# Internet and cell phone based smoking cessation programs among adolescents

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## ABSTRACT

Smoking cessation among adolescents is a salient public health issue. With the popular use of the Internet and cell phone usage among adolescents, smoking cessation programs are beginning to adopt these new delivery methods. The purpose of the study is to review interventions between 2005 and 2009 that used the Internet or cell phones for smoking cessation among 11 to 19 year olds. A systematic search of the CINAHL, ERIC, Google Scholar, and Medline databases was done independently by two researchers. A total of 10 articles met the inclusion criteria. Interventions mainly used the Internet as a form of assistance to enhance the effectiveness of the program. One intervention used text messaging through cell phones. Self-efficacy, household and social support systems and perceived benefits were found to be significant predictors. Programs with multiple approaches, using the Internet as an adjunct were more effective than programs that solely relied on the Internet. Currently, there are very few studies utilizing the Internet and cell phone as a program delivery method. Future research is needed to verify its success in cessation practices. Recommendations for future research are provided.

**Keywords**: smoking cessation, adolescents, internet, cell phone, intervention

## 1.    INTRODUCTION

Smoking in adolescents is a public health concern due to its impact of adopting risky health behaviors as they become adults [1]. In 2008, one in every five deaths was attributed to smoking cigarettes, which resulted in 5.1 million years of potential life that was lost [1]. Reports from 2007 revealed that 20% of high school students were smoking cigarettes. On a daily basis, an estimate of 4,000 adolescents smoked a cigarette for the first time. While the number of adolescents who smoke remain high, it is important to note that smoking in adolescents has reduced since 1997. Prevalence of adolescents smoking in 1997 was about 70.4% and this reduced to 50.3% by 2007 [2]. It is important to note that this reduction was also seen due to a lower number of adolescents reporting use of cigarettes, which still puts cigarette use as a public health concern.

Adult smokers typically had their first cigarette as an adolescent [3]. Of all adult smokers, approximately 89% of them had their first cigarette before the age of 18. Experimenting with cigarettes is a common behavior in high school students, which can lead them to become regular smokers and also exposes them to greater health risks. These risks consist of lung cancer, emphysema, chronic lung diseases, and cardiovascular diseases. In addition, 84% of those that began smoking felt they could not quit and were noted to be more vulnerable to nicotine dependence. Interestingly, of the adolescents that had smoked at least once a day for a month, 79.2% had tried to quit but failed due to dependence. Adolescents exhibit similar addictive behaviors to cigarettes as adults do. As smoking increases in adolescents, nicotine dependence enhances proportionally, which causes them to continue smoking as adults. Thus, determinants of smoking cessation in adults apply to adolescents as well.

### Aim

It is in this backdrop that the aim of this study was to systematically review articles that utilize the Internet or cell phones as part of a smoking cessation intervention that have been published between 2005 and 2009 and recommend ways to improve them. The focus of interventions was with adolescents in the ages 11-19 years.

## 2.    METHODS

Article searches were conducted on CINAHL, Google Scholar, ERIC and Medline for the time period 2005 to 2009. Keywords use to search for articles were: smoking cessation in adolescents, nicotine reduction, tobacco reduction, web-based, cell phone based, text messaging smoking cessation, nicotine reduction, tobacco reduction, teenagers, high school. Approximately 50 articles were located and narrowed down to 10 based on the inclusion and exclusion criteria. Two researchers conducted the search independently in arriving at the chosen studies. Some review articles regarding smoking cessation were located but could not be used for this study, as studies were primarily conducted in adults. Most reviews still focus on group based programs or include young adults in their interventions. Articles were fully read to determine eligibility. There are a lack of reviews with adolescents between the ages of 11 and 19 using the Internet or cell phones. In addition, Internet and cell phone use popularity among adolescents has increased in the past five years. Thus the search had to be dated back to 2005.

Criteria for inclusion were: (i) studies published between 2005 - 2009 (ii) studies in the English language, (iii) focus on adolescents, (iv) age group had to be between 11-19 years (v) Internet/cell phone use in the intervention (vi) randomized controlled design or quasi-experimental design or pre-test/post-

test design or qualitative design. The exclusion criteria were: (i) articles published before 2005, (ii) non- English articles (iii) inclusion of adults along with adolescents (iv) studies using individuals beyond 19 years of age (v) cross-sectional studies (vi) studies that did not use the Internet or cell phone in the intervention.

## 4. RESULTS

The first intervention by Hollis, and colleagues [4] looked at the efficacy of a brief counseling plus computer based tobacco intervention in teenagers regular seen for medical care. The program was called teen research approaches to cancer in a health maintenance organization (Teen REACH) and the computer portion was referred to as the pathways to change (PTC). Stages of change- Transtheoretical model was the theory used in the development of the PTC. Motivational interviewing was conducted after going through the PTC and two booster sessions throughout 11 months following post intervention. These booster sessions were not computer based but carried out by the counselors instead. Follow up assessments were made after one and two years post intervention.

There were 1254 participants in the PTC intervention and 1272 in the control (dietary) group [4]. Results indicated a significant number of participants smoke free at the one year follow up but was not seen at the second year follow up. For those that smoked more than one cigarette in the past 30 days at baseline were reduced at both follow ups. A significant number of smokers at baseline in PTC had considered themselves former smokers at follow up. It was also found at a 95% confidence interval, participants who received at least one booster had higher quit rates than those who had no boosters. The control group also showed high quit rates, which were maintained at the two years follow up. Overall the PTC can be of assistance in smoking cessation among adolescents.

The second intervention looked at a Internet assistance in an auricular acupressure smoking cessation program by [5]. Auricular acupressure is a non-invasive process, stemming from Chinese medicine, which stimulates auricular points. This causes endorphin levels to increase, maintenance of the sympathetic nervous system, and curbs nicotine addiction. A website including information on smoking cessation, discussion forums, online professional counseling and access to other cessation websites, was added to the acupressure for the intervention group (group one). The aim of the intervention was to reduce cigarette addiction and increase self-efficacy for quitting.

There were 77 participants who smoked and were non-randomly assigned to either group; group one had 38 and group two had 34 [5]. Results indicated a significant increase in self-efficacy for both groups (p < .05). With regard to quitting, 6 of the 38 (57%) participants quit, while only one out of 34 (2.56%) in group two quit. Nicotine dependence among group one was found to be statistically significant (p < .01). Participants in group one scored the website a mean of five out of seven possible points. Internet assistance allowed participants to obtain quick answers, convenient access to information and additional counseling, which was not available to the control group. It served as a form of social support as well. Overall, the intervention was found to be more efficacious.

The third intervention by Chen and Yeh [6] used the Internet as additional instruction in a smoking cessation program. The study not only developed a program but also conducted its evaluation. Seventy seven high school seniors were randomly assigned to the intervention or a control group. Self efficacy from the social cognitive theory was utilized in the development of the intervention, as it was found to be a predictor for smoking cessation. Lecture, online discussion forums, online questionnaires, group interactions, role plays and other webs sources were part of the intervention. Thus, offering a curriculum not solely reliant on the Internet.

Instruction was given to participants once a week for two hours and lasted for six weeks [6]. No instruction was provided to the control group. The average age of participants was 17 years and they had an average smoking duration of 2.5 years. A reduction in cigarette consumption at (p <.01) and increased smoking cessation attempts (p < .01) were seen with the intervention group. After scores were adjusted, increased smoking cessation attempts were found for both groups (p <.05).

Self-efficacy in the intervention group was also statistically significant (p < .01), which was not seen with the control group [6]. Correlations ran for this construct showed a positive significant relationship with smoking attitude (r = 0.55, p = 0.00), and a negative significant relationship with daily consumption (r = -0.48, p = 0.00) and addiction to smoking (r = -0.37, p = 0.00). Self-efficacy and cessation attempts had no relationship (r =.021, p = 0.21).

The Internet assisted instruction had a positive impact on participants [6]. Participants were able to use this tool to communicate with each other, pace themselves throughout the intervention, and served as a social support mechanism as found in the discussion forum. Internet in the role of assistance was effective.

The fourth intervention by Mermelstein and Turner [7] looked at the web support in a group based smoking cessation program. Not on tobacco (NOT) was the ten session group based program used, which stems from cognitive behavioral principles. The control group received the NOT program, while the experimental was given the NOT Plus. There were three aspects of the NOT Plus: (i) facilitator phone call to student at quit week and four booster calls between the end of treatment and the three month follow up, (ii) Not Hooked website, (iii) American Lung Association quitline access. The website consisted of facts and motivational messages, along with incentive gear for smoking cessation. A total of 351 participants that were smokers from 29 high schools in Illinois were involved; 181 were in NOT Plus and 170 in NOT.

Participants in the NOT Plus program had a 12.2% overall quit rate, while NOT had an 8.5% rate [7]. The NOT Plus program participants were found to be twice as likely to be abstinent than those in NOT. Also more women were more likely to quit than men and light smokers were more likely to quit than heavy smokers. Out of 181 in NOT Plus, 66 reported using the website and only 29 had confirmed use through password tracking. Minimal use of the quitline and calls were processed through. Overall, the NOT Plus had better abstinence rates, even at follow up. The website aided initial cessation but was not found at three month follow up. Phone calls had no

relationship with abstinence, nor were there any evidence indicating a significant role in quitting cigarettes.

The fifth intervention by Patten et al. [8] compared an Internet based intervention with a brief office intervention with 139 adolescents. Stomp out smokes (SOS) was the name of the Internet based intervention, which was based on the Comprehensive Health Enhancement and Support System module used with breast cancer patients. The brief office intervention (BOI) was based off of a national advisory of panel of experts from the American Medical Association and focus groups with teenagers. A health care model was being used by the BOI group.

Recruitment was done through three cities: Rochester, MN; Madison, WI; Hartford, CT [8]. Regular and intermittent smokers were recruited to enhance generalizability, along with randomization. The average age of participants was 15.7, with a majority of them being Caucasian (88%), 4% American Indian, and 3% Hispanic. Conditions for both groups were the same but differed in duration, number of sessions, and interactions with others. The SOS group had constant access to Internet and SOS material, while the BOI had four counseling sessions that met consecutively. Follow ups were made at week 4, 8, 12, 24, and 36 for both groups. Researchers hypothesized a higher abstinence rate at week 24 with the SOS group.

At baseline, no differences were seen between both groups [8]. Smoking abstinence rates among the SOS group was lower than the BOI at weeks 8, 12, 24 and 36; 12% and 6% respectively. Differences between groups were not seen at 24 weeks for percentage reduction from baseline measurements. There were a total of 127 smokers at this time. Within this group, the SOS participants were found to smoke fewer days in the week than those in BOI. Results for smoking abstinence rates at week 24 and 36 were lower among the SOS group than BOI.

Participants in the SOS group showed a decrease in the use of the website throughout the progression of the intervention [8]. The average days of use was found to be 6.8 +/- 7.1 days. The Internet based intervention was found to be ineffective in this study as well. Although, for those who did not cease their smoking habits, the SOS intervention was helpful in reducing the number of days they smoked. This was attributed to the self-management aspects of the SOS program. Overall, the SOS was not found to be as effective as the BOI intervention.

The sixth intervention was conducted by Woodruff, Conway, Edwards, Elliot, and Crittenden [9], which utilized an Internet chat room based intervention, called Breathing Room. Fourteen high schools from San Diego County were randomly assigned, with 77 individuals in the intervention group and 59 in the control. Age of participants ranged from 14 to 19 years, with the average being 16. A majority of the participants were Hispanics (51%), 28% were White non-Hispanics, 5% African Americans and 7% were Asian/Pacific Islanders.

The intervention took place over a seven week period which involved seven 45 minute chat room sessions and four online surveys [9]. The surveys were completed by both groups. Follow ups were conducted at three months and at 12 months. At baseline, there were no significant differences between the two groups. Significant changes from the intervention were seen with number of days smoked, and amount smoked per day in the past week. With regards to follow up, the intervention group had lower participation than the control.

Participants in the control group were found to gradually reduce smoking cigarettes [9] . Although, this could be attributed to readiness to quit within that group, as oppose to those assigned to the intervention. In the short term, the Internet chat room was useful for reducing cigarette consumption or helping adolescents stay off of them. Appearance and usefulness of the chat room was positively viewed but did not have high involvement. Results from the post-intervention follow up for the intervention indicated those individuals considered themselves to be former smokers. Follow up at three and 12 months did not yield similar results, indicating a need for booster sessions. Speculations of Internet as a sole delivery method were made.

The seventh intervention by Fritz, Hardin, Gore and Bram [10] looked at a computer based smoking cessation program to help move smokers along the stages of change. Development of the computerized adolescent smoking cessation program (CASCP) intervention modeled the American Lung Association's Not on Tobacco (NOT) program and attempted to follow the stages of change theory. Although, a stage matched intervention did not occur, enhancing self-efficacy was focused on. The intervention consisted of four half hour sessions and assessments were made at baseline, post intervention and a month after.

Two schools were randomly chosen to be in the intervention and control and a third school was involved due to shortage of participants; participants from the third school were randomly assigned [10]. A total of 121 participants were involved, with 61 in the intervention and 60 in the control. Results indicated no significant differences between groups with regard to demographics and exposure to smoking. The intervention group was found to have more quit attempts than the control (p = .05), and a reduction in the number of cigarettes smoked per day (p = .049). At the one month follow up, 23% from the intervention group had quit smoking. Nicotine dependence was also found to be reduced among the intervention group. Self-efficacy (p <.01) and negative perceptions (p =.035) of smoking were also higher in this group post intervention. In regards to stages of change, those in the intervention group showed a significant positive movement (p = .036) while the control did not. Overall, these findings are similar to the NOT program, indicating the CASCP to be as effective.

The eighth intervention used the Internet as assistance in a prevention and cessation program, which was conducted by Norman, Maley, Li and Skinner [11]. A mixture of the Internet, paper journals, a single group based motivational interviewing comprise the program, and follow up e-mails for six months. Paper journals were used to record assessment scores, which would be further discussed at a small group 10 minute motivational interview. Monthly e-mails tailored to the individual based on assessment scores were sent for six months post intervention. The Internet program was called Smoking Zine, which consists of five stages and emphasizes self- efficacy.

The Likelihood of Action Index (LAI) was used for its basis [11]. According to this framework, change in individual is determined by the number of behavior change conditions available. More behavior change conditions that are available, the more likely the individual's behavior will change.

Researchers hypothesized that the intervention group would have a higher resistance towards smoking and cigarette behavior, decreased intentions to smoke in the future and a decrease in overall cigarette use.

There were 1,402 diverse participants from 81 classes (nine - 12th) in the Toronto area; 85% were nonsmokers and 15% were smokers at baseline [11]. Follow ups were done at three and six months. Results from modeling indicate that significant impact on the behavioral intention to continue smoking ($p < .05$) and further tobacco use ($p < .05$) but not cigarette use ($p < .05$). Greater Smoking Zine influence was seen in smokers with high intentions to quit. In comparison with classes, participants in the 10th grade showed the highest response to the intervention.

Results were generalizable, due to the diverse sample used in the study [11]. Overall, the intervention was effective in its attempts to maintain motivation to decrease cigarette use and future intentions of it. The multi-faceted component of the intervention allowed for its appeal among users and its effectiveness.

The ninth intervention developed and pilot tested a multimedia cell phone-based smoking cessation program in Maori, New Zealand by Ossip-Klein and Webb [12]. This study had a focus group and a pilot study. Social cognitive theory was used as the theoretical foundation for the intervention. Text messages included smoking cessation videos and participants would also have the option to receive additional support messages referred to as CRAVE. Duration of the intervention was four weeks.

In the focus group, 27 students participated. Results indicated an interest in text messages a form of cessation support [12]. They also found these messages gave off positive reinforcement and viewed the videos as a relaxation tool towards cessation. The pilot study had a total of 15 participants, with only 13 reporting at follow up. Those results indicated nine individuals ceased smoking habits and four reduced their amount of smoking. Participants found the text messages to be useful in their cessation attempts. It offered social support, encouragement and advice that was conveniently available on their cell phones. This allowed for participants to access these messages at any time or day of the week.

The tenth intervention used a computer based curriculum for prevention and cessation in high school students by Prokhorov, and colleagues [13]. A smoking prevention interactive experience (ASPIRE) involved 1160 students from 16 minority inner-city high schools in Houston. The curriculum is based off the social cognitive theory and the transtheoretical model of change. Duration of the intervention was for five weekly sessions that were 30 minutes each and follow-up occurred 18 months afterwards.

Results indicated that former smokers and experimenters had higher smoking initiation rates [13]. Significant differences for smoking cessation were not found for either groups ($p > .05$). Participants in the intervention had a higher decisional balance, and reduced temptation to smoke ($p < .05$). At the same time, those findings were not consistent with Hispanic students. It was also found that Hispanic students who had not gone through an acculturation process were more likely to initiate smoking than their counterparts. Hispanic students were more likely to smoke due to environmental influences. Other cultural groups showed positive impacts of the ASPIRE program. Students listed as higher risk due to peer or parents smoking, had reduced initiation levels at that follow up. While a computer based multimedia program had positive impacts, it did not account for cultural differences.

## 5. DISCUSSION

The purpose of the study was to review smoking cessation interventions in adolescents in the ages 11-19 that used the Internet or cell phones published between 2005 and 2009. Since there were only ten such interventions it can be said that more studies using cell phones and the Internet are needed. Of the ten interventions, only one utilized the cell phone.

In terms of theory based interventions, four of the ten interventions (40%) used the social cognitive theory. Two interventions followed the transtheoretical model but did not base the program solely on the theory. Another study used a mixture of social cognitive theory, transtheoretical model, theory of planned action, and health belief model when developing the Smoking Zine website. The eclectic use of theories was referred to as Likelihood of Action Index (LAI), showed significant results with Smoking Zine, indicating the possibility of usefulness of the theory for other technologically advanced interventions. Self-efficacy is known to be a predictor in smoking cessation behaviors. Interventions that measured self-efficacy, confirmed this notion. Higher self-efficacy was shown to help in the reduction of days smoking, alleviating nicotine dependence and quit rates. Interventions not using a theory were based off of the American Lung Association's guidelines, Comprehensive Health Enhancement and Support System or cognitive behavioral principles.

Another set of categories with the interventions were, Internet based programs and Internet assistance based programs. Three interventions were solely Internet based while six used the Internet as an adjunct. Those that only used the Internet were not as effective, while Internet assistance programs were found to have a higher effectiveness level. Thus, it is more effective to introduce the Internet or text messages for additional assistance. In the role of assistance, usage of discussion forums and online counseling were found to be more effective, as results were maintained throughout follow ups. Smoking Zine, CASCP, ASPIRE, auricular acupuncture with Internet, and IAI held these effects due to convenient access of social support and professional advice. It also allows for cessation programs to have an individualized component and lets the participant progress at their own pace.

Internet assistance programs were often accompanied with some form of counseling. In these counseling sessions, motivational interviewing was primarily used. This method allows the individual to come to the main point, as opposed to the counselor providing that information. Counseling was provided by professional counselors, or physicians, ensuring a professional degree of assistance. This allows for participants to progress in their stages of change while gaining the confidence to quit smoking or at least reduce the number of days.

At the same time, booster sessions after interventions were found to be useful for this age group. This would allow for cessation maintenance to occur over the long term, as oppose

to short term. The brief intervention in the Teen REACH program, indicated a longer duration than one time, is needed. In addition, a problem faced with Internet programs was a lack of use [4]. This was primarily seen with programs that were solely based on the Internet. In order for full use of the websites, awareness of materials available needs to occur. These issues were also faced due to a variety of number of participants. Some intervention had large numbers as high as 2,526 participants, while other had as few as 13 participants.

Another point of interest with these interventions was cultural sensitivity. The ASPIRE intervention found the program did not work for Hispanic students due to their overpowering environmental influences [13]. Other interventions did not address this issue, as it was not a finding in their programs. Environmental influences play a vital role in smoking behaviors among adolescents. This is an area requiring more attention.

### Limitations of the interventions

There were several limitations to these studies. While a majority of the interventions utilized a theoretical framework, not all did. Household and social support was not explored in depth, which made it hard to determine its impact on cessation. A few studies found this determinant to be an influential role but failed to assess it. At the same time, all of the programs did not assess socio-cultural factors. Effectiveness of a cessation program was undeterminable for other cultures.

### Limitations of this review

There are some limitations in this review. First, interventions published in English language were included and many interventions especially in international settings are published in other languages which were excluded from this analysis. Second, only interventions published in four databases were included. While these databases are quite extensive yet these do not tap into all the health literature from all the countries. Further, many of the interventions often do not meet the rigors of being published in peer-reviewed journals and were thus excluded. Finally, differing evaluation methodologies and outcome indices were used in different studies. In the selection criteria attempts were not made to filter studies based on methodology or outcome indicators but effort was made to be more inclusive of various interventions. As a result conclusive meta-analysis type of work cannot be done with these studies and comments cannot be made regarding the effect size of the interventions.

### Conclusions

Preventing and ceasing smoking habits among adolescents, can minimize and almost eliminate future health concerns. Minimal studies among adolescents between the ages of 11-19 years old exist. Of the few available, interventions using the Internet have been found to be effective. In addition, self-efficacy was found to be a predictor in reducing and ceasing smoking. Internet should not be the sole method of delivering a smoking cessation program. Programs that use multiple methods were found have a better impact for maintenance of behavior post intervention. More interventions need to be conducted using these methods, to gain a better understanding of their role in smoking cessation.

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