often criticized for the lack of long-lasting effect. That is, telephone counseling often fails to maintain its effect during follow-up. For example, Table 1.1 illustrates that TSH's abstinence rates of post-treatment effects within multiple-session groups are 69%, 61%, 26%, and 11% respectively for immediate, one-monthly, 3-monthly, and 6-monthly follow-ups (D.-T. Chang, et al., 2006). A similar phenomenon is also found in single-session groups but with smaller size in which the rates are 15%, 15%, 11%, and 4% sequentially. Obviously, there is a decreasing trend of telephone counseling effect that is critically challenging to its overall effectiveness. This research suggests a need exists to improve the long-lasting effect of telephone counseling in smoking cessation after all counseling has been completed.

Table 1.1. Chi-Square Tests on Abstinence Rate Differences between Single Session and Multiple Sessions Groups

Time point	Single session group	Multiple sessions group
Immediate effect (n = 501)	15% (n_{11} = 307)	69% (n_{21} = 194)
1 month effect (n = 455)	15% (n_{12} = 307)	61% (n_{22} = 148)
3 months effect (n = 455)	11% (n_{13} = 307)	26% (n_{23} = 148)
6 months effect (n = 455)	4% (n_{14} = 307)	11% (n_{24} = 148)

Note: Each test at different time points is significant at the .001 level.

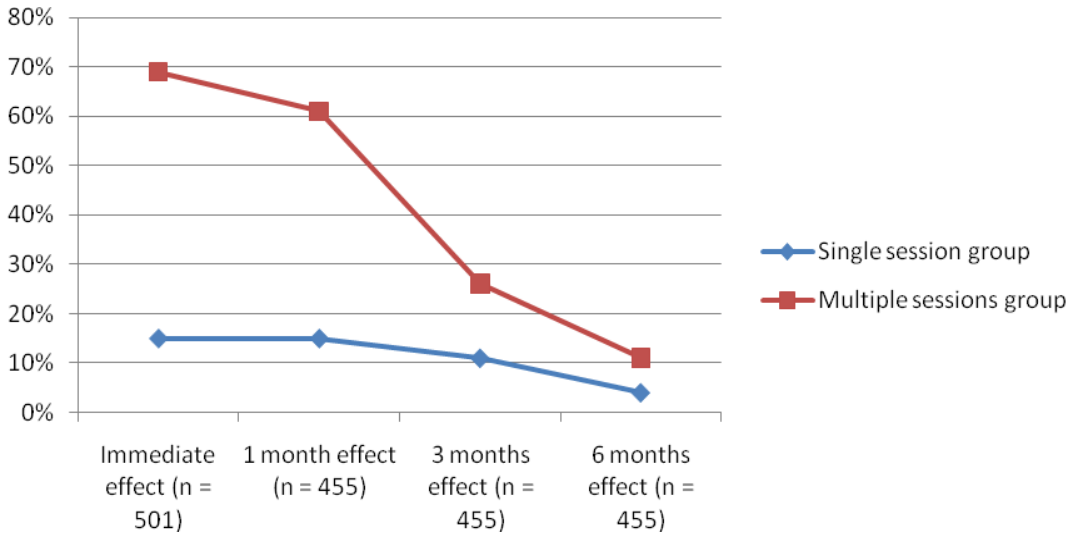


Figure 1.1. The Abstinence Rate Line Chart During Follow-Up between Two Groups within 6 Months

When people have quit smoking after their intervention, the relapse to smoking still happens in most cases as stated in the Transtheoretical Model and related research results (W. F. Velicer, Prochaska, Fava, Norman, & Redding, 1998). What is worse is that TSH generally does not provide any follow-up services. The reasons are mainly due to the limited human resources and lack of budget. Thus, the need to supplement this gap emerges as a priority objective of smoking cessation practice. In fact, adding booster sessions to maintain the program intervention effect has been highly recommended in designing prevention programs (National Institute on Drug Abuse, 2003) while often ignored in practice. The lack of booster session during follow-up often shortens the effect of that program no matter whether the smoking prevention program is school-based or community-based (Banks, n.d.; Elders, 1994; National Institute on Drug Abuse, 2003). Therefore, the research question for this study would be how to assess the potential for relapse and then deliver the client with specific messages to reduce such relapse.

1.3 An IT Solution: A Web-Phone Based Intervention System

Since this study is focusing on IT application, non-IT alternative methods in smoking preventions will not be discussed here. Among IT application methods available, several have been utilized in smoking prevention. Some examples are a computer-generated report (Prochaska, DiClemente, Velicer, & Rossi, 1993); tailored and personalized counseling letters (Etter, 2005); text messages on cell phones (Bramley et al., 2005; Rodgers et al., 2005; Steeh, Buskirk, & Callegaro, 2007) and computer-controlled telephone counseling (Friedman, 1998). A randomized controlled trial found that brief, structured telephone contact may be a cost-effective mechanism for improving adherence to diagnostic follow-up and treatment for a variety of cancer screening tests (Lerman et al., 1992).

Eight web-based interventions addressing smoking behavior with 5460 participants in total have yielded a mean effect size of .62 according to a meta-analysis paper (Barak, et al., 2008). Some studies on mobile phone-based services found that smart phones are very attractive and helpful to users for reasons such as convenience, privacy, and task-oriented brief intervention, etc. Thus web-phone, or Voice over Internet Protocol (VoIP) technology is showing its potential in dealing with the follow-up problem described previously.

A unique opportunity to test the effectiveness of VoIP technology in increasing the effectiveness of TSH's smoking cessation counseling services exists with "Teleherence[1]", which is a VoIP treatment adherence system created and maintained by Dr. Schoech (2005) and colleagues at the University of Texas, Arlington. Teleherence is described as follows:

> The Teleherence project applies web, phone, and prediction technology to the problem of adherence to treatment by mental health clients. Clinicians will interact with a web site that automatically

[1] * The Teleherence is a National Institute of Health, National Library of Medicine granted project coordinated by Dr. Schoech at UT Arlington that is entitled "Teleherence: Monitoring/Increasing Treatment Adherence via Web Telecommunications".

> delivers reminders and short survey questions via cell phone, landline, and web site. The web site will chart the responses of clients and significant others and use predictive techniques to provide suggestions on increasing client adherence to treatment and services.

The rationale for applying the Teleherence system to TSH's follow-up problem is that while its traditional "telephone counseling" has been evidenced as an effective approach in helping people specifically in quitting smoking, Teleherence avoids follow-up disadvantages of additional workload on staff, time-related limits, infidelity and immatureness of service quality, expenses of human labor, etc.

1.4 Purpose of the Study

This proposed research attempts to evaluate the efficacy of a web-phone-based online prevention system for smoking cessation, which uses a subsystem of the Teleherence project, developed at the University of Texas at Arlington. This proposal will firstly build up its theoretical basis of online prevention through a literature review, and then discuss the design of a web-phone adherence system, and the research to test it out in the TSH agency. The Teleherence system will be customized to fit the experimenting agency, TSH, and clients' needs including the infrastructure, language, culture, and staff. Through the assistance of this web-phone system, it is expected that the effect of telephone counseling in smoking cessation can be maintained during the follow-up period. If this web-phone smoking cessation system is effective, this research may shed light on how to design IT booster sessions in other human service areas such as substance abuse prevention. Finally, the focus here is not to compare the different effects among theories. Instead, it is to apply a practice model incorporating IT, theory, and practice wisdom so as to improve current practice.

1.5 Research Questions

The research question to be addressed in this study is “Can web-phone-based interventions prevent smoking relapse behavior during two months?” This can be divided into five concrete questions including:

(1) Can the WPI improve the subjects’ self-efficacy and decisional balance at a level with or even better than that in the beginning?

(2) Can the WPI reduce the client’s smoking relapse behavior via exposure to it for a specific period of time? In other words, is there any difference on smoking behavior between those who have received the web-phone smoking cessation intervention and those who have not?

(3) How long can the intervention prevent a subject from smoking relapse within the two-month period?

(4) What kind of exposure can best predict the total nonsmoking days of the TSH subjects? (dose-response relationship)

(5) What kind of study variables - in what combination, to what degree - can best predict the total nonsmoking days of the TSH subjects?

1.6 Definition of Terms

(1) Smoking Relapse: This is referred to the behavior from abstinence to smoking behavior. This study uses absolute definition of quitting smoking in which complete nonsmoking is considered as abstinence and the gradual decrease of smoking is excluded. Specifically, according to the TTM (W. F. Velicer, et al., 1998), relapse is defined as the regression from the action or maintenance stage (nonsmoking) to any earlier stage such as precontemplation, contemplation, or preparation stage (smoking). Various measures have been used to measure the change from

smoking to nonsmoking status such as “having quit for 7 days” as the abstinence rate, or 30 days and six-month periods as used in the stages of change in TTM. In this case, even quitting for one day is considered as nonsmoking status. To overcome this problem, this study will apply both the ordinal measure--stage of change, and the ratio measure--total nonsmoking days, to detect the subtle change in order to provide a more robust basis for further analysis.

(2) TSH counseling: “TSH counseling” is termed as the telephone counseling service that is provided by counselors at the TSH. It starts from a client’s call, and is followed by a series of proactive calls by counselors at the convenience of the client’s schedule. The TSH counselor discusses the quit method, quit date, and barriers on achieving this goal of quitting smoking with the client. This takes at least two sessions. It might be useful to use the number of sessions as a control variable since it has been shown to influence relapse.

(3) Web-phone intervention (WPI): this is referred to the services provided using the Teleherence system, an application of web-phone technology. The framework of WPI is based on the Transtheoretical model, incorporating the Two-phase model, Motivational Interviewing, and some other theories. The contents of intervention are based on TSH counseling practice and are intended to prevent smoking relapse.

CHAPTER 2

LITERATURE REVIEW

This study attempts to apply web-phone and related technologies to improve the telephone counseling effect during a three-month post-counseling period for smoking cessation clients. The literature on telephone counseling for smoking cessation practice will be reviewed as the basis of this study. Specifically, this chapter will review the theories and research relevant to online prevention intervention. After reviewing relevant studies in this section, two integrated theoretical models for grounding interventions are presented. Finally, guidelines for developing online prevention interventions shall be summarized so they can be used in the design and evaluation of the smoking cessation intervention system.

2.1 Theories and Research Relevant to Online Interventions

The literature on developing prevention interventions has consistently suggested that interventions grounded in theory tend to have a stronger impact (Amaro, Blake Susan, Schwartz Pamela, & et al., 2001); Mihalic, Fagan, Irwin, Ballard, & Elliott, 2004; Skiba, Monroe, & Wodarski, 2004; (Dryfoos, 1996). A theoretical model is important because it can guide the design, development, implementation, and evaluation of the online interventions. For example, content, dosage, fidelity, settings, subjects, and the training of implementers are all influenced by the theoretical model on which an online intervention is based. While online counseling applications are increasing, linking information technology (IT)–based interventions with theory has been difficult. One key difficulty has been the lack of consensus on a theoretical model to drive online interventions. Some IT–supported interventions are based on a clear theoretical

model; for example, virtual reality interventions for phobias are typically based on exposure therapy (Hoffman, n. d.) However, consistent theoretical models for grounding all phases of online interventions, that is, design, development, implementation, dissemination, and evaluation, have not yet been established.

This review does not try to be comprehensive, but seeks to pull together major theories from the fields of psychotherapy, social work, health promotion, gaming, and innovation dissemination that have potential for grounding the design, development, implementation, and evaluation of online programs. Theories reviewed are: (1) the health belief model, (2) theory of planned behavior and reasoned action, (3) social cognitive and social learning theory, (4) cognitive behavioral theory, (5) motivational models, (6) game theory, (7) resiliency theory, (8) ecological perspective, (9) diffusion of innovation, and (10) the transtheoretical model (Peng & Schoech, 2008).

Studies were reviewed to illustrate how these 10 theories have been used in online interventions. The goal of this review was to better understand the pros and cons of various theories and how they can be used for grounding the design, development, implementation, and evaluation of the online application that this research proposes. As will be seen in this analysis, the theories guiding the design of online interventions are seldom specified, so they must be deduced from intervention evaluations. Unfortunately, the theory used to design an intervention may not be the same theory that is used to evaluate the intervention. Therefore, while the underlying theories identified might not be very accurate, this speculation is necessary for the analysis in this section.

The 10 theories reviewed present a systematic way of looking at concepts and their interrelationship in order to explain what makes online counseling effective. After describing the theories, research will be cited to illustrate the theory's use and to examine its strengths and

weaknesses for underpinning online interventions. Extrapolating theories from research reports is difficult. Some of the underlying theories might be classified as models or perspectives, or vice versa. Many theories are overlapping, with each using similar concepts in slightly different ways. Some theories are not used alone but are combined with other theories when used in online interventions. The attempt in this review is not to standardize theoretical concepts and nomenclature but to explore the usefulness of theories for designing online interventions.

2.1.1 Health Belief Model

The Health Belief model (HBM) considers people as using a value-balancing mechanism to consider health-related factors before acting out a behavior. HBM addresses the individual's perceptions of the threat posed by a health problem (susceptibility, severity), the benefits of avoiding the threat, and factors influencing the decision to act such as barriers, cues to action, and self-efficacy (Glanz, Rimer, & National Cancer Institute, 2005). A study by Lin, Simoni, and Zemon (2005) found that HBM constructs, including perceived severity, perceived susceptibility, perceived benefits, self-efficacy, and perceived barriers, reliably predicted the risky sexual behavior of 144 Taiwanese students in the United States. Self-efficacy, defined as a person's belief in how capable he or she could perform a certain behavior, was the strongest predictor of the factors within the HBM.

Online applications using a pure HBM are infrequently found. A British application called SMS Teen-Text Line used HBM concepts in a project where a general practitioner gave clinical advice to youth and initiated intakes via mobile text messages (Buckley, 2005). Text messaging topics included the risk of unplanned teenage pregnancy with the reassurance of a confidential, nonjudgmental service for teenagers' pregnancy consultations. The outcome of first contact was usually either fast-tracking of an appointment or referral to another agency. The

success of using the Text Line could not be measured because no baseline data were collected. Nonetheless, HBM concepts, such as perceived severity or benefits, were perceived to be beneficial when connecting to high-risk youth via online mobile phone technology.

2.1.2 Theories of Planned Behavior and Reasoned Action

According to the theory of reasoned action (TRA), behavioral intention is influenced by the degree to which persons positively or negatively value a behavior (attitudes) and by beliefs about whether individuals who are important to the person approve or disapprove of the behavior (subjective norm). The Theory of Planned Behavior (TPB) includes an additional construct: people's perceptions of their ability to change their behavior (perceived behavioral control). Both TRA and TPB assume that behavioral intention, or one's readiness to perform a behavior, is the most important determinant of actually performing a behavior (Ajzen, 2002). Both TRA and TPB assume that all other factors (e.g., culture, knowledge, or environmental factors) operate through the models' constructs, and independently do not explain the likelihood that a person will behave a certain way. For example, increased knowledge might make one a more intelligent drug user rather than prevent substance abuse. While increased knowledge is not a major construct in TRA and TPB, it is often cited as a measure of prevention program effectiveness, possibly because increases in knowledge can be quickly produced and easily measured.

Some research supports the use of TPB in online interventions. Alcohol 101 is a CD-ROM program that helps college students make wise decisions about drinking. The program uses a variety of interactive features such as games, videos of high-risk drinking scenarios, a blood alcohol concentration (BAC) estimator, and information about impaired driving and high-risk sexual behavior. Reis, Riley, Lokman, and Baer (2000) found that students who received Alcohol 101 gained significantly more knowledge and had greater intent to use safe strategies

at parties than those in an alternative education group and in a no-treatment control group. Intent was measured by three factors: self-efficacy, attitudes and related expectations regarding the consequences of alcohol consumption, and peer norms. No behavioral outcomes were reported.

Some studies focus on just one or two of the constructs of TPB/TRA model. For example, in an evaluation of a culturally tailored smoking prevention program for Asian American youth, the pretest and posttest paired data (n = 161) showed that behavior intention was more closely associated with attitude, rather than with knowledge change (Ma, Yajia, Edwards, Shive, & Chau, 2004). After reviewing the literature, Neighbors, Larimer, and Lewis (Neighbors, Larimer, & Lewis, 2004) concluded that subjective norms were a key factor influencing college student drinking behavior and that norms could be influenced using e-mail or web pages. They tested whether alcohol consumption could be reduced by a computer-delivered normative feedback intervention that was personalized to reveal discrepancies between individual behavior, perceived typical student behavior, and actual typical student behavior. Results showed that normative feedback was effective in changing perceived norms and reducing alcohol consumption at three- and six-monthly follow-ups. In summary, the TPB/TRA suggest that online interventions for changing behavior can be evaluated by measuring behavioral intention, which is influenced by attitudes, norms, and perceived behavioral control. The TPB/TRA is supported by substantial research, and concrete guidance exists on constructing TPB/TRA measures (Francis et al., 2004; Ajzen, 2006a,b).

2.1.3 Social Cognitive and Social Learning Theories

Social learning theory (SLT) asserts that people learn from their own experiences and by observing the actions of others and the benefits of those actions (Glanz, et al., 2005). SLT was updated by social cognitive theory (SCT) in which behavior, cognition, and other personal

factors, along with environmental influences operate as interacting determinants that influence one another bidirectionally (Bandura, 1989). Bandura considers that self-efficacy is the most important personal factor in changing behavior and is a ubiquitous variable in health behavior theories (Glanz, et al., 2005). “Consider this” is an SCT-based Internet program consisting of six modules that reduce expectations concerning smoking and smoking prevalence (Buller et al., 2006). Buller and colleagues (Buller, et al., 2006) conducted a group-randomized pretest-posttest controlled study using sixth through ninth grade students in the United States (n=1,234) and Australia (n=2,077). Although the amount of program exposure was low, the study found a 30-day smoking prevalence reduction that was mediated by decreased subjective norms.

Another study by Duncan, Duncan, Beauchamp, Wells, and Ary (2000) gave stronger support to both SCT and TPB. They evaluated “Refuse to Use”, an interactive CD-ROM program designed to reduce adolescent substance use. The program uses video vignettes to teach refusal skills and socially acceptable responses to substance use situations, specifically, offers of marijuana. Students learn refusal skills by seeing and vicariously experiencing each choice that is made (Villarruel et al., 2000). Significant changes were observed at posttest on (1) the adolescent’s personal efficacy to refuse the offer of marijuana, (2) the adolescent’s intention to refuse marijuana if offered, and (3) the adolescent’s perceptions of the social norms associated with substance use and the importance of respecting another’s decision to refuse a drug offer. Although this program did not specify its theoretical background, the skills learned seem based on social cognitive theory. However, the evaluation was based in TPB concepts of personal efficacy, social norms, attitude, and intention. Refuse to Use demonstrates that an online intervention may be based on several compatible theories: one to design the intervention and another to evaluate the intervention. In summary, SLT/SCT supports online prevention

designs in which users interact with multimedia of real-life situations in order to influence TPB factors, especially perceived behavioral control, which is the same as self-efficacy.

2.1.4 Cognitive Behavior Theory

Cognitive-behavior theory (CBT), therapy, or treatment is a combination of cognitive therapy and behavioral therapy. CBT "…is a problem-focused approach designed to help people identify and change the dysfunctional beliefs, thoughts, and patterns of behavior that contribute to their problems. Its underlying principle is that thoughts influence emotions, which then influence behaviors'' (Office of Juvenile Justice and Delinquency Prevention Model Programs Guide, 2007). CBT techniques include development of trust, normalizing, coping strategy enhancement, reality testing, and work with dysfunctional affective and behavioral reactions to psychotic symptoms (Turkington, Dudley, Warman, & Beck, 2006 & Beck, 2006). Many well-researched applications are based on CBT, for example, COPE (Jones et al., 1999), FearFighter (Marks et al., 2003), and Beating the Blues (Proudfoot et al., 2004). Bruning-Brown, Winzelberg, Abascal, and Taylor (2004) evaluated the effectiveness of Student Bodies, an Internet-delivered CBT eating disorder prevention program for adolescents along with a supplemental program for their parents. Student Bodies is a structured, eight-week, psycho-educational intervention that includes a bulletin board to discuss reactions and to exchange emotional support. It was hypothesized that students using the prevention program would adopt healthier body images, eating, and dietary practices, and would decrease their level of weight and shape concerns. It was hypothesized that parents would decrease critical behaviors and attitudes toward their daughters', their own, and others' weight and shape. During the intervention phase (baseline to post assessment), significant group differences were found on the Eating Disorder Examination–Questionnaire (EDE-Q) Restraint subscale and on the overall knowledge test. The 165 female teens that used the program reported significantly reduced

eating restraint and had significantly greater increases in knowledge than did students in a comparison group. However, the significant differences were not maintained at follow-up. The 69 parents involved significantly decreased their critical attitudes toward weight and shape (Bruning Brown, et al., 2004). This study might have been the first intervention that attempted to change a student's family environment using online CBT, and the authors recommend the integration of student and parent prevention interventions.

Another web-based CBT application provided a 12-session program for panic disorder and agoraphobia (Farvolden, Denisoff, Selby, Bagby, & Rudy, 2005 Bagby, & Rudy, 2005). Study results revealed an extremely high attrition rate with only 12 (1.03 percent) out of 1,161 registered users of the Panic Center completing the 12-week program. For those who remained in the program less than 12 weeks, statistically significant reductions ($p < .002$) were found in self-reported panic attack frequency and severity from a 2-week baseline to data at 3, 6, or 8 weeks. This study suggests that while online CBT-based self-help interventions can be effective, they may also be associated with high attrition. Combining CBT with theories that motivate at various stages of change might be useful in reducing the dropout rate.

Tate, Jackvony, & Wing (2006) compared a CBT individualized feedback system delivered by computer to that delivered by a human counselor in a 6-month weight loss program. One hundred ninety-two adults were randomized to one of three treatment groups: (1) no counseling (NC; $n = 67$); (2) computer automated e-mail feedback (AF, $n = 61$); or (3) human e-mail counseling (HC, $n = 64$). The feedback algorithms used for the AF group were based on CBT, focusing on the weekly behavior change and suggesting behavioral strategies to improve adherence and weight loss (Tate, et al., 2006). Retention was 82 percent at 3 months and 80 percent at 6 months for all three groups. This study provides support for the use of CBT-based

self-management interventions that use automated, computer-tailored feedback to reduce attrition.

Another randomized trial (N = 393) evaluated a telephone-based cognitive-behavioral therapy (CBT) plus care management for primary care patients on its long-term results beginning antidepressant treatment versus usual care (Ludman, Simon, Tutty, & Von Korff, 2007). In a repeated measures linear model with adjustment for baseline scores, the phone therapy group showed significantly lower mean Hopkins Symptom Checklist (HSCL) Depression Scale scores from 6 months to 18 months versus usual care, $F(1, 336) = 11.28$, $p = 0.001$.

In summary, CBT's focus on education and cognitive change approaches makes it useful for online interventions. To handle the high attrition that occurs in some online self-help interventions, CBT might be combined with motivational models and techniques.

2.1.5 Motivational Models

Motivational models of change suggest that biological, psychological, sociological, and spiritual factors, as well as ‘‘therapeutic partnership’’ are important to enhance client motivation for change. Motivational interviewing can be defined as a counseling style that is client-centered, intended to support individuals in resolving ambivalence, and that supports the client in seeing the discrepancy between his or her current behaviors and his other larger goals and values (Walker, et al., 2007 & Stephens, 2007). Motivational strategies, for example, may focus on the clients' strengths rather than their problems and use empathy rather than authority or power (W. R. Miller, 1999a). Motivation-enhancing techniques are associated with increased participation in treatment as well as positive treatment outcomes. Walker and colleagues (2007) reviewed a series of studies using motivational enhancement therapy (MET) from various settings and concluded that the motivational model seem to be more powerful than other

theories in sustaining the effect of an intervention, but that different populations, at-risk behaviors, and stage of change may need very different motivational approaches.

The Drinker's Check-Up (DCU) is a software program based on the principles of brief motivational interventions for problem drinkers (Squires & Hester, 2004). It provides integrated assessment, feedback, and assistance with decision making for individuals experiencing problems with alcohol. A randomized control trial with 61 problem drinkers found DCU reduced user's drinking quantity and frequency by 50 percent with similar reductions in alcohol-related problems (Hester, Squires, & Delaney, 2005). Results were sustained through a two-month follow-up.

In another study (Swartz, Noell, Schroeder, & Ary, 2006), motivational materials were tailored to the user's race/ethnicity, sex, and age to design the intervention in which strategies for smoking cessation were presented via video-based internet site. Evaluation results of 351 qualifying adult smokers who were interested in quitting smoking in the next 30 days suggest that a smoking cessation program, with at least short-term efficacy, can be successfully delivered via the internet. The cessation rate at 90 days follow-up was 24.1% (n = 21) for the treatment group and 8.2% (n = 9) for the control group (p = 0.002). While using an intent-to-treat model, 12.3% (n = 21) of the treatment group were abstinent, compared to 5.0% (n = 9) in the control group (p = 0.015). In terms of effect sizes, these are 2.94 for behavioral testing, and 2.46 for intent-to treat model.

Encouragingly, computer-based brief motivational intervention has also been conducted with women in their postpartum and in treatment of drug use with positive results (Ondersma, Chase, Svikis, & Schuster, 2005). That is, women rated the motivation enhancement system as highly acceptable and reported significant increases in motivational level at post-intervention and at one-month follow-up.

In summary, motivational techniques can increase the effectiveness of online interventions, especially if they are customized to the user's situation and continually assess and increase user motivation throughout the intervention.

2.1.6 Game Theory

Many people are attracted to and engaged more deeply by information that is pictorial, interactive, challenging, and in motion (Foreman, 2006). A game is a simulation that uses techniques such as interactivity, feedback, challenge, and competition to motivate, amuse, or entertain. Online, multi-user games can allow many players to interact either synchronously or asynchronously. Some games allow users to form communities of players who create new worlds and challenges. While the science and underlying theories of online game design are evolving, projects such as the Serious Games Initiative are moving games from the entertainment sector into the area of behavioral change (see http://www.seriousgames.org/). Games such as Generation Fit, which includes yoga, stretching, and balance exercises on the action-oriented Wii platform, are especially interesting because they offer an interface that requires physical interactivity rather than keyboarding skills and sitting in front of a computer.

Surveys suggest game players tend to be younger and male (Griffiths, Davies, & Chappell, 2004), although these distinctions are beginning to fade. Results also show that in general, the younger the player, the longer they spent each week playing (Griffiths, et al., 2004). Malone and Lepper (1987) investigated students who played computer games and identified seven key factors for creating an intrinsically motivating instructional environment: challenge, curiosity, control, fantasy, cooperation, competition, and recognition.

In a series of computer-assisted instruction experiments, Lepper and Cordova (1992) demonstrated that computer games raise the efficiency of learning if they increase the intrinsic motivation and link the goals ‘‘winning the game’’ to ‘‘learning the material.’’ Belanich, Orvis, and

Sibley (2007) analyzed the questionnaires of 21 players of the ‘‘basic training’’ portion of a popular army game. The result showed that multimedia components such as graphic images and spoken text were recalled more accurately than printed text. Participants indicated that the following motivational factors influenced their likelihood to continue playing the game: challenge (not too hard and not too easy), realism (audiovisual realism and adhering to laws of nature), exploration (opportunity to discover new things), and control (manipulating the virtual environment through keyboard or mouse interface).

Several online human services prevention games exist, but evaluations have been limited. Reconstructors, a game to teach the neurobiology of substance abuse and research on club drugs, demonstrated significant knowledge gain across game episodes of middle school students (L. Miller, Moreno, Willcockson, Smith, & Mayes, 2006 Smith, & Mayes, 2006). However, as seen earlier when discussing TPB, knowledge increases are often not associated with behavior change.

Re-Mission, a video game online community that allows youth with cancer to connect and share information, demonstrated significant improvements in cancer-related self-efficacy, social quality of life, and cancer-specific knowledge in 375 youth with cancer at thirty-four medical centers. Participants who played Re-Mission maintained high levels of adherence to their prescribed medication regimens, had higher levels of chemotherapy in their blood, and took their antibiotics more consistently than those in the control group (Hopelab, 2006). Based on the successful results of Re-Mission, HopeLab is developing games to help youth with other chronic illnesses such as autism, depression, obesity, and sickle cell disease.

In summary, game techniques can increase the success of online interventions by attracting users, enhancing motivation, and maximizing intervention exposure. Linking

successful game characteristics with behavioral change theories is difficult but potentially rewarding.

2.1.7 Resiliency Theory

Resiliency is the ability to recover strength and spirit in both internal (self) and external (family, school, community, and peer relation) domains for a positive outcome to adversity (Catalano & Hawkins, 1996). Risk factors are personal characteristics or environmental conditions scientifically established to increase the likelihood of problem behavior (Kirby & Fraser, 1997). Protective factors are personal characteristics or environmental conditions that interact with risk factors and that have been scientifically established to reduce the likelihood of problem behavior. For example, a family risk factor might be the lack of parental supervision, while a protective factor might be effective parenting skills. The resiliency framework indicates that no single factor is essential but rather multiple factors (both risk and protective) combine to shape behavior (Development Services Group, 2007).

Exposure to multiple risk factors in the absence of protective factors has a cumulative negative effect on behavior. The exposure to, and development of protective factors in youth serves to buffer risk factors, interrupts the processes through which risk factors operate, and prevents the initial occurrence of a risk factor (Hawkins, Catalano, & Miller, 1992; National Institute on Drug Abuse, 2003). Many U.S. government departments suggest using risk and protective factors when designing prevention intervention programs; for example, see the National Institute on Drug Abuse (http:// www.drugabuse.gov/infofacts/lessons.html), the Substance Abuse and Mental Health Services Administration (http://bblocks.samhsa.gov/educators/lesson_plans/prevention_tools.aspx), the White House (http://guide.helpingamericasyouth.gov/programtool.cfm), and the Office of Juvenile Justice and Delinquency (http://www.dsgonline.com/mpg2.5/mpg_index.htm).

In summary, resiliency theory is useful for designing programs and targeting an intervention. However, resiliency theory does not provide a model for evaluating behavior change, because it involves multiple risk and protective factors and does not specify the interactions between these factors. Resiliency theory-based interventions may need a compatible theory for their evaluation.

2.1.8 Ecological Perspective

The key tenant of the ecological perspective is that individual behavior both shapes and is shaped by multiple levels of one's social environment (Glanz, et al., 2005). Research suggests that individually focused models will not be as successful in changing behavior as models that also focus on the family, peers, school, and the community (National Institute on Drug Abuse, 2003).

Combining the ecological perspective with resiliency theory, Marsiglia, Miles, Dustman, and Sills (2002) surveyed 2,125 Latino seventh graders as part of a school-based prevention intervention in the urban Southwest. Results demonstrated that youth's high degree of parental and school attachment was a protective factor against drug use. Another study tested ecological factors when predicting seven risk behaviors of abused adolescents (Perkins & Jones, 2004). The results show that peer group characteristics were the most commonly shared predictor for all seven risk behaviors, followed by positive school climate, religiosity, other adult support, family support, view of the future, and involvement in extracurricular activities.

In summary, support for including family, peers, school, work, community and other environmental factors in interventions is high. However, few evaluative studies were found of online interventions based on the ecological perspective. Perhaps evaluations are lacking because incorporating multiple intervention levels may require a more complex evaluation

design with lengthy pre-posttests in order for researchers to isolate the effects and interactions of each level.

2.1.9 Diffusion of Innovation Theory

Diffusion of innovation theory concerns the factors associated with the successful introduction of a new technology or behavior. When technology is involved, the term technology acceptance model is often used along with constructs such as perceived usefulness and ease of use (Adams, Nelson, & Todd, 1992). Rogers (2002) suggests that adoption of an innovation, such as a new process or tool, is determined by the nature of the innovation, the communication channels, and the receiver. Research concerning the nature of the innovation suggests innovations should be easily tried, reversible, advantageous, and consistent with the values, past experiences, and needs of the receiver. Research concerning communication channels suggests that behavior change processes where communication is clear, gradual, consistent, frequent, rewarded, and delivered over multiple channels will have a better chance of success. Research concerning the adoption units (individuals and others in their environment) suggests that behavior change will be more effective where the receiver system is cohesive (Kyriakidou et al., 2007).

In summary, given the high attrition associated with online interventions, factors that increase use and acceptance should be considered in the design process.

2.1.10 Transtheoretical Model

The Transtheoretical Model (TTM), or stages-of-change model, has its roots in smoking-cessation research (Prochaska & DiClemente, 1983). TTM is an integrative model focusing on decisional making of the individual (W. F. Velicer, et al., 1998). TTM proposes that people progress through six change stages: precontemplation, contemplation, preparation, action, maintenance, and termination (Prochaska & Norcross, 2001). At each stage, different

interventions produce optimal progress, so interventions that are matched to the respective change stage are more effective. TTM can be easily incorporated with other intervention theories. In TTM, ten typical change processes or strategies are the initiative forces that motivate people to change their Decisional Balance, Self-efficacy or Temptation, thus causing the change on the target behavior. The Decisional Balance contains cons and pros toward that health or problem behavior. They are associated with the stages of smoking cessation in which the pros outweigh the cons at precontemplation; the cons and pros become equal at the contemplation stage; and for the advanced stages, the cons outweigh the pros.

An interactive expert system in preventing smoking behavior has been designed in 1993 by Prochaska et al (1993). In that study, smokers (N = 756) were randomly assigned by stage of change to (a) standardized self-help manuals (ALA+ condition), (b) individualized manuals matched to stage (TTT condition), (c) interactive expert-system computer reports plus individualized manuals (ITT condition), or (d) a personalized condition with 4 counselor calls, stage manuals, and computer reports (PITT condition). The ITT condition was the best at 18 months and has equivalent results with the ALA+ and TTT conditions at 12 months during the follow-ups for smokers at all stages of change.

Later in 1999, the expert system based on TTM was named “The Pathways to Change system” (PTC) (W. F. Velicer & Prochaska, 1999). After assessing smokers via mail or telephone interview, each smoker receives a three- to four-page report that provides individualized recommendations matched to their needs and readiness-to-change. The cessation rates ranged from 22 to 26% as tested in a general population.

Another expert system named the Telephone-Linked Care (TLC) also used telecommunications technology that enables computer-controlled telephone counseling with patients in their homes (Friedman, 1998). This system applied three theories to design studies

that all obtain positive results including the Social Cognitive Theory to improve the medication adherence of elderly hypertension patients (n = 267) and to modify dietary behavior (n=49); and the Transtheoretical Model to motivate sedentary individuals to engage in exercise (n = 87). These studies show that the exposure to this system for as little as three months is associated with improvement in those health behaviors.

Etter and Perneger (2001) randomly assigned 2,934 subjects into a computer-tailored smoking cessation program versus no intervention. The intervention group received computer tailored e-mails for three months based on their stage of change, level of tobacco dependence self-efficacy, and personal characteristics. Results showed that abstinence was 2.6 times greater in the intervention group than in the control group (5.8 percent versus 2.2 percent). The program was most effective in ‘‘precontemplators’’ who were not motivated to quit smoking at baseline (intervention 3.8 percent versus control, 0.8 percent; p=.001). Similar positive results were found with an intervention where personalized smoking cessation advice, support, and distraction were delivered to smokers’ mobile phones (Rodgers, et al., 2005).

Two literature reviews have concluded with very positive recommendations that the research evidence favors TTM on smoking cessation. The first one reviewed 37 interventions (Spencer, Pagell, Hallion, & Adams, 2002); the other one reviewed 19 studies on the utilization of automated systems to smoking prevention or cessation with a conclusion that “the format where participants were mailed computer-generated feedback reports, was the modal intervention format and the one most consistently associated with improved outcomes” (Walters, Wright, & Shegog, 2006). The evidence to support TTM to reduce tobacco use was strong, with supportive studies being more numerous and of a better design than non-supportive studies. As a result, strong research exists for considering users’ stage of change in any online behavioral change intervention.

2.2 Integration and Guidelines for the Development of Online Interventions

Each theory has its strengths and weakness in helping design, develop, implement, and evaluate online interventions. Resiliency theory points out factors that should be increased and reduced by an intervention. The ecological perspective suggests risk and protective factors need to be considered in a user's social networks (e.g., family, peers, school-workplace, and community). Cognitive behavioral therapy offers a strong basis for the design of intervention components such as e-mail feedback. The transtheoretical model suggests designers target interventions to a user's current stage of change to increase their chance of success. Motivational and game theories provide techniques for making interventions fun and rewarding, thus reducing attrition, and increasing users' motivation to change. Diffusion theory focuses the developer on the importance of the values and characteristics of the user, innovation, and the communication channels in order to increase successful implementation, dissemination, and use. The theory of planned behavior provides a strong evaluation model where change factors and intentions can be measured rather than measuring actual behavior.

While each theory is useful, increasing the success of an online intervention by grounding it in multiple relevant theories can be a complex task. Glanz & Rimer (2005, p. 21) developed the integrative model in Figure 2.1 for understanding, explaining, and evaluating an individual's dynamics during behavior change associated with an online interventions. However, the model does not address the user's change stage, which could be embedded in each variable. Nor does it include knowledge, which might be added as an individual variable. Environmental factors, such as those identified by ecological and diffusion models are not well integrated into the individually oriented model in Figure 1 and seem to be almost an afterthought.

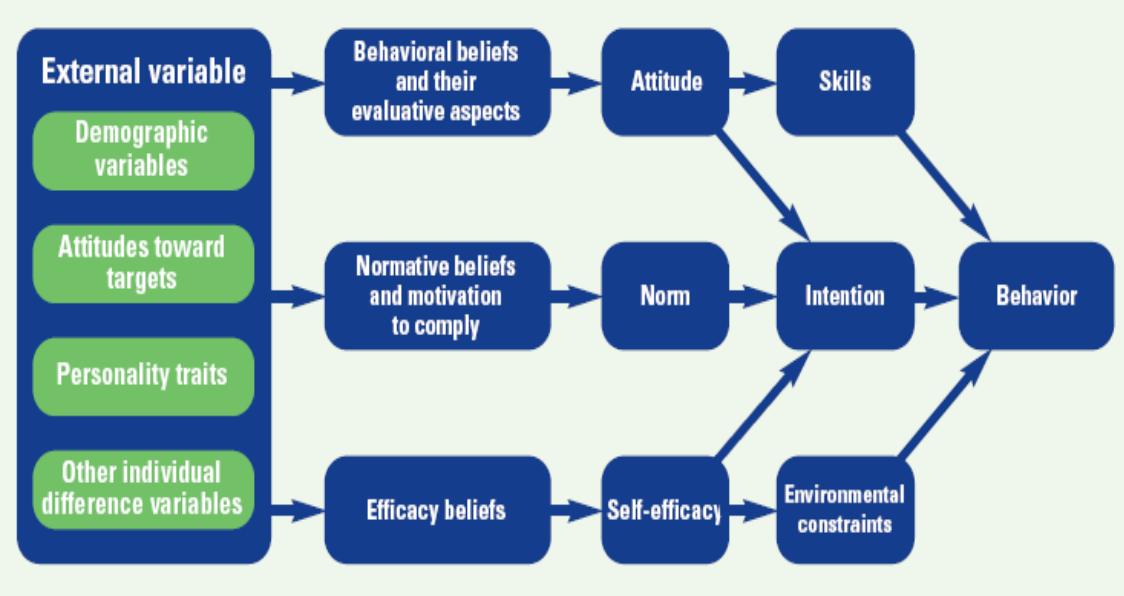


Figure 2.1. An Integrated Theoretical Model Useful for Evaluation and Design

Figure 2.2 presents another attempt to integrate theories into a model that can guide online intervention design and development (Peng & Schoech, 2008). Figure 2.2 suggests that online intervention developers approach behavior change from each of the corners of the triangle. Approaching behavior change from the top left corner makes one examine the protective and risk factors in users, their families, peers, schools, workplaces, and community. Approaching development from the bottom corner stresses that technology tools and gaming techniques be incorporated to ensure user acceptance and motivation to change. Approaching development from the top right corner suggests that models of behavior changes need to be combined with user's current stage of change to increase effective behavior change. While Figure 2.2 focuses the developer on considering and integrating theories during the design and development phase, it does not provide an evaluative framework for online interventions.

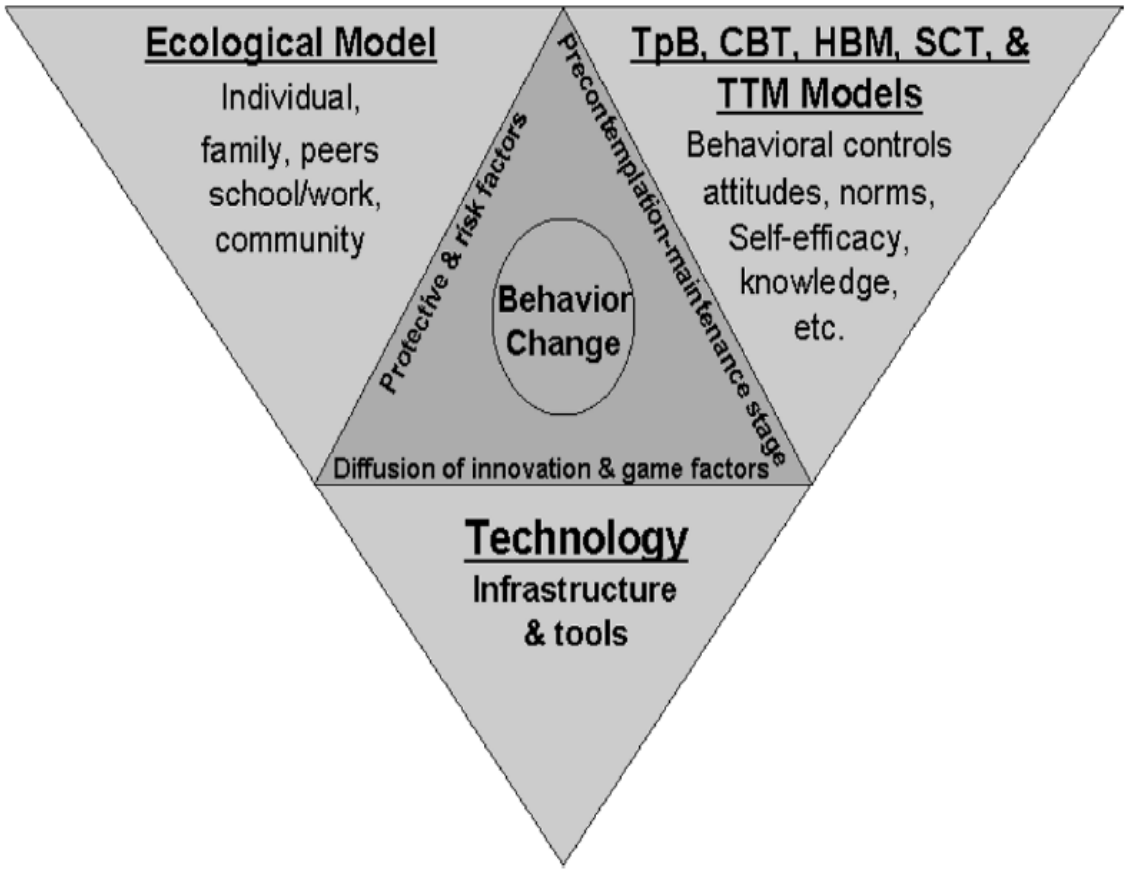


Figure 2.2. An Integrated Theoretical Model Useful for Online Intervention Design

Besides considering an integrated model for online program design, development, implementation, and evaluation, this review concludes with a list of guidelines. These should be considered only preliminary suggestions derived from theories, the literature, or the limited studies mentioned above. The guidelines have not been validated by substantial research on various populations or for many different types of online intervention. Thus, the guidelines point to the need for much additional research as well as provide development advice.

(4) Motivational and Transtheoretical models suggest that success could be increased by tailoring motivational messages to a person during each stage of change.

(1) Feedback delivered automatically via computer, Internet, or cell phone is a powerful tool and automatic tailored reinforcers that should be considered as a component of any online intervention.

(2) Online interventions can increase comprehension and retention by using interactive multimedia (pictures, animation, video, voice, music, etc.) in place of text.

(3) Knowledge gain may not be a good predictor of behavioral change and should be avoided as the sole measure of the success of an online intervention. In contrast, self-efficacy is consistently seen as a key predictor of behavior change.

(4) Online interventions should be given the capacity to assess and monitor program exposure or dosage. There may be an optimum dosage level with any interventions where providing less than the dosage severely sacrifices the chance for success, and providing more than the optimum dosage is a waste of resources. User's stage of change and motivation level might be factors in determining optimum dosage.

(5) Online interventions often tend to produce short-term effects, with long-term effects much more difficult to achieve. Evaluation designs should include at least 3 months follow-up to ensure that significant effects do not fade with time.

(6) Randomized controlled trial (RCT) or true experimental design has been deemed as a requisite for knowledge building. However, the RCT model works best with content that is structured, consistent, and repetitive over time. Interventions that take advantage of the interactive multimedia and game features of the Internet may not provide enough structure to ensure that each user consistently gets the

same intervention and dosage. New evaluative models are needed for online interventions.

(7) Tailored materials for individual smokers are effective, and are more effective than untailored materials, although the absolute size of effect is still small (Lancaster & Stead, 2005).

(8) The booster session can be designed to discuss how they have used what they learned during the earlier sessions or current pressures that they have (Banks, n.d.) or to reinforce the original prevention goals (National Institute on Drug Abuse, 2003).

2.3 Constructing the Theoretical Model for the WPI System at TSH

This section will discuss the model for TSH telephone smoking cessation counseling in order to narrow down the theories from general to specific, and to customize the web-phone-based smoking cessation system to local organization and clients. The literature review seems to favor the theories of TTM, CBT, and MI. It suggests that any web-phone-based intervention should be based in TTM theory while incorporating other theories if consistent with local agency practices. By using this approach, the probability increases for designing a successful intervention to prevent relapse after TSH smoking cessation counseling. Consistent with this approach, a local qualitative study of 16 successful clients of TSH in Taiwan also recommended a multiple methods approach for smoking cessation (C. -J. Chang & Wang, 2007). Two papers of the TSH former chiefs also confirmed that the counselors are mainly using the theories of TTM, Behavioral, CBT, and Rogers (C. -J. Chang & Wang, 2007; D.-T. Chang, et al., 2006). As a result, this study will adopt the TTM as the core framework. As concluded by Velicer et al (1998), the TTM provides advantages including a temporal dimension for behavior change, an appropriate recruitment of an entire population, high retention rates, and sensitive measures of

progress. In addition, being the most popular and useful theory that supports the IT applications especially in the field of smoking cessation, TTM has very specific measures and objectives associated with it.

Besides the theories with their research evidence, it would be better if a TSH's practice followed a standardized curriculum. According to the meeting with TSH supervisors on Aug 7 in 2008, the traditional five stages of TTM have been simplified to two phases and have been used as the counseling protocol for all of the TSH counselors. This two-phase model of smoking cessation was developed in the California Smokers' Helpline by Zhu et al (1996) that have been evaluated as effective in two longitudinal studies of randomized large samples (Zhu et al., 2002; S. H. Zhu, V. Stretch, et al., 1996). This model has been described in detail in the paper of Zhu et al. (1996) entitled "Telephone Counseling for Smoking Cessation: What's in a Call? ". Zhu has also been invited to the TSH for workshops.

In the two-phase model (S. H. Zhu, G. J. Tedeschi, et al., 1996), the objective at the first phase is to prepare the client to quit, and to stay off cigarettes after quitting at the second phase. According to this model, all of the follow-up sessions occurring after the first counseling session are termed as "relapse prevention". Accordingly, what is expected in this project would be to extend the themes of the second phase, which are to maintain the quitting status of those people who have set up their date of quitting. This has also been confirmed by the TSH staff in Aug 2008. According to the meeting with TSH staff, this model is consistent with the framework of TTM but is simpler so that it would not be too complicated to be implemented in practice. This division is consistently supported by the two sections dividing ten processes of change in TTM in which the first five are classified as Experiential Processes/ Conscious Raising which are used primary for the early stage transitions; while the last five are labeled Behavioral Processes/ Stimulus Control which are used primary for later stage transitions (W. F. Velicer, et

al., 1998). Following the two-phase model (Zhu et al, 1996), the TSH counselor should have set up the quit dates with those clients after the first counseling session. Then, the follow-up sessions will be focused on discussing the behavior maintenance issues such as effective coping, relapse prevention, and self-image in the follow-up proactive calls.

The most frequently discussed themes during counseling sessions have been summarized in the paper of a former chief of TSH. These are (C. -J. Chang & Wang, 2007):

(1) Deciding to either reduce smoking amount gradually or totally quit at once

(2) Dealing with withdrawal syndromes (physical)

(3) Facing their psychological struggling and clearing the barriers

(4) Reviewing past smoking motives and habits

(5) Looking for dynamics for quitting smoking

(6) Related resources

(7) Learning alternative methods to replace the original smoking habit

(8) Learning methods to maintain non-smoking. (cognitive, behavioral)

According to Chang and Wang (2007), the factors contributing to the success of quitting smoking may include:

(1) Awareness of connection between smoking behavior and negative emotions (decision balance)

(2) Feeling better physically after quitting smoking (decision balance)

(3) Self identification, especially for female smokers (decisional balance)

(4) Affirmation of self in terms of figure and image (decisional balance)

(5) Attitudes held by relatives and friends toward client's quitting smoking (norm)

(6) Achieving the goal of smoking cessation (self-efficacy)

(7) Quality of relationship between counselor and client

To better incorporate the guidelines from theory with practical wisdom, a preliminary meeting was held to blend the themes from the researcher, the TSH staff, and supervisors in August 2008. The WPI strategies suggested include: (1) remind and reinforce the user about their decisions that they have made previously, (2) facilitate the user to re-examine the reasons for stopping smoking, (3) refresh and reinforce coping skills for resisting smoking, (4) strengthen the user's self-efficacy, i.e., perceived behavioral control ability, (5) introduce clients to the withdrawal syndromes (6) teach clients how to deal with the barriers to quitting smoking, and (7) teach clients how to replace an old habit with a new healthy one.

Later in Dec 2008, the discussion with several TSH supervisors provided some other themes that they thought were frequently discussed during counseling sessions including: 1) to set up the date of quitting smoking; 2) to determine the quitting pace either to stop smoking at once or decrease the amount gradually; 3) to learn the withdrawal syndromes; 4) to clear the barriers on the way to achieving client goals; and 5) to learn some tips for maintaining the status of nonsmoking. The themes will be incorporated into the theoretical framework and matched to corresponding TTM stages. The principles for matching them with appropriate stages will be derived from the ten change processes of TTM (W. F. Velicer, et al., 1998), the action-based motivational interviewing plan (Erol & Erdogan, 2008a; W. Miller & Rollnick, 1991), and the two-phase model (S. H. Zhu, G. J. Tedeschi, et al., 1996). MI has been tested as highly compatible with TTM in the smoking cessation practice in studies (Erol & Erdogan, 2008b; Ramelson, Friedman, & Ockene, 1999).

TTM suggests that the intervention strategy should be based on the client's stage of change. Therefore, each time when the system calls back to the client, it will assess the client's stage of change at first and then deliver appropriate contents to that client. The TSH counselors are not required to set up the intervention content for their client. According to the definition of

the stages of change, the starting point of all clients of this study are at the Determination stage where the client has set up a quit date, or higher stages where the client has already quit for a period of time. As estimated by Velicer et al (1998), 15% of them may regress all the way to the Precontemplation, and most of them may regress to Contemplation or Preparation stages.

Based upon TTM, this study proposes that the key concepts to be changed are self-efficacy and decisional balance. Changes in these variables will lead to the changes of their stage toward quitting smoking. Other variables that may also contribute to the target behavior are the number of counseling sessions and the exposure to the WPI and thus they will also be included into this practice model to predict smoking behavior. Accompanied with the exposure to the web-phone system, these independent variables will either keep the client at the best stage or make positive movements in the clients' stage of smoking cessation. Also, some demographic variables such as gender, age, and participating motive may influence the result and thus will be collected for controlling variables if available. The intervention variables "processes of change or strategies for stages" will not be measured while the subjects' exposure to it will, that is the dosage, or the number of messages the web-phone system delivers to each client. Thus, the research framework is formed as shown in Figure 2-3.

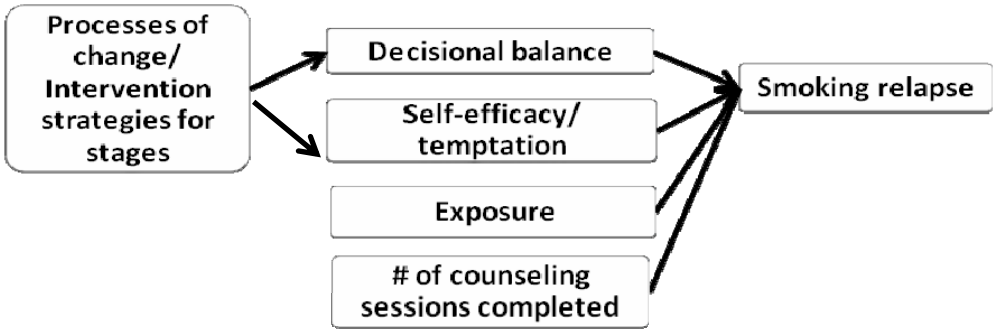


Figure 2.3. The Research Framework of WPI System

On deciding the exposure or dose response to telephone counseling in the smoking helpline, there are some standards to be followed. Based on the review of 48 trials (Stead, et al., 2006), “one or two brief calls are less likely to provide a measurable benefit; three or more calls increase the odds of quitting compared to a minimal prevention such as providing standard self-help materials, brief advice, or compared to pharmacotherapy alone”.

Through subjects’ repeated self-rating, the web-phone system can remind or reinforce them to change their status on decisional balance and self-efficacy. “Testing is a powerful means of improving learning, not just assessing it” (Roediger & Karpicke, 2006). Testing very much produces a learning effect (Bjork, 1975; Carrier & Pashler, 1992). While the “testing effect” is often considered a threat to internal validity, it may also function to move the client toward a desired status of knowledge, values, attitude, and even observable behavior. In the repeated measures design, the survey questions will be delivered to the subjects for more than three times, as suggested in the Cochrane review database (Stead, et al., 2006), they are expected to create the ‘testing effect” in which the subjects will learn the themes that have been repeatedly delivered to them. One study results demonstrated that testing effects occur even when single item lists are used, ruling out the view that testing effects are due solely to stronger interim associations (Kuo & Hirshman, 1996). However, according to the probability of relapse (Zhu & Pierce, 1995), the calls are suggested to be scheduled in a nonlinear fashion in which the days right after the last cigarette are considered as high risk that needs more intensive calls to help client, for example to call them on day 1, 3, 7, and 14. After that, the interval should be longer that calls on day 30, 45, 60, and 90. This is also consistent with the traditional survival analysis using Cox’s (1972) proportional hazard model such as that in Armitage’s (2005) paper in which the reduction of hazard rate can be predicted by the perceived behavior control in a TPB study. The three month period have been generally used to detect the effect of automatic

systems for smoking cessation (Friedman, 1998; W. F. Velicer & Prochaska, 1999; Wayne F. Velicer et al., 1993) and thus is suggested for this study.

It should be noted that this project is different from an “expert system” in which artificial intelligence is used to match individualized intervention to various needs, for example, as in the study of Velicer et al (1993) in which 16,572 unique reports for a six-month study were designed to give feedback to subjects at different stages. In contrast, the WPI does not provide that many various feedback items. In fact, too many questions or messages delivered during one call may make subjects feel bored or tired and thus lower the validity. Therefore, this study will minimize the number of items in each strategy to three at most. A shorter version of roughly 20 items covering the important variables will be designed and pilot-tested. Based on the pilot test results, the number of items in each strategy may be decreased or increased from the three initially selected.

2.4 Conclusion

Many online interventions for behavior change have been developed and researched within the past 15 years, while substantial evaluative research is emerging. Online interventions are especially relevant for the people who are “technologically savvy” and who feel at home in a Many online interventions for behavior change have been developed and researched within the past 15 years, while substantial evaluative research is emerging. Online interventions are especially relevant for the people who are “technologically savvy” and who feel at home in an online environment. The literature suggests that applications grounded in theory have a greater chance for success. This review of 10 major theories and selected supporting research is summarized in two integrative models and nine guidelines. This study constructs a theoretical model based on TTM, incorporated with MI, CBT, and the 2-phase model. The theoretical guidelines were then merged with TSH practice wisdom to develop the web-phone smoking

cessation intervention. As new technologies develop, such as mobile computing and the smart phone, we have an increasing number of IT tools that need to be considered and grounded in theories and existing research in order to improve the effectiveness of online interventions.

CHAPTER 3

RESEARCH METHODS

This chapter is designed to answer the question: “Can the current TSH intervention followed by a WPI get better results in preventing smoking relapse behavior than the current intervention only during the three months following the TSH counseling?” Following the telephone counseling of smoking cessation and follow-up practices at TSH, the WPI and delivering system of this study will be introduced. The Transtheoretical model (TTM) will be utilized for designing this intervention, while the research design will be proposed to implement this evaluation. The hypothesis will be derived from this design denominated with its testing method. Then, the methods about sampling, data collection, data analysis, implementation procedure, protection of human subjects, and anticipated problems and solutions will be proposed.

3.1 The Web-Phone Intervention

The goal of Web-Phone Intervention (WPI) is to help smokers prevent smoking relapse after they have completed the telephone counseling session with TSH counselors. Since this study is aimed at maintaining the effects of TSH counseling after subjects have completed telephone counseling in the TSH, this counseling service provided at TSH must be reviewed for the content basis of the follow-up. Then, the additional WPI and the Teleherence system will be described.

3.1.1 Counseling Service Provided by the TSH

The TSH is a government-funded agency but managed by a private organization, the Teacher Chang Foundation, which is known for its telephone counseling. It provides

consultation and counseling services via telephone to Taiwanese smokers who are willing to quit. According to a former director of TSH, the typical telephone counseling process for smoking cessation is categorized into consultation and counseling. Consultation is defined as an indirect service providing information or referral only, while counseling is a direct service helping clients to explore their questions deeply and to adjust themselves.

The TSH counseling is provided by either part-time or full-time counselors. They must have a bachelor's degree and be trained at least for 110 hrs of smoking cessation at the TSH. The TSH counseling starts when a client calls in to ask for help to quit smoking. The TSH counselor then interacts with them to collect background information, generally within 15-20 minutes. The questions asked relate to smoking experiences, motivation for quitting smoking, past experiences of quitting smoking, etc. Then, based on the client's agreement and available schedule, the TSH counselor will call back for a series of telephone counseling sessions to help clients move toward the goal of quitting smoking. The themes mostly discussed during counseling have been summarized in Chapter Two and will not be repeated here. The typical counseling process at TSH is summarized below (C. -J. Chang & Wang, 2007):

> While under the atmosphere of unconditional caring and acceptance, they (clients) confessed their difficulties on facing relapse, and reset the goal for smoking cessation…the changing of internal dialogue may stop the psychological dependence, and make an earlier adjustment for the changing of self-identification.

3.1.2 Follow-up at TSH

Most cases complete their counseling sessions within two months. The follow-up survey then follows the counseling session generally within seven days. This is conducted via telephone and no prevention strategy is used because the agency simply considers this as a check-up survey. Using a questionnaire, the research development staff asks a series of questions such as the satisfaction levels on service received, the number of days without

smoking, motivation of quitting smoking, the self-attributed factors that help them stop smoking, etc. Generally, it takes ten minutes for one client to complete. In addition to this in-house evaluation, the TSH is sometimes evaluated by an external evaluator on its outcome. For example, the latest one conducted by Dr. Hsu just ended in June 2009. After July 2009, the evaluation will be conducted by the TSH staff.

3.1.3 The Web-Phone Intervention

The WPI delivered by the Teleherence system is a nearly independent IT system that can assess subjects' smoking status and deliver appropriate advice based on their responses. The goal is to prevent the smoking relapse behavior of smokers. The WPI will remind subjects about most of the themes that were most frequently covered in the TSH counseling sessions. The WPI will be based on the two-phase TTM model, and follow the guidelines from research-based evidence of behavior change theories. After this proposal had been approved by the dissertation committee, this intervention content has been designed completely and is shown in part below.

After the introduction of the WPI, the Teleherence will begin with a stage assessment question "Have you quit smoking cigarettes?" Five choices representing five stages will prompt the subject including: (1) YES, I quit More than 3 months ago (Maintenance Stage); (2)YES, I quit LESS than 3 months ago (Action Stage); (3) NO, but I intend to quit in the next 30 days (Preparation Stage); (4) NO, but I intend to quit in the next 3 months (Contemplation Stage); (5) NO, and I do NOT intend to quit in the next 3 months (Precontemplation Stage) (Nigg et al., 1999). All the subjects, who have indicated their willingness to participate, will be invited into this study. As time goes by, most of them may regress back to the earlier stages. Therefore, the appropriate intervention strategies will be provided based on the current stage of that individual. These five stages are listed and associated with the appropriate strategies as illustrated in

Figure 3-1 (adapted from Erol & Erdogan, 2008a). For the Precontemplation stage, the strategies of conscious raising techniques are relevant, for example, to inform the subject about the anticipated benefits if the person can change from smoking to nonsmoking (Friedman, 1998). For the maintenance stage, the intervention strategies are behavioral management techniques such as rewarding; and the time interval between two calls will be longer. Using the form of rating questions, these intervention strategies remind or reinforce subjects to keep themselves in good status of decision balance and self-efficacy and thus lead subjects to maintain nonsmoking behavior. Based on the prediction of the smoking relapse probability (Zhu & Pierce, 1995; S. H. Zhu, G. J. Tedeschi, et al., 1996), this WPI developed a similar relapse prevention schedule (This will be shown in Table 3.2: Research design) for the subjects to be exposed to.

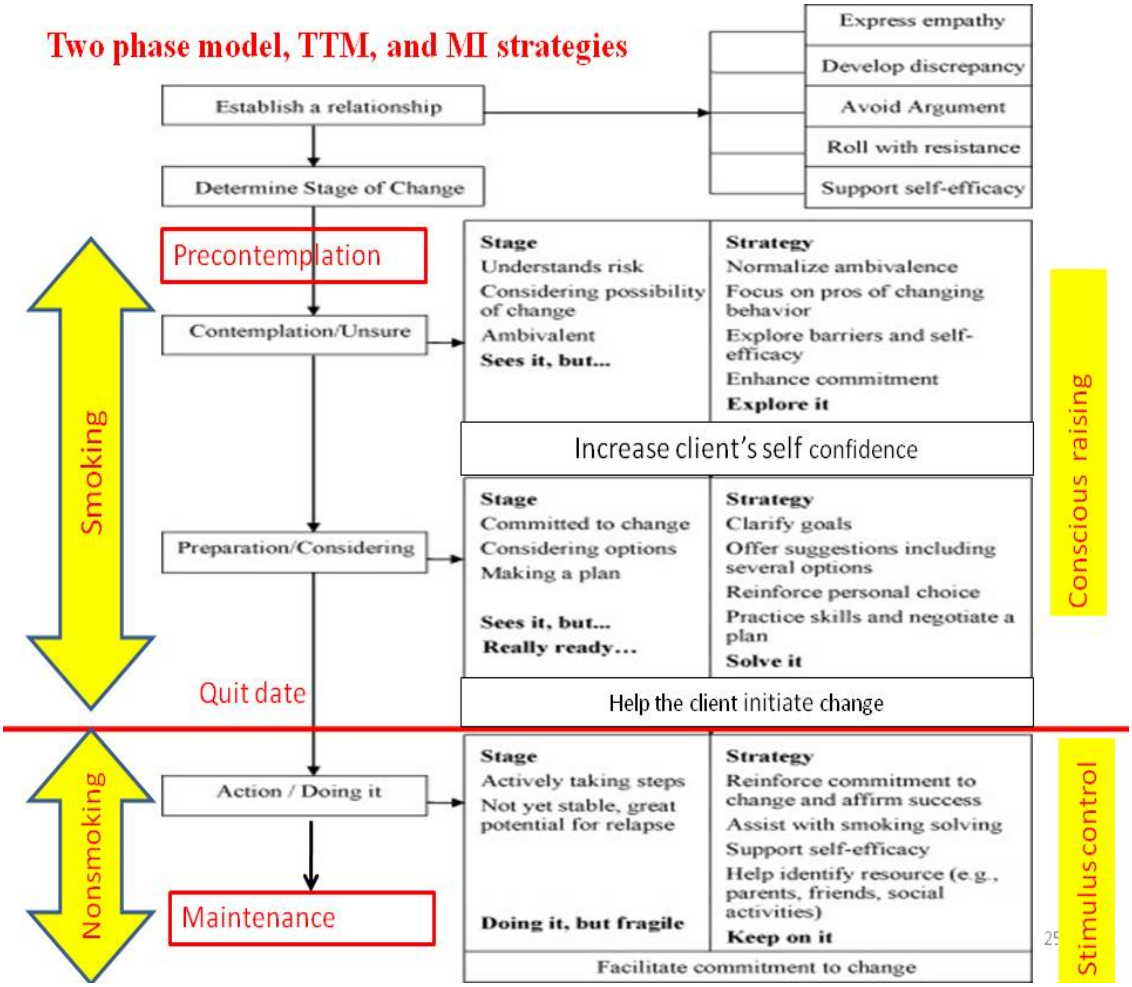


Figure 3.1. Two-Phase Model, TTM, and MI Strategies

The Teleherence system will deliver four parts of contents to the designated subjects including introduction, checkup or assessment, intervention, and feedback. These are outlined below:

(1) Introduction (Delivered on Week 1 Only)

A. Welcome.

B. Introduce how the WPI works, (informed consent, counseling ethics)

C. Summarize the possible risks and rights of the subject in this study, (informed consent, counseling ethics)

D. Obtain the subject's informed consent for participating in this study by pressing the number on telephone keypad. (informed consent, counseling ethics)

E. The responsibility will be declared by "No matter how hard we try to help you quit smoking, the decision right and responsibility would still belong to you. (Responsibility, MI)

(2) Checkup/Assessment (Conducted Weekly from Weeks 1 to 13)

F. Identify subject's stage of change. Although this was done during the counseling process, the subject's stage is subject to change and thus needs to be assessed before the intervention content is provided. This would also determine which intervention strategies subjects should receive within that phone call.

G. How many days have you not been smoking since the quit date that you have set up for yourself? (continuous abstinence)

(3) Intervention Strategies

Each stage of change toward smoking cessation is matched with an intervention objective and several intervention strategies. Each strategy is applying a counseling technique with its theoretical source(s) in parenthesis. At first, it will deliver the concern of this study about each subject's status on smoking cessation, and thus may say, "We are concerned about the progress you have made on achieving your goal". Then, the five stages are corresponded with several strategies below.

H. For "precontemplation" stage, raise consciousness

a. Inform the subject about the anticipated benefits if the person can change from smoking to nonsmoking. (pros or Decision balance, TTM & TPB)

I. For “contemplation” stage, increase self confidence

a. Normalize ambivalence (Decision balance, TTM; reframing automatic thoughts to setbacks being normal, CT (Beck, 1995, p. 270))

b. Focus on pros of changing behavior (Decision balance, TTM & TPB)

c. Explore barriers and self-efficacy (Self-efficacy, SCT & TPB)

d. Enhance commitment

J. For “preparation” stage, help initiate change

a. Clarify goals (goal-oriented questions, SFBT)

b. Offer suggestions including several options (Reframing, MI & CBT)

c. Reinforce personal choice (SCT)

d. Teach strategies or skills to deal with triggers to smoking (Self-efficacy, SCT & TPB)

K. For “action” stage, facilitate commitment to change

a. Reinforce commitment to change and affirm success (SCT)

b. Assist with smoking solving

c. Support self-efficacy (Self-efficacy, SCT & TPB)

d. Help identify resources, e.g., parent, friends, social activities

L. For “maintenance” stage, facilitate commitment to change (same with action stage)

(4) Closing Message.

M. MI suggests that summarizing subject's intervention progress may provide subjects with their progress toward the goal on a cognitive map (W. R. Miller, 1999b).

N. "Thanks for using the WPI. We will call you in the following weeks. Sincerely hope you can quit smoking successfully. Talk to you next time. "

A sample template for call session for a subject at the contemplation stage is below:

Objective 1: Normalize ambivalence. (Decision balance, TTM; reframing automatic thoughts to the notion that setbacks are normal, CT)(Beck, 1995, p. 270) (Corey, 2005, p. 178)

(1) <Introduction> Welcome to the TSH Relapse prevention system. We are concerned about the progress you have made in this week. The WPI will deliver some information to you based on your current status, so that you can achieve your goal on smoking cessation. Being accurate on your real smoking status will allow the WPI to give you messages tailored to your specific needs. All of the information and conversation is confidential.

(2) <TTM Stage determination> "Have you quit smoking cigarettes?" (1) YES, I quit More than 3 months ago (Maintenance Stage); (2) YES, I quit LESS than 3 months ago (Action Stage); (3) NO, but I intend to quit in the next 30 days (Preparation Stage); (4) NO, but I intend to quit in the next 3 months (Contemplation Stage); (5) NO, and I do NOT intend to quit in the next 3 months (Precontemplation Stage). <If the subject inputs 4, then…..>

(3) <Intervention instruction> Please use the telephone keypad to tell us "to what degree would you agree with the following statements?"

Item 1. It's normal to have ambivalence feelings when you have decided to quit smoking while still smoking. (unconditional positive regard and acceptance, Person-centered Therapy) (Corey, 2005, p. 178)

- Press 1 for "strongly agree"; press 2 for "agree", press 3 for "not sure"; press 4 for "disagree", press 5 for "strongly disagree". (The following questions apply to this response type.)

Item 2. On the way of quitting smoking, setbacks are normal. (reframing automatic thoughts, CT) (Beck, 1995, p. 270)

- Press 1 for "strongly agree"; press 2 for "agree", press 3 for "not sure"; press 4 for "disagree", press 5 for "strongly disagree". (The following questions apply to this response type.)

The Teleherence[2] is a web-phone-based intervention delivery system located at the University of Texas at Arlington. It allows a case manager to schedule reminders; calls a subject at agreed upon times, asks the questions; delivers reminders and messages; graphs responses on a web site; sends any alerts desired; and flags potential problems and opportunities using smart algorithms. The goal will be to prevent the smoking relapse. In this study, the Teleherence will call each subject, assess the subjects' stages by getting answers to a few questions, and immediately provide stage appropriate intervention contents to them. Intervention contents are formed of a specific combination of messages and questions, and are packaged in each module called a template. To handle the issues of using the Chinese language, a human TSH counselor will record all the intervention contents in mp3 files according to a Teleherence compatible format.

[2] The URL of Teleherence is at https://connect.uta.edu:7001/

Since this is a telephone-based service, the length of each call is of concern. Keeping it short and simple (KISS) (Schoech, 1999) thus become a key principle when designing the intervention and measurement contents. Its length should be balanced between the maximum that subjects will not lose their interest and attention while interacting with them, and the minimum that the scales can obtain their acceptable reliability and validity. Some preliminary criteria for optimal length of content in one call are set based on the typical telephone counseling sessions for smoking cessation as described by Zhu et al (S. H. Zhu, G. J. Tedeschi, et al., 1996) in which a follow-up call is about 10 minutes. If four strategies are to be delivered, each strategy should contain no more than two items. The number of questions in one call will be limited to 20. However, if the subject stays at the same stage for more than two weeks, they are required to listen to the same contents repeatedly. To avoid this problem, the number of question items for each strategy must be maximized. Namely, there will be many items developed in each strategy but only part of them will be delivered in one call. This length is also flexible to adapt to the subjects' needs if they want to expose themselves more in the WPI. In this case, the system will ask if they want to hear more messages. If yes, the system will deliver alternative messages in the same stage. The system also keeps a log to track how many messages they have listened to. If the items delivered are the same, they will be counted as different. The system will also record the number of messages listened to if the subject just hangs up.

The operational procedure of Teleherence system is listed below:

(1) The Teleherence is completely set up for the agency. All interventions will be recorded in the Chinese language by a local TSH counselor to insure the messages are culturally appropriate.

(2) The subjects' telephone numbers and other data for the use of Teleherence. Based on TSH and IRB decisions, all subject identifiable information may reside at TSH or the University of Texas at Arlington.

(3) System dials out and collects data from each subject in according to the stage of change and probability relapse schedule. The subject will receive appropriate contents based on their stage following these initial questions. The subject will be asked to answer questions by pressing the appropriate number(s) on the telephone keypad. The system will record these responses.

(4) System can provide a chart of the subjects' responses on counselor's or subject's demand.

(5) System records the exposure of subjects during the whole process, that is, the total number of messages will be logged and calculated.

(6) After the subject has been in this study for 13 weeks, the system terminates this service.

To ensure the intervention fidelity, a face validity check of the quality of questions and messages will be made. Questions and messages will be initially developed by the researcher with TSH consultation. They will then be rechecked by two counseling supervisors of TSH in terms of the face validity. They will also examine the issues such as the correct utilization of defined principles or the cultural competence. A pilot test of the WPI will be administered before its implementation. About six volunteer staff of TSH will be invited to receive 7 weeks of the WPI during a 7-day period so they can provide their opinions for final tuning. A 2-hour training session by the researcher will introduce the system to those counselors supplying subjects for the study so that they may introduce this service to their subjects and invite them to participate when their TSH counseling sessions have been completed. During the intervention process, the

researcher and the technology team will also provide prompt help for dealing with possible problems that occur.

3.2 Measurement

The variables that will be measured are: 1) stage of smoking, 2) total nonsmoking days, 3) self-efficacy (SE), 4) decisional balance (DB), and 5) exposure to intervention. The measuring methods are explained below.

3.2.1 Dependent Variable

To measure smoking behavior in individual, the consensus is clear that only total abstinence can be counted as successful outcome instead of the reduction in the number of cigarettes as action (W. F. Velicer, et al., 1998). Thus, in evaluating the effectiveness of smoking cessation program, it is calculated in the proportion of abstinent people within that group in terms of the abstinence rate. In addition, the duration of abstinence can be measured in terms of total nonsmoking days. This will be indicated by the subject during the 3 months of the research study. If he has been quitting, use the quit date to calculate. If he smoked again, use the date of the last smoke. If the answer is "0", that means he is smoking. For example, if one subject smoked on day 5, and is observed by the system on day 7, then he should answer 2.

Table 3.1.The Abstinence Measures, Analysis, and Effect Size

	Abstinence Rate/ Stage of change	Continuous Abstinence/ Total nonsmoking days
Recode or calculation method	Nonsmokers = subjects in the stages of action, maintenance. Smokers = subjects in the stages of precontemplation, contemplation, preparation.	Total nonsmoking days (TND) = the number of cumulative and consecutive days that the subject has ceased smoking since his quit date or after the date of the last smoke.

Table 3.1. - *Continued*

Descriptives in group	Abstinence Rate (AR) = # of Nonsmokers in one group ● AR1 = # of Nonsmokers / total in exp. group ● AR2 = # of Nonsmokers / total in cont. group A ● AR3 = # of Nonsmokers / total in cont. group B	Continuous Abstinence (CA) = Average of total nonsmoking days in one group (ATND) ● CA1 = Average days in exp. group ● CA2 = Average days in cont. group A ● CA3 = Average days in cont. group B
Hypothesis testing	Hyp: Proportions of nonsmokers in the 3 groups are different. AR1 ≠ AR2 ≠ AR3 AR1 ≥ AR2 ≥ AR3 Stat: Chi-square test	Hyp: TND of the 3 groups are different. CA1 ≠ CA2 ≠ CA3 CA1 ≥ CA2 ≥ CA3 Stat: one-way ANOVA & Scheffe's post hoc test
Effect size of the intervention	AR1/AR3	CA1 – CA3 / SD of sample's TND

Notes:

(1) # = number; SD = standard deviation

(2) exp. group = experimental group; cont. group = the control group

The smoking relapse behavior can be measured in two ways including the stage of change and total nonsmoking days. To determine subject's stage of change toward quitting smoking, Nigg et al. have designed an ordinal scale with only one question and five answers. However, this scale uses 30 days and 6 months as the interval, which may be too rough to sense the effect of this intervention. Therefore, all the 6-month answers are shortened to 3 months. Besides, a more sensitive measure using the "total nonsmoking days" will also be applied so that the subtle effect may be detected. These two variables are measured below.

Variable: Stage of change

Question: Have you quit smoking cigarettes?

Answer and scoring:

(1) NO, and I do not intend to quit in the next 3 months. (Precontemplation Stage)

(2) NO, but I intend to quit in the next 3 months. (Contemplation Stage)

(3) NO, but I intend to quit in the next 30 days. (Preparation Stage)

(4) YES, I quit less than 3 months ago. (Action Stage)

(5) YES, I quit more than 3 months ago. (Maintenance Stage)

Variable: Total nonsmoking days

Question: How many cumulative and consecutive days have you been quitting from smoking since your quit date or after the date of last smoke? Please press the number on your keypad. If you have been quitting, use the quit date to calculate. If you smoked again, use the date of the last smoke to calculate. If your answer is "0", that means you are smoking again.

3.2.2 Independent Variables

As for the two independent variables including self-efficacy and decisional balance, several valid and reliable measures that were designed in according with the Transtheoretical model for smoking are recommended based on the research results (retrieved from Cancer Prevention Research Center of the University of Rhode Island at http://www.uri.edu/research/cprc/measures.htm#Smoking on Mar 4th, 2009). Besides, since these measures will be administered via telephone, those of the short form are preferred. Every scale will be translated into the local language in Chinese and be revised to suit the needs of Taiwanese people. A reliability analysis of Cronbach's α will be conducted after pilot test. Permission on distributing these scales is automatically granted because they are consistent with the disclaimer in which these scales should be for research use and the references should be cited.

3.2.2.1 Decisional Balance

The Decision Balance scale involves weighting the importance of the Pros and Cons (W. F. Velicer, et al., 1998). The two-factors structure including pros and cons has been consistently found in 12 studies (Prochaska et al., 1994). The following statements represent

different opinions about smoking. Subjects are asked to rate HOW IMPORTANT each statement is to their decision to smoke according to the following five point scale.

Answers:

(1) Not important

(2) Slightly important

(3) Moderately important

(4) Very important

(5) Extremely important

Questions:

(1) Smoking cigarettes relieves tension.

(2) Smoking helps me concentrate and do better work.

(3) I am relaxed and therefore more pleasant when smoking.

(4) I'm embarrassed to have to smoke.

(5) My cigarette smoking bothers other people.

(6) People think I'm foolish for ignoring the warnings about cigarette smoking.

Scoring:

- PROS = 1 + 2 + 3
- CONS = 4 + 5 + 6

3.2.2.2 Self-Efficacy / Temptation

According to Plummer, et al. (2001),

> Self-Efficacy represents the situation-specific confidence that people have that they can cope with high-risk situations without relapsing to their unhealthy or high-risk behavior. This construct can be operationalized by either a temptation measure or a confidence measure. …Three factors have been identified as taxonomy of common types of tempting situations: negative affect of emotional distress, positive social situations, and craving or habit strength.

This study uses the scale consisting of situations items listed below that lead some people to smoke (W. F. Velicer, DiClemente, Rossi, & Prochaska, 1990). The subjects will be asked the question: HOW TEMPTED you may be to smoke in each situation. Please answer the following questions using the following five-point scale.

Answers:

(1) 1 = Not at all tempted

(2) = Not very tempted

(3) Moderately tempted

(4) Very tempted

(5) Extremely tempted

Questions:

(1) With friends at a party.

(2) When I first get up in the morning.

(3) When I am very anxious and stressed.

(4) Over coffee while talking and relaxing.

(5) When I feel I need a lift.

(6) When I am very angry about something or someone.

(7) With my spouse or close friend who is smoking.

(8) When I realize I haven't smoked for a while.

(9) When things are not going my way and I am frustrated.

Scoring:

- Positive Affect / Social Situation = 1+ 4+ 7
- Negative Affect Situations : 3+6+ 9
- Habitual / Craving Situation : 2+ 5+ 8

- The sum of these nine items ratings represents the self-efficacy score of that subject.

3.2.3 Control Variables

3.2.3.1 Exposure to Intervention

On the effect of telephone counseling in the smoking helpline, there are some standards to be followed based on the review of 48 trials that "One or two brief calls are less likely to provide a measurable benefit. Three or more calls increases the odds of quitting compared to a minimal intervention such as providing standard self-help materials, brief advice, or compared to pharmacotherapy alone." (Stead, et al., 2006)

The exposure to the intervention, also called dose response, is the degree that a subject has been exposed to the intervention. The items to be measured are listed below:

- Number of messages a subject hears over the 2 months WPI.
- Number of calls completed: the total number of calls completed.
- Total time length: refers to the total seconds that one subject has been using the WPI during the 2 months WPI.

3.2.3.2 The Other Control Variables

The other control variables include number of years of smoking, most important motive of quitting, gender, and age. These question items are collected when the subject agreed to participate in this study. In addition, the subjects are asked to fill in some other questions for the service delivery including: two telephone numbers that they wish to use in receiving the call from this study, the two best times that they wish to receive the call.

3.3 Research Design

To answer the research question of this study, two research designs were considered including the time series design with the control group, and the classical experimental research design. The time series design is good at detecting whether an intervention has had an effect significantly greater than the underlying trend (Grimshaw, Campbell, Eccles, & Steen, 2000). However, it requires a series of data that were measured intensively and for multiple times in identical format. Besides, the repeated measures of all variables may produce the “testing effect” in which the subjects may feel bored, and thus decrease the response rate. Thus, the time series design may need to be adjusted for the use of this study. On the other hand, the classical experimental research design can measure change in a problem or attitude (Kumar, 1999, p. 83) but is short at long-term observation. To adjust these two designs to this study which needs to measure during follow-up, this study plans to arrange two posttests at the end of the two months after the WPI has started for that individual subject. In addition, there will be a brief weekly checkup with two outcome questions only. One is the stage identification, and the other is the total nonsmoking days. The stage is required for "abstinence rate", while the total nonsmoking days is a continuous measure of smoking cessation behavior which can provide more consecutive and detailed information regarding subject’s smoking relapse behavior and thus allows stronger analysis of outcome such as linear regression analysis. This brief checkup provides more continuous observations on each subject and avoids taking subjects much time. It should be noted that this checkup call is different from the intervention call where this checkup is limited to only two questions in one call, while the latter will add intervention contents based on the stage detected. Thus, a research design with randomized controlled groups comparing pretest and three posttests plus eight weekly checkups is formed as illustrated in Table 3-2.

Table 3.2. Research Design

	Week # / Contents	1	2	3	4	5	6	7	8	9
Experimental group	Checkup	C	C	C	C	C	C	C	C	C
	Intervention	XX	XX	XX	X	X	X		X	
	Observation	O11				O12				O13
Control group A	Checkup	C	C	C	C	C	C	C	C	C
	Observation	O21				O22				O23
Control group B	Checkup	C								C
	Observation	O31								O32

Notes:

(1) The symbols and corresponding meanings are listed below.
- C: Checkup of smoking stage and total nonsmoking days, 2 items, measured weekly.
- X: the WPI formed of change processes or strategies, 12 items or above. One X means this content will be conducted one time within that week, and XX means this content will be conducted two times within that week.
- O: Observation of Self-efficacy (SE) and Decisional balance (DB) plus the Checkup, 4+6+2= 12 items, measured monthly.
- If the call the scheduled call in one week contains intervention or observation, the checkup will also be combined and implemented in one call.

(2) The lowered two digit numbers of each O represent the group and its sequential order of that event. The first digit is based on its group number in this study, and the second digit is its occurring order of that event; 1 means the 1st Observation (pretest), while the others are posttests. For example, O21 means the pretest in the 2nd group.

In this design, each of the subjects will be randomly assigned to one of the three groups: (1) the experimental group to receive a two-month WPI with 4 times observations plus 8 weekly checkups; (2) the control group A to receive 3 times observations plus 8 weekly checkups; or (3) the control group B to receive 2 observations only. All of the three groups will be observed on all variables including self-efficacy, decisional balance, and checkup at the first week as a pretest, and the 8th week as two-month posttest. To capture qualitative feedback about the WPI, subjects receiving the intervention will be asked to comment on the intervention at the end of the 2nd month. No analysis will be completed on the subject's responses;

however, they might provide valuable insight into how this new intervention is received and works or does not work.

This design is composed of three components and three groups at weekly intervals during a three-month period. The three components are Checkup (C), Intervention (X), and Observation (O). The Checkup (C) consists of smoking stage and total nonsmoking days, 2 items, measured weekly. The WPI (X) is formed of the change processes or intervention strategies that are based on a series of questions or statements. However, these will not be delivered at one time. Instead, only the strategies that are appropriate for the stage of that subject will be delivered. The designated intensity or the number of intervention delivered within a time period is assigned roughly in consistence with the relapse prevention schedule (Zhu & Pierce, 1995; S. H. Zhu, V. Stretch, et al., 1996). The Observation (O) consists of three measurements including Self-efficacy (SE), Decisional balance (DB), Checkup, approximately 4 + 6 + 2 = 12 items, measured monthly. Both intervention and observation contain checkup.

Furthermore, each of the three groups has its essential position in answering this research question. The experimental group is arranged to see if the system is effective in prevent smoking relapse which should be shown in the difference between pretest and posttests results before and after they have been exposed to this intervention for three months. The control group A is arranged to see if the WPI is better than no intervention. Besides, the exposure to repeatedly test may also decrease the probability of subjects' smoking relapse. Thus the arrangement of the control group B would be helpful to answer the question that "if the 4 observations and 13 weekly checkups are minimized to only two observations, would there be any difference between this group and the others?" The control group will be compared with the experimental group on each test. These two control groups will provide a measure of difference

between pre & post to compare with the experimental group and help rule out environmental influences that may occur between pre & post, e.g., media or community coverage of smoking.

3.4 Research Hypothesis

The hypotheses in an experimental research may include two parts: the testing of its integrity of theoretical framework, and the effect of its intervention. The first part of the hypothesis regarding the internal consistence of the TTM will not be tested here because these have been immensely supported and demonstrated in many studies (i.e. Erol & Erdogan, 2008a, n = 275 ; Brett A. Plummer et al., 2001, N = 2808). For the second part regarding the effect of the intervention, the research design (as shown in Table 4-2) is designed to answer the proposed question: “Can the current TSH intervention followed by a WPI get better results than the current intervention only?” The hypothesis will be listed following the five research questions, and accompanied with their calculation and statistical testing methods.

Presumption: Equivalence between groups

Hypothesis 1-1: At pretest, there should be no significant difference on the abstinence rate and total nonsmoking days among the three groups. The abstinence rate is the proportion of nonsmokers within that group. Those who are identified as in the stages of Action or Maintenance will all be considered as nonsmokers. Although the randomization has assumed theoretical equivalence between groups, the actual difference will still be examined to serve as a reference basis for future comparison.

- $O_{11} = O_{21} = O_{31}$
- Statistical method: Chi-square for abstinence rates difference test, independent sample t-test for total nonsmoking days means difference test

Hypothesis 0-2: At pretest, there should be no significant difference between the control and the experimental group on the number of years of smoking, and the number of counseling sessions completed. (Note: This will depend on the release of data from the TSH.)

- $O_{11} = O_{21} = O_{31}$
- Statistical method: one-way ANOVA

Research question 2: Can the WPI keep the subjects' self-efficacy and decisional balance from decreasing post-TSH intervention?

Hypothesis2-1: The decisional balance scores of the experimental group will be significantly higher than those of the control groups A and B, at one-month, two-month, and 3-month time points.

- one-month effect : $O_{12} \geq O_{22}$ (Independent sample T-test)
- two-month effect : $O_{13} \geq O_{23}$ (Independent sample T-test)
- 3-month effect : $O_{14} \geq O_{24} \geq O_{32}$ (One way ANOVA and Scheffé's post hoc test)

Hypothesis2-2: The self-efficacy scores of the experimental group will be significantly higher than those of the control group A and B, at one-month, two-month, and 3-month time points.

- one-month effect : $O_{12} \geq O_{22}$ (Independent sample T-test)
- two-month effect : $O_{13} \geq O_{23}$ (Independent sample T-test)
- 3-month effect : $O_{14} \geq O_{24} \geq O_{32}$ (One way ANOVA and Scheffé's post hoc test)

Research question 2: Can the WPI reduce the subject's smoking relapse behavior via the exposure to it for a 3-month period? In other words, is there any difference between those who have received the WPI and those who have not?

Hypothesis3-1: The abstinence rate in the experimental group will be significantly higher than those in the control groups A and B, at one-month, two-month, and 3-month time points.

- one-month effect : $O_{12} \geq O_{22}$
- two-month effect : $O_{13} \geq O_{23}$
- 3-month effect : $O_{14} \geq O_{24} \geq O_{32}$
- Statistical method: Chi-square test

If the WPI can really work, the abstinence rates of three groups within the three months period should proceed as illustrated in Figure 3.1. In the first several weeks, the abstinence rates should go down a little as expected and the WPI system may have not enough time to make observable difference between groups at this moment. The average total nonsmoking days would be similar. After the subjects have been exposed to intervention for more than one month and above, the abstinence rates differences between experimental and control groups should be observed, and become more and more salient as time goes by. As a result, the best time point to determine if this intervention is effective might be at the three-month point or the 13th week.

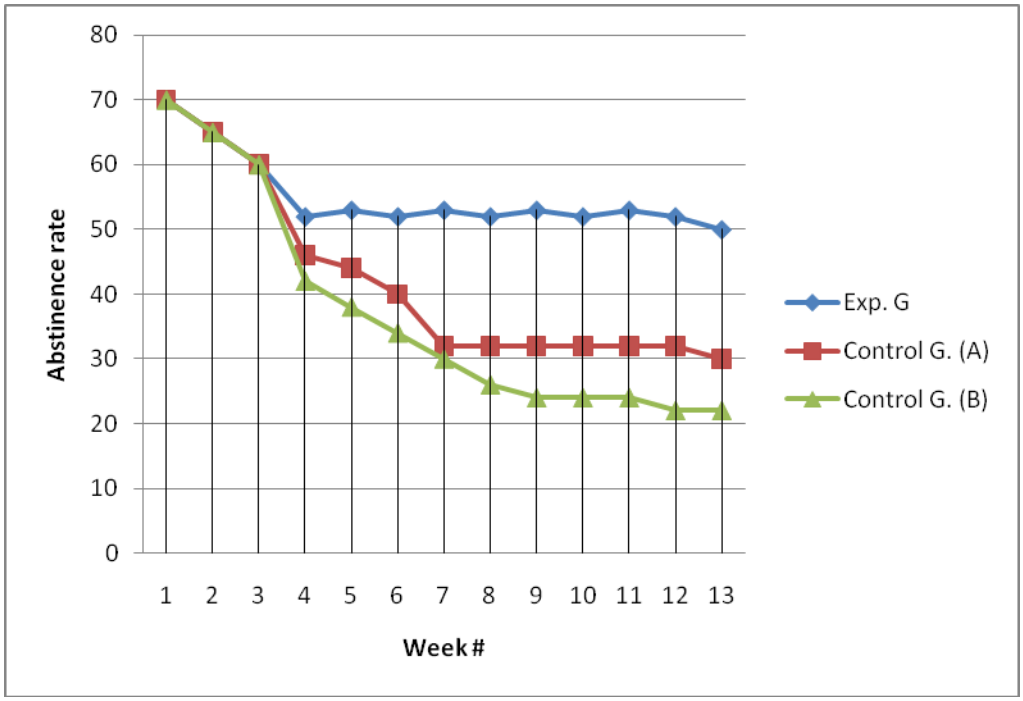
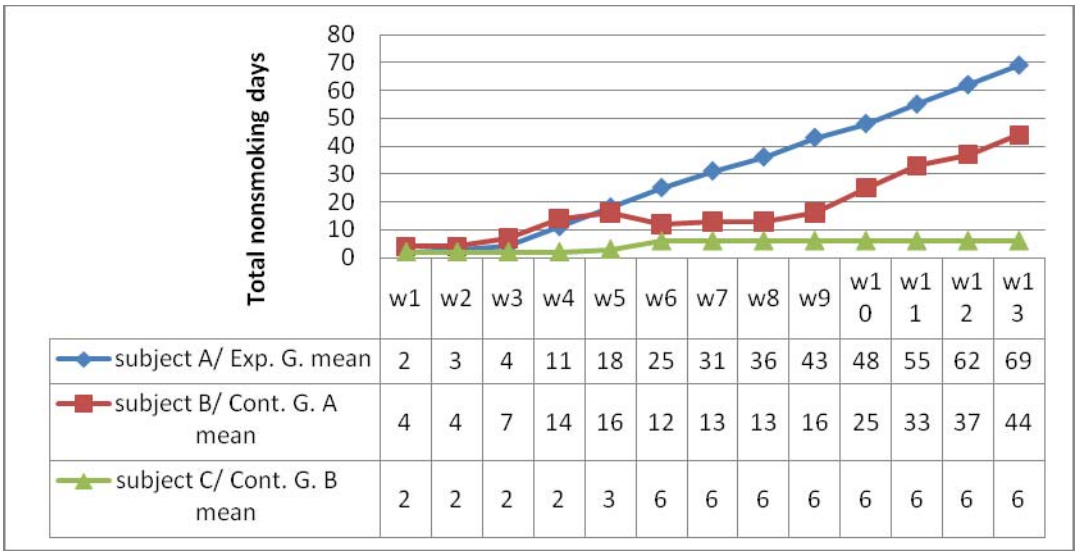


Figure 3.2. The Hypothetical Lines of Abstinence Rates of Three Groups

Research question 3: How long can the intervention prevent a subject from smoking relapse within the 3-month period?

Hypothesis4-1: The average total nonsmoking days of the experimental group will be larger than those of the two control groups, at 1-, 2-, and 3-month time points.

- total nonsmoking days = test date – quit date
- one-month effect : $O_{12} \geq O_{22}$ (Independent sample T-test)
- two-month effect : $O_{13} \geq O_{23}$ (Independent sample T-test)
- 3-month effect : $O_{14} \geq O_{24} \geq O_{32}$ (One way ANOVA and Scheffé's post hoc test)



	w1	w2	w3	w4	w5	w6	w7	w8	w9	w10	w11	w12	w13
subject A/ Exp. G. mean	2	3	4	11	18	25	31	36	43	48	55	62	69
subject B/ Cont. G. A mean	4	4	7	14	16	12	13	13	16	25	33	37	44
subject C/ Cont. G. B mean	2	2	2	2	3	6	6	6	6	6	6	6	6

Figure 3.3. The Hypothetical Lines of Continuous Abstinence of Three Groups

Research question 4: What kind of exposure can best predict the total nonsmoking days of the TSH subjects? (dose-response relationship)

Hypothesis5-1: Subjects, who listen to more items each week will keep more days of nonsmoking. (Pearson's r)

Hypothesis5-2: Subjects, who listen to more messages/strategies from the WPI in total will keep more days of nonsmoking. (Pearson's r)

Hypothesis5-3: Subjects, who have longer duration of total calls will keep more days of nonsmoking. (Pearson's r)

Research question 5: What kind of study variables, in what combination, to what degree, can best predict the total nonsmoking days of the TSH subjects?

Hypothesis6-1: A best prediction model for nonsmoking days can be formed by the variables in this study. The R-square value of this model is estimated to be over .4, which means all of the predictors can explain the variation of subjects' total

nonsmoking days for over 40%.

- Statistical method: multiple linear regression analysis, a prediction model will be calculated three times at 1-, 2-, and 3-month.

3.5 Sampling

The target population of this study is those who have stopped smoking as a result of TSH counseling. To recruit samples from this population, the criteria are that the subjects must

- be aged over 18;
- be able to understand Chinese;
- be willing to join this study as a subject and provide a personal phone number for receiving the call back;
- have completed at least two telephone counseling sessions at the TSH; and
- have set up a quit date, and have quit smoking at the end of the counseling sessions.

The required sample size should be determined by the statistical methods, number of groups, effect size, and significance level. This can be computed by the power analysis software "G*Power 3.0.10" (Faul, Erdfelder, Lang, & Buchner, 2007). (Retrieved at http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3, Dec 31, 2008) To compute a required sample size for this study, three statistical methods were compared with the conditions: significance level (α) = .05, power (1- β) = .95, and large effect size. The results show that the suggested minimal sample size required is 102 in total (see Table 3.3).

Table 3.3. The Required Sample Sizes in Three Statistical Tests

Statistical tests	α	Power (1- β)	Large effect size	Required sample size
Chi-square (two-tailed)	.05	.95	.5	80
Independent T-test (one tail, two groups)	.05	.95	.8	70 (35 for each group)
F-test (one way, 3 groups)	.05	.95	.4	102

The study sample is defined as those who have completed at least two counseling sessions and have set up a date of quitting smoking. Those who are eligible will be invited by counselors at the end of counseling sessions. Since they have all determined to quit smoking, they are either at the action or maintenance stage of change as defined by the TTM. Except for the subjects who refuse to participate, those who have accepted an invitation will be randomly assigned individually to one of the three groups: the experimental group, the control group A, or the control group B. To ensure the sample size can reach the minimal requirement of 102 in total, and to prevent the impact of attrition rate during the intervention period, the receiving of cases will not stop until there are 150 in total, and 50 in each group. To prevent the artificial interference, the “double blind” principle will be applied. That is, nobody will know who is in any group.

3.5.1 Data Collection

Self-reported approach and key pressing input method will be used as data collection methods in this study. Self-reported smoking cessation rates have been demonstrated to be very accurate (W. F. Velicer, Prochaska, Rossi, & Snow, 1992). There are two types of testing for all of the subjects participating in this study including the weekly checkup of two questions on dependent variables, and monthly observation including all of the independent variables and dependent variables during the 8 weeks implementation period. Every subject has the same starting week while participating in this study. When the system calls the subject, it will conduct

the assessment/checkup and intervention if arranged within the same call. The subject will have to listen to the instruction and question items one by one, and input their answers via their telephone keypad. Before the end of a call, the system will check missing values and ask the subject to answer if needed. In addition, the exposure of subject to the WPI will be collected by the system during process.

3.5.2 Data Analysis

Those statistical methods for the hypothesis testing have been listed in the Research hypothesis section previously. Every variable in this study will be summarized with appropriate descriptive statistics including frequency, central tendency and dispersion. On dealing with the missing cases, the attrition rate has been a threat to internal validity. There are two levels of solutions: strict level and medium level. The strict level assumes the lost participants to follow-up to be continuing smokers, while the medium level assumes the lost participants to follow-up to be half smokers and half not. In order to have more detailed information about this effect, both the two levels will all be applied to those effect-testing hypotheses.

While calculating the effect size, Cohen (1988, p. 20) suggested a method that is appropriate for two independent samples t-test as shown below. It is the difference between the mean values of the two groups, divided by the standard deviation that can be expressed as

$$d = (Mean_A - Mean_B) / \sigma$$

where $Mean_A$, $Mean_B$ = population means expressed in original measurement, and σ is the standard deviation of either population (since they are assumed equal). This is also called **Cohen's d** that around .2 are considered small effects, around .5 are considered moderate, and around .8 are considered large effects (Coe, 2000). Therefore, the effect size in terms of total nonsmoking days can be calculated using the following equations.

one-month effect size = $[(O_{11} - O_{12}) - (O_{21} – O_{22})] /\sigma$

two-month effect size = $[(O_{11} - O_{13}) - (O_{21} – O_{23})] /\sigma$

3-month effect size = $[(O_{11} - O_{14}) - (O_{21} – O_{24})] /\sigma$

On the other hand, since the abstinence rate is based on proportion, the effect size in terms of abstinence rate is calculated by dividing the proportion of nonsmokers post quit date in the experimental group, by the proportion of nonsmokers in the control group. These will also be calculated per month during the three-month period. At last, a multiple Regression analysis will be utilized to see if the study variables can form a best model in predicting the total nonsmoking days.

3.5.3 Implementation Procedure

As shown in Figure 3.2, the implementation of this research is incorporated by research and intervention. This flowchart starts with the intake of a client at TSH. After the subjects have completed their counseling sessions, they are then recruited into this project. They will be randomly assigned into one of the three groups to receive different contents. When the number of subjects comes to 150, the project will terminate. All the processes of this research are listed below.

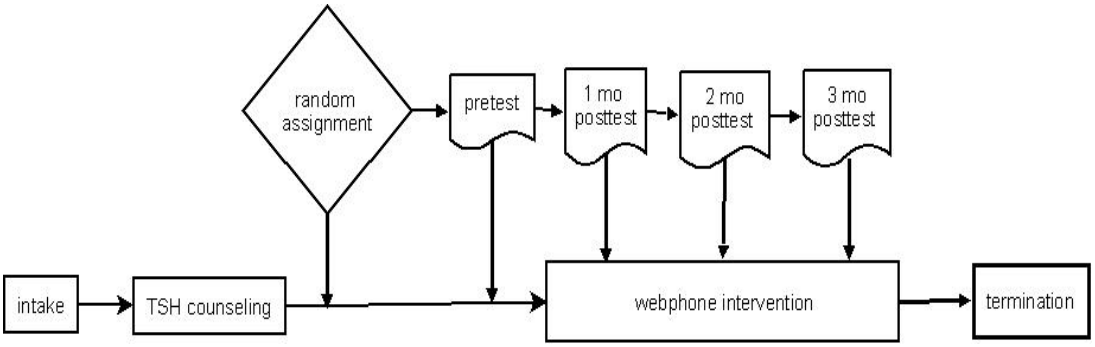


Figure 3.4. The Implementation Flowchart of Research and Intervention

(1) Literature review and writing the draft proposal

(2) Looking for cooperating agency and selecting target population

(3) Discussing with the agency: administrators, counselors, and IT staff

(4) Developing the prevention materials

(5) Writing up proposal

(6) IRB: UTA, TSH

(7) Complete development of the prevention materials

(8) System testing

(9) Set up system with agency help

(10) Training counselors and system administrators

(11) Recruit subjects at the end of human counseling sessions

(12) Agency enter client's data

(13) Randomly assign clients into three groups

(14) Pretest

(15) Counselor discusses with client about the best situation to receive phone call, including frequency, time period. Then, the counselor activates the WPI for that subject.

(16) System starts calling subjects for checkups, intervention, and observation for 13 weeks.

(17) System keeps monitoring subject's status of smoking cessation and exposure.

(18) When system has been providing services to a subject for 13 weeks, system terminates the service for that subject.

(19) When the total amount of subjects has come to 150, the system stops operating for the TSH.

(20) Data analysis

(21) Paper writing and presentation.

3.5.4 Protection of Human Subjects

The researcher has passed the online IRB training provided by UTA and obtained a certificate. This study will simply use the phone numbers to dial to the subject on agreed times without having their personal information. Besides, subject's informed consent on participating in this project will be obtained before the study starts. The client's database will reside at an independent server. No harm will be brought to the subject during the implementation of this study.

3.5.5 Anticipated Problems and Solutions

(1) To avoid poor recording quality, use professional media working room to record the voice.

(2) To avoid ecological fallacy, this research result should not be over-generalized to those smokers who are not similar to the sampling criteria. For example, those who have not made a call to TSH for help on quitting smoking may not be accepted.

(3) To avoid the attrition of subjects, the system will send an alert e-mail to the system administrator if there is no response from subjects. The TSH staff may call out to check if there is any problem on receiving this service but will not do any intervention.

CHAPTER 4

FINDINGS

After the research methods were finalized as stated in the first three chapters, the sample changed, thus changing many details of the implementation and analysis. All these changes are discussed in the first part of Chapter 4. As a result, this chapter will cover four sections including the adjusting of the original proposal due to the change of cooperating agency, the implementation summary, sample description, and hypothesis testing results.

4.1 Adjusting the Proposal

The original proposal was revised when implemented due to several practical difficulties. The most influential one is that the original cooperating agency was changed from Taiwan Smokers Helpline (TSH) to Tajen University (TJU), which caused the research design and methods to be revised. These changes will be described and explained in each section.

4.1.1 Changing the Cooperating Agency and Targeted Population

The original cooperating agency was changed from Taiwan Smokers Helpline (TSH) to Tajen University (TJU), which caused the research design to be revised. In fact, the researcher has contacted more than 15 agencies in Taiwan while only one gave a promise to cooperate with this study. The contacting process is summarized below.

- John Tung Foundations (JTF): JTF is a private agency that is aimed at helping people promoting their health. It has been running several programs on campaigning quitting smoking. The researcher was interested in their e-mail program, “Quit and Win”. However, JTF refused to cooperate because their clients were all registered online and had not been identified as to whether they were real smokers or not.

- Taiwan Smokers Helpline (TSH): TSH was initiated and financially supported by government, while operated by a private agency- “Teacher Chang Foundation (TCF)”. The researcher has been in communication with the TSH staff about the cooperating details since writing this proposal for more than 2 years. After this proposal was approved by the UTA committee on Jul 11, 2009, the researcher then translated the proposal into Chinese and sent it to the governmental superiors of TSH for review. However, they were afraid that it may reveal the clients’ privacy and to bother clients by calling them repetitively. Therefore, they decided to turn down the cooperating possibility in spite of the strong willingness of TSH staff.
- Chenhsiu University (CHU) and other universities: The researcher then tried to change the target population to university student smokers in one or two university. The requirement for an appropriate university should be one with many smokers. To the researcher’s knowledge, the smoking prevalence rates among technology universities is higher than that of general university and thus aimed to find if there is any willingness to cooperate with the project. CHU is a technology university located in an urban area in southern Taiwan. The corresponding CHU staff had been showing his willingness in referring this service to the student smokers in CHU. However, his superior was not willing to sign the agency consent letter as required in the IRB protocol. Revealing client’s personal information without their permission was also an expressed concern. Some other 15 universities rejected without giving any reason.
- Tajen University (TJU): TJU is a technology university located in a rural area in southern Taiwan. After discussing with the Chief of Student Counseling Center and the Dean of Student Affairs, they all supported this study. The TJU promised to

provide their student smokers name list and signed the Agency Consent Letter (see Attachment A). Then the Military Officer provided the TJU smokers name list. The Chief of Student Counseling Center helped to deal with the orientation to subjects and to exclude all the barriers that occurred during the process.

Accompanied with the agency change, the targeted population was also changed from the "successful clients" of TSH to "unwilling clients" in university because they were kind of being "caught" smoking on campus by the Military Officer although there was no punishment for them. It was anticipated that they would show more resistance when participating in this study such as not to pick up the call, or lie to the question.

In response to the change, the direction of intervention goal was adjusted. When working with the TSH clients, most of the subjects would start from nonsmokers at the 4^{th} or 5^{th} stages and the goal was to keep them stay at the same stage or prevent them from going back to the earlier stages. However, when working with the TJU students, the direction of goal should be changed to the opposite. That is, most of the subjects would start from the earlier stages and the goal would be to move forward the current stages of subjects, especially those in the experimental group, by having them being exposed to the WPI to a certain degree for a minimum of certain time period.

4.1.2 Revising Research Design

The research design was revised based on several thoughts. First, the original intervention was set up as a follow-up to the TSH telephone counseling and lasted for 13 weeks. But for now, it changes to serve as an independent intervention which is designed for the smokers of the general population. According to the guidelines from the literature review, anti-smoking program effect generally comes out after the subject has been exposed to the intervention for 1 month or for more than three calls. Thus, a 13-week period was not required

to be that long. Therefore, it is expected that the first 4 weeks of intervention would suffice to see if the intervention was effective or not. The second reason is that 13 weeks seems to be too long for a college student to work through and may lessen their willingness in participating in this study. Third, the question items within each intervention strategy would have had to be repeated mostly after six or seven calls. If two calls are arranged in one week, totally different items may be exhausted after the first 4 weeks. Based on these concerns, the research design was revised as shown in Table 4.1. Compared to the original one, the changes were to discard all events from weeks 9 to 12, and to move those in week 13 forward to week 9. Specifically, the subjects in the experimental group will receive eight intervention calls and three observation calls. Weekly checkup questions or the stage of change question would be incorporated into the intervention surveys or the observation surveys if that subject was scheduled to receive a call at the same week. The calls schedule was arranged according to the literature review guidelines so that it was more intense in the beginning and less intense later. This call schedule was two calls per week from the 1st to 3rd week; one call per week from the 4th to 6th weeks; no call for the 7th week; and one call per week from the 8th to 9th weeks.

Table 4.1. Revised Research Design

Group	Pretest	One-month intensive schedule						Posttest	One-month tapering schedule			Posttest
	W11	W12	W21	W22	W31	W32	W4	W5	W6	W7	W8	W9
Exp G	O_{11}	X_1	X_2	X_3	X_4	X_5	X_6	O_{12}	X_7		X_8	O_{13}
Cont G (A)	O_{21}	C	C	C	C	C	C	O_{22}	C		C	O_{23}
Cont G (B)	O_{31}											O_{32}

Note. C: Check-up, O: Observation, X: Intervention. Both X and O contains C.

Definition of weekly checkup, intervention, and observation calls are listed below:

- Checkup call (C): In this type of call, the subject would be asked about the stage of change question, if his answer falls at the 4th or 5th stage, then a TND question will be followed to ask the subject "How many days have you been not smoking?" This question was answered by subject's voice and recorded by the WPI.
- Intervention call (X): In this type of call, the subject would be asked about the stage of change question and TND if applicable, then about 5 to 8 question items tailored to address the subject's stage of change would be provided.

- Observation call (O): In this type of call, the subject would be asked about the stage of change question and TND if applicable, then nine question items of SE and six question items of DB follow.

4.1.3 Revising Measurement of Outcome

The original measurement, “total nonsmoking days”, is more sensitive to those people who are at the Action or Maintenance stage, and is not appropriate for the revised targeted population who are mostly at the Precontemplation stage. The original "total nonsmoking days" measure would be unable to detect any progress of the subjects because most of them are smokers and would not have quit smoking yet. The same situation existed with the other measure "proportion of nonsmokers within group". Another measurement was needed to determine if the intervention was effective because the change on the subjects smoking behavior would not have occurred so quickly to be detected by the proposed measurements. One of the solutions was found in Martin, Velicer, & Fava’s (1996) study on smoking cessation that used a measure of stage movement to detect intervention effects, to analyze the pattern of change, and detect differential treatment effects for different stages. They found that “Differences in the transition probabilities between treatment and the control groups represented a good method for assessing intervention effects”. The “stage movement” represents the dynamic process of a subject from one time point to another later time point on stage of change question. In fact, the "stage movement" was not a new variable in this study; it was computed by the difference between two stages of a subject at two time points. To operationalize the revised measure, each stage of change was assigned with a number so that 1 is for pre-contemplation stage, 2 for contemplation stage, 3 for preparation stage, 4 for action stage, and 5 for maintenance stage. The value of stage movement is the difference between the stage number at pretest and that at posttest. The equation can be listed as:

Stage movement = stage number at posttest - stage number at pretest

All possible stage movements of a subject from pretest to posttest can be listed in the matrix as Table 4.2. revised from Martin, Velicer, & Fava (1996).

Table 4.2. Matrix for all possible Stage Movements from Pretest to Posttest

Posttest / Pretest	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Stage 1	0	1	2	3	4
Stage 2	-1	0	1	2	3
Stage 3	-2	-1	0	1	2
Stage 4	-3	-2	-1	0	1
Stage 5	-4	-3	-2	-1	0

According to Table 4.2, all possible figures of stage movement may range from -4 to +4. It should be noted that the interval between each number are not assumed as equal because the “stage of change” variable is still considered as an ordinal scale rather than interval. The positive figures are representing progression of a subject from earlier stage to advanced stage, while the negative ones are representing the regression of a subject from advanced stage to earlier stage. The diagonal elements, marked as “0”, are representing stability of a subject’s stage status from pre to posttest i.e. staying the same at stage 2 from pretest to posttest. However, since there were 9 categories of stage movement from -4 to 4 and there were only 39 or 38 subjects in a group, it can be foreseen that the number of cases in each category would be very few, thus causing the problem of weak power. As suggested by Rosenthal (2001, p. 121), “Categories are often collapsed when the frequency of responses in one or both categories is very low.” Therefore, the positive elements above the diagonal were categorized into “improved” while those below and on the diagonal ones were categorized into “unimproved”. Consequently the two categories formed a new measure named “improvement”, and was used to measure the outcome of this study.

Since the "stage of change" is an ordinal variable, the differences between its adjacent values are not considered as equal. Consequently, the “improvement” should be deemed as

dichotomized variable rather than interval or ratio one. The appropriate statistical method for testing a correlation between a nominal IV (group membership) and a nominal DV (improvement) would be Chi-square, while the one for testing causal relationship between them would be logistic regression. The overall summary of the effectiveness of an intervention or effect size can also be calculated by comparing the proportions of "improvement" between the experimental and the control groups. To calculate its effect size, odds ratio (OR) is often utilized and can be calculated using the following equation (Rosenthal, 2001, p. 116):

OR = odds for first group / odds for second group

4.1.4 Revising Research Framework

The changes made to the proposed research framework were to: (1) Remove the variable "processes of change" which was measured in terms of exposure; (2) Remove the number of counseling sessions completed since the subjects did not receive this service at all; (3) Add the demographic variables including gender, age, school type, and participating motive; and (4) Revise the outcome measure from smoking relapse to improvement. The new framework is illustrated in Figure 4.1.

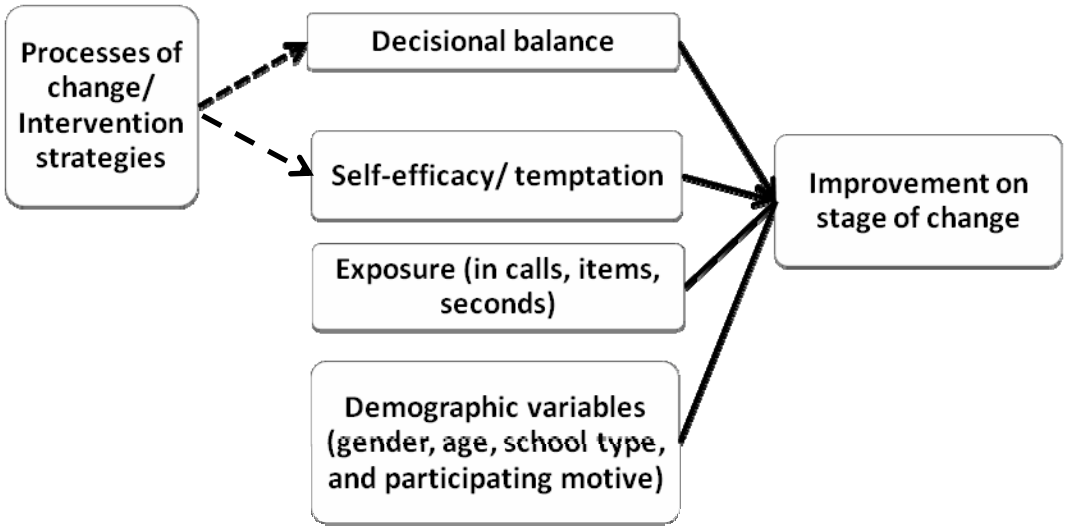


Figure 4.1. Revised Research Framework

4.1.5 Revising Research Question and Hypothesis

The overarching research question becomes "whether the WPI is effective or not in preventing smoking relapse behavior? If yes, how strong is it and what influences its effectiveness?" The pretest was to be implemented at week 1, while the two posttests were to be at weeks 5 and 9. The "one-month effect of intervention or check-up with intensive schedule" would be observed between weeks 1 and 5; the "one-month effect of intervention with tapering schedule" between weeks 5 and 9; and the "two-month effect" between weeks 1 and 9. These effects would be measured by the hypothesis comparing the proportion of "improved subjects" between different groups. It was expected that the experimental group should produce a higher proportion of "improved subjects" than the two control groups. In addition, if the "check-up" could work, the control group A should have a higher proportion than the control group B. All of

the research hypotheses and their corresponding analysis methods in parenthesis are listed below:

Presumption Hypothesis. Equivalence between Groups at Pretest

(1) Hypothesis 1-1: At week 1, there should be no significant difference between the experimental group and the control group on the average of total nonsmoking days, number of smoking years, self-efficacy, decisional balance-pros, and decisional balance-cons. (O11 = O21 = O31, one-way ANOVA)

(2) Hypothesis 1-2: At week 1, there should be no significant difference between the experimental group and the control group on the proportion of nonsmokers. (O11 = O21 = O31, chi-square test)

(3) Hypothesis 1-3: At week 1, there should be no significant difference between the experimental group and the control group on the proportion of stage of change. (O11 = O21 = O31, chi-square test)

Hypothesis 2. Difference between Pre and Post Test on Self-Efficacy and Decisional Balance

(1) Hypothesis 2-1: At week 5, the average self-efficacy and decisional balance-pros in the experimental group will be significantly higher than those at week 1. (1 month effect: $O_{12} > O_{11}$, paired samples t-test)

(2) Hypothesis 2-2: At week 9, the average self-efficacy and decisional balance-pros in the experimental group will be significantly higher than those at week 1. (2 month effect: $O_{13} > O_{11}$, paired samples t-test)

Hypothesis 3. Difference between Groups on Self-Efficacya Decisional Balance

(1) Hypothesis 3-1: At week 5, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly higher than those of the control group A ($O_{12} < O_{22}$), while the decisional balance-cons will be lower. (one-month effect: $O_{12} \geq O_{22}$, independent sample t-test)

(2) Hypothesis 3-2: At week 9, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly higher than those of the control group A and B ($O_{12} < O_{22} < O_{33}$), while the decisional balance-cons will be lower. (two-month effect: $O_{13} \geq O_{23} \geq O_{33}$, one way ANOVA and Scheffé's post hoc test)

Hypothesis 4. Difference Between Groups on Abstinence Rates (TND and Number of Nonsmokers)

(1) Hypothesis 4-1: From weeks 2 to 9, the means of TND in each week in the experimental group will be significantly higher than that in the control group A. (one-month effect: $O_{12} > O_{22}$, independent sample t- test)

(2) Hypothesis 4-2: At week 9, the mean of TND in the experimental group will be significantly higher than that in the control group A; and that in the control group A will be significantly higher than that in the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, one-way ANOVA)

(3) Hypothesis 4-3: At week 5, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A. (one-month effect: $O_{12} > O_{22}$, chi-square test)

(4) Hypothesis 4-4: At week 9, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A ; and that of

the control group A will be significantly higher than that of the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, chi-square test)

Hypothesis 5. Difference between Groups on Improvement

(1) Hypothesis 5-1: At week 5, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A. (one-month effect: $O_{12} > O_{22}$, chi-square test)

(2) Hypothesis 5-2: At week 9, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A and the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, chi-square test)

Hypothesis 6. Difference between the “Improved” and “Unimproved” Groups on Exposure

(1) Hypothesis 6-1: At week 5, the “improved” group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 5, compared to the “unimproved” group. (independent sample t-test)

(2) Hypothesis 6-2: At week 9, the “improved” group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 9, compared to the “unimproved” group. (independent sample t-test)

Hypothesis 7. Prediction for Improvement

(1) Hypothesis 7-1: At week 5, a best prediction model for subject’s “improvement” can be formed by the variables in this study. (logistic regression)

(2) Hypothesis 7-2: At week 9, a best prediction model for subject's "improvement" can be formed by the variables in this study. (logistic regression)

Logistic regression was to be employed to test hypothesis 7 because the DV "improvement" is a dichotomized variable and the predictors are mixed with discrete and continuous ones. Another reason is that the goal of logistic regression analysis is to correctly predict the category of the outcome for individual cases (Tabachnick & Fidell, 2001, p. 519). Therefore, one set of variables in this study will be combined in a model to predict the correctness of classification on the group membership of "improvement".

4.2 Implementation Summary

4.2.1 Promoting Cultural Competence and Face Validity

In order to promote cultural competence and face validity, the intervention and measurement contents of this study were reviewed by two local experts after being translated into Chinese. The expertise of two local experts is summarized as following. (1) Dr. Cheng-Fang Yen, a psychiatrist and professor in Kaohsiung Medical University Chung-Ho Memorial Hospital, whose expertise is in psychiatry, mental health of children and youth, substance abuse, and neurosis; and (2) Dr. Ching-Jan Chang, an associate professor in National Changhwa University of Education, who has previously been the Director of Taiwan Smokers Helpline, and has published numerous articles regarding smoking and telephone counseling. Their comments have all been incorporated into the design and revision of intervention and measurement.

4.2.2 Recruiting Subjects

The University of Texas Arlington Institutional Review Board (UTA IRB) approved the IRB protocol of this study (Protocol No. 2010.0111s, previously 2009.1669, see Attachment A), effective from Mar 15th, 2010 to Mar 14th, 2011. Then, the researcher sent an official letter via

the employing agency, Kaohsiung Medical University (in Taiwan), to the cooperating agency, Tajen University (TJU), to ask for the students name list of smokers. The TJU provided two name lists including 241 student smokers, who were found smoking at some corner of campus during the three semesters from fall 2009 to fall 2010. These lists entailed the smokers' names, department, grade, home phone numbers, or cell phone numbers, which were written on the student profiles. After checking, the 241 students became 214 because 27 of them were duplicated. The researcher then invited each of them by phone call using the "Sentences used in the invitation phone call" attached in the IRB protocol. After several rounds, 64 (29.9%) of them were inaccessible due to the following reasons: invalid phone numbers, not answering the calls at different times; student's parent was not willing to provide the student's current phone number, although the parent promised to inform the students to call back the researcher back but they did not. In addition, 39 (18.2%) rejected the invitation to participate. At last, 116 (54.2%) students among the 214 agreed to this study, therefore, the 116 volunteer students were recruited as subjects of this study.

Among the 116 subjects, 71 promised the researcher that they would attend the orientation meeting held by the researcher in TJU, while only 41 actually attended. The researcher then informed the remaining subjects individually via phone call and obtained their schedule for receiving future calls from this study. All subjects agreed to the Informed Consent Document that was explained to them during the orientation meeting or the phone call. Everyone was then assigned with a unique number and was randomly assigned into one of the three groups by systematic numbering including: (1) the experimental group with 39 subjects; (2) the control group A with 39 subjects; (3) the control group B with 38 subjects. Double-blind principle was applied because neither the researcher nor the subjects knew which group they were in.

4.2.3 Important Events

Since this study is longitudinal, some important historical events that occurred during this process should also be marked to provide more explanation to the research results, especially the changing of response rate. The sources of important events contained either Teleherence system or TJU campus. The events are listed in the order of dates below.

(1) May 13th, 2010: The researcher holds the orientation meeting for subjects at TJU.

(2) May 19th, 2010: The WPI starts delivering calls to the 116 subjects.

(3) Jun 6th, 2010: Those who answered 4 or 5 (representing stage 4 or 5) on question item “q20100 (stage of change)” should have been directed to record their voice (for “total nonsmoking days”), but the blank waiting time after recording was too long which may have confused them to believe that the call was finished. This problem can be seen among the subjects’ answers through weeks 1-1, 1-2, 2-1, 2-2 in which only one subject continued the question items after the recording item. This problem might have caused all of the people who were considered nonsmokers to not be exposed to the intervention. However, the nonsmokers in the experimental group were still very few (about 2 to 4 persons per survey in a week). The engineer replied that the blank length of 60 seconds was the minimum and was impossible to be reduced. The researcher then added more instruction before the subject’s entering the recording question, i.e., “Please press # or 1 to stop recording”.

(4) Jun 21 to 25, 2010: TJU final exams (during weeks 5 and 6 of this study). This may have affected the response rate of some subjects.

(5) Jun 25 to Sep 12, 2010: TJU Summer vacation (during weeks 6 to 9 of this study). Some of the students graduated or left this school, thus might have a different schedule with the one they have given to the researcher on the paper-based survey or in the phone call.

(6) July 12th, 2010: Due to a security certificate issue with the Teleherence server at UTA, some of the calls did not succeed.

(7) Jul 19th to 21th, 2010: Teleherence system crashed and disabled all of the scheduled calls for 3 days (during week 9 of this study).

(8) System wrongly made duplicated calls to persons without identifying that they have completed the surveys. Roughly, four to eight persons have received this type of duplicated calls.

(9) System did not show correct signs for those who have missed the calls thus misled the researcher into losing the chance to reschedule for them. Roughly, four to eight persons have missed the scheduled calls for one to two days due to this event.

(10) Jul 23rd, 2010: Intervention ends.

(11) Sep 13th to 24: The qualified subjects were informed to get compensation of 200 Taiwan Dollars at TJU Counseling center.

4.2.4 Data Cleaning and Processing

The data for this study was collected from three types of sources including: 1) the Teleherence system, 2) a self-administered short survey at pretest, and 3) the smokers name lists provided by TJU Military Officer. The latter two types of data were directly coded into the software MS Office Excel or SPSS for analysis, while the data from Teleherence system was processed through the following steps.

(1) Collect valid call records. The “call missed” record, which meant the call was not picked up, was deleted first. The rest call records that contain at least one answer in each were considered as “valid calls”.

(2) Calculate the exposure. From the valid calls, three variables of exposure were calculated for each subject, including: (1) the number of question items that have been answered, (2) the duration of each call in seconds, and (3) the total number of calls. These steps were mostly done with the MSOffice Excel and SPSS software.

(3) Identify the “unique call record for each subject on each survey. The other variables, except for exposure in this study were further extracted from the pool of “valid calls”. Each subject was identified with a “unique call record” to represent his or her status on that survey. Since a subject may have received the same survey for more than one time and thus given different answers on the same question, the priority order of recruiting the unique call was the “complete” one and then the call was marked as “disconnected by the subject”. If the call records were all “disconnected by the subject”, the one in which the answer to the stage of change was at an earlier stage would be selected for the use of data analysis. For example, if one subject answered stages 1 and 2 at different times for the same survey, the record in which the answer to stage question was 1 would be selected. Applying this high level of recruiting criteria was one of the attempts to exclude the possibility of getting successful results by chance.

4.2.5 Reliability Analysis

Although the scales have been reported as highly reliable, a reliability analysis was implemented to assure consistence of measurement in the three scales used in this study including self-efficacy, decisional balance-pros, and decisional balance-cons based on the data collected at weeks 1 , 5, and 9. As a result, the overall Cronbach's Alpha coefficients of Self-efficacy scale (N of items = 9) were .862 (n = 95), .934 (n = 47), and .899 (n = 37) at weeks 1, 5, and 9 respectively, in order (see Table 4.3 for detail). These figures indicate that the Self-efficacy scale was quite reliable through the three times observation. The reliability analysis on each item of the Self-efficacy scale based on week 1 data is followed at Table 4.4.

Table 4.3. Reliability Analysis on Self-Efficacy Scale Based on Weeks 1, 5, 9 Data

Week #	Mean	Variance	Std. Deviation	Cronbach's Alpha	N of Items	Valid N	Valid %
W1	24.77	58.456	7.646	.862	9	95	81.9
W5	20.66	80.403	8.967	.934	9	47	40.5
W9	22.11	70.099	8.373	.899	9	37	31.9

Note. List-wise deletion based on all variables in the procedure. Total N is 116.

Table 4.4. Reliability Analysis on Self-Efficacy Items Based on Week 1 Data

Item	Mean	Std. Deviation	N	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.when eating with friends at a party	2.22	1.054	95	22.55	50.250	.475	.857
2. When first getting up in the morning	2.51	1.295	95	22.26	46.664	.571	.849
3. When you are very anxious and stressed.	3.01	1.333	95	21.76	45.441	.625	.844
4. Over coffee while talking and relaxing.	2.46	1.192	95	22.31	47.491	.581	.848
5. When you feel you need a lift.	2.93	1.223	95	21.84	44.879	.738	.833

Table 4.4 - *Continued*

6. When you are very angry about something or someone.	*2.76*	*1.310*	*95*	*22.01*	*46.500*	*.573*	*.849*
7.when you are together with smokers	2.77	1.233	95	22.00	49.340	.439	.862
8. When I realize I haven't smoked for a while.	2.93	1.178	95	21.84	46.241	.676	.839
9. When things are not going my way and I am frustrated.	3.19	1.249	95	21.58	46.055	.640	.842

Note. The subject was asked the question: "HOW TEMPTED may you be to smoke in each situation? Please answer the following questions using the following five-point scale. The answers are 1 = Not at all tempted, 2 = Not very tempted, 3 = Moderately tempted, 4 = Very tempted, 5 = Extremely tempted."

Furthermore, the overall Cronbach's Alpha coefficients of Decisional Balance-pros scale (N of items = 3) were .713, .840, and .797 at weeks 1, 5, 9 respectively (See Table 4.5). Reliability analysis on each item is followed at Table 4.6.

Table 4.5. Reliability Analysis on DB-Pros Scale Based on Weeks 1, 5, 9 Data

Week #	Mean	Variance	Std. Deviation	Cronbach's Alpha	N of Items	Valid N	Valid %
W1	6.73	6.925	2.632	.713	3	92	79.3
W5	6.64	11.149	3.339	.840	3	47	40.5
W9	6.58	7.850	2.802	.797	3	36	31.0

Note. W1 = week 1, W5 = week 5, w9 = week 9, total N = 116. a. List-wise deletion based on all variables in the procedure.

Table 4.6. Reliability Analysis on DB-Pros Item Based on Week 1 Data

Item	Mean	Std. Deviation	N	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
w1-50201. Smoking cigarettes relieves tension.	2.15	1.037	92	4.58	3.763	.519	.641
w1-50202. Smoking helps me concentrate and do better work.	1.93	1.067	92	4.8	3.704	.507	.653
w1-50203. I am relaxed and therefore more pleasant when smoking.	2.64	1.191	92	4.09	3.091	.576	.568

At last, the overall Cronbach's Alpha coefficients of Decisional Balance-cons scale (N of items = 3) were .446, .672, and .837 at weeks 1, 5, 9 respectively (See Table 4.7). Reliability analysis on each item is followed at Table 4.8. It is worth noting that the coefficient at week 1 is not satisfactory (Cronbach's Alpha = .446). The reliability analyses of self-efficacy, DB-pros, and DB-cons at week 5 and at week 9 are in Appendix A.

Table 4.7. Reliability Analysis on DB-Cons Based on Weeks 1, 5, 9 Data (Total N = 116)

Week #	Mean	Variance	Std. Deviation	Cronbach's Alpha	N of Items	Valid N	Valid %
W1	7.70	6.278	2.506	.446	3	91	78.4
W5	7.29	10.028	3.167	.672	3	45	38.8
W9	7.36	10.409	3.226	.837	3	36	31.0

Note. List-wise deletion based on all variables in the procedure.

Table 4.8. Reliability Analysis on DB-Cons Item Based on Week 1 Data

Item	Mean	Std. Deviation	N	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
w1-50204. I'm embarrassed to have to smoke.	2.11	1.069	91	5.59	3.844	.308	.301

Table 4.8 - *Continued*

w1-50205. My cigarette smoking bothers other people.	3.29	1.319	91	4.42	3.268	.266	.366
w1-50206. People think I'm foolish for ignoring the warnings about cigarette smoking.	2.31	1.236	91	5.40	3.575	.252	.387

4.3 Sample Description

The sample distribution will be described in its demographics, independent variables, and control variables. Sample distribution on dependent variable including stage of change, total nonsmoking days, number of nonsmokers, and stage movement will be analyzed with its related hypothesis testing so as to be more easily referenced.

4.3.1 Subjects

The subjects were all students enrolled in Tajen University (TJU) when this study started its intervention in Taiwan. Each of them had been found smoking on campus at least once and was identified with names and contact information by TJU staff. After being invited in phone calls by researcher, 116 were willing to participate in this study as subjects. After randomization, the number of subjects was 39, 39, and 38 in the experimental group, the control group A, and the control group B respectively. Sample's demographic distributions are listed in Table 4.9. Among them, 107 were male (92.2%) and 9 (7.8%) female (N = 116); 73 (62.9%) were at college level, 34 (29.3%) at junior college level, 2 (1.7%) at two-year institute level (valid N = 109); mean of age was 19.64 (SD = 1.337, valid n = 109), ranged from 16 to 22. Mean of smoking years was 4.45 (SD = 2.92), ranging from 0.17 to 13 years. On the multiple responses question "which method are you using for quitting smoking?"; 8 persons were trying the method of "reducing smoking amounts", 5 "chewing gum", 5 "not buying tobacco", and 1 "keeping self

busy", and 1 "controlling self". For the motive of participating in this study, a multiple responses question, 46 of 116 respondents gave their answers in which 31 (35.2%) were for personal health, 19 (21.6%) for saving money, 16 (18.2%) for other's health, 16 (18.2%) for the 200 dollars gift (compensation of this study).

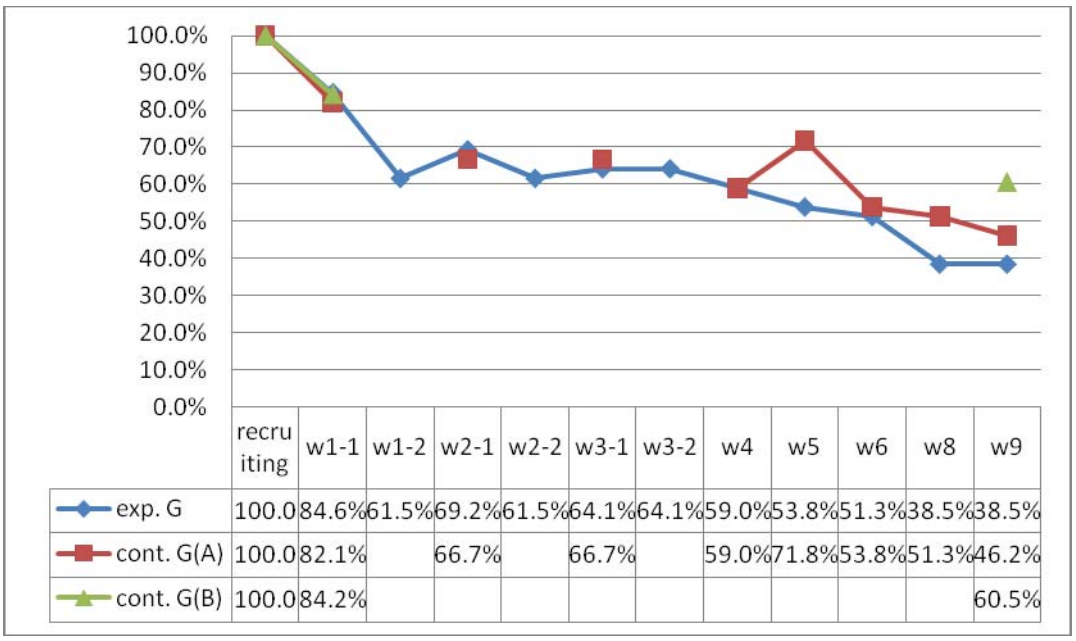
Table 4.9. Sample Distributions on Group, Gender, School, Grade, and Age (N = 116)

Variable	Values	Frequency	Percent	Valid Percent
Group	experimental group	39	33.6	33.6
	control group A	39	33.6	33.6
	control group B	38	32.8	32.8
Gender	male	107	92.2	92.2
	female	9	7.8	7.8
School	junior college	34	29.3	31.2
	college	73	62.9	67.0
	2-years institute	2	1.7	1.8
	Missing	7	6.0	
Grade	1	20	17.2	18.3
	2	39	33.6	35.8
	3	26	22.4	23.9
	4	19	16.4	17.4
	5	5	4.3	4.6
	Missing	7	6.0	
Age	16	1	.9	.9
	17	6	5.2	5.5
	18	13	11.2	11.9
	19	27	23.3	24.8
	20	37	31.9	33.9
	21	14	12.1	12.8
	22	11	9.5	10.1
	Missing	7	6.0	

4.3.2 Response Rate

The response rate here refers to the proportion of "the number of persons that have answered at least one question in the designated survey" compared to "the number of persons when being recruited within the same group". In this study, the response rate for each group was decreasing gradually after each test-by-test (see Figure 4.2). For the experimental group, the response rate was 84.6%, 53.8%, and 38.5% at weeks 1, 5, and 9; for the control group A it

was 82.1%, 71.8%, and 46.2% at weeks 1, 5, and 9; and for the control group B it was 84.2% and 60.5% at weeks 1 and 9 respectively, in order. On the other hand, when considering the response rate over the whole sample, using the number of persons at recruiting time points as 100% (116), it decreased to 92.2% (107) at the 1st week, and 48.3% (56) at week 9. Moreover, nine subjects never responded to the system throughout the whole process. Since the response rate serves as an indicator of sample attrition rate and may influence the estimation of effect size, this will be an important issue and will be further discussed in Chapter 5.



	recruiting	w1-1	w1-2	w2-1	w2-2	w3-1	w3-2	w4	w5	w6	w8	w9
exp. G	100.0	84.6%	61.5%	69.2%	61.5%	64.1%	64.1%	59.0%	53.8%	51.3%	38.5%	38.5%
cont. G(A)	100.0	82.1%		66.7%		66.7%		59.0%	71.8%	53.8%	51.3%	46.2%
cont. G(B)	100.0	84.2%										60.5%

Figure 4.2. Response Rate in Each Group at Each Test
Note. The time intervals on the horizontal axis are not equal with each other. Based on the most intensive measuring intervals in the experimental group, if the data at any time point was not collected in any other group, the lines between two neighboring data points were not drawn.

4.3.3 Exposure

Exposure serves as an important indicator of the degree the subject was actually exposed to the intervention or the system. The researcher started utilizing the WPI to deliver

calls to each subject from May 19 in 2010. The calls for each subject were initially designated in according to the research design and the subjects' schedules that they indicated. However, after one week, the researcher found that only 50% (58/116) of the sample had completed the 1st survey which meant the response rate for pretest was too low. Based on the rule of thumb that an experiment should maximize the difference between the experimental group and the control group by exposing the subjects in the experimental group to the maximum, therefore the researcher decided to identify the subjects who had not completed their surveys and created new schedules for them repeatedly until the week for that survey had ended. The reschedule activity occurred almost every other day. Fortunately, this method really helped raise the response rates for several weeks. In addition, to avoid the influence of human interference on the result, the researcher avoided making any phone call to any subject during this period. The whole intervention actually lasted for about 9 weeks starting from May 19 to Jul 23 in 2010.

Among the 633 valid calls, 475 (75.0%) were "call completed" representing that every question in the survey has been provided with an answer; 144 (22.7%) were "call disconnected"; and 14 (2.2%) were "stuck in voicemail" indicating that the call was picked up by either a person or a machine and that no other action was taken by the answerer. The other characteristics of exposure are listed in Table 4.10 such as the survey type of that call, its targeted group, week #, # of calls scheduled, and # of valid calls.

Table 4.10. Exposure Characteristics in Terms of Valid Calls

Survey Type	*Survey title*	*Targeted group*	*Week #*	*# of calls Scheduled*	*# of Valid calls*	*Percent in Valid calls*
Monthly Observation	cont-b-w1	All	1	116	129	20.4
Monthly Observation	cont-b-w5	Exp. G. & Cont. G (A)	5	78	67	10.6
Monthly Observation	cont-b-w9	All	9	116	95	15.0
Weekly check	wc-2	Cont. G (A)	2	39	27	4.3
Weekly check	wc-3	Cont. G (A)	3	39	26	4.1

Table 4.10 - *Continued*

Survey Type	*Survey title*	*Targeted group*	*Week #*	*# of calls Scheduled*	*# of Valid calls*	*Percent in Valid calls*
Weekly check	wc-4	Cont. G (A)	4	39	25	3.9
Intervention	week-1-1	Exp. G.	1	39	25	3.9
Intervention	week-1-2	Exp. G	1	39	28	4.4
Intervention	week-2-1	Exp. G.	2	39	31	4.9
Intervention	week-2-2	Exp. G	2	39	28	4.4
Intervention	week-3	Exp. G.	3	39	27	4.3
Intervention	week-4	Exp. G	4	39	25	3.9
Intervention	week-6	Exp. G.	6	39	29	4.6
Intervention	week-8	Exp. G	8	39	24	3.8
			Total	855	633	100.0

Note. For calculating exposure, a subject may be identified with more than one valid call in a survey. This is because the Teleherence system always validates whether one subject has completely answered all of the questions in a survey. If the survey is not completed, it will make another three attempts until completed. Besides, as mentioned previously, the researcher creating new schedules for those who had not completed the survey may also cause duplicated call records. For the purposes of data collection, the most complete survey results were used.

Table 4.11 lists the numbers of calls, items, and seconds in each group during two periods including weeks 1 to 5, and weeks 1 to 9. During the period from weeks 1 to 9, the mean number of calls (with SD and valid n) was 8.61 (SD = 5.18, n = 36) for the experimental group, 6.80 (SD = 3.50, n = 35) for the control group A, 2.35 (SD = 1.28, n = 34) for the control group B, and 4.13 (SD = 3.11, N = 105) for total sample.

Table 4.11. Sample Distribution on # of Calls, Items, and Seconds from Weeks 1 to 5 and 1 to 9 in Each Group

		Weeks 1 to 5			Weeks 1 to 9		
Group (n)	Statistics	Calls	Items	Secs	Calls	Items	Secs
Exp. G. (n = 36)	Mean	6.47	55.33	1036.75	8.61	71.81	1378.97
	SD	3.29	27.88	489.61	5.18	43.30	788.45
Cont. G. (A) (n = 35)	Mean	4.51	31.91	595.46	6.80	38.97	849.23
	SD	1.96	14.14	239.49	3.50	19.01	454.78
Cont. G. (B) (n = 34)	Mean	1.26	17.29	288.59	2.35	28.41	567.71
	SD	.67	9.81	129.74	1.28	18.49	356.14
Total (N = 105)	Mean	4.13	35.21	647.39	5.98	46.81	939.70
	SD	3.11	24.62	447.48	4.52	34.71	657.16

4.4 Hypothesis Testing

4.4.1 Testing Hypothesis 1. Equivalence between Groups at Pretest

Hypothesis 1-1: At week 1, there should be no significant difference between the experimental group and the control group on the average of total nonsmoking days, number of smoking years, self-efficacy, decisional balance-pros, and decisional balance-cons. ($O_{11} = O_{21} = O_{31,}$ one-way ANOVA)

The result is shown in Table 4.12. As mentioned, the TND question was answered by few subjects in each group ranging from 0 to 6 at each test. The total valid responses were 15 only, representing only 14.3% of 105 valid cases. The SDs of each group were very large, even larger than the mean. Besides, mean is very sensitive to the outliers and thus became very unstable here. Apparently, the TND became inappropriate to be a measure of outcome. Therefore, although the result of one-way ANOVA on the difference of TND means between three groups at week 1 was significant ($F = 4.498$, $df = 2, 12$, $p = .035 < .05$), it was ignored. The analysis of "improvement" based on stage of change was applied instead.

Table 4.12. One Way ANOVA on TND Means Difference between Three Groups at Week 1

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum	F	Sig.
experimental group	6	91.17	88.396	36.087	2	182	4.498	.035
control group A	6	30.17	45.305	18.496	1	120		
control group B	3	212.33	139.987	80.821	90	365		
Total	15	91.00	105.185	27.159	1	365		

The ANOVA test results are shown in Tables 4.13 and 4.14. The averages of the other variables in each group were all not significantly different from each other including the number

of smoking years (F = 1.290, df = 2, 40, p = .286, n = 43), self-efficacy (F = .999, df = 2, 95, p = .372, n = 98), decisional balance-pros (F = .008, df = 2, 90, p = .992, n = 93), and decisional balance-cons (F = 2.931, df = 2, 88, p = .059, n = 91).

Table 4.13. ANOVA Test on the Number of Smoking Years, SE, DB-Pros, and DB-Cons – Descriptives

Survey title	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
w1_SE	experimental group	35	22.71	7.626	1.289	20.09	25.33
	control group (A)	32	24.91	8.708	1.539	21.77	28.05
	control group (B)	31	25.32	8.064	1.448	22.36	28.28
	Total	98	24.26	8.130	.821	22.63	25.88
w1_DBpros	experimental group	32	6.63	3.139	.555	5.49	7.76
	control group (A)	31	6.71	2.209	.397	5.90	7.52
	control group (B)	30	6.67	2.695	.492	5.66	7.67
	Total	93	6.67	2.684	.278	6.11	7.22
w1_DBcons	experimental group	32	6.88	2.121	.375	6.11	7.64
	control group (A)	30	8.00	2.181	.398	7.19	8.81
	control group (B)	29	8.31	3.001	.557	7.17	9.45
	Total	91	7.70	2.506	.263	7.18	8.23
Smoking_yrs	experimental group	14	5.4643	3.66094	.97843	3.3505	7.5780
	control group (A)	14	3.8690	2.00881	.53688	2.7091	5.0289
	control group (B)	15	4.0333	2.80603	.72451	2.4794	5.5873
	Total	43	4.4457	2.92223	.44564	3.5464	5.3451

Table 4.14. ANOVA Test on the Number of Smoking Years, SE, DB-Pros, and DB-Cons

Survey title	Group	Sum of Squares	df	Mean Square	F	Sig.
w1_SE	Between Groups	131.987	2	65.993	.999	.372
	Within Groups	6278.636	95	66.091		
	Total	6410.622	97			
w1_DBpros	Between Groups	.113	2	.056	.008	.992
	Within Groups	662.554	90	7.362		
	Total	662.667	92			
w1_DBcons	Between Groups	35.282	2	17.641	2.931	.059
	Within Groups	529.707	88	6.019		

Table 4.14 - *Continued*

	Total	564.989	90			
Smoking_yrs	Between Groups	21.732	2	10.866	1.290	.286
	Within Groups	336.925	40	8.423		
	Total	358.657	42			

Hypothesis 1-2: At week 1, there should be no significant difference between the experimental group and the control group on the proportion of nonsmokers. ($O_{11} = O_{21} = O_{31}$, chi-square test)

As shown in Table 4.15, the test on the difference between the experimental group and the control group on the proportion of nonsmokers at week 1 was not significant, chi-square = .162, df = 2, p = .922, valid n = 97.

Table 4.15. Chi-Square Test on Proportion of Nonsmokers within Each Group at Week 1

Group	Statistics	Week1_Nonsmokers		Total
		Smoker	Nonsmoker	
experimental group	Count	27	6	33
	% within group	81.8%	18.2%	100.0%
control group A	Count	26	6	32
	% within group	81.3%	18.8%	100.0%
control group B	Count	25	7	32
	% within group	78.1%	21.9%	100.0%
Total	Count	78	19	97
	% within group	80.4%	19.6%	100.0%

Hypothesis 1-3: At week 1, there should be no significant difference between the experimental group and the control group on the proportion of stage of change. ($O_{11} = O_{21} = O_{31}$, chi-square test)

To further assure the equivalence between groups, the stage of change was also utilized to examine if there is any difference between different groups. The result in Table 4.16 indicates that there was no significant difference between the experimental group and the

control group on the proportion of stage of change, Chi-Square = 8.221, df = 8, p = .412 (two-sided). Although 9 cells (60.0%) have expected count less than 5, the valid sample size was 97 (that is larger than 40), therefore the Pearson's chi-square value was used.

Table 4.16. Equivalence between Groups on the Proportion of Stage of Change at Week 1

Group		1.Precontemplation	2.Contemplation	3.Preparation	4.Action	5.Maintenance	Total
experimental group	Count	22	4	1	1	5	33
	% within group	66.7%	12.1%	3.0%	3.0%	15.2%	100.0%
control group A	Count	16	8	2	3	3	32
	% within group	50.0%	25.0%	6.3%	9.4%	9.4%	100.0%
control group B	Count	12	11	2	3	4	32
	% within group	37.5%	34.4%	6.3%	9.4%	12.5%	100.0%
Total	Count	50	23	5	7	12	97
	% within group	51.5%	23.7%	5.2%	7.2%	12.4%	100.0%

To summarize the above results, the tests on the presumed equivalence between the experimental group and the control groups have all yielded consistent results that they were practically equivalent on all of the variables utilized. The only exception was total nonsmoking days, which was already identified as an inadequate measure for this research. In summary, the randomization has produced equivalence for future comparison between the three groups in terms of these variables.

4.4.2 Testing Hypothesis 2. Difference between Pre and Post Test on Self-Efficacy and Decisional Balance

Hypothesis 2-1: At week 5, the means of self-efficacy and decisional balance-pros in the experimental group will be significantly lower than those at week 1, while the

decisional balance-cons will be higher. (1 month effect: $O_{12} > O_{11}$, paired samples t-test)

Hypothesis 2-2: At week 9, the means of self-efficacy and decisional balance-pros in the experimental group will be significantly lower than those at week 1, while the decisional balance-cons will be higher. (1 month effect: $O_{13} > O_{11}$, paired samples t-test)

The paired samples t-test results are shown in Tables 4.17 and 4.18. Table 4.17 indicate that the correlation between the self-efficacy (SE) at week 1 and that at week 5 are significant (r = .657, p = .001) and the correlation between the self-efficacy at week 1 and that at week 9 are significant too (r = .599, p = .030). In Table 4.18, the paired samples means difference between week 1 and 5 on SE was significant, t = 3.574, df = 20, p = .002 < .01, n = 21. The average SE at week 5 (M = 20.24, SD = 7.52) was significantly lower than that at week 1 (M = 24.81, SD = 5.510) indicating the improvement of average self-efficacy of the subjects in the experimental group from weeks 1 to week 5 (means difference = 4.571, SD = 5.861, effect size = .78); and that between weeks 1 and 9 was also significant, t = 2.821, df = 12, p = .015 < .05, n = 13. The average SE at week 9 (M = 18.92, SD = 8.291) was significantly lower than that at week 1 (M = 24.81, SD = 5.510) indicating the improvement of average self-efficacy of the subjects in the experimental group from week 1 to week 9 (means difference = 5.231, SD = 6.685, effect size = .78). On the other hand, the paired samples means difference test between weeks 1 and 5 on decisional balance-pros (t = 1.125, df = 20, p = .274) and decisional balance-cons (t = .243, df = 20, p = .810) were not significant. The paired samples means difference test between weeks 1 and 9 on decisional balance-pros (t = .240, df = 12, p = .814) and decisional balance-cons (t = -.138, df = 12, p = .892) were not significant either.

Table 4.17. Descriptives and Correlation of Self-Efficacy and Decisional Balance-Pros between Weeks 1 and 5 and 9 in the Experimental Group

	Survey Title	Mean	N	Std. Deviation	Std. Error Mean	Correlation	Sig.
Pair 1	W1-SE	24.81	21	5.510	1.202	.657	.001
	W5-SE	20.24	21	7.752	1.692		
Pair 2	W1_DB-pros	7.38	21	3.324	.725	.394	.078
	W5_DB-pros	6.48	21	3.371	.736		
Pair 3	W1_DB-Cons	7.29	21	2.171	.474	-.091	.693
	W5_DB-Cons	7.10	21	2.663	.581		
Pair 4	W1-SE	24.15	13	5.757	1.597	.599	.030
	W9-SE	18.92	13	8.291	2.300		
Pair 5	W1_DB-pros	6.46	13	2.933	.813	.401	.174
	W9_DB-pros	6.23	13	3.370	.935		
Pair 6	W1_DB-Cons	6.92	13	2.397	.665	.063	.839
	W9_DB-Cons	7.08	13	3.378	.937		

Table 4.18. Means Difference of SE, DB-Pros, and DB-Cons between Weeks 1 and 5 and 9 in the Experimental Group

	Survey Title	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference				
					Lower	Upper			
Pair 1	w1-SE - w5-SE	4.571	5.861	1.279	1.903	7.240	3.574	20	.002
Pair 2	w1_DB-pros - w5_DB-pros	.905	3.687	.804	-.773	2.583	1.125	20	.274
Pair 3	w1_DB-cons - w5_DB-cons	.190	3.586	.783	-1.442	1.823	.243	20	.810

Table 4.18 - *Continued*

Pair 4	w1-SE - w9-SE	5.231	6.685	1.854	1.191	9.271	2.821	12	.015
Pair 5	w1_DB-pros - w9_DB-pros	.231	3.468	.962	-1.865	2.326	.240	12	.814
Pair 6	w1_DB-cons - w9_DB-cons	-.154	4.018	1.114	-2.582	2.274	-.138	12	.892

4.4.3 Testing Hypothesis 3. Difference between Groups on Self-Efficacy and Decisional Balance

Hypothesis 3-1: At week 5, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly lower than those of the control group A ($O_{12} < O_{22}$), while the decisional balance-cons will be higher. (one-month effect: $O_{12} \geq O_{22}$, independent sample t-test)

The independent sample t-test results indicate that the hypotheses were all rejected as shown in Tables 4.19 and 4.20. At week 5, none of the anticipated differences between the experimental group and the control group A was significant (for SE at week 5, t = -.177, df = 46, p = .860; for DB-pros at week 5, t = -.296, df = 45, p = .768; for DB-cons at week 5, t = -.263, df = 45, p = .794.), including self-efficacy, Mean of exp. G. = 20.24; SD = 7.752, Mean of cont. G(A) = 20.70, SD = 9.907, decisional balance-pros, Mean of exp. G = 6.48, SD = 3.371; Mean of cont. G(A) = 6.77, SD = 3.374, and decisional balance-cons, Mean of exp. G = 7.10, SD = 2.663; Mean of cont. G(A) = 7.35, SD = 3.655.

Table 4.19. Independent Samples t-test on SE, DB-Pros, and DB-Cons between Groups at Week 5

	Group	N	Mean	Std. Deviation	Std. Error Mean
w5-SE	experimental group	21	20.24	7.752	1.692
	control group A	27	20.70	9.907	1.907
w5_DB-pros	experimental group	21	6.48	3.371	.736
	control group A	26	6.77	3.374	.662
w5_DB-cons	experimental group	21	7.10	2.663	.581
	control group A	26	7.35	3.655	.717

Table 4.20. Independent Samples t-test on SE, DB-pros, and DB-cons between Groups at Week 5

	Levene's Test for Equality of Variances			t-test for Equality of Means						
	Equal variances assumed	F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference.	
									Lower	Upper
w5-SE	Yes	.664	.419	-.177	46	.860	-.466	2.628	-5.756	4.825
	Not			-.183	45.994	.856	-.466	2.549	-5.596	4.665
w5_DB-pros	Yes	.039	.845	-.296	45	.768	-.293	.990	-2.286	1.700
	Not			-.296	42.961	.769	-.293	.989	-2.288	1.702
w5_DB-cons	Yes	2.924	.094	-.263	45	.794	-.251	.954	-2.172	1.670
	Not			-.272	44.587	.787	-.251	.923	-2.110	1.608

Hypothesis 3-2: At week 9, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly lower than those of the control group A and B ($O_{12} < O_{22} < O_{33}$), while the decisional balance-cons will be higher. (two-month effect: $O_{13} > O_{23} > O_{33}$, one way ANOVA and Scheffé's post hoc test)

Similar with the t-test results at week 5, the ANOVA results at week 9 indicate that the hypotheses were all rejected as shown in Table 4.21 and Table 4.22. At week 9, none of the anticipated differences between the experimental group and the control group A and the control group B was significant, for SE at week 9, F = 2.280, p = .114, df = 2 ,44; for DB-pros at week 9, F =.251, p =.779, df = 2, 33; for DB-cons at week 9, F =.076, p =.927, df = 2, 33. For self-efficacy, Mean of exp. G = 18.92, SD = 8.291; Mean of cont. G(A) = 14.80, SD = 10.311; Mean of cont. G(B) = 22.05, SD = 10.384, for decisional balance-pros, Mean of exp. G = 6.23, SD =

3.370; Mean of cont. G(A) = 7.11, SD = 2.892; Mean of cont. G(B) = 6.57, SD = 2.277; and for decisional balance-cons, Mean of exp. G = 7.08, SD = 3.378; Mean of cont. G(A) = 7.56, SD = 3.779; Mean of cont. G(B) = 7.50, SD = 2.929.

Table 4.21.The Statistics of SE, DB-pros, and DB-cons at Week 9

Variable	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
w9-SE	experimental group	13	18.92	8.291	2.300	13.91	23.93
	control group A	15	14.80	10.311	2.662	9.09	20.51
	control group B	19	22.05	10.384	2.382	17.05	27.06
	Total	47	18.87	10.103	1.474	15.91	21.84
w9_DB-pros	experimental group	13	6.23	3.370	.935	4.19	8.27
	control group A	9	7.11	2.892	.964	4.89	9.33
	control group B	14	6.57	2.277	.609	5.26	7.89
	Total	36	6.58	2.802	.467	5.64	7.53
w9_DB-cons	experimental group	13	7.08	3.378	.937	5.04	9.12
	control group A	9	7.56	3.779	1.260	4.65	10.46
	control group B	14	7.50	2.929	.783	5.81	9.19
	Total	36	7.36	3.226	.538	6.27	8.45

Table 4.22. The Means Difference of SE, DB-pros, and DB-cons at Week 9

Variable	Group	Sum of Squares	df	Mean Square	F	Sig.
w9-SE	Between Groups	440.964	2	220.482	2.280	.114
	Within Groups	4254.270	44	96.688		
	Total	4695.234	46			
w9_DB-pros	Between Groups	4.125	2	2.062	.251	.779
	Within Groups	270.625	33	8.201		
	Total	274.750	35			
w9_DB-cons	Between Groups	1.660	2	.830	.076	.927
	Within Groups	362.645	33	10.989		
	Total	364.306	35			

4.4.4 Testing Hypothesis 4. Difference between Groups on Abstinence Rates

Hypothesis 4-1: At week 5, the means of TND in the experimental group will be significantly higher than that in the control group A. (one-month effect: $O_{12} > O_{22}$, independent sample t- test)

As discussed previously, the TND can only be applied to the sample in which most subjects' stages are at 4 and 5. When examining it in the data of this study, it was found that the number of subjects that can answer this question became continuously fewer at each week, ranging from 2 to 8 in either the experimental group or the control group A (see Table 4.23). Despite this restriction, the t-test was still implemented, and was compared at each week. The result shows that the difference of TND means at each week between the experimental group and the control group A was significant at week 6 only; all the rest were not (see Table 4.24). Since it was based on a small part of the total sample, it would be inappropriate to compare this with the hypothetical rising lines of TND of the three groups (in Figure 3.2) following each week.

Table 4.23. TND Statistics in Exp. G. and Cont. G(A) at Each Week

	Group	N	Mean	Std. Deviation	Std. Error Mean
w11_TND	experimental group	6	91.17	88.396	36.087
	control group A	6	30.17	45.305	18.496
w21_TND	experimental group	2	60.00	14.142	10.000
	control group A	3	70.00	70.000	40.415
w31_TND	experimental group	6	54.17	77.174	31.506
	control group A	2	36.50	9.192	6.500
w4_TND	experimental group	3	60.67	35.796	20.667
	control group A	5	59.00	70.014	31.311
w5_TND	experimental group	2	56.50	75.660	53.500
	control group A	4	150.75	160.994	80.497
w6_TND	experimental group	6	14.50	22.740	9.283
	control group A	2	125.00	35.355	25.000
w8_TND	experimental group	3	90.00	79.373	45.826
	control group A	1	110.00	.	.
w9_TND	experimental group	5	41.80	44.763	20.018
	control group A	5	81.80	103.941	46.484

Table 4.24. TND Means Difference Test between Exp. G and Cont. G(A) at Each Week

									Test for Equality of Means	
		Levene's Test for Equality of Variances							95% Confidence Interval of the Difference	
	Equal variances assumed	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
w11_TND	Yes	12.217	.006	1.504	10	.163	61.000	40.551	29.35	151.35
	No			1.504	7.457	.174	61.000	40.551	33.71	155.71
w21_TND	Yes	5.337	.104	.190	3	.862	-10.000	52.705	177.73	157.73
	No			.240	2.236	.830	-10.000	41.633	172.20	152.20
w31_TND	Yes	2.285	.181	.307	6	.769	17.667	57.603	123.28	158.62
	No			.549	5.386	.605	17.667	32.170	63.27	98.61
w4_TND	Yes	.659	.448	.038	6	.971	1.667	44.393	106.96	110.29
	No			.044	5.976	.966	1.667	37.517	90.22	93.56
w5_TND	Yes	1.345	.311	.753	4	.493	-94.250	125.111	441.61	253.11
	No			.975	3.933	.386	-94.250	96.654	364.41	175.91
w6_TND	Yes	.722	.428	5.353	6	.002	110.500	20.644	161.01	59.99
	No			4.144	1.290	.107	110.500	26.668	313.19	92.19
w8_TND	Yes	.	.	.218	2	.848	-20.000	91.652	414.35	374.35
	No			.	.	.	-20.000	.	.	.
w9_TND	Yes	13.182	.007	790	8	.452	-40.000	50.611	156.71	76.71
	No			.790	5.434	.462	-40.000	50.611	-167.03	87.03

Hypothesis 4-2: At week 9, the mean of TND in the experimental group will be significantly higher than that in the control group A; and that in the control group A will be significantly higher than that in the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, one-way ANOVA)

The same situation was found when testing hypothesis 4-2. At week 9, the number of valid cases in each group was 5, 5, 8 - that was very few of each group and the standard deviations for each group was even larger than the mean. The outlier, whose TND was 1000, also highly affected the mean of TND. These signals indicated that the TND was not an appropriate measure here. Therefore, the result is shown in Table 4.25 for reference but is not reported.

Table 4.25. ANOVA of TND Means Difference between the Three Groups at Week 9

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
experimental group	5	41.80	44.763	20.018	-13.78	97.38	7	120
control group A	5	81.80	103.941	46.484	-47.26	210.86	1	210
control group B	8	199.38	346.709	122.580	-90.48	489.23	2	1000
Total	18	122.94	240.196	56.615	3.50	242.39	1	1000

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	88119.469	2	44059.735	.740	.494
Within Groups	892677.475	15	59511.832		
Total	980796.944	17			

Hypothesis 4-3: At week 5, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A. (one-month effect: $O_{12} > O_{22}$, chi-square test)

Hypothesis 4-4: At week 9, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A ; and that of the control group A will be significantly higher than that of the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, chi-square test)

Table 4.26 shows the testing result of hypothesis 4-3 in which 2 cells (50.0%) have expected count less than 5, therefore Fisher's Exact Test was applied instead and found that the exact p (1-sided) was .498 > .05, valid n = 50. The null hypothesis was accepted that there was no difference between groups on the proportion of nonsmokers. A similar result was also found at week 9 that the differences between the three groups on proportion of nonsmokers at week 9 were not significant (chi-square = 1.403, df = 2, p = .496 > .05, valid n = 56, see Table 4.27).

Table 4.26. Difference between Two Groups on Proportion of Nonsmokers at Week 5

Group	Statistics	Smoker	Nonsmoker	Total
experimental group	Count	19	3	22
	% within group	86.4%	13.6%	100.0%
control group A	Count	23	5	28
	% within group	82.1%	17.9%	100.0%
Total	Count	42	8	50
	% within group	84.0%	16.0%	100.0%

Note. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.52.

Table 4.27. Difference between 3 Groups on Proportion of Nonsmokers at Week 9

Group	Statistics	Smoker	Nonsmoker	Total
experimental group	Count	13	2	15
	% within group	86.7%	13.3%	100.0%
control group A	Count	14	5	19
	% within group	73.7%	26.3%	100.0%
control group B	Count	19	3	22
	% within group	86.4%	13.6%	100.0%
Total	Count	46	10	56
	% within group	82.1%	17.9%	100.0%

Note. a: 3 cells (50.0%) have expected count less than 5. The minimum expected count is 2.68.

Both the two measures, TND and proportion of nonsmokers, were found to be unable to detect the difference between groups at each test due to the differences between the proposed and actual samples; the original scale “stage of change” was then applied. Both graphical and statistical approaches of analysis were utilized. The distribution of stages of change in each group is illustrated in Figures 4.3, 4.5, and 4.6 for comparison.

First, the proportions of the five stages of change in the experimental group at each test are illustrated in Figure 4.3. Three features were identified:

(1) The most salient characteristic was the lowering down trends of the stage 1 line, representing that the number of persons in stage 1 decreased from week 1 to week 3, rose up a little at week 4, decreased until week 6, and finally jumped back at week 8 and 9.

(2) In contrast to the stage 1 line, the stage 2 line gradually rose up and crossed over the stage 1 line with the first crossover occurring between week 3-1 and 3-2; the second crossover occurring between week 3-2 and 4; and the last crossover occurred between week 6 and 9. The crossover of two stage-lines may be interpreted as “stage movement” of a “group” of people toward quitting smoking between different stages (lines).

(3) The lines representing stages 3, 4, and 5 were all at the bottom of the figure indicating that the proportions of the three stages were not changing as obviously as the proportions of stage 1 and 2.

The first two features pointed out that the effect of this intervention was most obvious between stages 1 and 2, while the movements among the advanced stages (3, 4, 5) did not have sufficient time to occur yet. Since the proportion of certain stage may be inflated by missing cases, the frequency of each stage of change was also illustrated in Figure 4.4.

Comparing with Figure 4.3, the swinging of the stage 1 line was a little smaller in frequency but still existed. The more precise method in estimating effect size incorporating missing cases will be discussed further in Chapter 5.

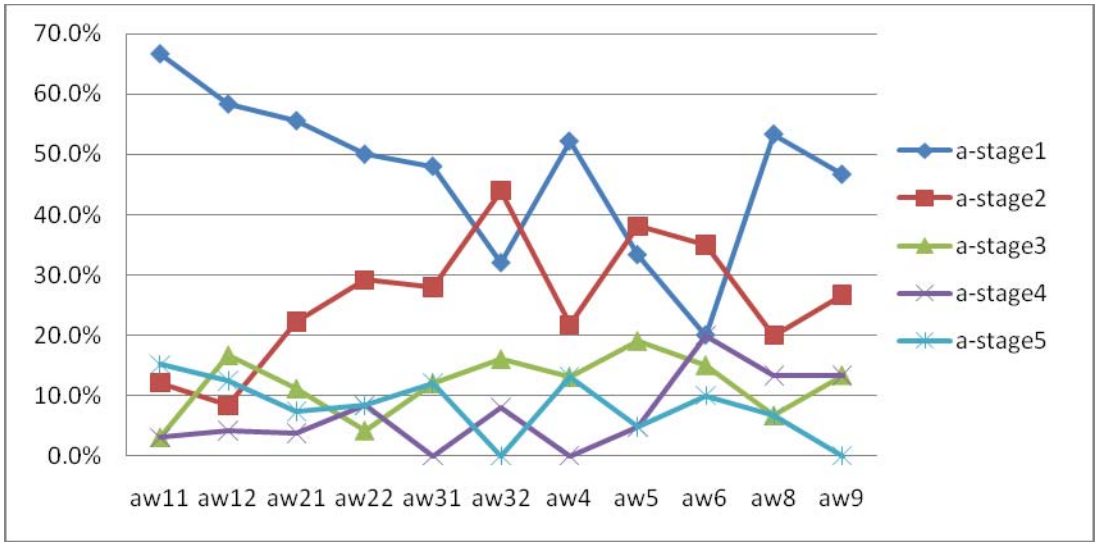


Figure 4.3. Proportion of Subjects at Each Stage in the Experimental Group

Notes:

(1) The time intervals on horizontal axis are not equal with each other.

(2) aw11: "a" represents the experimental group, "w" represents week, 11 represents the first week, first test. These rules apply to the other similar legends including aw12, aw21, aw22, etc.

(3) stage1: "a" represents the experimental group; "stage1' is the precontemplation stage of change; a-stage1 refers to the proportion of subjects who were at stage 1 at this time point within the experimental group. These rules apply to the other similar legends including a-stage2, a-stage3, a-stage4, a-stage5.

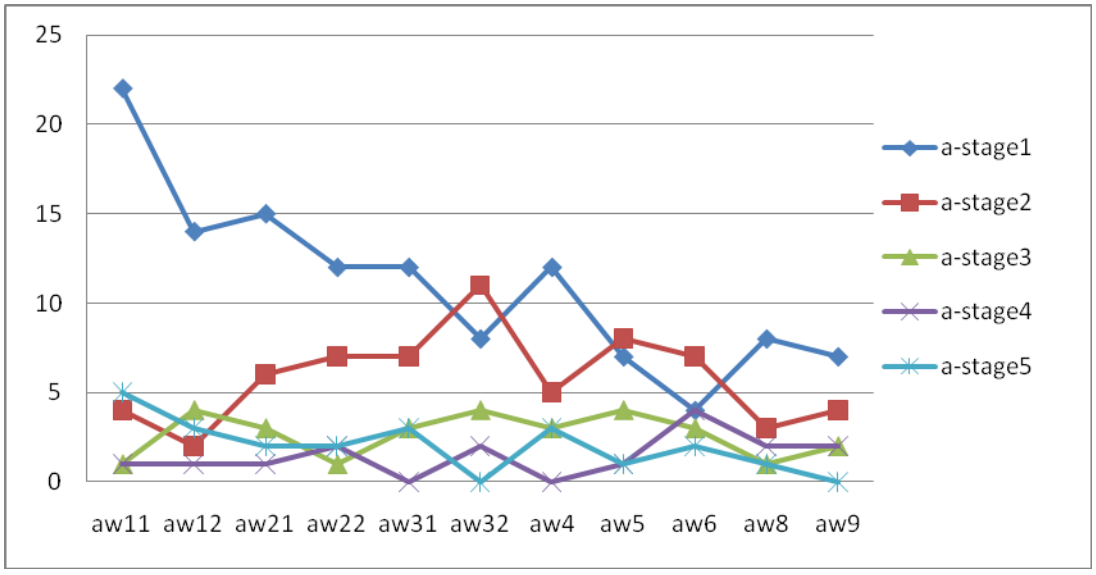


Figure 4.4. Frequency of Subjects at Each Stage in the Experimental Group
Note. The time intervals on horizontal axis are not equal with each other.

Figure 4.5 shows the proportion of subjects at each stage in the control group A. Obviously, the five lines representing five stages of change were all going horizontally without changing directions much through the 9 weeks. Although there was a little wave on stages 1, 2, and 4, at week 9 they came back very close to their baseline levels at week 1. Compared to the lines in the experimental group in Figure 4.3, the five lines in the control group A seemed not to have any apparent slope. Since the subjects in the control group A received the weekly check-up in which only a single question about stage of change was asked in each call at each survey", it implies that this type of service had no effect on promoting the progression. Nevertheless, it seemed to have prevented the regression of the subject's stage of change during the 9-week period.

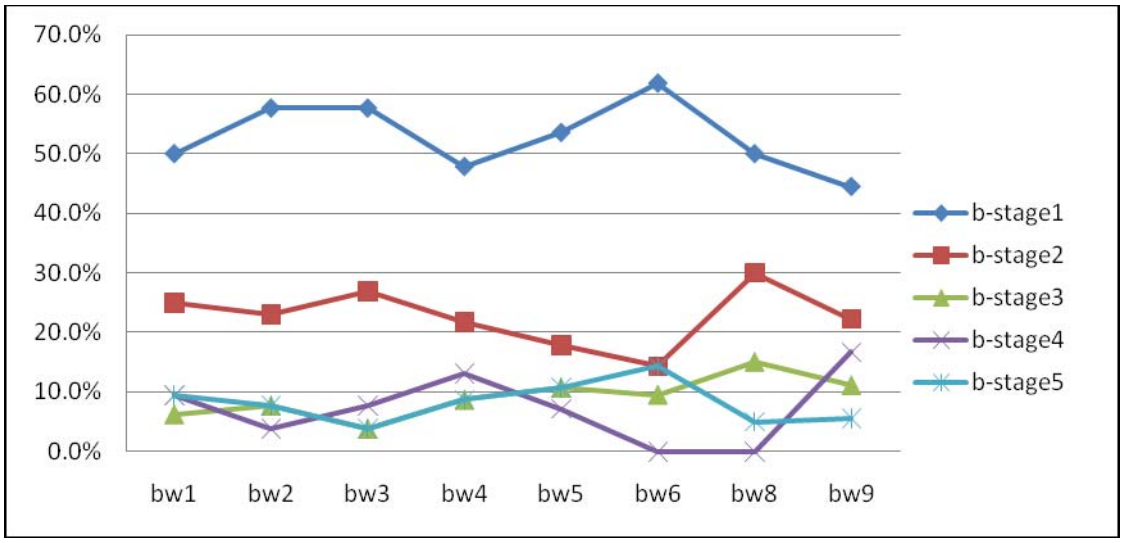


Figure 4.5. Proportion of Subjects at Each Stage in the Control Group A

Figure 4.6 shows the proportion of subjects at each stage in the control group B. The stage 1 line even raised up about 20% at week 9 compared to that at week 1; and the stage 2 line decreased about 10% at week 9 compared to that at week 1. The stage 4 line decreased to zero and stages 5 and 3 lines all remained unchanged. However, the subjects of the later three lines represented relatively smaller parts of the group.

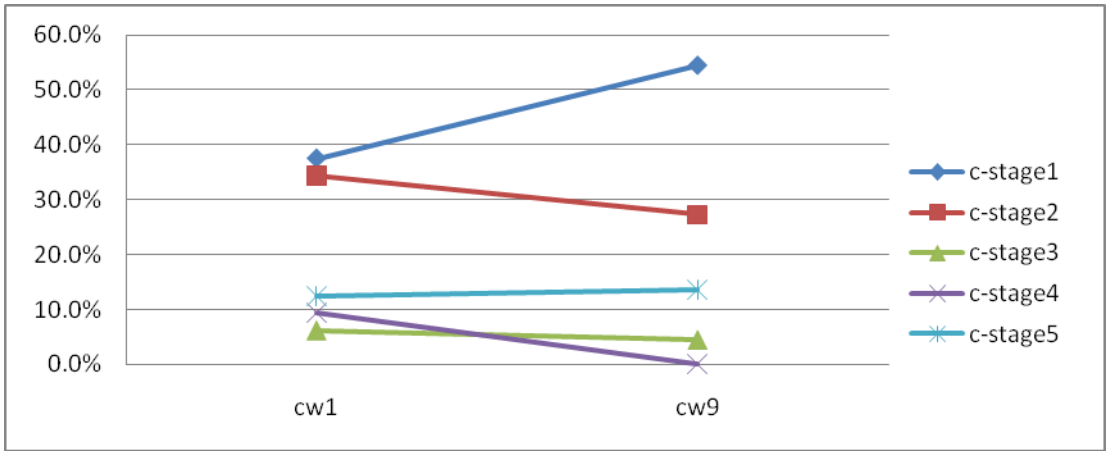


Figure 4.6. Proportion of Subjects at Each Stage in the Control Group B

By comparing Figures 4.3, 4.4, 4.5, and 4.6, an important finding was made. That is, the five lines, representing the proportion of subjects at five stages of change in one group, were going in different directions in different groups specifically for the stage-1 and stage-2 lines. In the experimental group, the stage-1 line was going down mostly while the stage-2 line was going up, and these two lines were crossing with each other 4 times during the 9-week process. In the control group A, the 5 lines went horizontally overall. In the control group B, the stage-1 line even rose up and stage-2 line went down indicating the subjects were getting worse without any intervention. In terms of stage of change, three levels of effects were matched to describe the three groups below.

(1) Better Effect. The effect in the experimental group can be termed as "better effect" because the subjects were moving from stage-1 to stage-2 mostly and else.

(2) Stable Effect. The effect in the control group A can be termed as "stable effect" because the subjects were not changing much through week 1 to 9.

(3) Worse Effect. The effect in the control group B can be termed as "worse effect" because the subjects were even getting into a worse situation.

This finding visually supports the findings that the experimental group changed positively, the control group A stayed the same, while control group B got worse. The statistical approach will be applied later using the variable "improvement" which was recoded from the difference of stage of change between two time points.

4.4.5 Testing Hypothesis 5. Difference between Groups on Improvement

Hypothesis 5-1: At week 5, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A. (one-month effect: $O_{12} > O_{22}$, chi-square test)

Hypothesis 5-2: At week 9, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A and the control group B. (two-month effect: $O_{13} > O_{23} > O_{33}$, chi-square test)

In this study, the stage movements were calculated two times between the pretest at week 1, and posttest at weeks 5 and 9 respectively. To understand better what the figures mean, the percentage that is larger than 5% is highlighted in bold. Overall, more than half of the total sample stayed at the same stage when it had been one month (55.3% at week 5), or two months (64.8% at week 9) (see Table 4.28). The second and third highest proportions all emerged at the area of positive stage movement. This is more obvious when illustrated in bar chart in Figure 4.7. Except for the bars located at "0", most of the rest were distributed at the area of positive stage movement. However, this analysis is not for the test of precise intervention effect yet because it is still based on the unit of total sample combining all of the three groups. The test of precise intervention effect will be examined later using group membership.

Table 4.28. Stage Movement Frequency at Weeks 5 and 9 (Valid n = 47, 54)

	Weeks 1 to 5			Weeks 1 to 9		
Stage movement	Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
-4	0	0	0	1	.9	1.9
-3	2	1.7	4.3	1	.9	1.9
-2	0	0	0	0	0	0
-1	2	1.7	4.3	4	3.4	7.4
0	26	22.4	55.3	35	30.2	64.8
1	10	8.6	21.3	6	5.2	11.1
2	4	3.4	8.5	3	2.6	5.6
3	2	1.7	4.3	3	2.6	5.6
4	1	.9	2.1	1	.9	1.9
Sub-total	47	40.5	100.0	54	46.6	100.0
Missing	69	59.5		62	53.4	
Total	116	100.0		116	100.0	

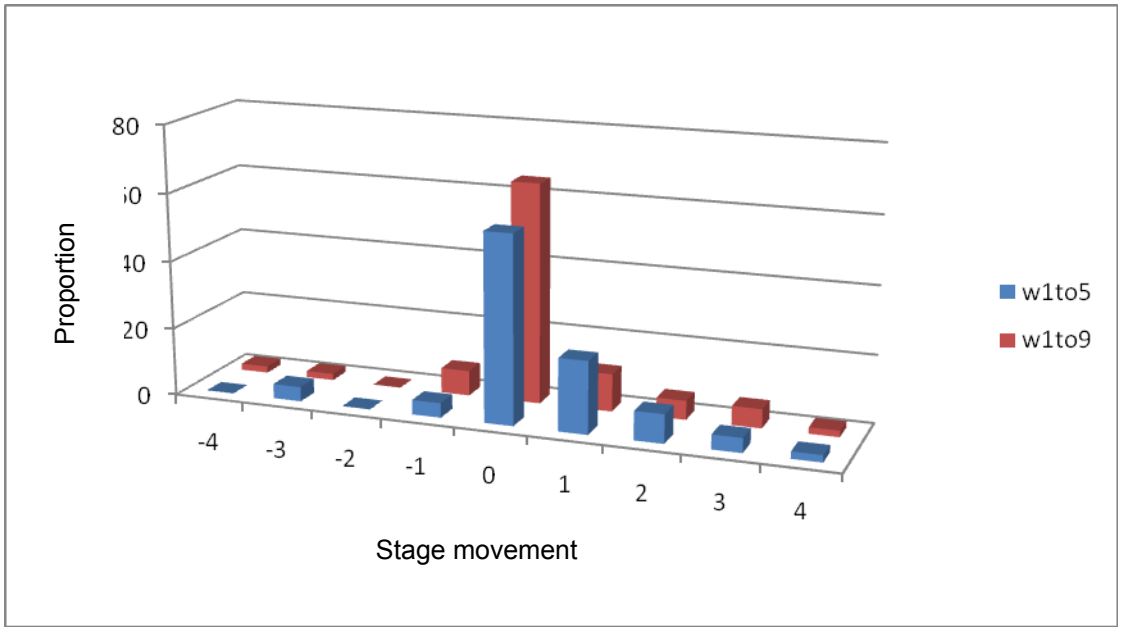


Figure 4.7. Proportional Bar Chart of Stage Movement at Week 5 and 9
Note. The bars in the front of the graph represent the stage movement proportions from weeks 1 to 5.

Since the number of subjects at each stage movement value were relatively small resulting in lower statistical power, the values of stage movements were further collapsed into two types including (1) improved, representing positive stage movement (moving forward) values from 1 to 4, and (2) unimproved, representing negative stage movement values or staying at the same stage from -4 to 0 (moving backward or unchanged).

Between weeks 1 and 5, the “improved” proportion of subjects, who transitioned forward in the experimental group was 54.5 %, much greater than that of the control group A (20.0%), chi-square = 6.049, df = 1, p = .014 < .05, n = 47 (see Table 4.29). Since the minimum expected count in one cell is 7.96, and one of them is 5, the Fisher's Exact Test was also referenced, where p = .015 < .05 (one-sided). The results were to reject the null hypothesis. To further examine the strength of relationship between them, the index of predictive association

coefficient lambda was applied but was insignificant (lambda = .231, p = .250 > .05). Figure 4.8 clearly illustrates the proportions difference between these two groups in bar chart.

Table 4.29. Proportions Difference of Improved vs. Unimproved between Weeks 1 and 5

Group	Statistics	Improved	Unimproved	Total
Experimental group	Count	12	10	22
	% within group	54.5%	45.5%	100.0%
Control group a	Count	5	20	25
	% within group	20.0%	80.0%	100.0%
Total	Count	17	30	47
	% within group	36.2%	63.8%	100.0%

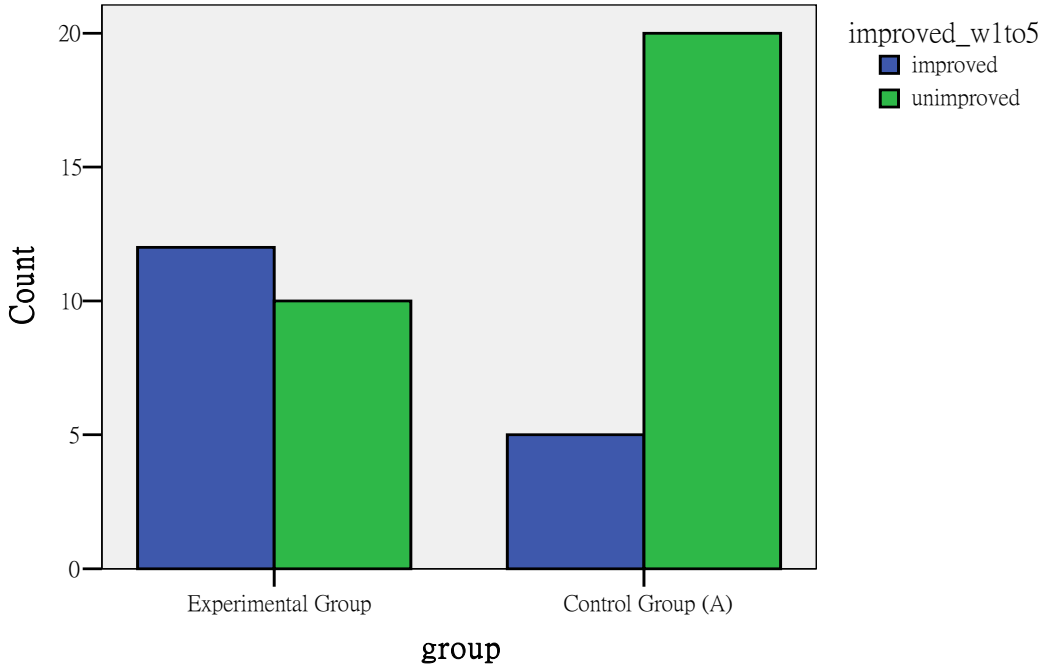


Figure 4.8. Bar Chart of Improvement in Two Groups from Weeks 1 to 5
Note. The bar of proportion of "improved" in each group is at the left side of the reader.

Looking at Figure 4.9, the proportion of improved subjects in a group was largest in the experimental group, then the control group A, followed by the control group B. The "improved" and "unimproved" proportions of subjects from weeks 1 to 9 in each group are listed in Table

4.30. Between weeks 1 and 9, although the “improved” proportion of subjects in the experimental group was decreasing to 40 %, the control group A 22.0%; and the control group B 14%, the test for proportions difference between the experimental group and the control group A, and the control group B on improvement from weeks 1 to week 9 was not significant, Chi-Square = 3.216, df = 2, p = .200, n = 54. Since 2 cells had expected count less than 5. Fisher's Exact Test was applied, p = .579 > .05.

Table 4.30. Proportions on Stage-movement from Weeks 1 to 9

Group	Statistics	Improved	Unimproved	Total
Experimental group	Count	6	9	15
	% within group	40.0%	60.0%	100.0%
Control group a	Count	4	14	18
	% within group	22.2%	77.8%	100.0%
Control group b	Count	3	18	21
	% within group	14.3%	85.7%	100.0%
Total	Count	13	41	54
	% within group	24.1%	75.9%	100.0%

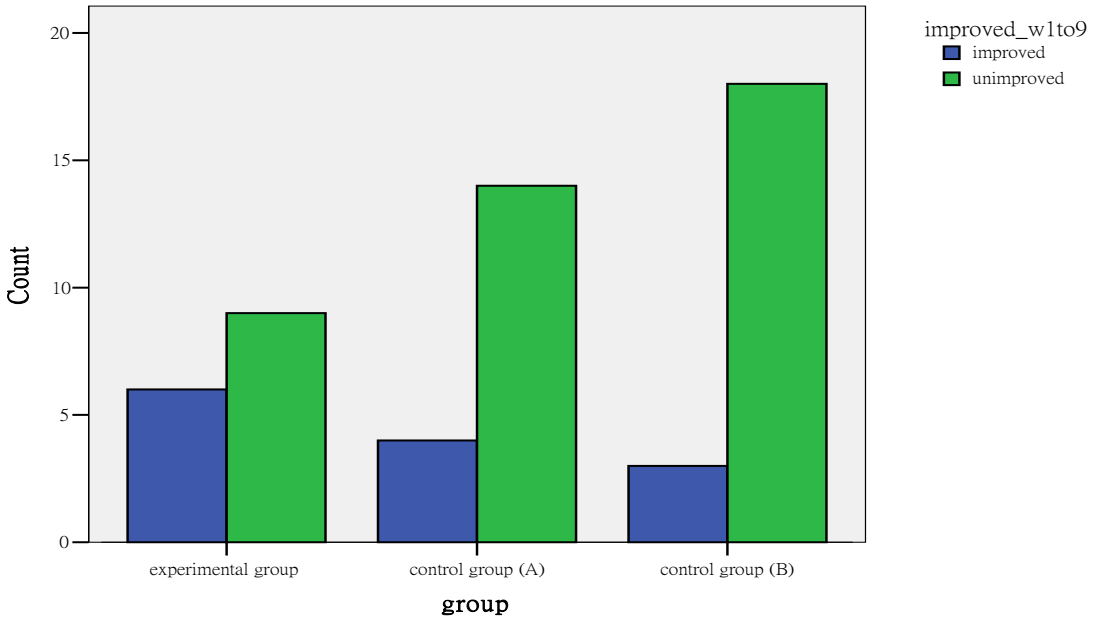


Figure 4.9. Bar Chart of Improvement in Each Group from Weeks 1 to 9
Note. The bar of proportion of “improved” in each group is at the left side of the reader.

Similar with the effect between weeks 1 and 9, the result was also found on the effect between weeks 5 and 9. Table 4.31 shows the “improved” and “unimproved” proportions of subjects from weeks 5 to 9 in the experimental group and in the control group A. Between weeks 5 and 9, the proportion of “improved” subjects was 13.3 % and 5.6% in the experimental group and the control group A, respectively. However, the chi-square test on the difference between them was not significant (chi-square = .599, df = 1, n = 33, p = .439 > .05. Since two cells had expected count less than 5, Fisher's Exact Test was applied, p = .579 > .05). Figure 4.10 shows the subtle difference on the frequency of “improved” subjects between these two groups.

Table 4.31. Proportions of Improvement from Weeks 5 to 9

Group	Statistics	Improved	Unimproved	Total
Experimental group	Count	2	13	15
	% within group	13.3%	86.7%	100.0%
Control group a	Count	1	17	18
	% within group	5.6%	94.4%	100.0%
Total	Count	3	30	33
% within group	9.1%	90.9%	100.0%	

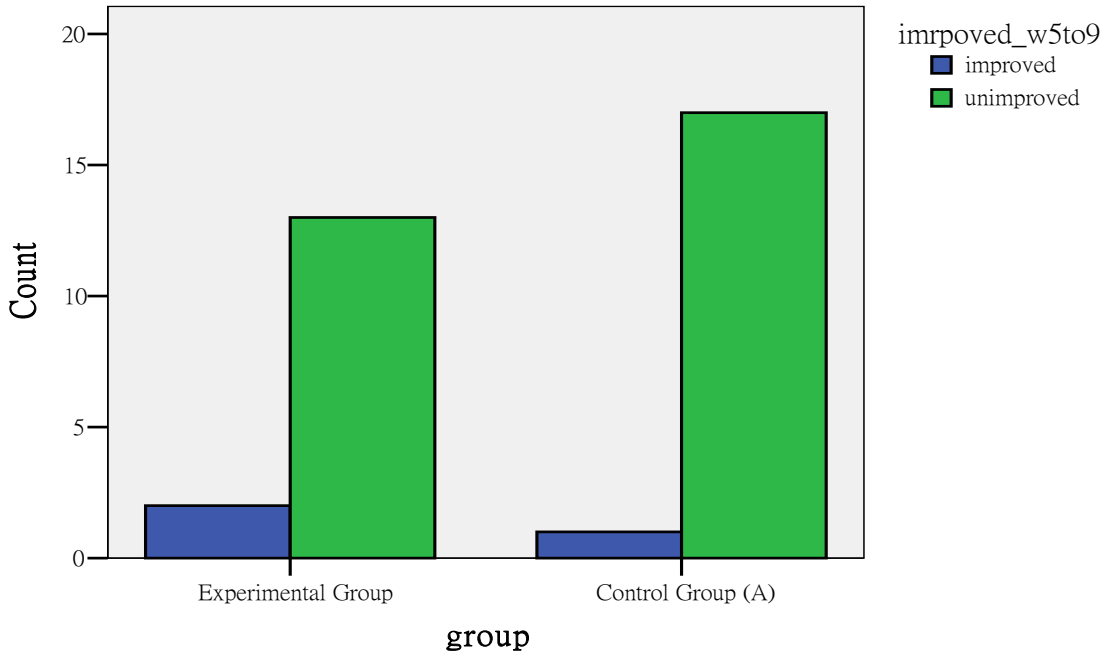


Figure 4.10. Bar Chart of Improvement in Two Groups from Weeks 5 to 9
Note. The bar of proportion of "improved" in each group is at the left side of the reader.

4.4.6 Testing Hypothesis 6. Difference between the "Improved" and "Unimproved" Groups on Exposure

Hypothesis 6-1: At week 5, the "improved" group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 5, compared to the "unimproved" group. (Independent sample t-test)

Hypothesis 6-2: At week 9, the "improved" group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 9, compared to the "unimproved" group. (Independent sample t-test)

The above hypotheses were analyzed using all of the call records that contained at least one valid answer from subjects. The test results for difference between the "improved" group and "unimproved" group on the number of calls, items, or seconds from weeks 1 to 5

were all not significant (see Table 4.32). The results for weeks 1 to 9 were similar (see Table 4.33). None of the exposure measures was significantly related with the subject's improvement on stage of change between weeks 1 and 9.

Different from the other hypotheses, this series of hypothesis broke the designated boundaries between groups and used "improvement" to classify the subjects into different groups. Thus, the "non-significant difference" results indicated that no matter which group the subject belonged to, the difference between improved and unimproved subjects did not come from their degrees of exposure to the WPI.

Table 4.32. Difference between the "Improved" Group and "Unimproved" Group on the # of Calls, Items, or Seconds from Weeks 1 to 5

	Improved_w1to5	N	Mean	Std. Deviation	T	Df	Sig. (2-tailed)	Mean Difference
Calls	Improved	17	7.35	2.396	1.195	45	.238	.786
	Unimproved	30	6.57	2.029				
Items	Improved	17	61.76	22.410	1.757	45	.086	10.798
	Unimproved	30	50.97	18.949				
Secs	Improved	17	1134.00	430.736	1.784	45	.081	202.233
	Unimproved	30	931.77	337.611				

Table 4.33. Difference between the "Improved" Group and "Unimproved" Group on the # of Calls, Items, or Seconds from Weeks 1 to 9

	Improved_w1to9	N	Mean	Std. Deviation	T	Df	Sig. (2-tailed)	Mean difference
Calls	Improved	13	9.00	4.983	1.037	52	.304	1.561
	Unimproved	41	7.44	4.648				
Items	Improved	13	69.46	37.664	.835	52	.407	9.413
	Unimproved	41	60.05	34.708				
Secs	Improved	13	1428.15	758.308	1.068	52	.290	222.178
	Unimproved	41	1205.98	618.490				

4.4.7 Testing Hypothesis 7. Prediction for Subject's Improvement

Hypothesis 7-1: At week 5, a best prediction model for subject's improvement can be formed by the variables in this study. (Logistic regression)

4.4.7.1 Evaluation of Assumptions of Logistic Regression at Week 5

Six practical issues are recommended to be examined before running the logistic regression analysis (Tabachnick & Fidell, 2001, pp. 521-523, 551-559). The evaluation of six assumptions and the corresponding revising are listed below.

(1) Ratio of cases to variables. Too few cases relative to the number of predictor variables may yield many problems. It was found that one category of "school" variable, 2-years institute, contained only 1 case. The solution was to collapse this category with another similar category "college". Thus, the new variable named "school_2cat" with two categories replaced the "school".

(2) Adequacy of expected frequencies and power. If the expected frequencies for all pairs of discrete are too small, the analysis may have little power. This was solved after collapsing the categories of school. No two-way table has more than 20% of the cells having frequencies less than 5, and no expected frequencies were less than one.

(3) Linearity in the logit. To test this assumption, the linearity should be formed by the interaction of continuous variable and its natural log. However, the two significant predictors, including group and school at week 5 were all dichotomous variables and thus no need to check on this issue.

(4) Absence of multicollinearity. When analyzing week 5 data, the two dummy variables, school (1) representing junior college, and school (2) representing college were found to have exceedingly large standard errors, which was a

signal of multicollinearity. This issue was also solved by collapsing the categories of school. Besides, the three types of variables measuring exposure were also found with exceedingly high correlation coefficients of Pearson's r of .8. To avoid overlapping in meaning, and to keep the core variable for practical use, the "item" was considered as more useful and was kept in this analysis.

(5) Absence of outliers in the solution. Two outliers (client numbers = b119, b188) were identified by computing the standard residuals of each subject. They were filtered before implementing the analysis of logistic regression.

(6) Independence of errors. The levels of outcome measure, "improvement" for each subject, is independent from repeated measure error or matched case-control error, because neither was the improvement of each subject within group a repeated measure, nor was each subject assigned to the three groups with matching approach. Therefore, this issue did not exist in this analysis.

After revision based on the evaluation of assumptions, the logistic regression was implemented again and results are shown below.

4.4.7.2 Significance Tests for Each Predictor at Week 5

The data for this analysis is based on the surveys collected from week 1 to week 5 where only the experimental group and the control group A were completely measured, while the control group B was only measured at week 1 and thus was excluded from this analysis. The first step of logistic regression is to establish the relationship between variables (Tabachnick & Fidell, 2001, p. 519). To find the relationship, all the variables in this study were all entered into the prediction model including the demographic variables (group, gender,

school, grade, age, smoking years, participating motive), SE (w5), DB-pros (w5), DB-cons (w5), and exposure (calls, items, seconds) to predict the classification of "improvement". However, it was found that the number of valid cases became zero because none of the subjects had all of the answers on the listed variables (see Appendix B for the valid n in each variable). This issue had restricted the possibility to predict outcome with all of the variables simultaneously. Therefore, the variables with fewer responses were removed from this model. Then, the individual variables were tested for their relationship with the improvement as shown in Table 4.34. Non-significant coefficients of Score values were produced for exposure (calls, items, seconds), SE, DB-pros, and DB-cons at week 5. The only successful predictors were "group" and "school". That is, the improved and unimproved subjects differed only in their group memberships and school types. As a result, these two variables were recruited to predict the improvement.

Table 4.34. Relationship between Individual Variables and Improvement at Step 0 at Week 5

Variable	Score	df	Sig.	Variable	Score	df	Sig.
Group(1)	4.325*	1	.038	W5_se	1.249	1	.264
School	7.156*	2	.028	W5_db-pros	.404	1	.525
School(1)	4.780*	1	.029	W5_db-cons	.356	1	.551
School(2)	6.720*	1	.010	Calls_w1to5	.626	1	.429
Gender(1)	.008	1	.929	Items_w1to5	2.253	1	.133
Grade	.275	1	.600	Secs_w1to5	2.249	1	.134
Age	1.866	1	.172				

Note. W5_SE = Self-efficacy at week 5; w5_DB-pros = Decisional Balance pros at week 5; w5_DB-cons = Decisional Balance cons at week 5; calls_w1to5, the items_w1to5, and secs_w1to5 represented the numbers of calls, items, and seconds from week 1 to 5, respectively. * $p < .05$

At week 5, 42 subjects (36.2% of 116) were available for analysis in which 20 were in the experimental group and 22 were in the control group A. The sample was split into 20 improved and 24 unimproved subjects. Since the three variables including school, group, and

improvement were all categorical, they were all converted into dummy variables. Table 4.35 shows the coded values and frequencies of each variable.

Table 4.35. Variables, Coding Values, and Frequencies

Variables	Value	Frequency	Parameter coding
School_2categories	junior college	10	1
	college	32	0
Group	experimental group	20	1
	control group A	22	0
Improvement	improved	14	0
	unimproved	28	1

At step 0 of logistic regression analysis, the Wald test for constant as the only predictor was significant, Wald = 4.484, df =1, p = .034 < .05, the Exp(B) or the Odds Ratio was 2.0, indicating that the constant-only model can reliably predict the improvement. On the other hand, the tests for relationships between the improvement and individual predictors “group(1)” (Score = 8.066. df = 1, p = .005 < .01) and “school_2cat(1)” (Score = 7.941, df = 1, p = .005 < .01) were all significant.

4.4.7.3 Assessing Goodness-of-fit of Models at Week 5

The Omnibus Tests of Model Coefficients (table omitted), which compares the two models between the constant-only model and the full model with two predictors, were significant, χ^2 = 23.219, df = 2, n = 42, p = .000 < .001, confirming that the group and school as a set reliably predicts improvement. The -2 Log likelihood is 30.248, Cox & Snell R Square = .425, and Nagelkerke R Square = .590 indicating that the strength of association between the set of predictors and improvement are at medium level. That is, approximately 42.5% to 59.0% of variance of improvement can be explained by the predictors “group” and “school”.

At step 1, using the two predictors group and school to assess the goodness-of-fit of this model, the Hosmer and Lemeshow Test was applied and was not significant; Chi-square =

.000, df = 2, p = 1 > .05. This indicated that there was a perfect fit between current and perfect models, in that the two predictors as a set can reliably predict the outcome.

To know how well this model can predict the classification of outcome variable, the Classification Tables of step 0 and step 1 were compared. Table 4.36 shows the results of classifying all cases with predicted values above .5 as 0 (improved) and all cases below as 1 (unimproved). At step 0, the constant was used to predict the improvement and the total correctness rate was 66.7%. At step 1 predicting with group and school_2cat, of the subjects, who were improved, 28.6% were correctly classified by the model; of those who were unimproved, 100.0% were correctly classified by the model. Overall, 76.2% of subjects can be correctly predicted by the set of variables, much better than the constant-only model of 66.7%.

Table 4.36. Combined Classification for Steps 0 and 1 at Week 5

		Predicted		
	Observed	Improved	Unimproved	Percentage Correct
Step 0	improved	0	14	.0
	unimproved	0	28	100.0
	Overall Percentage			66.7
Step 1	improved	4	10	28.6
	unimproved	0	28	100.0
	Overall Percentage			76.2

Note.

(1) Step 0: Constant-only model.
(2) Step 1: An incomplete model in which group and schoold_2cat are predictors.
(3) The cut value is .500

4.4.7.4 Parameter Estimates at Week 5

To estimate the influence degree of the two predictors in the equation at Step 1, the SPSS provides the Wald test as shown in Table 4.37. However, the statistics for group and school were aberrant in which their Wald values were all zero (df = 1) and the significance probability were all .998 (close to 1). This type of Wald test result has been pointed out as misleading when testing of a single parameter in the binomial logit model in which the test

statistic would decrease to zero as the distance between the parameter estimate and null value increases; the likelihood-ratio test or other large sample tests would be recommended instead (Hauck & Donner, 1977).

Table 4.37. Variables in the Logistic Regression Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	group(1)	-21.006	8980.673	.000	1	.998	.000
	school_2cat(1)	-21.257	8980.673	.000	1	.998	.000
	Constant	21.257	8980.673	.000	1	.998	1705223669.956

Note. Variable(s) entered on step 1: group, school_2cat.

In order to get a better picture for the relationship between the predictors and outcome variables, a chi-square test was supplemented to explore the relationship between "school" and "improvement" since they were all dichotomous. The result was helpful in understanding this fact. In Table 4.38, the chi-square test between school_2cat and improvement at week 5 was significant ($\chi^2 = 7.941$, df = 1, $p = .005 < .01$, n = 42). Looking into the percentages in the cells, the junior college students tended to be improved (70.0%) while the college students tended to be unimproved (78.1%). The Odds ratio was 8.32, which meant that the junior college student was 8.32 times more likely to be improved at week 5 compared to those college students. According to Rosenthal (2001, p. 118), this is considered as a "strong" strength of relationship. In addition, an elaboration model analysis is often recommended for this type of analysis, which is formed of several dichotomous variables. It would be ideal to inspect the relationship in different groups. However, the results did not advance the knowledge on this fact because the numbers of valid cases in several cells were close to zero (Tables omitted).

Table 4.38. Chi-Square Test between School_2cat and Improvement at Week 5

			Improved_w1to5		Total
			Improved	Unimproved	
school_2cat	junior college	Count	7	3	10
		% within school_2cat	70.0%	30.0%	100.0%
	college	Count	7	25	32
		% within school_2cat	21.9%	78.1%	100.0%
Total		Count	14	28	42
		% within school_2cat	33.3%	66.7%	100.0%

To summarize the results of logistic regression analysis based on week 5 data, the two predictors “group” and “school” as a set was found to be able to reliably predict the subject’s improvement on stage of change at week 5. The prediction correctness rate was 76.2%; better than that of the constant-only model at 66.7%.

Hypothesis 7-2: At week 9, a best prediction model for subject’s improvement can be formed by the variables in this study. (Logistic regression)

4.4.7.5 Evaluation of Assumptions of Logistic Regression at Week 9

All the data collected from week 1 through week 9 was analyzed with logistic regression analysis using the same procedure as described in section hypothesis 7.1. This time, 52 cases (44.8% of 116) were available for analysis. The variables, which were found significantly related with the outcome “improvement” were “age” and “school” (see Table 4.39). The six assumptions of logistic regressions were then tested with these two variables. Multicollinearity issue was found because the correlation coefficients between the two variables and their interaction were as high as or around .81. This was understandable because their meanings were overlapping in which one of the main difference among different school types was age. Then, the solution was to delete one of them. Since continuous scale would support analysis that is more powerful and provide more detailed information than a dichotomous scale, thus the decision was to keep the

"age" in the model and delete "school". Therefore, the "age" was used as the only predictor to predict the subject's improvement at week 9 compared to that at week 1. The other five assumptions were also tested and no problem was found.

Table 4.39. Relationship between Individual Variables and Improvement At Step 0 at Week 9

Variable	Score	df	Sig.	Variable	Score	df	Sig.
Age	8.256*	1	.004	School	6.237*	2	.044
Group	1.327	2	.515	School(1)	6.071*	1	.014
Group(1)	.961	1	.327	School(2)	4.418*	1	.036
Group(2)	.019	1	.891	Items_w1to9	.006	1	.940
Gender(1)	1.163	1	.281	Overall statistics	13.813	7	.055

4.4.7.6 Significance Tests for Each Predictor at Week 9

The "improved" was coded as "0" while "unimproved" as "1'. At step 0, in which constant was the only predictor, the unstandardized regression coefficient was significant (B = 1.316, standard error = .340, Wald =15.013, df = 1, p = .000, Exp(B) = 3.727. On the other hand, the regression coefficient of "age" was also significant with Score value of 8.256, df = 1, p = .004 < .01.

4.4.7.7 Assessing Goodness-of-fit of Models at Week 9

The Omnibus Tests of Model Coefficients (table omitted), which compares the two models between the constant-only model and the full model with two predictors, were significant, χ^2 = 8.903, df = 1, n = 52, p = .003 < .01, confirming that age as a set reliably predicts improvement at week 9. However, the Cox & Snell R Square = .157 and Nagelkerke R Square = .244 indicate that the strength of association between age and improvement was quite low. That is, approximately 15.7% to 24.40% of variance of improvement at week 9 can be explained by the predictor "age".

At step 1, the predictor in the model was age. To assess the goodness-of-fit of this model, the Hosmer and Lemeshow Test was applied and no significant difference was found,

Chi-square = 2.171, df = 4, p = .704 > .05, indicating that there was no significant difference between observed and expected models, in that the predictor as a set can reliably predict the outcome.

Table 4.40 shows the combined Classification Table for steps 0 and 1 at week 9. At step 0, the predicted correctness was 78.8%. At step 1, of the subjects who were improved, 27.3% were correctly classified by the model; of those who were unimproved, 97.6% were correctly classified by the model. Overall, 82.7% of subjects can be correctly predicted by the set of variables. With the predictor "age', the prediction model indicated a better success rate at 82.7% than that of constant-only model at 78.8%.

Table 4.40. Combined Classification for Steps 0 and 1 at Week 9

		Predicted		
	Observed	Improved	Unimproved	Percentage Correct
Step 0	improved	0	11	.0
	unimproved	0	41	100.0
	Overall Percentage			78.8
Step 1	improved	3	8	27.3
	unimproved	1	40	97.6
	Overall Percentage			82.7

Note.
(1) Step 0: Constant-only model.
(2) Step 1: An incomplete model in which group and school_2cat are predictors.
(3) The cut value is .500

4.4.7.8 Parameter Estimates at Week 9

At step 1, the regression coefficient of age was also significant, B = .793, S.E. = .305, Wald = 6.750, df = 1, p = .009, Exp(B) = 2.209 (see Table 4.41).

Table 4.41. Variables in the Equation at Week 9

		B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C. I. for Exp(B)	
								Lower	Upper
Step 1	age	.793	.305	6.750	1	.009	2.209	1.215	4.017
	Constant	-13.869	5.762	5.794	1	.016	.000		

Note. Variable(s) entered on step 1: age.

To summarize the results of logistic regression analysis based on the data from week 1 to week 9, the single predictor “age” as a set was found to be able to reliably predict the subject’s improvement on stage of change at week 9 compared to that at week 1. The prediction correctness rate was 82.7%; better than that of the constant-only model at 78.8%.

CHAPTER 5

DISCUSSION

One hundred and sixteen college student smokers were recruited from a university located in southern Taiwan in May of 2010. They were randomly assigned to the three groups of this study to receive different combinations of intervention, check-up, and observation calls for 9 weeks. The tests of equivalence between groups indicated that they were practically equivalent on all of the variables and thus provided equal levels of baseline at pretest for comparisons at posttests. This chapter will discuss the findings to answer the revised research questions in the beginning. The other issues to be discussed will be the effect size and statistical power; research design; sample source and attrition; measurement; and agency capacity to incorporate IT solutions in their work patterns. After discussing these, it is expected that this study may contribute its efforts to make further steps above the current knowledge background by identifying the lessons learned and the issues unsolved.

5.1 The Revised Research Questions

The overarching research question for this study is "Is the WPI effective or not in preventing smoking relapse behavior? If yes, how strong is it, and what influences its effectiveness?" In detail, six concrete questions were proposed. The discussions of the findings are provided to answer these questions below.

Question 1. Can the WPI improve the subjects' self-efficacy (SE), decisional balance-pros (DB-pros), and decisional balance cons (DB-cons) better than that in the beginning?

Stated briefly, "yes" for SE at weeks 5 and 9, and "no" for DB-pros and DB-cons at weeks 5 and 9. Within the experimental group, the paired samples difference between weeks 1

and 5 on the means of SE was significant, t = 3.574, df = 20, p = .002 < .01, n = 21; and that between weeks 1 and 9 was also significant, t = 2.821, df = 12, p = .015 < .05, n = 13. A medium effect size of 0.78 was found in each t-test results. The paired samples means difference test between weeks 1 and 5 on decisional balance-pros (t = 1.125, df = 20, p = .274) and decisional balance-cons (t = .243, df = 20, p = .810) were not significant. The paired samples means difference test between weeks 1 and 9 on decisional balance-pros (t = .240, df = 12, p = .814) and decisional balance-cons (t = -.138, df = 12, p = .892) were not significant either. The paired samples t-tests on the means difference between weeks 1 and 5 and 9 on decisional balance-pros and decisional balance-cons were all not significant.

Compared with the meta-analysis result of 92 web-based interventions with overall mean weighted effect size of .53 (medium effect)(Barak, et al., 2008), this study has produced a much higher effect size of .78 if using self-efficacy as the outcome measure. This effect size is also larger than the average effect sizes of traditional face-to-face therapy. Overall, the hypotheses that the subjects in the experimental group will improve on self-efficacy either at one-month or at two-month posttest were supported. On the other hand, the hypothesis that the subjects in the experimental group will improve their DB-cons and decrease DB-pros at one-month or at two-month posttest were all rejected, and the p-values were all very far from the significance level of .05.

Question 2. Can a 4-week exposure to the WPI reduce the client's smoking relapse behavior? In other words, is there any difference on SE, DB-pros, DB-cons, and smoking behavior between those who received the web-phone smoking cessation intervention for 4 weeks and those who did not?

In addition to the pre and posttest comparison within group above, the SE, DB-pros, and DB-cons were also compared between different groups at weeks 5 and 9. However, at

week 5, none of the anticipated differences between the experimental group and the control group A was significant (for SE at week 5, t = -.177, df = 46, p = .860; for DB-pros at week 5, t = -.296, df = 45, p = .768; for DB-cons at week 5, t = -.263, df = 45, p = .794.) Similar results were found at week 9 that none of the anticipated differences between the experimental group and the control group A and the control group B was significant (for SE at week 9, F = 2.280, p = .114, df = 2 ,44; for DB-pros at week 9, F = .251, p = .779, df = 2, 33; for DB-cons at week 9, F = .076, p = .927, df = 2, 33). The hypotheses regarding the difference between groups on the means of SE, DB-pros, and DB-cons at weeks 5 and 9 were all rejected. The p-values were also very far from the significance level of .05. This result initiated an additional valued question that "Did the self-efficacy of subjects in the control group A also improve at week 5 and at week 9?" To answer this question, additional pair samples t-tests were implemented.

Tables 5.1, 5.2, and 5.3 indicate that the paired samples difference between weeks 1 and 5 on self-efficacy mean of the control group A was significant (for the pair of w1_SE & w5_SE, r = .505, p = .009 < .01; t = 2.392, df = 25, p = .025, n = 26). The self-efficacy mean of the control group A was also improved between weeks 1 and 9 (for the pair of w1_SE & w9_SE, r = .274, p = .344; t = 3.542, df = 13, p = .004, n = 14). This finding suggests a "measurement" effect due to the WPI calling to collect data. That is, just calling subjects weekly and asking about smoking behavior had an impact. On the contrast, the mean of DB-cons in the control group A at week 5 was found significantly lower than that at week 1 (for the pair of w1_DB-cons & w5_DB-cons, r = .712, p = .000; t = 2.672, df = 23, p = .014, n = 24), indicating that the mean of DB-cons became worse at week 5 than that at week 1. The paired samples t-test on DB-pros between weeks 1 and 9, and DB-cons between weeks 1 and 5 and that between weeks 1 and 9, were not significant. These results in control group A provide explanations for why the

proposed differences on SE, DB-pros, and DB-cons between the experimental group and the control group A at week 5 and at week 9 were all not significant.

Table 5.1 Paired Samples t-test on SE, DB-pros, and DB-cons -- Descriptives

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	w1_SE	25.46	26	9.056	1.776
	w5_SE	21.00	26	9.980	1.957
Pair 2	w1_SE	26.36	14	8.491	2.269
	w9_SE	15.79	14	9.940	2.656
Pair 3	w1_DB-pros	6.83	24	2.180	.445
	w5_DB-pros	6.63	24	3.321	.678
Pair 4	w1_DB-cons	8.17	24	2.057	.420
	w5_DB-cons	6.88	24	3.340	.682
Pair 5	w1_DB-pros	6.33	9	1.871	.624
	w9_DB-pros	7.11	9	2.892	.964
Pair 6	w1_DB-cons	8.33	9	2.291	.764
	w9_DB-cons	7.56	9	3.779	1.260

Table 5.2 Paired Samples t-test on SE, DB-pros, and DB-cons – Correlations

		N	Correlation	Sig.
Pair 1	w1_SE & w5_SE	26	.505	.009
Pair 2	w1_SE & w9_SE	14	.274	.344
Pair 3	w1_DB-pros & w5_DB-pros	24	.832	.000
Pair 4	w1_DB-cons & w5_DB-cons	24	.712	.000
Pair 5	w1_DB-pros & w9_DB-pros	9	.270	.483
Pair 6	w1_DB-cons & w9_DB-cons	9	.250	.516

Table 5.3. Paired Samples t-test on SE, DB-pros, and DB-cons

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	S.E Mean	95% CI of the Difference				
					Lower	Upper			
Pair 1	w1_SE - w5_SE	4.462	9.509	1.865	.621	8.302	2.392	25	.025
Pair 2	w1_SE - w9_SE	10.571	11.168	2.985	4.123	17.020	3.542	13	.004
Pair 3	w1_DB-pros - w5_DB-pros	.208	1.933	.395	-.608	1.025	.528	23	.603

Table 5.3 – *Continued*

Pair 4	w1_DB-cons - w5_DB-cons	1.292	2.368	.483	.292	2.292	2.672	23	.014
Pair 5	w1_DB-pros - w9_DB-pros	-.778	2.991	.997	-3.077	1.521	-.780	8	.458
Pair 6	w1_DB-cons - w9_DB-cons	.778	3.898	1.299	-2.218	3.774	.599	8	.566

At last, it might be interesting to know if the same situation occurred in the control group B. Additional paired samples t-test results showed that their SE, DB-pros, and DB-cons between weeks 1 and 9 were not significantly different (for the pair of w1_SE & w9_SE, t = 1.465, df = 18, p = .160; for the pair of w1_DB-pros & w9_DB-pros, t = -.111, df = 13, p = .913; for the pair of w1_DB-cons & w9_DB-cons, t = .779, df = 13, p = .450).

To synthesize and summarize the answers for Questions 1 and 2, the WPI improved the subjects' self-efficacy (SE) at week 5 and at week 9 both for the experimental group by delivering the intervention calls, and for the control group A by delivering the weekly check-up calls. However, the WPI did not reduce the decisional balance-pros (DB-pros), and did not increase the subject's decisional balance-cons (DB-cons) at week 5 and at week 9 compared to those at week 1 for either the experimental group or the control group A. These results indicated that the "weekly check-up" improved the SE but not DB-pros and DB-cons either at week 5 or at week 9. The significant improvement on SE between weeks 1 and 5, and that between weeks 1 and 9 further affirmed the causal-effect relationship between the experimental contents and effects. That is, the effects existed only in the experimental group, in which subjects received "intervention" calls, and in the control group A, in which subjects received "check-up" calls, rather than the control group B, in which subjects received "no intervention or checkup call".

Based on the improvements of SE at weeks 5 and 9 in the two groups, the next step was to examine the results on the outcome measure using stage of change. To evaluate the effectiveness of smoking cessation program, the two measures, total nonsmoking days (TND)

and number of nonsmokers in a group, were found inappropriate because the nonsmokers in each group were still few at weeks 5 and 9. In addition, the difference tests at weeks 5 and 9 on “number of nonsmokers in a group” and TND were all not significant. Therefore, the “stage of change” and “improvement”, were applied since they can detect more precisely the effect of this intervention within the two-month period.

Utilizing the visual approach based on “stage of change”, the pictures of the five lines, representing the proportion of subjects at five stages of change in each group in the Figures 4.3, 4.5, and 4.6 were compared. An important finding was made that the three figures illustrated different meanings in each group specifically on the stage-1 and stage-2 lines. In terms of stage of change, this finding visually support that the experimental group changed positively, the monitoring the control group A stayed the same, while the control group B got worse. The figure in each group can be categorized into three levels of effect including getting “better, stable, and worse”. These are described below.

(1) Better effect. In the experimental group, the stage-1 line was going down while the stage-2 line was going up, and these two lines were crossing with each other four times during the 9-week process. The picture in the experimental group can be termed as “better effect” because the subjects were mostly moving from stage-1 to stage-2 from weeks 1 to 9.

(2) Stable effect. In the control group A, the 5 lines went horizontally overall. The picture in the control group A can be termed as “stable effect” because the subjects were not changing much through weeks 1 to 9.

(3) Worse effect. In the control group B, the stage-1 line even rose up and stage-2 line went down indicating the subjects were getting worse without

any intervention. The picture in the control group B can be termed as “worse effect” because the subjects were even getting into a worse situation.

On the other hand, the statistical approach using “improvement” was utilized to calculate the effect sizes or odds ratios of being “improved” between different groups at the same period. Since the improvement is in proportion, the appropriate method to calculate effect size would be odds ratio (OR). According to Rosenthal (Rosenthal, 2001, p. 116),

OR = odds for first group / odds for second group

The “effect size” in this study was calculated by “dividing the odds of being improved in the first group by the odds in the other group at the same period”. In terms of odds ratio (OR), the one-month effect size of intervention with intensive schedule was the OR of being improved between weeks 1 and 5. The two-month effect size of intervention was the OR of being improved between weeks 1 and 9. The one-month effect size of intervention with tapering schedule was the OR of being improved between weeks 5 and 9. These odds ratios were calculated from the data in Table 4.27, Table 4.28, and Table 4.29 respectively, as shown in Table 5.4.

Table 5.4. Odds Ratios of “Improved” between Weeks 1, 5, and 9

	One-month effect with intensive schedule (weeks 1 to 5)	One-month effect with tapering schedule (weeks 5 to 9)	Two-month effect (weeks 1 to 9)
Odds of experimental group (OG1)	1.1978 (n = 22)	.1534 (n = 15)	.6667 (n = 15)
Odds of the control group A (OG2)	.25 (n = 25)	.0593 (n = 18)	.2853 (n = 18)
Odds of the control group B (OG3)	----	----	.1669 (n = 21)
Odds ratio (OG1/OG2)	4.80* ($\chi2$ = 6.049, df = 1, p = .014 < .05, n = 47)	2.59 ($\chi2$ = .599, df = 1, p = .439, n = 33)	2.33 ($\chi2$ = 1.224, df = 1, p = .269, n = 33)

Table 5.4 - *Continued*

Odds ratio (OG1/OG3)	----	----	4.00 ($\chi 2$ = 3.086, df = 1, p = .079, n = 36)
Odds ratio (OG2/OG3)	----	----	1.71 ($\chi 2$ = .415, df = 1, p = .52, n = 39)

Note.

(1) The chi-square test was significant at one-month effect size only, while the others were not. * $p < .05$
(2) Missing cases were not included.
(3) Odds = the proportion of "improved" compared to the proportion of "unimproved" in a group.
(4) OR = odds for first group / odds for second group
(5) ---- = not applicable

Since the three groups were found equivalent on the study variables at week 1, the different contents that were delivered from WPI became main factors to explain why there were differences between groups after being exposed to the WPI for one month and for two months. The ratio of odds of being improved for any above pair of groups would be the size of that effect or "difference". According to the revised research design (Table 4.1), the difference between the experimental group and the control group A was "intervention (X)"; the difference between the experimental group and the control group B was "intervention (X) and checkup (C)"; the difference between the control group A and the control group B was "checkup (C)". These differences were calculated for their effect sizes as shown in Table 5.4.

In Table 5.4, the chi-square test was significant at the period between weeks 1 and 5 only, while the others (between weeks 5 and 9 and between weeks 1 and 9) were not. By keeping this limitation in mind, it would be useful to discover what differences the WPI made in different groups. The effect sizes are listed below.

(1) Effect size of one-month intervention with intensive schedule. Since the odds for the experimental group subjects to be improved were 1.1978 and the odds for the control group A subjects were .25, the odds ratio was 4.8 ($\chi 2$ =

6.049, df = 1, p = .014 < .05, n = 47). That is, after one-month intervention with intensive schedule, the odds for a subject to be improved in the experimental group between weeks 1 and 5 are 4.8 times more likely than are those in the control group A. OR of 4.8 between 4 and 10 is considered as a “large” size of association or “strong” strength of association.

(2) Effect size of one-month intervention with tapering schedule. This was measured at the period between weeks 5 and 9, by comparing the odds difference between the experimental group and the control group A. The effect size measured was 2.59 (medium size), however, the chi-square test was not significant ($\chi 2 = .599$, df = 1, p = .439, n = 33). That is, after a one-month intervention with tapering schedule, the odds for smokers in experiment group to be improved was 2.59 times more than those in the control group A.

(3) Effect size of two-month intervention. This was measured at the period between weeks 1 and 9. Two types of comparison were calculated. First, the comparison of the odds between the experimental group and the control group A was OG1/OG2 = 2.34 (small size); the chi-square test was not significant ($\chi 2 = 1.224$, df = 1, p = .269, n = 33). In other words, after a one-month intervention with an intensive schedule plus a one-month intervention with a tapering schedule, the odds for smokers in the experiment group to be improved were 2.34 times more likely than those in the control group A. Second, the comparison of the odds between the experimental group and the control group B was OG1/OG3 = 4.0 (Large size); the chi-square test was not significant ($\chi 2 = 3.086$, df = 1, p = .079, n = 36). In other words,

after two-month intervention, the odds for smokers in experiment group to be improved was 4.0 times more likely than those in the control group B, but this result was not significant.

(4) Effect size of two-month check-up. This was measured at the period between weeks 1 and 9 by comparing the odds difference between the control group A and the control group B. The OR was OG2/OG3= 1.71 (small size); the chi-square test was not significant ($\chi 2$ = .415, df = 1, p = .52, n = 39). That is, after receiving 2 months of check-up calls, the smokers in the control group A were 1.71 times more likely to be improved than those in the control group B between weeks 1 and 9. Thus, there was a small, non-significant effect due to the WPI weekly measurement questions.

The OR is generally interpreted in terms of the size of association in which if the odds ratios larger than 1 are used, then OR of 1.5 is small; OR of 2.5 is medium; OR of 4 is large; OR of 10 is very large (Rosenthal, 2001, p. 118). To summarize the effect sizes of the WPI in terms of the OR of subjects for being improved on stage of change scale:

(1) after a one-month intervention with an intensive schedule between weeks 1 and 5, the smokers in the experimental group were 4.8 times more likely to be improved than those in the control group A (OR = 4.8, large size of association, p = .014 < .05);

(2) after a one-month intervention with a tapering schedule, the smokers in the experiment group were 2.59 times more likely to be improved than those in the control group A (OR = 2.59, medium size of association, p = .439);

(3) after a one-month intervention with an intensive schedule plus a one-month intervention with a tapering schedule, the smokers in the experiment group

were 2.34 times more likely to be improved than those in the control group A (OR = 2.34, medium size of association, p = .269).

(4) after a two-month intervention, the smokers in the experiment group were 4.0 times more likely to be improved than those in the control group B (OR = 4.0, large size of association, p = .079).

(5) after receiving 2 months of check-up calls between weeks 1 and 9, the smokers in the control group A were 1.71 times more likely to be improved than those in the control group B (OR = 1.71, small size of association, p = .52).

It is recommended that when interpreting the OR, the chi-square test result should accompany any interpretation. In this study, the chi-square test result was significant only for the one-month effect with the intensive schedule, while the others were not significant. Overall, based on the subject's improvement on stage-of-change, either the effect of a one-month intervention or checkup with intensive schedule was all evident, but the other effects were not supported including the effect of a two-month intervention, the effect of a two-month check-up, and the effect of a one-month intervention with a tapering schedule. The latter findings were not surprising, because the subjects' relapse behavior or the tapering-off of intervention effect is always deemed as normal as depicted in the Transtheoretical Model. The optimum schedule of automated interventions to reduce the tapering-off effect would be a knowledge gap for researchers to endeavor on in the future.

At last, the effect size and statistical power for each research hypothesis are calculated and listed in Table 5.5. In addition to the outcome measure of "improvement", the effect on self-efficacy and decisional balance could be deemed as the main areas where the intervention can influence the outcome according to the research framework. In terms of self-efficacy, the effect

size calculated from t-test was .78 for either week 5 (n = 21) or at week 9 (n = 13), indicating that the subjects in the experimental group had moderately better self-efficacy than those in the control group A at both one month and two months. For DB-pros and DB-cons, the effects were not significant either at week 5 or at week 9.

Table 5.5. Hypothesis, Effect Size, and Observed Power

Hypothesis	Statistical tests	Measure	n	Effect size	Observed power
1-1: At week 5, the means of self-efficacy and decisional balance-pros in the experimental group will be significantly lower than those at week 1, while the decisional balance-cons will be higher.	1 month effect: O12 > O11, paired samples t-test	SE, DB-pros, DB-cons	48, 47, 47	.78 (for SE)	.964
1-2: At week 9, the means of self-efficacy and decisional balance-pros in the experimental group will be significantly lower than those at week 1, while the decisional balance-cons will be higher.	1 month effect: O13 > O11, paired samples t-test	SE, DB-pros, DB-cons	13	.78 (for SE) N.S. for DB-pros & DB-cons	.842
2-1: At week 5, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly higher than those of the control group A (O12 < O22), while the decisional balance-cons will be lower.	one-month effect: O12 ≥ O22, independent sample t-test	SE, DB-pros, DB-cons	48, 47, 47	N.S.	N.S.
2-2: At week 9, the means of self-efficacy and decisional balance-pros of the experimental group will be significantly higher than those of the control group A and B, while the decisional balance-cons will be lower.	two-month effect: O13 > O23 > O33, one way ANOVA	SE, DB-pros, DB-cons	47, 36, 36	N.S.	N.S.

Table 5.5 - *Continued*

3-1: At week 5, the means of TND in the experimental group will be significantly higher than that in the control group A.	one-month effect: O12 > O22, independent sample t-test	TND	15,5,8,8,6,8,4,10	N.S.	N.S.
3-2: At week 9, the mean of TND in the experimental group will be significantly higher than that in the control group A; and that in the control group A will be significantly higher than that in the control group B.	two-month effect: O13 > O23 > O33, one-way ANOVA	TND	18	N.S.	N.S.
3-3: At each week, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A.	one-month effect: O12 > O22, chi-square test	proportion of nonsmokers		N.S.	N.S.
3-4: At week 9, the proportion of nonsmokers of the experimental group will be significantly higher than that of the control group A ; and that of the control group A will be significantly higher than that of the control group B.	two-month effect: O13 > O23 > O33, chi-square test	proportion of nonsmokers	56	N.S.	N.S.
4-1: At week 5, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A.	one-month effect: O12 > O22, chi-square (one-tailed)	improvement	47	4.8	.796
4-2: At week 9, the proportion of improved subjects of the experimental group will be significantly higher than that in the control group A and control group B.	two-month effect: O13 > O23 > O33, chi-square test	improvement	36, 39	OG1/OG3 = 4.0 OG2/OG3 = 1.71	N.S.

Table 5.5 - *Continued*

5-1: At week 5, the "improved" group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 5, compared to the "unimproved" group.	Independent sample t-test	calls, items, or seconds	47	N.S.	N.S.
5-2: At week 9, the "improved" group of subjects has higher means of the calls, items, or seconds on using the system during the period from weeks 1 to 9, compared to the "unimproved" group.	Independent sample t-test	calls, items, or seconds	54	N.S.	N.S.
6-1: At week 5, a best prediction model for subject's improvement can be formed by the variables in this study.	Logistic regression	improvement	42	Exp(B) for group & school were not applicable by Wald's test.	Total correctness rate = 76.2%
6-2: At week 9, a best prediction model for subject's improvement can be formed by the variables in this study.	Logistic regression	improvement	52	Exp(B) for age = 2.209	Total correctness rate = 82.7%

Note. N.S. = Non-Significant (thus was not applicable in this cell), OR = Odds Ratio = Exp(B)

Overall, the WPI was able to move the subjects at least one-step further in terms of stage of change toward smoking cessation, especially for those who began the intervention at the precontemplation (stage-1) or contemplation stage (stage-2). In terms of effect size, it was 4.8 times more likely that a subject in the experimental group would be improved on stage of change compared to the one in the control group A. This effect tapered off resulting in an effect size of 2.34 a month after the intervention ended. There was also a measurement effect that could be seen by the comparison between the control group A, who received weekly calls to measure smoking behavior and the control group B who only received a call at week one and week 9. It may require more time than 4 weeks of intervention for a person to make a further change from the stage of contemplation to preparation or another advanced stages.

It seems the intervention system had worked once when it had run for one month (weeks 1-5), but most subjects seemed to regress back to the original status at the end of the intervention at week 9. This is understandable because the schedule of intervention calls were intensive during the beginning 4 weeks ("one-month intervention with intensive schedule" period) while less intensive between weeks 6 and 9 ("one-month with tapering schedule), and there was even a blank schedule at week 7. The WPI content or schedule that needs to be improved would be the one-month with tapering schedule session between weeks 6 and 9 and thereafter. Perhaps to extend the intensive schedule for longer than two months would have better effect.

The significant effect of the one-month intervention with intensive schedule on SE within the experimental group and the significant effect of the one-month check-up with intensive schedule on SE within the control group A suggest that the WPI could be added to the initial phases of a smoking intervention program to make clients more susceptible to change. More research might be necessary to determine why the WPI has an effect as only self-efficacy was found to change of all the variables measured in this study. Findings suggest that the intervention messages might be changed also, maybe shortened, because just calling subjects and asking a question about smoking seemed to have a small effect.

Question 3. How long can the intervention prevent a subject from smoking relapse within the two-month period?

Since the TND and number of nonsmokers were not appropriate in answering this question, the self-efficacy and improvement were used instead. First, either the self-efficacy at week 5 or that at week 9 was better than that at week 1 within the experimental group and the control group A, while the DB-pros and DB-cons were not significantly changed at week 5 or at week 9. As concluded in the previous section, the WPI can improve the subjects' self-efficacy

level with four types of contents including the one-month intervention with intensive schedule, two-month intervention (one-month intervention with intensive schedule plus one-month intervention with tapering schedule), one-month checkup with intensive schedule, and two-month checkup (one-month checkup with intensive schedule and one-month checkup with tapering schedule).

Second, in terms of improvement on stage of change scale, the subjects in the experimental group were 4.8 times more likely to be improved than those in the control group A at week 5. The intensive schedule of calls can possibly move a client at least one-step further on a five stages of change scale. The WPI was designed with a schedule of 2 calls per week for the first 4 weeks, 1 call per week at weeks 4 through 6, and a blank at week 7, then 1 call at week 8. The one-month intervention with tapering schedule between weeks 5 and 9 seemed not strong enough to prevent tapering off on stage of change. These results suggest that either the intervention calls or the check-up calls can improve the subject's self-efficacy after one-month or after two months. In practice, it is commonly recommended that if a smoker has quit smoking for more than six months, then the possibility for one to smoke again will be very small. It would be more practical if the intensive schedule may be extended for more than 4 weeks, i.e. 8 or 12 weeks, to examine if the clients can move to an advanced stage of change such as Action or Maintenance.

Question 4. What kind of exposure can best predict the improvement of the subjects? (dose-response relationship)

None of the exposure variables, including number of calls, number of items, and call length in seconds was found to be predictors of the subjects' improvement on the stage of change scale. Future research may try using the other variables including the change

processes or intervention strategies (Martin, et al., 1996), and type of message (informational messages, motivational messages received).

Question 5. What kind of study variables, in what combination, to what degree, can best predict the improvement of the subjects? That is, can the independent and control variables predict the correct classification of subjects to be either improved or unimproved after being exposed to the intervention for one month and after one month tapering schedule at two months?"

Figure 5.1 shows the latest research framework after being examined by research results. The results showed that at week 5, the improvement of subjects was best predicted by group and school (total correctness rate of prediction = 76.2%); at week 9, the improvement of subjects was best predicted by age (total correctness rate of prediction = 82.7%). From a cross-sectional perspective, the theoretical relationships between variables were partly supported in which the only variable related with improvement at week 5 was self-efficacy; while the DB-pros, DB-cons, exposure, and most of the demographic variables were all unrelated. A similar result was found in a cross-sectional study in which age, peer influence, and self-efficacy were major predictors of student smoking behaviors (N = 2477) (Wang, Yang, Chu, & Wu, 2009).

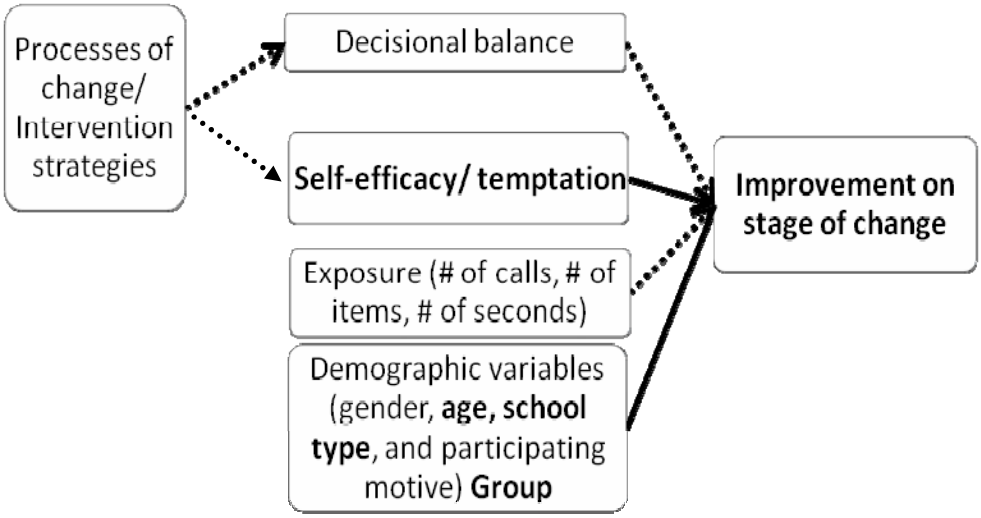


Figure 5.1. Research Framework Examined by Research Results

Note.

(1) The relationships in dotted lines were not significant in this study.
(2) The Processes of change / intervention strategies were not measured.
(3) Group and school were significantly predicting improvement at week 5, while age was significantly predicting improvement at week 9. The significant predictors are highlighted in bold.

The "change process/ intervention strategies" may be added into this prediction model. It has been applied to some cross-sectional studies and was significant in predicting smoking behavior (Martin, et al., 1996). However, it often contains at least 3 dimensions or 10 categories. If one of the purposes is to know the effect from different dimensions, the required sample size would need to be increased to the corresponding level as required by statistical power.

Although the three exposure variables (number of calls, number of items, number of seconds of all calls length) were not found to be significantly related with the subjects' improvement on stage of change, it is recommended to keep them as covariates in the

regression model because they represent the actual degrees of difference on exposure, or dosage, between different subjects.

Another possible predictor would be the motive of participating in this study. Although this was measured in this study as a multiple responses question, only 46 of 116 respondents gave their answers in which 31 (35.2%) were for personal health, 19 (21.6%) for saving money, 16 (18.2%) for other's health, 16 (18.2%) for the 200 dollars gift (compensation of this study). To know if these participating motives were related with the improvement, these responses were converted into dummy variables to test if their individual relationships were significantly related with the improvement on stage of change. All the results were insignificant. Still, more research is needed on how much the compensation of 200 Taiwan Dollars (approximately 6 US dollars) influences the result. In this study, the price was set up as low as possible so that it would not influence the willingness, or even the answers of subjects. In addition, this study tried to minimize the influence since each subject in the three groups all received this compensation money. If there had not been subject randomization or the subjects in different groups had received different amounts of compensation, then the compensation would become an important factor when explaining the results.

From a longitudinal perspective, it is interesting to know that the predictors at weeks 5 and 9 were different. That is, the group and school were predictive for improvement at week 5, while the age was at week 9. This indicated that group and school were important predictors for subject’s improvement between weeks 1 and 5, while age was important between weeks 1 and 9. This might be interpreted to mean that the “group” or “school type” had influenced the subject’s smoking decision at the first month, but lost the power of influence at the latter month because the schedule changed from intensive to tapering. That is, the WPI became weaker in maintaining the subject on the same track toward smoking cessation in the 2nd month thus

yielding the power of influence to the age of the subjects. A longitudinal study based on Taiwan Smokers Helpline (TSH) clients also found that the “confidence level of quitting smoking” (equivalent to self efficacy) was the best predictor for smoking cessation at immediate, one-month, two-month, and 6-month posttest abstinence rates (Ching-Jan Chang, Wang, & Hsu, 2009).

5.2 Research Design

The research design based on theories and related research evidence was very useful in evaluation of IT application because it incorporates longitudinal and cross-sectional perspectives, and mixes with different measurements. However, it was not easy to apply because of its complicated design, related analysis methods, and a larger sample size was needed. Implementing the analysis based on this design was a highly complicated affair that necessitated many cautious transformations and computations among different software packages. Complicated tasks included designing a 9-week schedule of messages for 116 subjects in three different groups and uploading them to Teleherence, downloading and converting raw data from a Teleherence web page to Excel, converting data from Excel to SPSS, and designing equations in Excel. Thus, if this design is utilized by future researchers, they should be aware that it might take a lengthy period to figure out and to set up the details. In addition, a design containing three groups will need to have at least 102 persons as a basic sample size to satisfy the minimum of 34 in each group in ANOVA test (as suggested by G-power 3.010). The attrition rate may also need to be taken into account to prevent the decreasing of statistical power. A longer period or different combinations and schedules of WPI messages may be needed to clarify the effect. Larger sample sizes would enhance the statistical power, and so this is desirable in future research.

The setting up of the schedule of calls is worthy of discussion. Ideally, the arranging of the schedule should have been tailored based on each individual's progress toward smoking cessation. However, in this study, the schedule for every subject was set up at the same intensity throughout for all clients where the schedule was intense in the first month and less intense in the 2nd month. The ideal principle was not implemented due to the limitations of the Teleherence system. Future Teleherence developments that can support this design principle would be a critical task in subsequent research.

Another lesson learned was that when implementing the research design, it would be better to avoid any artificial interference to simplify the causal inference. In this study, the researcher avoided calling any subject during the implementation period including the technical check call to those who had not completed survey. This "hands off" policy was found specifically useful when evaluating an IT application project. Another option to avoid human interference would be to arrange the technical check call to every subject during the 2nd week and make sure that everybody received this call. In this way, it can be assumed that equal influence was made to the subjects in different groups. Thus, the factor of human interference may be excluded when comparing different groups, but still cannot be ruled out when comparing pre and posttest differences. At last, if the purpose were to maximize the intervention effect in practice rather than to clarify the relationship in a study, then more frequent and interactive calls should be encouraged instead.

5.3 Difficulty on Obtaining Sample Source

Obtaining the sample for this research was very difficult. The sample from TJU used in this study probably was attributed to the Chief of Student Counseling Center of TJU, who is enthusiastic concerning the students' health. However, this interest cannot be counted on in future studies. The most important reason for participation rejection from agencies was the

ethical concern that the agency should not release clients' information to researchers without written consents. The second important concern was that the agency staffs worried that the calls from this study may cause resistance or protests from the subjects. These two reasons prevented almost all of the agencies' willingness to cooperate with this project. In spite of the official letter sent to the agency, frequent communications between the researcher and agencies, and promising to maintain the UTA IRB protocol of this study, agency staffs still did not feel the situation secure enough to accept and to cooperate with this project. The third concern might have been a worry to add additional tasks on a staff member, since this type of study preferably needs an intra-organizational staff member to work as a case manager through the whole process. A final concern might have been whether the WPI was effective or not. It is suggested that these issues be resolved so that future studies could obtain more trust from agencies, and thus reach the targeted population.

5.4 Incorporating Sample Attrition in Estimating Effect Size

After recruiting subjects into this study, a key concern was how to avoid sample attrition problem or the increasing number of missing cases, and how to treat these missing cases when interpreting the research result. The "missing case" refers to the subject who did not respond to one survey. The "attrition rate" refers to the proportion of missing cases on one survey; and the "response rate" refers to the numbers of valid cases on one survey. In this study, the response rates were decreasing week by week. The response rate for the total sample at week 5 and week 9 was 64.94% (50 of 77) and 48.28% (56 of 116) respectively. At the 5th week, the response rate was 53.8% and 71.8% for the experimental group and the control group A respectively. At the 9^{th} week, this phenomenon became worse where the response rate for each group was 38.5%, 46.2%, and 60.5% respectively. In other words, the attrition rate at week 9 for the three groups was 61.5%, 54.8%, and 39.5% respectively.

Since the sample attrition seriously influences the interpretation of research results, it would be very important for future research to address how to avoid the worsening of sample attrition. One of the traditional ways is to deliver compensation to the subject afterword. In this study, the compensation of 200 Taiwan Dollars (approximately 6 US Dollars) for each subject after WPI has implemented might have worked for a few subjects. However, the statistical tests on the relationships between this participating motive and the subject's exposure or improvement on stage of change were not significant. No matter whether it can save the sample attrition or not, it may be reasonable to pay throughout the research for subject's efforts. However, the payment should not be set too high to influence the subject's participation or even their response types.

The missing case can be divided into either temporary or permanent. The temporary missing case is the subject who did not respond to one call of a survey for any reason. This could be solved by making the three following calls, or by creating a new schedule. On the other hand, the permanent missing case refers to the subject, who dropped out and did not respond to any future surveys. This type of missing case was very hard to be contacted by the researcher. A possible solution would be to have agency staff or the case manager explore the possible reasons or to exclude possible barriers. Another possible explanation for the sample attrition rates was that the intense intervention schedule seemed to have caused some resistance from some experimental subjects. This suggests that future research is needed to determine the optimum number of calls clients prefer each week during a web-phone type intervention.

The possible results of missing cases (35.16% at week 5, and 51.72% at week 9) need to be incorporated into the estimation of intervention effect size. An alternative way of estimating the responses of missing cases would be to assume that they were at the stage where stage

was last measured. In this way, the answer in terms of closest time point would be utilized. However if cases were just distributed into each stage of change using two levels of proportions, it would be more rigorous.

The original two levels of solution in incorporating missing cases into estimating the effect size were the strict level, assuming the lost participants to WPI to be continuing smokers, and the medium level, assuming the lost participants to WPI to be half smokers and half not. This was replaced with the new outcome measure “improvement” and was added with “Low level”. This estimation was based on the “improvement” which was recoded from the “stage of change” question and only for the subjects in the experimental group. They were calculated based on the data collected at weeks 1, 5, and 9. The three levels of estimating were:

(1) High level (strict level), assuming all of the missing cases were unimproved,

(2) Medium level, assuming half of the missing cases were improved and half of them were unimproved, and

(3) Low level, assuming all of the missing cases were improved.

The estimated odds ratios were calculated by dividing “the estimated odds of being improved in the experimental group” by “the original odds in the other group as defined”. The estimated results are shown in Table 5.6 and the detail of calculation is in Appendix C. Comparing the current level with the three estimated levels of effect size found that current level was close to the medium level. For example, current data shows that the OR was 4.8 at week 5 between the experimental group and the control group A, while the OR at medium level was 4.43, OR at high level was 1.78, and OR at low level was 11.6. Table 5.6 provides three levels of effect sizes at weeks 5 and 9 between different pair of groups. This analysis suggests that the results presented in Chapters 4 and 5, using valid responses, were roughly at the medium level of estimating when the missing cases were incorporated. Even when all the missing cases

were considered as “unimproved” at the high level, the estimated OR was at 1.78, indicating the positive effect existed, while at week 9, the estimated OR could range from 0.64 to 11.67, indicating that the subjects may have the most possibility to be improved. Therefore, by estimating the missing cases in the three levels, this table also provides a framework for generalizing the results to practice or other research.

Table 5.6. Incorporating Missing Cases in Estimating the Effect Size at Weeks 5 and 9

Week #	Odds in first group / Odds in second group	Current level	Low level	Medium level	High level
W5	G1/G2-	4.80	11.60	4.43	1.78
W9	G1/G2	2.33	11.67	3.00	0.64
W9	G1/G3	4.00	20.00	5.14	1.09

In addition to the statistical approach, this report also presented a visual approach using “stage of change” to project the possible distribution of responses on the stage of change scale at each week. The effect size for each week using stage of change was not calculated because the numbers of valid cases in stages 3, 4, and 5 at each survey were too small to support robust testing, and because the effect size cannot be calculated with five categories. These include: (1) High level (strict level): assuming 100% of the missing cases were all at stage 1, as shown in Figure 5.2; (2) Medium level: assuming the missing cases were distributed at each stage the same as what they were at pretest, as shown in Figure 5.3. Comparing the two pictures with previous result from Figure 4.3 would provide a clearer understanding about the degree of the intervention effect.

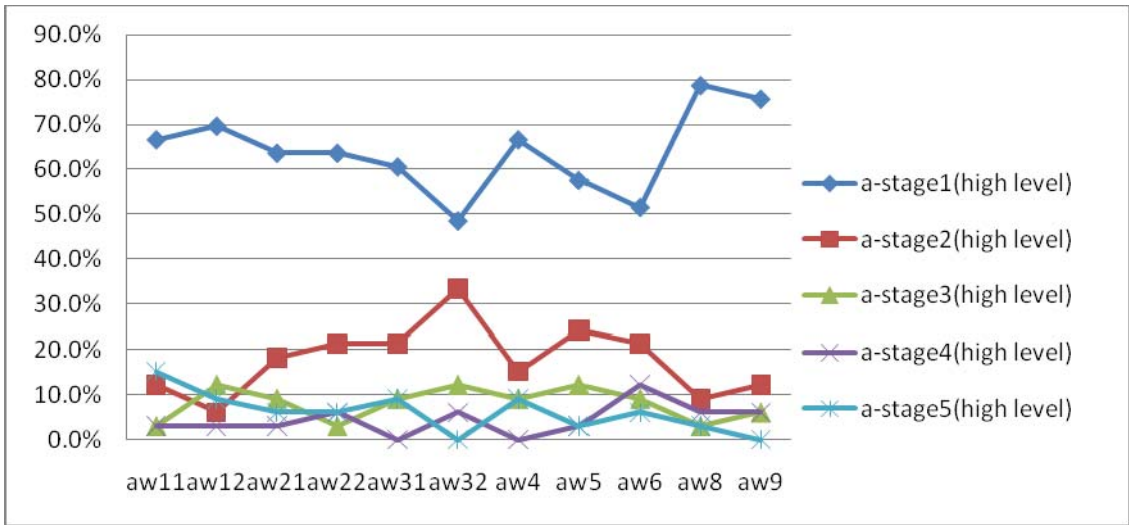


Figure 5.2. Estimated Proportions of Subjects at Each Stage in the Experimental Group (High Level)

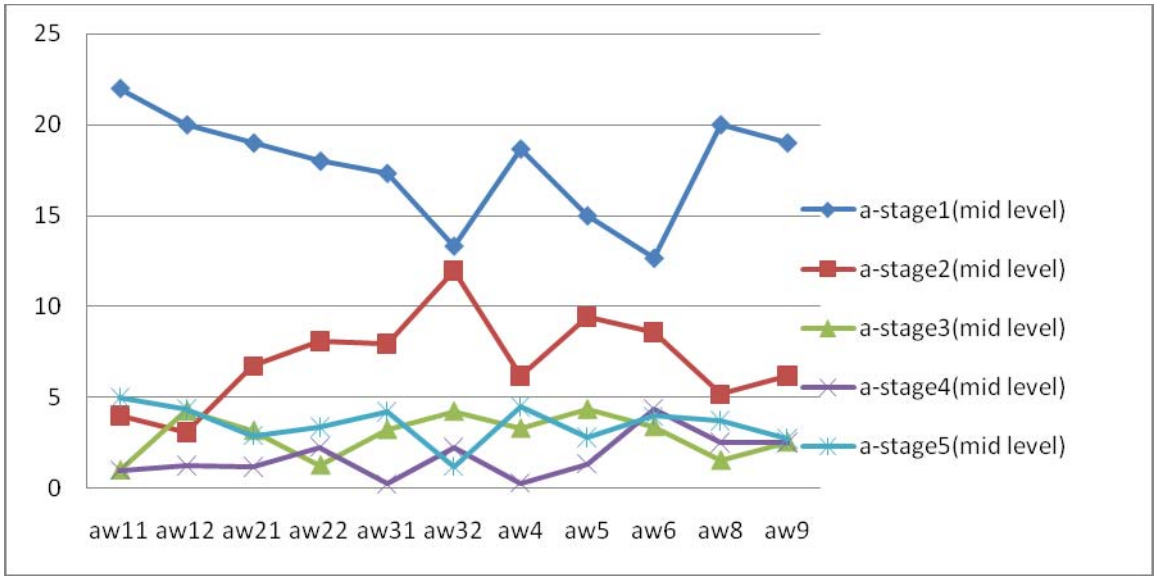


Figure 5.3. Estimated Proportions of Subjects at Each Stage in the Experimental Group (Medium Level)

The estimated effect sizes at week 5s and 9 became clearer when accompanied with the comparison between Figure 4.3 with Figures 5.2 & 5.3. The most salient feature was on the distance between and the locations of stage-1 and stage-2 lines. At the high level in Figure 5.2, the shortest distance between stage-1 and stage-2 lines was at the second survey of week 3, and the stage-1 line ranged between 50% and 80%. While at medium level in Figure 5.3, the two lines were almost at equal height at the second survey of week 3, indicating the proportion of subjects at stage-1 were almost equal to the proportion at stage-2. However, the lines moved far apart from each other after that point. The best level was found at Figure 4.3 in which the two lines even crossed with each other four times during the 9 weeks indicating a large proportion of subjects in the experimental group were moving from stage 1 toward stage 2 and even the other advanced stages. These three figures suggest that the true effect size of the WPI might be better reduced to certain proportions if the missing cases were incorporated. However, the overall effect was still positive when the missing cases were estimated in the two levels.

5.5 Measurement & Data Collection Method

The original measure, TND, was continuous. The new measures were ordinal (stage of change, stage movement) or discrete (improvement) variables. These changes led the statistical method to be changed. As commonly known, when the outcome is continuous and the assumptions regarding it and the predictors are met, multiple regression may be more powerful than logistic regression (Tabachnick & Fidell, 2001, p. 521). The lowering down of measuring level unavoidably led to subsequent changes on the other methods used.

There were three types of data collection method in this study including self-administered questionnaire, telephone keypad pressing, and voice recording. From the measurement methods used, it was hard to know whether the subject was telling the truth or not

about stopping smoking. It was anticipated that subjects would show more resistance when participating in this study, for example, by not picking up the call, or lying in response to the question. For example, one subject in the recording of TND answered that “(expletive)! I haven’t been smoking for 500 years.” Fortunately, this aberrant answer occurred only once in this study. However, it is still expected to occur again and more frequently in a larger sample or with subjects that are more reluctant in future studies. In addition, the quality of voice recording sometimes was down due to the noise around the subject, or the unclear speech of the client. If this question can be digitalized in the same form as the other question items, then these problems probably would be alleviated.

Using improvement as an outcome measure has several limitations due to its dichotomous nature. It cannot show the detail of subjects improvement; even its origin variable, the “stage movement”, is not an interval scale, and thus cannot be used for mathematical operations such as adding or subtracting. It also limited the analysis method to logistic regression instead of using linear multiple regression, which is considered more powerful.

Although the TTM theory on the stages of change suggests that people may regress back from an advanced stage to any earlier stage at any time, it is possible to consider inconsistent answers as a reliability issue. In this study, subjects were asked the stage of change question at the beginning of each call. Some subjects were found to have inconsistent answers for the same survey at the short interval of several days, for example, the two cases illustrated in Table 5.7. To explore further the reliability issue, the test-retest reliability method was utilized to analyze the “stage of change” question by counting the number of times subjects answered the stage of change question consistently. Since the WPI may deliver the same survey again for those who did not complete it, the subjects who had different answers on their current stage of change for the same survey would be counted as inconsistent subjects, while

subjects who had only one answer would be considered as consistent. Using the single question results of “stage of change” on weeks 1 and week 9 surveys, it shows that among the 97 respondents, 12 subjects had inconsistent answers. The test-retest reliability of this question is calculated as 1 - (12/97) = 87.63%. Week 9 survey shows that 8 among the 56 respondents had inconsistent answers. The test-retest reliability of this question is calculated as 1 - (8/56) = 85.71%. The overall reliability is 86.67% as calculated by the average of these two coefficients, indicating that the stage of change question was “quite reliably” measured.

Table 5.7. Two Case Examples of Reliability Issue on Stage of Change Question

Survey Record Id	Status	Client Nick name	Start Time	End Time	Duration	Survey Title	Stage of change-q
5477	Completed	Case 1	2010/7/13 13:03	2010/7/13 13:03	00:33	wc-8	1
5493	Completed	Case 1	2010/7/13 13:17	2010/7/13 13:18	01:26	wc-8	5
5440	Completed	Case 2	2010/7/13 12:45	2010/7/13 12:47	02:28	wc-8	1
5496	Completed	Case 2	2010/7/13 13:18	2010/7/13 13:19	01:09	wc-8	4

Note. The Client Nick names listed here were changed to be different with those in the study to protect client’s privacy.

It is worthy of discussion that the Reliability coefficients on Decisional Balance-cons were lower at week 1 while higher at weeks 5 and 9 (Cronbach's Alpha = .446, .672, .837 at weeks 1, 5, and 9, respectively, N of items = 3, see Table 4.8). Reliability analysis at week 1 is not satisfactory (Cronbach's Alpha = .446). The low reliability coefficients of DB-cons may imply that its questions were not reliably responded to by the subjects, possibly from both random errors and systematic errors, and thus could not yield significant differences between groups. Since the entire question items of Decisional Balance-cons were negative statements, this may be understandable because the subject may have been accustomed to positively stated question and may not be prepared for answering questions that were stated oppositely. In

addition, the questions were delivered via mobile/cell phone that may cause a little tension and yielded more erroneous or inconsistent responses for these question items.

A lesson was learned on determining which measure was appropriate for detecting the effect. The TND and number of nonsmokers in one group would be appropriate when the majority of subjects were successful clients since it supports a stronger power for statistical analysis. On the other hand, when most of the subjects were at the very beginning stages toward quitting smoking, the stage of change scale would be an appropriate measurement. This is due to the difficulty that a health-related behavior change is often initiated in covert form and turns out to be observable later. The “self-efficacy” and “decisional balance pros and cons” thus were also commonly recommended as outcome measures in many studies as well. Taking the example of this study, the positive changes on self-efficacy toward smoking cessation was observed at week 5 and at week 9 within the experimental group and within the control group A, however, the number of nonsmokers was not sufficient to robustly answer the question as to whether there was change on “nonsmoking” behavior among the subjects. In addition, since five stages of change would need at least 35 valid cases within each group of stage as a minimum of 165 subjects to support stronger analysis, collapsing categories is recommended when the sample size is too small.

Another limitation was how to detect the dynamic process of subjects on a measure during a long-term experiment. In this study, the “stage movement” was a very convenient way of demonstrating the overall progress of subjects. However, the same problem would occur if the different categories of stage movement were used as the grouping variable. The research would need a large sample or would need to collapse the categories i.e. the two categories of “improvement” when transformed from stage of change. This method would be more persuasive when demonstrating the system’s performance or client’s working progress.

5.6 Agency Capacity to Incorporate IT Solutions in Their Work Patterns

For an agency to incorporate Web-phone based IT solutions in their work patterns, several conditions are suggested to be satisfied. First, a case manager, who has been in charge of the group of clients, and is willing to promote their health status, would be highly recommended. If there had been a case manager from the agency to control all of the process, the clients would have been more tightly attached to the WPI through the emotional bond. It is highly suggested that any future research strongly consider funding someone in the agency to help carry out the study. IN addition, the case manager must be equipped with basic computer skills in Excel, SPSS, and learn to be familiar with the Teleherence and can communicate with the programmer if needed. On the other hand, a budget for the project would cover the required expenses for clients. At last, it would be more attractive to the agency if the evidence of intervention effect, the amount of time and human labor that would be saved while using WPI can be provided.

If the WPI is used in the future, involving a large agency might be a good idea. Since the WPI can be set up as a welfare service for employees, the organization administrator might be interested in applying a WPI-type service. Organizations may be willing to take care of their employees' health by paying for this service. However, the network of related services would need to be set up in advance, for example, referring clients to a local clinic with specific contact information if needed. Besides, it would be preferable if preliminary research can be implemented to adjust the WPI to the specific clientele and culture. Then, the effect of large-scale study of WPI would be secured.

CHAPTER 6

CONCLUSION

This study was aimed to test a WPI system at Teleherence at UTA. One hundred and sixteen volunteer subjects were recruited from the student smokers name list of a university located in southern Taiwan. They were randomly assigned to three different groups with double-blind principle. The subjects in the three groups were assigned to receive different combinations of intervention with intensive or tapering schedules, check-up, and observation calls in different schedules as follows: 1) subjects in the experimental group received one-month intervention calls between weeks 1 and 5 with an intensive schedule, and then received one-month intervention calls with a tapering schedule between weeks 5 and 9; 2) subjects in the control group A received one-month "check-up" calls between weeks 1 and 5 with an intensive schedule, and another one-month "check-up" calls between weeks 5 and 9 with a tapering schedule; and 3) subjects in the control group B received one observation call at each of weeks 1 and 9. The findings are:

(1) After receiving one-month intensive intervention, the subjects in the experimental group were significantly improved on self-efficacy and stage of change toward smoking cessation. After receiving one-month intensive and one-month tapering schedule of intervention, the subjects were significantly improved on self-efficacy but not on stage of change toward smoking cessation.

(2) After receiving one-month intensive check-ups, the subjects in the control group A were significantly improved on self-efficacy and stage of change

toward smoking cessation. After receiving two-month check-up, the subjects in the control group A were significantly improved on self-efficacy but not on stage of change toward smoking cessation.

(3) Without receiving any intervention or check-up calls (other than receiving observation calls at weeks 1 and 9), the subjects in the control group B were not improved either on self-efficacy or on stage of change toward smoking cessation.

(4) The subjects' improvement between weeks 1 and 5 can be predicted by the group and school type as a set with 76.2% correctness rate. The subjects' improvement between weeks 1 and 9 can be predicted by age with 82.7% correctness rate.

(5) Three figures were drawn in terms of the proportion of each stage of change illustrating that the experimental group improved, the monitoring control group A stayed the same, while the control group B got worse during the 9-week process.

(6) Four types of effect size were identified and calculated using the subject's improvement on 5 stages of the change scale as the outcome measure. 1) The "one-month effect size of intervention with intensive schedule" was 4.8 (large size) when comparing the experimental group to the control group A; 2) the one-month effect size of intervention with tapering schedule was 2.59 (medium size) when comparing the experimental group to the control group A; 3) the two-month effect size of intervention was 2.34 (small size) when comparing the experimental group to the control group A, and was 4.0 (large size) when comparing the experimental group to the control group B; and 4)

the two-month effect size of check-up was 1.71 (small size) when comparing the control group A to the control group B. To interpret the effect size, take the example of “one-month effect size of intervention with intensive schedule” between weeks 1 and 5, the odds for a subject to be improved in the experimental group were 4.8 times more likely than were those in the control group A.

The results of this study are summarized in Figure 6.1. Overall, the experimental group was improved on SE at weeks 5 and 9; the control group was also improved at weeks 5 and 9, while the decisional balance within these two groups remained unchanged at weeks 5 and 9. That is, the effects existed both in the experimental group, in which subjects received “intervention” calls, and in the control group A, in which subjects received “check-up” calls, rather than the control group B, in which subjects received “no intervention or checkup call”. These results further affirmed the causal-effect relationship between the WPI and its effects on improving smoker’s self-efficacy and moving clients toward smoking cessation on the 5 stages of change scale.

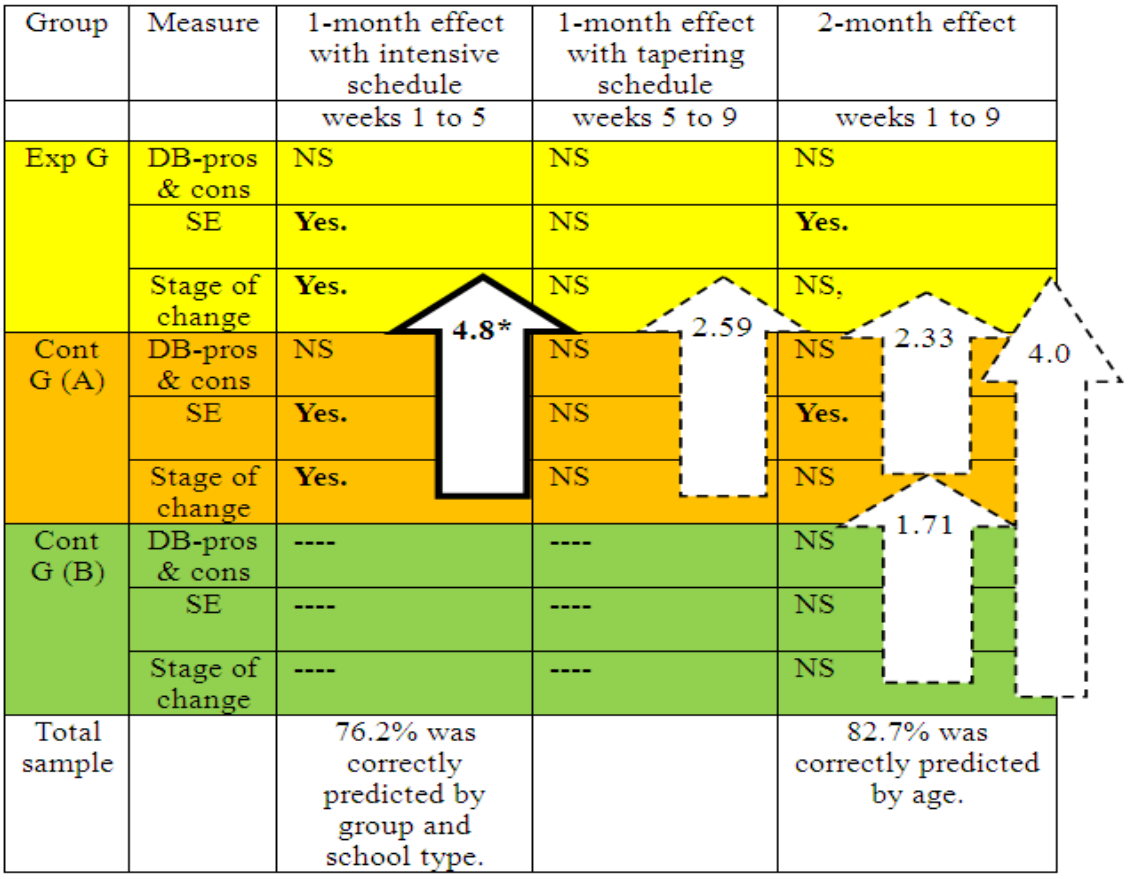


Figure 6.1. Effects of the WPI in Overview

Note. No significant difference between groups was found on each variable at pretest. Pre and posttest comparison within groups is noted in cells; between groups comparison is noted in arrows across cells. The arrow in bolded line indicates a significant test result, while the others in dotted line indicate non-significant test results. The odds ratios or effect sizes are labeled on each arrow.

In addition to the current data presented, the missing cases were incorporated to provide a comprehensive framework viewing the effect of the WPI based on the subjects' responses on the stage of change question at each survey. Using a statistical approach, the missing cases at week 5s and 9 were estimated in three levels (high, medium, low) based on the subject's improvement on stage of change scale and the effect sizes were calculated as

shown in Table 5.2. Using a visual approach, the possible proportions of each stage of change in the experimental group were also illustrated in two levels (high and medium) as shown in Figures 5.2 and 5.3.

6.1 Limitation of the Results

All of the results should be interpreted cautiously considering the following limitations. The best population to be generalized from the research results would be “college student smokers who were caught smoking and volunteered to participate in the WPI”. If applied to the general population, many differences between these subjects may cause different effects such as age, school type, etc. Although this study was conducted in a Taiwan college and in Mandarin Chinese language, the measurement tools or intervention framework and contents of the text version, rather than the audio version, can also be easily applied to different ethnicities or cultures after revision. Additional limitations should be noted when applying the materials in this study elsewhere.

Some environmental events that occurred during the implementation process of WPI were impossible to be controlled and may have influenced this study on the degree of exposure and on the response rate. Both the Teleherence events (the system crashing or the making of duplicated calls), and TJU campus events (occurrence of final exams and summer vacation), may have lowered the response rate to some degree. Although randomization has yielded a practical equivalence between different groups for the comparison between groups, the exposure to intervention and overall response rate on observation questions still need to be above a certain level to strengthen the power of evidence.

The “Hawthorne effect” is inevitably a threat of internal validity for any experimental study. Although the positive effects on improvement of self-efficacy and stage of change were observed in the experimental group and the control group A, some of the differences between

their pre and posttests may have been due to the fact that they knew they were being observed. When comparing the effect size based on the pre and posttest, the Hawthorne effect should be taken into account. The Hawthorne effect becomes a competing explanation for the effect observed, and it may not be possible to control it in advance in an experimental study. However, from a treatment point of view, the Hawthorne effect might be deemed as part of the goal of the WPI since calls were intended to remind the subjects that they were being "observed". On the other hand, when calculating the effect size by comparing two groups, because the randomization and double-blind principle have implemented the equivalence on study variables between different groups, the Hawthorne effect should be ignored.

Difficulty in getting samples and sample attrition have both created the issue of small sample size, and thus may have decreased statistical power. To address this limitation, the researcher attempted to find as many agencies as possible to enlarge the sample size. However, the ethics of the research also were of concern, and this restricted cooperation and willingness from agency staff or administrators.

The effect sizes of the WPI in preventing smoking relapse were calculated based on the odds of a person for being improved in one group compared to that in another group. Although the odds ratios were calculated, not all of them were significant at the chi-square test. The values of odds ratio ranged from 0 to infinity. Even two very small odds may yield a very large effect size. Therefore, it should be noted whether the original chi-square test result was significant or not when interpreting the odds ratio.

6.2 Implications

The results on evaluating the WPI system on preventing smoking relapse lent support to the application of IT to the human services. Although the WPI has been designed based on many evidence-based guidelines and was implemented with high cautiousness, some

implications and insights may be provided for future practice, policy, WPI, and research as follows.

6.2.1 Implications for Practice

The result shows that the smokers who were intensively exposed to the WPI for a one-month intervention with intensive schedule (OR = 4.8) or a two-month intervention (OR = 4.0) were more likely to make progress on the 5 stages of change scale. Web phone interventions may be an alternative for clients since there will be more and more people who prefer a service that is more standardized, freely scheduled, more scientific or evidence-based with fewer human errors, more convenient to that based on a mobile phone system, and an even more effective way in helping them initiate their first steps toward quitting smoking. WPI type interventions may be an important supplement to traditional anti-smoking interventions. In addition to the smoking practice, the intervention contents based on TTM and other theories may be applied to similar fields such as substance abuse after changing the intervention contents.

6.2.2 Implications for Policy

A budget would be required to support researchers to conduct this type of project. A WPI-type intervention might be very cost-effective if applied to teens or children who are more comfortable with mobile phones. WPI can contact any home phone or mobile phone, and thus can increase access to treatment and reduce the digital divide to some degree. For example, this study used the WPI server located in the USA to call people located in Taiwan. Since smokers tend to be resistant to participate in this type of program, and tend not to be willing to pay for their own health problems, similar research and demonstration projects must be funded by government.

The WPI has been found effective in some aspects such as to improve smoker's self-efficacy, and to make progress based on stages of change scale specifically for the earlier stages in this study. If the effect of improvement can also be found between advanced stages of change by future studies, this program can be authorized by government to apply to general medical or helping practices such as clinics, schools, or organizations as a stand-alone service or a supplemental segment of professional services. It will save much effort in moving the smokers from precontemplation stage to contemplation stage, and even assist in preparation for the above stages. However, this study did not find evidence on the movement from the third to the fifth stages of change. This will need further long-term study to clarify whether this effect exists in the WPI.

6.2.3 Implications for the WPI

The framework of WPI that was based on the TTM, two-phase models, MI, and other theories, was found useful in assisting the smokers in improving their self-efficacy and making progress on stage of change after one-month or two-month interventions or check-ups. The theories for web-phone based intervention were well incorporated in the framework. The WPI has been found to be an effective system in initiating a client's first steps toward quitting. It can serve as a starting point for future WPIs and as a basis for extending the contents. Namely, both the diversity and number of question items may be increased so that the intervention weeks could be expanded without repeating the same questions. The adoption of the materials from fashion media or governmental web sites may have better effect since it increases the possibility of reinforcing consistent information locally and nationally. Besides, some male subjects suggested that they prefer to listen to the female voice. Since the voice used in WPI was male, the system may provide a female voice version for subject's optional choice.

When applying the guideline of tailored messages for individuals, the current design of WPI was based on the client's current stage of change only, so if this feature can be extended to adopt more characteristics such as "school type" or "age" which were found predictive on subject's improvement at week 5 or week 9, it would be more powerful in producing its effect. In addition, the Teleherence system needs to be equipped with more features and improved for its fidelity such as minimizing crashing events, to make sure it keeps track of every call, to provide more flexible ways in arranging schedules, to directly generate statistical output based on the case manager's practical needs, to extend the query dates period from 1 week to more weeks to best cover all of the calls during the whole process, etc. Since about one-third of the subjects were using two cell-phone numbers, it might be a considered feature if the call is missed then the WPI may shift from one number to another number of the subject. A better full-featured IT system might ensure more stable implementation process and reduce the labor of case managers.

In addition, as a communication tool, the WPI used a predetermined frame to talk to client without any flexibility for the subject to talk on any other issue. The WPI was highly task-oriented on its designated contents while ignoring the other types of intervention strategies or change processes. Although the face validity check on WPI messages provided by the two local experts provided a defense on this issue, a more interactive intervention that may truly "listen to or reflect" the client is always more desirable and useful as shown by other research. To make the WPI more interactive, it may ask the subjects if they want to change the schedules, or if they have any feedback or barrier that needs to be attended to, during the WPI implementing process.

The significant effect of a one-month intervention with an intensive schedule on SE within the experimental group and the significant effect of a one-month check-up with an

intensive schedule on SE within the control group A suggest that the WPI could be added to the initial phases of a smoking intervention program to make clients more susceptible to change. In addition, because similar effects on SE were all observed in the experimental group and in the control group A, and the difference on SE between groups was not significant both at week 5 and at week 9, the intervention messages might be shortened.

6.2.4 Implications for Research

The research design of this study was very powerful, thus it is recommended that it be used in the evaluation of future IT applications. However, the researcher should be prepared to set up the equipment and methodology related to the design. It is powerful, because it incorporates longitudinal and cross-sectional perspectives, and mixes different measurements. However, if this design were to be utilized by an inexperienced researcher, it may take a long period to understand and to set up the details. One study suggests that 3 months of calls followed by 3 months of tapering was too short of a time period and that added time might be needed for clients with substance abuse issues (Puccio et al., 2006). The optimum schedule of automated interventions to reduce the tapering-off effect would be a knowledge gap for researchers to focus on in the future.

There was a worthy lesson in determining which measure would be better for detecting the outcome. It was learned that for the successful clients who are at stages 4 or 5, “TND” and “number of nonsmokers” would be appropriate, while for the clients who are at stages 1 to 3 toward their quitting smoking, the stage of change scale would be an appropriate measurement. Moreover, if further analysis on system performance or client’s working progress were needed, the “stage movement” and “improvement” recoded from stage of change would be better measures of outcome.

For measuring tools, it is recommended to continue using self-efficacy because it has high reliability and was found significant when comparing it between weeks 1 and 5 and 9. On the other hand, it is suggested that the DB-pros and DB-cons be discarded or revised, because they did not have good reliability and were non-significant with the other variables despite the fact that they were commonly cited and have been reviewed by two local experts in this study. In addition, the number of items for self-efficacy can also be reduced from nine items to six items without sacrificing its reliability. This would benefit the client by shortening the length of observation call(s).

Since this study found only group and school were predictive on subject improvement between weeks 1 and 5, and only age was predictive on subject improvement between weeks 1 and 9, and the prediction correctness rate was 76.2% and 82.7%, the prediction models might be improved by adding some other variables that were found related to smoking behavior. For example, the “change process” or “intervention strategies” can be added into the prediction model and be weighted by the “number of items”. Then, the quality type and quantity of exposure would be calculated more precisely.

When implementing the intervention and maximizing its effect, the researchers should cautiously make sure every subject understand the content stated on the Informed Consent Document, because often subjects are mostly unwilling to participate. Not only do they need to know their rights as a subject in a study (including their personal sense of responsibility in making a commitment to the study), but also need to know how to maximize their welfare through participation in this study. Thus, a short talk to motivate the subjects at the orientation meeting might be suggested, followed by a 30-minute training session to demonstrate how to use the WPI and make sure that everyone can use it well. In this way, the intervention effect would be maximized and possible barriers would be minimized. Another option would be to

apply the WPI as a standardized supplemental service segment for agencies whose clients are diagnosed as appropriate for receiving such an automated service.

The obtaining of samples can be the most challenging issue for this type of research. Before implementing this IT application research, the researcher must be familiar with that field and have kept in contact with the key staff member of many agencies if the research intends to contact clients through their assistance. When designing the project for the agency, the staff and the administrator must be informed or be involved in developing this program if possible. The researcher must communicate frequently with the administrator of the agency; establish good relationship with the agency; demonstrate research evidence with published papers; reduce the financial burden of the subjects or agency staff; and plan some form of financial remuneration for the assisting staff.

In conclusion, the preliminary effectiveness of WPI system has been partially supported under this randomized controlled trial. The effects were observed on the improvement of self-efficacy at weeks 5 and 9, and on stage of change at week 5 both in the experimental group and in the control group A, while not in the control group B. Overall, the analyses identified that either by the content of the intervention messages or by weekly check-up, the WPI was able to improve: 1) the smoker's self-efficacy after either one month or two months; and 2) the smoker's stage of change after one month. These findings provide strong support for further research on and possible adoption of WPI programs as a powerful tool in helping smokers move toward quitting, especially for those who are at the earlier stages. The following effects were not supported with robust evidence on the subject's improvement of stage of change including: 1) the effect of a two-month intervention; 2) the effect of a two-month check-up; and 3) the effect of intervention or check-up with a one-month tapering schedule. These would be the knowledge gaps researchers should focus on in the future.

APPENDIX A

RELIABILITY ANALYSIS

A1. RELIABILITY ANALYSIS OF SE AT WEEK 5—ITEMS STATISTICS

Item	Mean	Std. Deviation	N
1.when eating with friends	2.04	1.141	47
2.when getting up	2.04	1.215	47
3.when stressed	2.55	1.230	47
4.when relaxed	2.17	1.185	47
5.when you need to keep up your spirits	2.45	1.299	47
6.when angry	2.21	1.250	47
7.when being together with smokers	2.28	1.228	47
8.when it has been a long time for nonsmoking	2.28	1.263	47
9.when things are not going well	2.64	1.276	47

A2. RELIABILITY ANALYSIS OF SE AT WEEK 5— ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.when eating with friends	18.62	67.328	.629	.933
2.when getting up	18.62	64.502	.739	.927
3.when stressed	18.11	64.010	.756	.926
4.when relaxed	18.49	64.951	.735	.927
5.when you need to keep up your spirits	18.21	61.432	.849	.920
6.when angry	18.45	64.035	.740	.927
7.when being together with smokers	18.38	63.850	.766	.925
8.when it has been a long time for nonsmoking	18.38	62.894	.794	.923
9.when things are not going well	18.02	63.500	.751	.926

A3. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 5-- ITEMS STATISTICS

Item	Mean	Std. Deviation	N
1.relief	2.15	1.215	47
2.concentration	2.04	1.285	47
3.relaxation	2.45	1.332	47

A4. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 5 ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.relief	4.49	5.864	.647	.832
2.concentration	4.60	5.463	.672	.810
3.relaxation	4.19	4.723	.803	.676

A5. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 5 ITEM STATISTICS

Item	Mean	Std. Deviation	N
4.embarrassed	2.16	1.278	45
5.bothering others	3.07	1.483	45
6.ignoring warnings	2.07	1.304	45

A6. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 5 ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
4.embarrassed	5.13	5.391	.506	.553
5.bothering others	4.22	3.813	.693	.251
6.ignoring warnings	5.22	6.359	.300	.794

A7. RELIABILITY ANALYSIS OF SELF-EFFICACY AT WEEK 9 -- ITEM STATISTICS

Item	Mean	Std. Deviation	N
1.when eating with friends	2.14	.948	37
2.when getting up	2.22	1.294	37
3.when stressed	2.68	1.375	37
4.when relaxed	2.00	1.080	37
5.when you need to keep up your spirits	2.51	1.325	37
6.when angry	2.59	1.343	37
7.when being together with smokers	2.41	1.257	37
8.when it has been a long time for nonsmoking	2.59	1.257	37
9.when things are not going well	2.97	1.323	37

A8. RELIABILITY ANALYSIS OF SELF-EFFICACY AT WEEK 9 -- ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.when eating with friends	19.97	63.916	.349	.907
2.when getting up	19.89	59.988	.421	.906
3.when stressed	19.43	53.586	.726	.882
4.when relaxed	20.11	59.266	.581	.893
5.when you need to keep up your spirits	19.59	52.470	.827	.874
6.when angry	19.51	52.923	.787	.877
7.when being together with smokers	19.70	57.048	.604	.892
8.when it has been a long time for nonsmoking	19.51	53.590	.811	.876
9.when things are not going well	19.14	52.009	.857	.871

A9. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 9 -- ITEM STATISTICS

Item	Mean	Std. Deviation	N
1.relief	2.08	.996	36
2.concentration	1.97	1.028	36
3.relaxation	2.53	1.276	36

A10. RELIABILITY ANALYSIS OF DB-PROS AT WEEK 9 -- ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.relief	4.50	4.143	.669	.704
2.concentration	4.61	4.016	.674	.695
3.relaxatin	4.06	3.368	.609	.783

A11. RELIABILITY ANALYSIS OF DB-CONS AT WEEK 9 -- ITEM STATISTICS

Item	Mean	Std. Deviation	N
4.embarrassed	2.31	1.238	36
5.bothering others	2.78	1.267	36
6.ignoring warnings	2.28	1.210	36

A12. RELIABILITY ANALYSIS OF DB-CONS AT WEEK 9 -- ITEM-TOTAL STATISTICS

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
4.embarrassed	5.06	4.683	.783	.689
5.bothering others	4.58	5.164	.632	.840
6.ignoring warnings	5.08	5.164	.688	.784

APPENDIX B

NUMBER OF VALID CASES FOR EACH VARIABLE

NUMBER OF VALID CASES FOR EACH VARIABLE

	Group	Gender	School	Grade	Age	Smoking_yrs
Valid	116	116	109	109	109	43
Missing	0	0	7	7	7	73

	Motive_1	Motive_2	Motive_3	Motive_4	Motive_5	W5_DB-cons
Valid	31	17	19	16	6	47
Missing	85	99	97	100	110	69

	Quitting	W5_SE	W5_DB-pros	W9_SE	W9_DB-pros	Items_w1to5
Valid	43	48	47	47	36	106
Missing	73	68	69	69	80	10

	W9_DB-cons	Secs_w1to5	Calls_w1to5	Calls_w1to9	Items_w1to9
Valid	36	106	106	106	106
Missing	80	10	10	10	10

	Secs_w1to9	W5_TND	W9_TND
Valid	106	6	18
Missing	10	110	98

APPENDIX C

INCORPORATING MISSING CASES IN ESTIMATING THE EFFECT SIZE AT WEEKS 5 AND 9

INCORPORATING MISSING CASES IN ESTIMATING THE EFFECT SIZE

	Current level	Low level	Medium level	High level
W5G1-IMPROVED	12	29	20.5	12
W5G1-UNIMPROVED	10	10	18.5	27
W5G1-TOT	22	39	39	39
W5G1-ODDS	1.2	2.9	1.11	0.44
W5G2-IMPROVED	5	19	12	5
W5G2-UNIMPROVED	20	20	27	34
W5G2-TOT	25	39	39	39
W5G2-ODDS	0.25	0.95	0.44	0.15
W5G1/G2-OR	4.80	11.60	4.43	1.78
W9G1-IMPROVED	6	30	18	6
W9G1-UNIMPROVED	9	9	21	33
W9G1-TOT	15	39	39	39
W9G1-ODDS	0.67	3.33	0.86	0.18
W9G2-IMPROVED	4	25	14.5	4
W9G2-UNIMPROVED	14	14	24.5	35
W9G2-TOT	18	39	39	39
W9G2-ODDS	0.29	1.79	0.59	0.11
W9G1/G2-OR	2.33	11.67	3.00	0.64
W9G3-IMPROVED	3	20	11.5	3
W9G3-UNIMPROVED	18	18	26.5	35
W9G3-TOT	21	38	38	38
W9G3-ODDS	0.17	1.11	0.43	0.09
W9G1/G3-OR	4.00	20.00	5.14	1.09

APPENDIX D

IRB APPROVAL LETTER

March 24, 2010

THE UNIVERSITY
OF TEXAS
AT ARLINGTON

Office of Research
Administration
Box 19188
202 E. Border St., Suite 214
Arlington, Texas
76019-0188

T 817.272.3723
F 817.272.1111

http://www.uta.edu/research
Expertise at UT Arlington
http://www.uta.edu/expertise

Be A Maverick

Pakorn Sujchaphong
Kenneth Price, PhD
Dean of Business
The University of Texas at Arlington
Box 19377

EXPEDITED APPROVAL OF HUMAN SUBJECT RESEARCH

IRB No.: 2010.0111s
TITLE ***University Policy Discussion***

Effective Date: March 15th, 2010
Expiration Date: March 14th, 2011

Approved Number of Participants: 400 **(Do not exceed without prior IRB approval).**

The University of Texas Arlington Institutional Review Board (UTA IRB) has made the determination that this research protocol involving human subjects is eligible for expedited review in accordance with Title 45 CFR 46.110(a)-(b)(1), 63 FR 60364 and 63 FR 60353, category (7). The IRB Chairman (or designee) approved this protocol effective **March 15th, 2010.** IRB approval for the research shall continue until **March 14th, 2011.**

APPROVED NUMBER OF PARTICIPANTS:

This protocol has been approved for enrollment of a maximum of **400** participants and is not to exceed this number. If additional data are needed, the researcher must submit a modification request to increase the number of approved participants **before** the additional data are collected. Exceeding the number of approved participants is considered an issue of non-compliance and will result in the destruction of the data collected beyond the approval number and will be subject to deliberation set forth by the IRB.

INFORMED CONSENT DOCUMENT:

The IRB approved and stamped informed consent document (ICD) showing the approval and expiration date must be used when prospectively enrolling volunteer participants into the study. The use of a copy of any consent form on which the IRB-stamped approval and expiration dates are not visible, or are replaced by typescript or handwriting, is prohibited. The signed consent forms must be securely maintained on the UT Arlington campus for the duration of the study plus a minimum of three years after the completion of all study procedures (including data analysis). The complete study record is subject to inspection and/or audit during this time period by entities including but not limited to the UT Arlington IRB, Regulatory Services staff, OHRP, and by study sponsors (if the study is funded).

MODIFICATION TO AN APPROVED PROTOCOL:

Pursuant to Title 45 CFR 46.103(b)(4)(iii), investigators are required to, "promptly report to the IRB ***any*** proposed changes in the research activity, and to ensure that such changes in approved research, during the period for which IRB approval has already been given, are **not initiated without prior IRB review and approval** except when necessary to eliminate apparent immediate hazards to the subject." Modifications include but are not limited to: Changes in protocol personnel, number of approved participants, and/or updates to the protocol procedures or instruments and must be submitted via the electronic submission

system. Failure to obtain approval for modifications is considered an issue of non-compliance and will be subject to review and deliberation by the IRB which could result in the suspension/termination of the protocol.

ANNUAL CONTINUING REVIEW:
In order for the research to continue beyond the first year, a Continuing Review must be completed via the online submission system within 30 days preceding the date of expiration indicated above. A reminder notice will be forwarded to the attention of the Principal Investigator (PI) 30 days prior to the expiration date. Continuing review of the protocol serves as a progress report and provides the researcher with an opportunity to make updates to the originally approved protocol. Failure to obtain approval for a continuing review will result in automatic ***expiration of the protocol*** all activities involving human subjects must cease immediately. The research will not be allowed to commence by any protocol personnel until a new protocol has been submitted, reviewed, and approved by the IRB. Per federal regulations and UTA's Federalwide Assurance (FWA), there are no exceptions and no extensions of approval granted by the IRB. The continuation of study procedures after the expiration of a protocol is considered to be an issue of non-compliance and a violation of federal regulations. Such violations could result in termination of external and University funding and/or disciplinary action.

ADVERSE EVENTS:
Please be advised that as the principal investigator, you are required to report local adverse (unanticipated) events to The UT Arlington Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence.

HUMAN SUBJECTS TRAINING:
All investigators and key p : documented Human Subjects
Training or CITI Training earch Administration;
Regulatory Services. Com completion date.

APPENDIX E

THE IRB PROTOCOL

COLLABORATION:
If applicable, approval by the appropriate authority at a collaborating facility is required prior to subject enrollment. If the collaborating facility is *engaged in the research*, an OHRP approved Federalwide Assurance (FWA) may be required for the facility (prior to their participation in research-related activities). To determine whether the collaborating facility is engaged in research, go to: http://www.hhs.gov/ohrp/humansubjects/assurance/engage.htm

CONTACT FOR QUESTIONS:
The UT Arlington Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human research subjects. Should you have questions or require further assistance, please contact Robin Dickey by calling 817-272-9329.

Sincerely,

Patricia Turpin

Digitally signed by Patricia Turpin
DN: o=The University of Texas System, ou=The University of Texas at Arlington CA, ou=www.verisign.com/repository/CPS Incorp. by Ref.,LIAB.LTD(c)99, cn=Patricia Turpin, email=pturpin@uta.edu
Date: 2010.03.26 15:39:42 -05'00'

Patricia Turpin, Ph.D., RN, NEA, BC
Clinical Associate Professor
UT Arlington IRB Chair

APPENDIX E

THE IRB PROTOCOL

附件三：電話邀請的用詞

- 在取得吸菸學生的名單與電話號碼之後，研究主持人將打電話給學生，並用下列詞句邀請學生參與本研究：
  - ■「嗨，你好！冒昧打擾你！由於【大仁科技大學】學生諮商中心很關心你的健康，所以他們推薦你參加這一項戒菸的研究。你只需要用自己的電話來聽一些戒菸方面的問題，並用按鍵回答，最少二通，最多 16 通。如果你全程參加完，就可以獲得 200 元禮券，以酬謝你的辛勞，同時你也有可能更健康哦～如果你對這個研究有任何疑問，可以向【大仁科技大學】學生諮商中心查證該公文。這個是自願性的，你隨時可以拒絕參加，不會有任何不良後果。請問你有興趣嗎？」
  - (1) 當學生回答：「是，我想參加！」，則研究者會說：「感謝你。請在__月___日至___日(共三日)的上班時間，親自至學校的學生諮商中心聽詳細說明並填寫同意書。如有任何疑問，請不要客氣聯絡我，我的電話是 0987029548 彭武德。再見！」
  - (2) 當學生回答：「不，我不想參加！」，則研究者會說：「好的，謝謝你！不好意思打擾你了！再見！」

Attachment 3: Sentences Used In The Invitation Phone Call (附件三：電話邀請的用詞)

- After obtaining the students' names and telephone numbers, the PI will call each of them and invite them to participate in this study using the following sentences:
  - ■ " Hi, how are you? Excuse me for bothering you. Since the student counseling center of TJU is highly concerning about your health, so they recommend this quitting smoking research to you. All you need to do is to listen to some questions about quitting smoking within the calls, and answer them by pressing the keys. There will be two calls at least and 16 at maximum. If you participate the research process completely, then you will be given 200 dollars gift coupon as a reward for your labor. In the mean time, you might become healthier. If yo have any question regarding this study, you may confirm the official letter with the student counseling center of <TJU >. This is voluntary. You may refuse to participate at any time without any negative consequences. Are you interested in?
    - (1) If the student's reply is "Yes, I want to participate.", then the PI's answer: "Thank you. Please go to the student counseling center during the office hours between date 1 and date 2 (3 days in total) for the detailed description of this study and signature on the Informed Consent documen Should you have any question, please feel free to contact me at my cell phone 0987029548. See you.
    - (2) If the student's reply is "No, I don't want to participate.", then the PI answers "OK, thank you. Excuse me for bothering you. See you.

MAR 1 5 2010

APPROVED

MAR 1 4 2011

Institutional Review Board

附件四：知後同意書(受試者用)

Attachment 4: Informed Consent (for subject) (附件四：知後同意書，受試者用)

注意：左方所列的中文句子與右邊的英文是一樣的，受試者僅需閱讀並填寫**中文部份**即可。

Note: The Chinese sentences listed at left are equivalent in meaning with the English at right. The subject simply need to look at and fill in the **Chinese part**.

美國德州大學阿靈頓分校

機構審議委員會合約編號：2009-1669

The University of Texas at Arlingtc

Institutional Review Board Protocol number: 2009-166

1 **研究主持人姓名**：彭武德

1 PRINCIPAL INVESTIGATOR NAME: Wu-Der Peng

2 **計畫題目**：網路電話處遇系統預防吸菸復發之評估研究

2 TITLE OF PROJECT: Evaluation of a web-phone intervention system on preventing smoking relapse

3 **引言**：敬邀參加本研究，這是自願性的。請詳閱下列資訊，如有不懂之處請提出問題。

3 INTRODUCTION: You are being asked to participate in a research study. Your participation is voluntary. Please read the following information in detail. Please ask questions if there is anything you do not understand.

4 **目的**：本研究目的在評估網路電話處遇系統預防吸菸復發的效果。

4 PURPOSE: The objective of this dissertation proposal is to evaluate the effectiveness of an intervention delivered via web-phone on preventing smoking relapse.

5 **參與研究所需的時間**：受試者參與本研究所需的時間一共八週。每位受試者會接到本研究的電話至少 2 通，最多 16 通，每週從 0 通至 2 通不等。每通電話所需時間從 2 分鐘至 10 分鐘不等，其中包含 1 至 35 題的問題。總計整個研究期間內，你可能要花至少 20 分鐘，最多大約 120 分鐘在接聽電話。預訂在取得機構審議委員會核可後才會開始進行本研究。請容許我稍候以電話通知。

5 DURATION: The total time period for subject's participation is 8 weeks. Each subjec will receive 2 to 16 phone calls in total from the Teleherence system, and 0 to 2 calls for each week. In each call, the time lengths vary from 2 to 10 minutes; and the numbers of questions vary from 1 to 35 at maximum. The estimated total time length for your time on the phone calls may vary from 20 to 120 minutes. It will start after IRB approval has been obtained. Please allow me to inform you by phone later.

6 **流程**：本研究使用教育測驗(認知的)與調查的過程，以測量你吸菸的行為與意見，並提供建議給你。此過程完全由電腦自動控制，每個人聽到的不一定相同。該電腦系統的目標是要讓你多考慮一些有關吸菸行為方面的決定。任何一位台灣的大學生，只要曾被貴校學務處人員指認出是吸菸者皆可參加本研究。如果你同意參與本研究，請配合下列事項：

(1) 請填妥本表最後所附的「同意書」，將其交到貴校的學生諮商中心，會有專人將其收集後轉交至研究主持人手上。

6 PROCEDURES: This study uses educational tests (cognitive) and survey procedures to measure your smoking behavior and opinions and to offer advices to you. The whole process is automatically controlled by the computer. The contents for different person may vary. The aim of the system is to help you to consider more on making a healthier decision on their smoking behavior. Any college student, who have been identified as smokers by the staff at the Office of Student Affairs of the universities is eligible to this study. If you agree to participate in this study, please cooperate with th following things:

(1) Please fill in the "informed consent" as attached and turn in it to the Student Counseling Center. A staff there will be specifically responsible for collecting you document and transfer it to the principal investigator (PI).

(2) The PI will key-in all of your information to a very secure computer, and lock all the paper sheets at a iron cabin.

(2) 研究主持人將全部受試者資料輸入一個有特別安全防護的電腦，並將這些文件鎖在一個鐵櫃。

(3) 研究主持人以 1 到 3 重覆報數的方式，將名單上的受試者隨機安排到三組中的其中一組。這三組所接受的內容不同，分別是：

- (一)實驗組：接受處遇、3 次月觀察、以及 5 次週檢測；
- (二)控制組 A：接受 3 次月觀察、以及 5 次的週檢測；
- (三)控制組 B：接受 2 次月觀察，包含週檢測。
- 只有實驗組有接受處遇，其他二組則只有接受測驗。
- 為避免人為因素干擾，研究主持人與受試者均不知那些人在那一個組別。

(4) 在接下來的八週內，電腦系統將依這些資訊撥電話給你，你將聽到一些預先錄音的問題或句子，包括詢問你現在戒菸的情形、詢問你對於吸菸的看法、提醒你有關吸菸與戒菸的好處與壞處。電腦系統會根據你的答案，提供適合你的戒菸相關資訊與技巧。

(5) 當你接到本研究的電話時，請辨認本服務的來電顯示號碼是 +8175330452，避免誤以為是詐騙電話而漏接。

(6) 由你本人親自接聽。

(7) 若你沒接到電話，電腦會在五分鐘後再撥一次給你。

(8) 當電話中有問你問題時，請以你手上的電話按鍵輸入你的答案，輸入時請參考下列按鍵配置圖：

1 非常同意	2 同意	3 不確定
4 不同意	5 非常不同意	6 再聽一次
7 下一段	8 上一段	9 待會再接
*	0	#

(3) The PI uses the numbers through 1 to 3 repeatedly to randomly assign individual t one of the three groups. The three groups are:

- 1) the experimental group to receive the intervention and 3 times monthly observations plus 5 weekly checkups;
- 2) the control group A to receive 3 times monthly observations plus 5 weekly checkups, or
- 3) the control group B to receive 2 times monthly observations.
- Only the experimental group receive the intervention, while the rest two groups receive measuring.
- To avoid the human's factors interfering, both the PI and subjects may not know who is in which group.

(4) Within the future 8 weeks, the computer system will call you based on these information. You will hear about the prerecorded questions or statements, includin asking your smoking status, asking your opinions on smoking, reminding you the advantages and disadvantages of smoking and nonsmoking. Based on your answers, the computer system will provide you the appropriate information and techniques on quitting smoking.

(5) When you received the phone calls from this study, please recognize if the caller i is +8175330452 to avoid mistaking it as a cheating call and thus missing it.

(6) Listen to the phone call by yourself.

(7) If you miss the phone call, the system will call you again 5 minutes later.

(8) When you are asked with questions, please use the keypad on your telephone to input your answers in according to the keys allocation graph below.

1 strong agree	2 agree	3 Not sure
4 disagree	5 strongly disagree	6 hear again
7 next item	8 previous item	9 call me later
*	0 keypad instruction	#

(9) The system will record your input in responding to each questions.

(10) At the last call, you will be asked to leave a voice message regarding your feelings and thoughts while using this system. Your answers will be recorded, bu will not link to identify your personal identity. These files will be destroyed after this study has ended for six years.

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	③按鍵說明	

(9)這套系統將紀錄你在各題所輸入的按鍵數字。

(10) 在最後一通電話中，本系統將請你以留言方式提供你在使用過本系統後的感覺與想法，你的答案將會被錄音，但不會辨識你的個人身份。此檔案將於本研究結束後六年內銷毀。

7 **參加本研究的好處：**

(1)如果你被隨機安排在「實驗組」，你**將會**從本系統得到最適合你現在狀況的戒菸相關知識與專家的意見，並能從測驗題的重覆提醒來監督自己戒菸的進展情形，效果勝過你自行戒菸哦。

(2)如果你被隨機安排在「控制組」，你**將不會**從本系統得到最適合你現在狀況的戒菸相關知識與專家的意見，但能從測驗題的重覆提醒來監督自己戒菸的進展情形，效果勝過你自行戒菸哦。

(3)參加本研究後，你有可能變成不吸菸者，也可能沒變。若能從此戒菸，你將省下一筆吸菸所需的開銷，並讓身體更健康。

(4)如果這一套協助戒菸方式有效，將嘉惠更多想戒菸的人，提供他們另一種戒菸方式可用。

8 **補貼金**

- 在這八週結束時，如果你完全都接到本研究設定要撥給你的電話或只漏接了一通，你就可以獲得新台幣 200 元禮券(大約是美金 6 元)，不管你是否有戒菸。領取的時間是在這八週結束後的二週內，再請你至 貴校的學生諮商中心領取！

9 **參加者可能的風險**

(1) 參與本研究時你所需要做的就是「接聽電話」，這與您的日常活動一樣。但由於你必須以電話上的按鍵來回答問題，建議你不要同時做其他事，以免發生危險。例如同時騎機車和接電話。

(2) 長期且密集地使用手機是否會導致癌症，目前尚無定論。但若你平常的手機使用量就很高，請調整你的手機使用時間長度，以避免該

7 POSSIBLE BENEFITS :

(1)If you are randomly assigned to the "experimental group", you **will** receive the knowledge and expert's opinions addressing your current status toward quitting smoking. You may also benefit from the repeatedly reminding of testing questions so as to monitor your progressing toward quitting smoking. The effect is better than that of using self-help quitting smoking.

(2)If you are randomly assigned to the "control group", you **will not** receive the knowledge and expert's opinions addressing your current status toward quitting smoking. However, you may benefit from the repeatedly reminding of testing questions so as to monitor your progressing toward quitting smoking. The effect is better than that of using self-help quitting smoking.

(3)After participating in this study, you probably will change to a nonsmoker or will not change. If you quit smoking, you will save a lot of money due to smoking behavior, and make you healthier.

(4)If this helping approach of quitting smoking works, the people who are willing to quit may benefit from this because there will be one other option to choose.

8 COMPENSATION:

- At the end of the 8 weeks, if you have received all of the designated calls for you or missed only one call, a compensation of two hundred New Taiwan Dollars (approximately 6 US Dollars) will be provided to you no matter whether you have quit smoking or not. Please pick-up the coupon within two weeks after the 8 week at the Student Counseling Center of the university where you are enrolled.

9 POSSIBLE RISKS/DISCOMFORTS (List any reasonably foreseeable risks or discomforts to the subject. If there are potential health risks list them here):

(1) When participating in this study, all you need to do is to receive the phone calls that is similar with what you do regularly. However, since you need to concentrate to the questions and press the keypad, we suggest that you should not do some other things at the same time to prevent possible risks such as riding motorcycle and receiving phone call at the same time.

(2) It is uncertain whether long term and intense using cell phone may cause cance However, if you use cell phone very intensively, please adjust the time length t

潛在的風險。萬一你在長時間使用手機後感覺不舒服，請自行至附近的醫院做必要的檢查。

(3) 當你被重覆問到個人戒菸狀況的問題，可能讓你覺得氣餒或厭煩。

(4) 當你聽到一些新的或比較不一樣的想法，可能讓你有被威脅的感覺。

(5) 要花一些時間接聽電話中的訊息及回答問題，可能讓你覺得不太方便。

(6) 當手機設備系統故障導致你無法接到該接的電話時或未按照原訂時程傳送時，可能讓你覺得不太方便。

10 其他流程或處遇

- 如果你決定不參加本研究，且尚未簽署同意書，則你不需做任何事。

11 中途退出研究

- 如果你已簽署同意書，你仍可隨時中斷你在本研究的參與，不會因此而受到懲罰或有所損失，這是你被賦予的另一種權利。但是如果你能留個訊息給研究者或學生諮商中心，你的決定將會更快生效。

12 參與者人數

- 本研究的對象是目前就讀於台灣各大專院校的大學部學生，經學校辨識曾有吸菸習慣，有興趣於本研究，並願意擔任受試者，預估總計有 150 人參加。

13 保密

(1) 你所簽署的同意書將會被鎖在高雄醫學大學研究主持人的辦公室內的一個檔案櫃。而受試者的電子資料檔也將會被單獨且保密地存放在一個安全的伺服器，網址在 https://teledb.uta.edu:7001/agency，只有研究者及負責的資訊人員可看到這些資料。受試者的答案不可能在研究之外的情境洩露出去。

(2) 萬一美國德州大學阿靈頓分校審議委員會有必要檢視你在此研究的資料，他們也會依法對那些紀錄保密。你提供的研究資料將不

avoid the potential risks. Should you feel uncomfortable after long time using c cell phone, please go to a local hospital for required checkup.

(3) You might feel frustrated or bored while being asked about your smoking cessation status.

(4) You might feel threatened by hearing about something new and different,

(5) You might feel inconvenienced by the time spent listening to phone messages and answering questions over the phone,

(6) You might feel inconvenienced due to equipment system failures resulting in phone calls not being delivered or being inappropriately delivered.

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10 ALTERNATIVE PROCEDURES/TREATMENTS:

- If you decide not to participate and have not signed any documents in this study, you don't need to do anything. Nothing will happen to you.

11 WITHDRAWAL FROM THE STUDY:

- If you have signed the informed consent in this study, you still may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled. However, it will make your decision effective sooner if you drop a message to the researcher or the student counseling center.

12 NUMBER OF PARTICIPANTS:

- The subjects for this study are the undergraduates who are currently enrolled in an university in Taiwan; have been identified as smokers by university staff; is interested in this study; and is willing to participate as a subject. It is estimated tha 150 participants in total will be enroll in this study.

13 CONFIDENTIALITY:

(1) The Informed Consent documents signed by you will be kept under a locked fil cabinet at the PI's office in the KMU. The subjects' electronic profiles will be kept separate and confidential at the security server at https://teledb.uta.edu:7001/agency in which only the researcher and the responsible IT staff have the access. No disclosure of the human subjects' responses outside the research is possible.

(2) If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, then The University of Texas at Arlington will protect the confidentiality of those records to the extent permitted by law. Your research records will not be released without your consent unless required by law or a court order. The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying

會被洩露出去，除非有你的書面同意，或是法律要求或法院的命令。你的參與所產生的資料將來可能會讓其他研究者取得，但純粹以學術研究為目的，在此不詳述。若有此情形，這些資料也不會包含任何可資辨識你身份或你個人參與情形的資訊。

(3) 由於本研究也接受「高雄醫學大學 97 學年度教師專題研究計畫」贊助經費，計畫編號為 KMU-M098029 號，故該校有權審視本研究的資料，並依法保密。

(4) 請注意：(a)在本研究的最後一通電話中，你的留話會被錄製成 mp3 檔；(b)這些檔案將會被謄成文字稿，且不會有可辨識出你個人身份的資訊；(c)這些檔案將會存放在安全的伺服器上(如上所列)；(d)僅供研究主持人聽，且僅供研究目的之用；(e) 這些檔案將會被保存著以供未來的分析。

(5) 如果本研究的結果有出版，或在科學性質的研討會上報告，你的個人身份將不會被洩露出去。

(6) 本研究以電腦處理個人資料的方式悉遵守「電腦處理個人資料保護法」(民國 84 年 08 月 11 日公布)的規定，你的權益也受到該法的保障。

14 如有問題請連絡

- 若你需要了解學生參與本研究的權益，請向你所在的學校學生輔導中心主任連絡。
- 大仁科技大學的學生，請洽許修齊主任，電話：(08)7624002 轉 678 或 134。
- 你也可以連絡研究主持人彭武德，上班時間的電話：07-3217997 轉 16；手機：0987029548；e-mail:wudepe@kmu.edu.tw；住址：807 高雄市三民區十全一路 100 號。

簽名表示同意

- 本人謹代表此研究，已經解說本研究的目的、過程、可能涉及的好處及風險：
- 收同意書者簽章：

information that could associate you with it, or with your participation in any study.

(3) Since the research project is sponsored by the KMU, it will also have the legal right to review your research records and will protect the confidentiality of thos records to the extent permitted by law.

(4) Please note: (a) that at the last telephone call sessions of this study your voice message will be recorded into mp3 files; (b) that the files will be transcribed into text files so that no personally identifying information is visible on them; (c) that they will be kept in the secure server (as listed above); (d) that they wil be heard only for research purposes by the investigator; and (e) that they will b will be retained for possible future analysis.

(5) If the results of this research are published or presented at scientific meetings, your identity will not be disclosed.

(6) The processing of your research data are all following the regulations speculate in "The Computer Processing Personal Data Protection Law" (announced on Aug 11th, 1995). Your rights and benefits are also protected by this law.

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14 CONTACT FOR QUESTIONS:

- Questions about this research or your rights as a research subject may be directed to the Chief of Student Counseling Center at the university where you are enrolled
- For those of Tajen Univ, please contact the Chief, Hsiu-Chi Hsu, at (08)7624002 ext 678 or 134.
- You may also contact the PI, Wu-Der Peng, at (07)3217997 ext 16 during office hours; cell phone: 0987029548; e-mail:wudepe@kmu.edu.tw; or Address: 10(Shihchuan 1st Rd, Sanmin Dist, Kaohsiung city, 807。

CONSENT:

- As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:
- Signature and printed name of person obtaining consent

☐Ta-Jen University _____ Date_____

□大仁科技大學_____日期：_____

- 研究主持人簽章：_____日期：_____

- 請簽名以示你確定你已經讀過、或已有人讀給你聽過這份文件。你已經被告知本研究的目的、過程、可能的好處與風險，且你已收到此文件的影印本。在你簽名前，你有問問題的機會，而且隨時可問其他問題。
- 你參與這份研究是出於自願的。簽署這一張表格不是在免除你任何合法的權利。若你拒絕參加本研究，並不會讓你因此而受到懲罰或免除任何好處，這是你被賦予的另一種權利。而且你隨時可拒絕參加本研究，不會讓你因此而受到懲罰或減少任何好處，這是你被賦予的另一種權利。

- 自願者簽名：：_____日期：_____

- Signature and printed name of principal investigator: _____ Date:_____

- By signing below, you confirm that you have read or had this document read to you. You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been give the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.
- You voluntarily agree to participate in this study. By signing this form, you are nc waiving any of your legal rights. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled, and you may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

- SIGNATURE OF VOLUNTEER:_____ DATE:_____

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BIOGRAPHICAL INFORMATION

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