

A Review of the Literature on Adolescent Smoking and Cessation Programs

By

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Abstract

Over 4.5 million adolescents smoke cigarettes (Johnston, 2001; American Lung Association, 2003) half of all adolescents who become addicted to cigarettes will smoke for at least 20 years before they quit (Choi, Ahluwalia, & Nazir, 2002), 80% of adult smokers began when they were adolescents (Abrantes et al., 2008), and an estimated 6.4 million children aged <18 years living today will die prematurely as adults because they began using tobacco during adolescence (American Lung Association, 2003; Centers for Disease Control and Prevention [CDC], 2006c).

A majority of adolescents wants to quit tobacco with up to two-thirds reporting an attempt at quitting in 2007 (Abrantes et al., 2008). Smoking cessation programs for adolescents are not well studied and have not received the same amount of research that smoking cessation programs for adults have received (Sussman, Sun, & Dent, 2006; Abrantes et al., 2008).

This review of the literature on adolescent smoking and cessation programs provides a summary of what has been studied to date and what needs to be done in order to provide the best evidence-based smoking cessation programs for adolescents.

A Review of the Literature on Adolescent Smoking and Cessation Programs

Introduction

This paper reviews the recent literature on adolescent smoking and cessation programs. Articles published in English between 2004 and 2009 inclusive were identified through the National Library of Medicine's Gateway Search Engine. The terms teen, smoking, and cessation were used to search the database and 1,359 articles and abstracts were found in MEDLINE/PubMed for those dates. Article titles and abstracts were reviewed for relevancy to the topic of adolescent smoking cessation and the articles in this review are limited to those available electronically through PubMed, the Internet, and the University of North Carolina at Chapel Hill Health Science Library.

These articles address the health effects of smoking, the prevalence of adolescent smoking, the types of smoking cessation programs available, the evidence of effectiveness of adolescent smoking cessation programs, and the implications for future research. A summary to inform future program development is included.

Health Concerns and Smoking

In 1964, the Advisory Committee to the Surgeon General of the U.S. Public Health Service on Smoking and Health issued a groundbreaking report that definitively documented the negative health effects of smoking (U.S. Department of Health, Education, and Welfare, 1964). The principal finding of this report was that cigarette smoking was associated with a 70% increase in the age-specific death rates of males, and to a lesser extent with increased death rates of females.

It showed that smoking causes chronic bronchitis and cancers of the lung and larynx. The 2004 Surgeon General's Report on the health effects of smoking added to the list of diseases that are caused by smoking: cancers of the stomach, uterine cervix, pancreas, and kidney; acute myeloid leukemia; pneumonia; abdominal aortic aneurysm; cataract; and periodontitis (U.S. Department of Health and Human Services, 2004).

In addition to the negative health effects seen in adults, there are additional effects seen in adolescents who use tobacco. One of the major negative health effects for adolescents that smoke is the rate of lung growth is reduced, as is the maximum level of lung function that can be achieved. Young smokers are less physically fit than their non-smoking peers are and are significantly more prone to respiratory problems: shortness of breath, coughing spells, phlegm production, and wheezing. These respiratory issues can lead to problems in adulthood such as chronic obstructive pulmonary disease (CDC, 1994).

According to the U.S. Department of Health and Human Services (2004), "quitting smoking has immediate as well as long term benefits, reducing risks for diseases caused by smoking and improving health in general." Cigarette smoking is the leading preventable cause of morbidity and premature death in the United States (CDC, 1994; CDC, 2007).

Prevalence of Adolescent Smoking

Adolescent smoking prevalence reached its peak for males in the 1940s and in the 1970s for females (Johnston, 2001).

Nelson et al. (1995) reported on data for trends in adolescent cigarette smoking from 1974 through 1991. Smoking prevalence among adolescents in 1974 ranged from between 22% to 43% and by 1991 had declined to between 10% and 29%. There was a decline in smoking in all surveys examined for the years covered, and by 1991 prevalence among female and male adolescents reached parity. Beginning in 1985, Black adolescents were less likely to smoke than their White peers were and by 1991, the differences were substantial.

Johnston (2001) reported that the Monitoring the Future Study found smoking prevalence in 2000 for adolescents in the 8th and 12th grades between 14% and 32%.

The CDC (2006c) reported that the 2002 National Youth Tobacco Survey showed current use of tobacco in any form was 13.3% in middle school students and 28.2% in high school students.

The Global Youth Tobacco Surveillance, 2000-2007 (Warren et al., 2008) reported that in 2004 13% of adolescents in the United States between 13 and 15 years old were current cigarette smokers.

The CDC (2006b) reported a prevalence of smoking among 15 to 18 year old U.S. high school students at about 23% for 2005.

Backinger (2009) presented a Tobacco Control Update to the National Cancer Advisory Board and reported there were 3 million youth smokers in the U.S. (20% of youth) during 2006-2007 and that half of all high school students had tried smoking.

Characteristics and Attitudes of Adolescent Smokers

Adolescent smokers want to quit tobacco (Balch et al., 2004; CDC, 2006a; Stanton, Baade, & Moffatt, 2006; Abrantes et al., 2008; Fritz, Wider, Hardin, & Horrocks, 2008).

Balch et al. (2004) found that adolescents considered addiction to cigarettes real, powerful, stealthy, and insidious. Adolescents consider cravings critical to self-perceptions of addiction whether or not they still smoke. They believe that quitting smoking is achievable and desirable. Established adolescent smokers consider it too hard to quit in the immediate future but seem more ready to quit than experimenters. Many experimenters considered quitting a matter of willpower. Current smokers tried to reduce the harm by switching to "light" brands. Adolescents showed low awareness, familiarity, use, and recognition of cessation programs. The authors report that for adolescents, the social environment plays a heavy role in smoking and cessation. Few adolescent smokers are aware of smoking cessation programs, understand them, or have them available.

Castrucci, Gerlach, Kaufman, and Orleans (2004) looked at adolescents, organized sports, and tobacco use. They found that participation in organized sports did not appear to be protective against tobacco experimentation and use, but the odds were 43% greater of wanting to quit tobacco among adolescents participating in organized sports.

Jones, Schroeder, and Moolchan (2004) studied a sample of adolescents who were screened for a randomized study of nicotine replacement therapy. They

were looking at association with friends who smoked and the number and duration of previous quit attempts. The authors found that time spent with smoking friends translated into fewer quit attempts but not the duration of quit attempts. The authors attribute these findings to dissonance in the adolescents attempting to quit tobacco but still spending time with friends who smoke.

Steinberg, Delnevo, Foulds, and Pevzner (2004) reviewed data from the 1999 New Jersey Youth Tobacco Survey to describe patterns of adolescent smoking, dependency, and quitting behavior. They found that adolescents who were frequent smokers smoked more cigarettes per day, were more dependent on nicotine, and had lower self-efficacy in quitting. The authors reported that the majority of adolescent smokers were not being asked about their smoking status by health care providers. The authors conclude that incorporating tobacco treatment into routine medical care as the 2000 U.S. Public Health Service guidelines recommend requires greater attention.

Turner and Mermelstein (2004) studied reasons for quitting among 351 adolescents between 14 and 19 years old in a school-based cessation program. The authors confirmed that adolescents' concern about health was frequently given as one reason for quitting but the major reason given for quitting smoking was to save money. The conclusion provided by the authors is that motivation is a potent predictor of smoking cessation for adolescents as is having friends that support the adolescent in their quit attempt.

Turner, Mermelstein, Berbaum, and Veldhuis (2004) studied school-based smoking cessation programs and predictors of attendance among 349 adolescents

between 14 and 19 years old. They found that individual characteristics predicted attendance. Early in the quit program, extrinsic factors such as location and timing were the major predictors of attendance. Predictive factors such as motivation and stress played a role in attendance along with the extrinsic factors later in the smoking cessation program.

Castrucci and Gerlach (2005) examined the association between adolescents' attitudes toward quitting smoking, their beliefs about whether or not their parents know they smoked, and their parents' attitudes about smoking. This study included 4,593 adolescents between 13 and 19 years old who smoked within the previous 30 days. The findings reported by the authors indicate that adolescent smokers who felt their parents' opinions about smoking were important were more likely to think seriously about quitting.

Semer et al. (2005) developed a motivational intervention based on physical attractiveness and oral health and studied its feasibility and acceptability among 139 high school students between 16 and 19 years old. The intervention consisted of three parts: computer simulations of the effects on facial appearance from tobacco use and oral cancer; analysis of facial skin type and fingernail care with advice to quit tobacco to avoid wrinkling, yellowing of fingernails, and staining of fingers; and oral cancer screening by a county school nurse. They found that the program was feasible and acceptable in motivating students to enter a six-week cessation program. The authors conclude that the motivational program also had the benefit of providing education and information to the students.

Stevens, Colwell, Smith, Robinson, and McMillan (2005) studied whether adolescents who report negative affect as a reason for smoking differ in their behaviors, attitudes, self-efficacy, and nicotine dependence from those who report other reasons for smoking. The authors studied 721 adolescents who were referred to the Adolescent Tobacco Use Awareness and Cessation Program (ATCP), which is a Texas program for adolescents ticketed for possession or use of tobacco while under the age of 18. The participants were placed in one of two groups based on the presence or absence of negative affect. Both groups participated in a cognitive-behavioral smoking cessation program. The authors found that adolescents with a negative affect for smoking were more likely to see themselves smoking in the future and had less self-efficacy to quit smoking compared to those without a negative affect for smoking.

Abdullah and Ho (2006) studied the attitudes toward smoking cessation among 32 secondary school students in Hong Kong. Their focus groups identified several barriers to smoking cessation including boredom, the influence of peers, smoking urge, pressure from schoolwork, needing to do something with their hands, concentration difficulties, and peers who gave them free cigarettes. Overall, the authors contend the main reason adolescents find smoking cessation difficult is peer pressure.

Amos, Wiltshire, Haw, and McNeill (2006) studied attitudes towards smoking cessation in a group of 99 Scottish adolescents between 16 and 19 years old. They report similar findings to Abdullah and Ho (2006) in that the barriers

identified by this group of teens were having friends who smoke, stress or boredom, and the smoking culture at school or work.

Adolescents who try to quit smoking mainly attempt cessation without any assistance (CDC, 2006a). The authors report that decreasing the number of cigarettes smoked is the most common unassisted method used by the young smokers (age 16-24) interviewed. The other methods utilized were not buying cigarettes, exercising more, quitting with a friend, telling others they were no longer smokers, and switching to light cigarettes. The editorial note that accompanied the article stated that smoking cessation interventions using cognitive-behavioral approaches showed promise, and since the FDA has not approved any pharmaceutical interventions for minors, counseling approaches were essential for smokers under the age of 18.

Kim (2006) studied 706 Korean adolescents in Seoul to test the applicability of the Transtheoretical model (TTM) to understand smoking behavior change. The adolescents completed surveys and the author found the results of the surveys were in agreement with results seen in Western countries. The self-efficacy of the participants' ability to avoid tobacco differed based on their stage and that the more self confident they were they could resist smoking the further along the stages of the TTM they were.

Leatherdale (2006) explored the interest of 3,136 Canadian teen smokers in participating in a school-based smoking cessation program. The author found most of the adolescent smokers were unaware of school-based smoking cessation programs and they were not interested in participating in a school-based program.

Molyneux et al. (2006) conducted surveys with 4,065 UK students between 13 and 16 years old to determine their preferences for smoking cessation programs. Of the students surveyed, 888 were current smokers. The findings were that the students preferred confidential, non-judgmental services delivered during school-hours by a trained counselor. The adolescents wanted to be able to attend the program with friends and wanted access to nicotine replacement therapy. The authors found the participants were aware of smoking cessation methods but did not perceive these to be effective. The findings in this study are in contrast to what Leatherdale (2006) reported and could be due to different smoking norms between Canada and the UK.

Stanton et al. (2006) examined predictors of self-initiated smoking cessation among 2,451 students in grades 8 to 12 in Queensland, Australia who reported smoking within the previous week or had smoked at least ten cigarettes in their lives. Written questionnaires were given to the students and the authors found more than 60% of the students were involved in smoking cessation activities. School lessons about smoking were found to be positively related to cessation activities, but the strongest predictor of students being involved in smoking cessation activities was whether they had influenced peers not to smoke.

Woodruff, Lee, and Conway (2006) explored smoking and quitting history variables and stage of readiness to quit in 121 multi-ethnic adolescents. They also looked at smoking and quitting history variables and attitudinal factors as correlates of readiness to quit in this group of adolescents. The authors found the adolescents studied were frequent but not heavy smokers. Adolescents in the

preparation stage were more likely to be Hispanic, less frequent smokers, less recent smokers, and lighter smokers. The adolescents in the preparation stage had experienced longer quit periods, had a greater number of quit attempts, and had tried to quit most recently. The adolescents in this stage reported more self-efficacy for quitting and saw less benefits of smoking. Precontemplators had the most negative smoking/quitting history and attitudes. The authors conclude cognitive and affective approaches to smoking cessation may be the most effective methods of supporting smokers in the precontemplation and contemplation stages.

Researchers looking at smoking for different groups found adolescents between 12 and 17 years old had higher levels of nicotine dependence than smokers from other groups that smoked the same number of cigarettes per day did ([No authors listed], 2007). Adolescents were more likely to become addicted to tobacco after smoking fewer cigarettes per day than adults smoke. The article indicated teen smoking cessation programs increased the probability of quitting in the short-term and evidence was lacking that long-term abstinence was increased. The clinical approaches for teen smoking cessation provided include screening adolescents and their parents for tobacco use; using behavioral and counseling interventions; and considering using bupropion or nicotine replacement therapy if the adolescent is addicted to nicotine. Understanding how teens think and leveraging teen motivations were reported as being important in providing successful smoking cessation programs for adolescents. School-based programs worked better than clinic-based programs and the two programs endorsed by the

Substance Abuse and Mental Health Services Administration (N-O-T and Project EX) were examples of appropriate programs for adolescent smoking cessation.

Bancej, O'Loughlin, Platt, Paradis, and Gervais (2007) reviewed 52 studies published in English between 1990 and 2005 for estimates of prevalence of smoking cessation attempts among smokers between 10 and 20 years old. The authors' review showed average prevalence of any smoking cessation attempt of 58%, 68%, and 71% in the past six months, 12 months, and ever. These high prevalence rates of smoking cessation attempts were seen for all smokers, not just those who smoked daily or for late adolescents. Most adolescent smokers had made multiple quit attempts. The prevalence was high for relapse within six months of their longest quit attempt among those who made attempts.

Curry et al. (2007) reviewed the data on community-based tobacco cessation programs for adolescents to understand their prevalence and characteristics. They found most were multi-session programs based in schools and the programs served less than 50 students per year. The main challenge reported was recruiting participants for smoking cessation programs. The content of most programs included behavioral-cognitive components similar to adult programs and were tailored to adolescent needs. The most common group that delivered the cessation program was teachers and the authors reported that 73% of adolescents who started a program completed the program. The authors found fewer programs in communities where smoking is increasing among the adolescent population.

Dijk, Reubsæet, de Nooijer, and de Vries (2007) sought to identify predictors of transition toward smoking cessation among adolescents between 14 and 18 years old from six European countries (Denmark, Finland, the Netherlands, Spain, Portugal, and the UK). The authors reviewed surveys from 1,353 adolescents and found smokers who had quit by six months had perceptions at baseline of fewer social influences to smoke, more negative associations with smoking, and more confidence in their ability to avoid smoking than those who did not quit. The authors found more experience with smoking was associated with less successful quit attempts at six months.

Krishnan-Sarin et al. (2007) examined the relationship between impulsivity and smoking cessation intervention response among 30 treatment-seeking adolescents between 14 and 18 years old. The adolescents were participating in a school-based smoking cessation program that lasted for four weeks. The results of the study showed adolescents who were more impulsive at the beginning of the intervention were less likely to achieve smoking cessation.

MacDonald, Rothwell, and Moore (2007) conducted interviews with 25 Welsh adolescents between 13 and 18 years old. They were looking at adolescent preferences for smoking cessation interventions and found adolescents preferred support from their friends and family in helping them to quit tobacco. The adolescents wanted a cessation project leader who was friendly, confidential, supportive, and respected. Participants reported wanting flexible support that would allow them to “drop-in” as needed and was not rigidly scheduled. The

adolescent participants felt schools were “toxic” environments and not supportive of smoking cessation.

Myers, MacPherson, Jones, and Aarons (2007) describe the development and evaluation of the Ways of Quitting questionnaire (WOQ) to measure smoking cessation strategies used by adolescents. The development of the questionnaire included six adolescent focus groups to review wording and format of the questionnaire that was then tested on 88 adolescents between 14 and 19 years old. The authors grouped the smoking cessation strategies into eight categories: 1) social support; 2) treatment and advice; 3) avoidance; 4) reduction; 5) substitution; 6) medication; 7) distraction; and 8) unclassified. The top five smoking cessation strategies attempted by the adolescents testing the questionnaire were: not having cigarettes with them (81.8%), keeping occupied by doing other things (81.8%), trying not to buy cigarettes (79.5%), cutting down by smoking only during certain times (79.5%), and quitting cold turkey (78.4%). The conclusion reported by the authors was that the WOQ was useful to use and was valid for the criterion measured.

Abrantes et al. (2008) studied youth risk behaviors in relation to smoking cessation. They examined data from 2,033 students who completed the 2003 Youth Risk Behavior Survey. Their results showed that 63.5% of the students had made a quit attempt in the past year but only 10% were successful in quitting tobacco. The authors discovered that for adolescents, being in a depressed mood, participating in organized sports, and seeing a dentist in the past year were associated with an increased likelihood of making a quit attempt. On the other

hand, characteristics associated with decreased likelihood of making a cessation attempt were high-risk sexual activity and drug use other than alcohol and marijuana. Negative predictors of successful cessation were fighting, risky sexual behavior, and marijuana and drug use including using alcohol before the age of 13.

Bandi, Cokkinides, Westmaas, and Ward (2008) used data from the 2004 National Youth Tobacco Survey to determine whether parental practices that discourage cigarette smoking affect adolescent smoking cessation. Their analysis was conducted on information from 1,629 adolescents between 11 and 18 years old and the adolescents were classified into three age groupings: 11-13 years, 14-16 years, and 17-18 years. The results showed that in the youngest age group, adolescents who received 'do not smoke' messages from their parents were in a higher stage of readiness to quit compared to those who did not receive such messages. There were no differences found in the oldest age group of adolescents. The authors report neither household smoking nor peer smoking was significantly associated with the stage of readiness to quit. The affect of parental 'do not smoke' messages appear to decrease in effectiveness as the adolescent ages.

Dalum, Schaalma, Nielsen, and Kok (2008) studied the smoking cessation process of Danish adolescents and their attitudes toward cessation programs using group discussions with 26 smokers and ex-smokers between 15 and 21 years old. All participants had quit or attempted to quit tobacco on 1 January 2004. The authors found smoking cessation for adolescents was an individual process and successful quitting depended on whether the adolescent was willing to engage in

an iterative learning process. The authors found the group was split almost evenly on whether they had prepared for their quit attempt but they found preparing did not equate with successful quitting. They discovered there were two different approaches used by the adolescents for quitting. One group saw quitting as a contest in which they quit on the set day and tried to see how long they could stay smoke-free. The other group went through a learning process with minor relapses from which they learned new coping skills to overcome barriers.

Fritz, Wider et al. (2008) studied adolescents' patterns of smoking, perceptions about smoking, and outlined quit strategies for adolescents who participate in school-based cessation programs as part of a study on a computer-based cessation intervention (Fritz, Hardin, Gore, & Bram, 2008). The authors report the top five reasons adolescents gave for smoking were relaxation, stress reduction, depressed/worried, for pleasure, and for appearance. The methods the adolescents reported as being most useful for cessation efforts were provision of information on cigarette content and its effects, the benefits of quitting, and learning about measures to stay on track.

Horn et al. (2008) studied the socio-demographic and smoking-related characteristics of teen smokers who participated in the N-O-T program. The authors reviewed data from 5,892 teens between 14 and 19 years old who participated in the N-O-T program between 1998 and 2006 in Florida, North Carolina, New Jersey, Wisconsin, and West Virginia. The authors found the smokers who participated in the N-O-T programs started smoking on the average at the age of 12 years, and that the earlier an adolescent began smoking the greater

was his/her nicotine dependence. The N-O-T participants were likely to be poly-tobacco users and had made more quit attempts than a comparable group of teen smokers. In addition, they were ready to quit smoking, believed important people in their life would be supportive in their cessation attempts, but had lower confidence in their ability to quit tobacco.

Horn, Noerachmanto, Dino, Manzo, and Brayboy (2008) examined the characteristics of American Indian (AI) adolescents who participated in the N-O-T smoking cessation program in North Carolina. They compared information on 91 AI youth who participated in the program in 2004 with 138 non-Native youth (95.7% White) who participated in the N-O-T program in 2000. The authors found that compared to the non-Native adolescents AI teens tried their first cigarette later, smoked less per day, used cigars as their other type of tobacco, were less addicted to nicotine, and were more ready to quit tobacco.

Hutchinson, Richardson, and Bottorff (2008) analyzed data from the British Columbia Youth Survey on Smoking and Health II to describe current smoking rates, age of initiation, and smoking cessation efforts among 1,337 Aboriginal adolescents in British Columbia. They also sought to examine the relationships between cigarette smoking and socio-demographic characteristics, depression and domains of life satisfaction. The authors found the rate of smoking increased with age and a greater percentage of female adolescents smoked than male adolescents did; however, the female adolescents smoked fewer cigarettes than males. They found having a smoker for a best friend was the strongest predictor of smoking for an adolescent, increasing the odds by a factor of 5.9.

Adolescents who had the most symptoms of depression had increased odds of being a smoker. Teens who were in the top quartile of the family domain of life satisfaction were less likely to be smokers and those in the lower three quartiles of satisfaction with friends had lower odds of being a smoker compared to adolescents in the top quartile. The authors comment that this may be an indication of the strong effect of peers on smoking status. For smoking cessation, the authors determined there were no differences between female and male adolescents in regards to thinking about quitting, having intentionally quit smoking for greater than 24 hours at least once in the previous year, and believing it was hard to quit tobacco.

Leatherdale (2008) examined how smoking behavior and beliefs, physical activity and weight, and social influences are associated with intentions to quit smoking in adolescents from Ontario, Canada. The author used self-reported data from 26,924 students using the Tobacco Module of the School Health Action, Planning, and Evaluation System (SHAPES). Of the 26,924 surveys, 2,292 were completed by occasional smokers, 2,376 by daily smokers, 3,655 were ex-smokers, and 18,601 were never smokers. The author found occasional smokers do not intend to quit, most daily smokers intended to quit, and adolescents who believed they could quit were more likely to be overweight, physical active, or had smoking friends. The reason most occasional smokers did not intend to quit was that they either did not consider themselves to be smokers or they reported they had already quit although they had also reported they had smoked in the preceding 30 days.

Myers and MacPherson (2008) described an evaluation of the psychometric characteristics of the Adolescent Reasons for Quitting scale (ARFQ). This scale measures the motives of adolescents for quitting tobacco. Semi-structured interviews, self-completed questionnaires, and measurement of expired carbon monoxide (CO) were used for the evaluation on 109 high school students between 14 and 19 years old. The study showed three subscales. The Short-Term Consequences subscale was not a significant predictor of cessation attempts. The Social Disapproval subscale significantly predicted cessation attempts over the 6-month follow-up. Finally, the Long-Term Consequences subscale significantly predicted quit attempts in the three months after baseline. The authors conclude the ARFQ may be helpful in understanding the adolescent smoking cessation process.

Poynter, Bullen, Whittaker, and Grigg (2008) investigated the characteristics of adolescents under the age of 18 years old who called New Zealand's Quitline. In the 24 months studied, 2,371 adolescents called Quitline seeking assistance in quitting smoking. The authors found female and older teens were the most frequent callers. There was a significantly higher proportion of Māori and adolescents of Pacific ethnicity compared to adult callers to Quitline. The authors also found under-18s were given NRT half as often as adults even with similar levels of nicotine addiction and those under 18 were more likely to be using a cell phone to call Quitline than adults were. The authors recommend more accessible and effective smoking cessation programs for adolescents.

Smith, Cavallo, McFetridge, Liss, and Krishnan-Sarin (2008) examined the course of tobacco withdrawal symptoms in 54 adolescent smokers who volunteered to participate in a 4-week smoking cessation program described in the Contingency Management section of this paper (Krishnan-Sarin et al., 2006). The authors found adolescents experienced increases in cravings and restlessness after quitting tobacco. There were gender differences reported in withdrawal symptoms. Female adolescents experienced a peak in withdrawal symptoms that then declined. Male adolescents experienced little change in withdrawal symptoms over the course of treatment. The authors found withdrawal symptoms on the day of cessation did not predict relapse during the 4-week treatment period. The authors conclude withdrawal symptoms may not be a factor in adolescent smoking relapse and that other factors need to be explored to provide effective cessation programs for adolescents.

Woodruff, Conway, and Edwards (2008) studied 136 adolescents between 14 and 19 years old to see whether socio-demographic characteristics and baseline psychosocial factors were related to short-term smoking cessation and reduction in smoking. Participants in the intervention condition participated in a virtual world study described by Woodruff, Conway, Edwards, Elliott, and Crittenden (2007) in the Other Therapies section of this paper. The authors of this study found social support, self-efficacy, and perceived benefits of quitting tobacco predicted changes in the amount smoked by the adolescent participants. This study showed socio-demographic characteristics were not related to changes in smoking behavior.

Branstetter, Horn, Dino, and Zhang (2009) studied data from 5,892 adolescent smokers between 14 and 19 years old who participated in the N-O-T program between 1998 and 2006 in five states: Florida, North Carolina, New Jersey, Wisconsin, and West Virginia. They were looking at how smoking history, intervention readiness, and social context predicted cessation, reduction, and increased use. The authors found those adolescents who reduced their smoking were similar to those who successfully quit except, those who reduced were more likely to start the program in the contemplation stage and the quitters were more likely to start in the preparation stage. Those who increased their smoking were heavier smokers at baseline, were more addicted to nicotine, and were more likely to have someone close to them who smoked (parents, siblings, and significant others). They also reported less motivation and confidence in quitting. The authors also found important differences between the genders. For female adolescents, having a sibling who smoked, or having a significant other who smoked was related to the number of cigarettes smoked per day.

Kleinjan et al. (2009) studied the relations between readiness to quit smoking, levels of nicotine addiction, and smoking behavior of friends in 850 Dutch adolescents between 13 and 18 years old. The authors found readiness to quit smoking was the most important determinant of a quit attempt and nicotine addiction was important for whether a quit attempt would be successful. They found parental smoking was important to an adolescent's readiness to quit but peer smoking was more important to nicotine dependence.

Kleinjan, van den Eijnden, and Engels (2009) studied a sample of 363 Dutch adolescents between 15 and 18 years old to determine the extent to which adolescents adhere to disengagement beliefs, and the relationship between these beliefs and motivation to quit tobacco. The authors describe disengagement beliefs as rationalizations or justifications for continuing smoking and found they are common among adolescent smokers more than among adult smokers. This attachment to disengagement beliefs negatively affects smoking cessation.

O'Loughlin, Gervais, Dugas, and Meshefedjian (2009) used data from the Nicotine Dependence in Teens study to identify adolescents who reported not smoking at the baseline survey and subsequently started smoking during any of the follow-up surveys. They identified 319 adolescents between 12 and 13 years old who began smoking and studied the sequence and timing of milestones in the process of smoking cessation. The authors found novice smokers increased exposure to tobacco within one to two months after their first puff of a cigarette. At this point, the young smoker was confident about their ability to quit smoking. They progressed to expressing a desire to quit and came to understand quitting required a serious effort. Cravings, withdrawal symptoms, and tolerance emerged over the next two years as the novice smoker began to smoke monthly and the novice smoker lost confidence in their ability to quit smoking. The authors indicate at about one year after the first puff of a cigarette, the young smokers in this study escalated to daily smoking and the adolescents realized they were smokers because quitting was very hard. The authors report that tobacco dependence was evident at about 14 months after the first puff.

Finally, Van Zundert, Nijhof, and Engels (2009) studied relapse in 135 adolescents between 15 and 20 years old who were daily smokers and who were motivated to quit tobacco. The purpose of the study was to provide information on Social Cognitive Theory-derived smoking-specific cognitions and intensity of smoking on relapse. Study participants were assigned a smoking quit day and completed questionnaires for up to two months after the quit date. The authors report the main findings of this study were that predictors of relapse within three weeks after quitting were strong positive feelings about smoking, low self-efficacy to quit, and heavy baseline smoking status.

Youth Tobacco Cessation Research Challenges

Diviak, Curry, Emery, and Mermelstein (2004) reported on the difficulties in recruiting adolescents into smoking cessation studies. The major difficulty reported involved obtaining parental consent for those under the age of 18. The authors state that best practices for adolescent smoking cessation programs have been unable to be elucidated because of limited data. The recommendations to resolve issues around obtaining consent for adolescent participation in smoking cessation studies include easing the requirements for obtaining parental consent, protecting the confidentiality of adolescent smoking status, seeking waivers of parental permission, and working collaboratively with their IRB to obtain approval for the study.

Internet recruitment challenges are explored in the article by Koo and Skinner (2005). They report on two studies for which the authors attempted to recruit teenagers to answer questionnaires evaluating a smoking-cessation Web

site. They report a disappointingly low recruitment rate of about 0.2% to an e-mail invitation. Challenges of Internet-based studies include the inability to verify participant age, geographic location, and the possibility of multiple responses from the same participant.

Smoking cessation terminology used by adults may not have the same meaning for adolescents. MacPherson, Myers, and Johnson (2006) discovered through their questionnaire given to 94 adolescents between 14 and 18 years old who were participating in a study of smoking self-change that the terms 'quit' and 'stop' were understood similarly to how adults use the terms. However, the authors found that to a sizeable minority these terms meant a temporary change in smoking behavior. The term 'cut down' was understood to mean a reduction in frequency or quantity but for some adolescents it meant half of the quantity smoked.

Addiction is also a term that can have different meanings to adolescents and adults. Chassin, Presson, Rose, and Sherman (2007) explored the meaning of this term with 500 adolescents and 909 parents. The authors reported their findings show that for both adolescents and adults, addiction includes two dimensions: positive reinforcement and an 'out-of-control' or compulsive component. Adolescents did not differentiate between the two components as one being more important than the other but adults viewed the compulsive component as being more important in addiction. The authors conclude the findings may be important for prevention programs for adolescents and because they viewed the

components of addiction as being equal, smoking prevention messages focused solely on addiction may be weakened for the adolescent.

Kealey et al. (2007) describe nine strategies for improving recruitment and retention in adolescent smoking cessation studies. These are 1) proactively identifying smokers in the population to be studied; 2) including both smokers and non-smokers in the study; 3) mailing the Informed Consent form directly to parents of potential participants and telephoning those who do not respond; 4) delivering the smoking cessation therapy via telephone; 5) calling the adolescent directly; 6) making multiple attempts to reach the adolescent when phoning; 7) respecting the adolescents' privacy and re-assuring them of their privacy; 8) tailoring the intervention and the dose to the individual adolescent; and 9) respecting the adolescent as a person and communicate this to him/her throughout the intervention. The authors achieved good results recruiting adolescents for a telephone counseling intervention for smoking cessation utilizing these nine strategies.

The Hutchinson Study of High School Smoking (Liu et al., 2007) is the largest group-randomized trial (2,151 older adolescents) for adolescent smoking cessation. It incorporated many of the strategies outlined by Kealey et al. (2007) in the article above. The major innovations according to the authors were proactive identification of adolescent smokers and defining smoking broadly to include smokers without motivation to quit and those adolescents who smoked infrequently. They also used a phased recruitment strategy that extended over three years. The proactive recruitment of smokers required the inclusion of non-

smokers in order to protect the privacy of the smoking adolescents. It did provide the advantage of enrolling the non-smokers as helpers to their smoking peers in quitting smoking.

Literature on recruitment and retention of adolescents into smoking cessation intervention studies was reviewed by Backinger et al. (2008). The review consisted of 55 articles published from 1976 to June 2004. Forty-five studies were conducted in the United States and ten studies conducted in the United Kingdom, Australia, Canada, China, New Zealand, Sweden, and Thailand. Most of the studies reviewed used a combination of recruitment methods and were primarily conducted in the school setting. The authors report studies with adolescents who smoked five or less cigarettes per day had the highest recruitment numbers and studies with adolescents who smoked six or more cigarettes per day had the higher retention rates. Interestingly, the use of incentives resulted in lower retention rates at the end of the intervention than did those studies that did not offer incentives to participants.

Smoking Cessation Guidelines

Klein and Camenga (2004) discussed the Pediatrician's role in counseling smoking cessation for the teen smokers who come to them for health care. The authors report the National Cancer Institute materials on tobacco and the 2000 U.S. Public Health Service guidelines (Fiore, 2000) recommended brief counseling interventions modeled after interventions that have been demonstrated to be effective with adults. They state that if symptoms of addiction are present, NRT may be offered to adolescent smokers.

The Treating Tobacco Use and Dependence: 2008 Update Clinical Practice Guideline is based on more than 8,700 research articles from 1975 forward and is the third to be published since 1996 (Fiore et al., 2008). It is applicable for all tobacco users; however, further research into effective strategies for tobacco cessation therapies for adolescents is needed.

The Clinical Practice Guideline outlines ten key recommendations for effective smoking cessation: 1) repeated intervention and multiple quit attempts are often required to treat tobacco dependence; 2) every tobacco users should be consistently identified and treated when seen in the health care system; 3) tobacco cessation treatments are effective across many populations and smokers should be encouraged to use them; 4) brief treatments are effective and should be offered by clinicians to every smoker; 5) effectiveness of counseling increases with intensity (dose) and both problem solving/skills training and social support should be used as part of counseling; 6) effective medications are available to assist in quitting tobacco and they should be offered to smoking patients except when contraindicated or sufficient evidence does not exist for effectiveness in subpopulations (e.g. adolescents); 7) the combination of counseling and medication is more effective than alone; 8) telephone quitline counseling is effective and patients should have access to them; 9) motivational treatments should be provided to smokers unwilling to quit; and 10) insurance plans should cover the counseling and medication treatments outlined in the guideline.

Waugh and Lorish (2008) commented on the Clinical Practice guidelines and stated there are three conditions to make counseling patients more productive:

practical solutions to barriers patients encounter when attempting to quit tobacco should be utilized, clinicians must try to influence the smokers decision to stop tobacco use, and a team-approach should be utilized to assist the patient stop smoking once they have made their decision to quit.

Smoking Cessation Programs for Adolescents

The literature on programs used to help adolescents quit tobacco falls into several categories including cognitive-behavioral methods, contingency management methods, nicotine replacement therapies, pharmacologic therapies, other types of therapies, and any combination of the above.

Previous Literature Reviews

Camenga and Klein (2004) reviewed additions to the adolescent smoking cessation literature from 1 June 2003 to 1 May 2004 and found adolescent attitudes toward smoking cessation were affected by smoking history (high-level of smoking caused health concerns). Behavioral interventions were the focus of smoking cessation efforts for adolescents and adolescents were using NRT without evidence of effectiveness.

Milton et al. (2004) did not endorse specific smoking cessation interventions since the authors felt the studies done to date lacked quality or consistency of findings; however, they did try to provide "better practices" so an evaluation of smoking cessation programs could be made by the consumer. The authors recommended using research from adult smoking cessation to inform adolescent smoking cessation interventions and cautioned about the lack of research on using NRT for adolescents. They called for a comprehensive

approach to smoking cessation therapies for adolescents. They recommended taking into account the importance environmental factors (such as tobacco taxes, smoke-free policies, anti-smoking advertising, and location of cessation program delivery) play in such a comprehensive approach.

Adelman (2006) provided a review of evidenced-based approaches to adolescent smoking cessation interventions. The author recommended the PHS guidelines for tobacco assessment and treatment and adolescent-specific, school- or community-based programs that teach coping skills. The evidence for NRT was not present and since adolescent smokers smoked differently than adult smokers did, its use could not be recommended. Pharmacologic and alternative therapies did not have evidence to support their use. Finally, the author reported the evidence to support gender differences in tobacco cessation was insufficiently explored.

Grimshaw and Stanton (2006) provided an extensive review of randomized controlled trials, cluster-randomized controlled trials, and controlled trials to date for adolescent smoking cessation. The authors were unable to recommend any one model of smoking cessation program. The N-O-T program was found to be as effective as other interventions but the definition of cessation used by the program was challenged. The authors indicated NRT had little evidence of effectiveness for adolescent smoking cessation and neither did the use of bupropion show evidence of effectiveness as an adjunct to NRT or when used alone. Recommendations for future research included the role of motivation to quit tobacco in eventual cessation and the use of NRT. The authors also

recommended using biochemical evaluations of smoking cessation to determine accurate quit rates.

Sussman et al. (2006) performed a meta-analysis of 48 teen smoking cessation studies that were conducted between 1970 and 2003. Their analysis indicated cognitive-behavioral programs were found to be effective for adolescent smoking cessation. Motivation-theory-related programs were also found effective as was social influences programming. Classroom-based programs were found to be effective and the effectiveness of programs consisting of up to five sessions was shown. There was no increase in effectiveness of programs having more than five sessions. Pharmacologic therapy (nicotine replacement or prescription medications) did not show efficacy for the adolescent attempting to quit tobacco nor were any approved by the F.D.A for use in adolescents at the time of their analysis.

Curry, Mermelstein, and Sporer (2009) summarized the research in adolescent tobacco cessation treatment. The authors reported the majority of adolescents smoked their first cigarette in early adolescence and oftentimes, older teens are already addicted to tobacco. The evidence for behavioral-based smoking cessation interventions is strong for increasing the chance of adolescents quitting tobacco and pharmaceutical interventions lack the evidence to support their use.

Finally, Sussman and Sun (2009) provided a summary of the systematic reviews of the adolescent smoking cessation literature that had occurred to date. They discussed the two meta-analyses (Grimshaw & Stanton, 2006 and Sussman et al., 2006) and reported both indicated motivation and cognitive behavioral

strategies were effective in teen smoking cessation but the evidence for pharmacologic therapies being effective for adolescents was not present. This paper covered the literature from January 1970 through December 2007 and indicated smoking cessation interventions for adolescents should be delivered in an environment that is structured for youth since they do not impose structure on themselves. The dose of the intervention should be at least five sessions and should be structured to be fun, involve games, dramatization, and alternative medicine concepts. The contents of smoking cessation programs should emphasize cognitive-behavioral, motivational theory-related and social influences contents. Coping skills for avoiding smoking in social situations should be provided, as should coping methods for stress. The authors state further research on pharmacologic interventions for smoking cessation is still necessary before their use can be recommended.

Cognitive-Behavioral Methods

Dino, Kamal, Horn, Kalsekar, and Fernandes (2004) examined the association between state of change and smoking cessation outcomes. They studied 382 youth who participated in either the American Lung Association's N-O-T program or a brief self-help smoking cessation intervention (BI). The results indicated the relationship between state of change and cessation outcomes varied by treatment dose. They also showed BI participants in the preparation stage of the Trans-Theoretical Model (TTM) were 25 times more likely to quit smoking at post baseline than were adolescents in the contemplation or precontemplation

stages. Greater forward stage movement from baseline to post baseline was seen in N-O-T participants than in BI participants.

Horn, Dino, Kalsekar, and Fernandes (2004) studied 258 adolescent smokers in West Virginia and North Carolina comparing the N-O-T intervention to a 15-minute brief self-help intervention (BI). The authors report the N-O-T participants achieved higher quit rates than did the participants receiving BI. They also noted lower quit rates among these rural teens than seen in studies of non-rural N-O-T participants. They suggest tailoring the N-O-T intervention for rural youth that would take into account their specific needs similar to what Denham, Meyer, & Toborg (2004) reported.

Lipkus et al. (2004) studied 402 adolescents between 15 and 18 years old. The study stratified participants based on stage of readiness to quit and compared self-help materials with video to self-help materials, video, and telephone counseling. The authors report cessation rates did not differ between groups and based on an intent-to-treat analysis, the combined self-help, video, and telephone-counseling intervention at least doubled the 3%-7% yearly cessation rate typically found among unaided teen smokers. The self-help materials and counseling improved teens' attitudes toward smoking and quitting.

Project EX is an eight-session smoking cessation intervention that is school clinic-based and was developed in the United States. Zheng et al. (2004) explored the use of Project EX for teens in Wuhan, China. They enrolled 46 adolescents between 16 and 17 years old. The authors were looking at cessation rates achieved by the program along with information on whether or not the

program could be translated successfully to a different culture. The program was conducted off campus and outside of school hours. The authors reported the program was useful for the participants in quitting tobacco with the 30-day quit rate about 3.5 times higher than the 3% quit rate usually seen at the clinic. The authors concluded Project EX is acceptable to Chinese adolescents, the program translated successfully, and it provided an increased cessation rate in the short-term.

Brief motivational interventions in a hospital outpatient clinic or Emergency Department for adolescent smoking cessation were studied by Colby et al. (2005). The study compared motivational interviewing (MI) with brief advice (BA) in 85 adolescents between 12 and 19 years old recruited from patients seen in the Emergency Department or an outpatient adolescent clinic. The findings from this study did not show a difference between the two groups in smoking abstinence rates at one and three months. The authors point out the importance of verifying smoking cessation by biochemical means since they found that not all of the adolescents who reported quitting had done so when biochemical verification was used.

Hollis et al. (2005) explored the efficacy of brief counseling plus a computer-based tobacco intervention for adolescents. They studied 2,526 adolescents between 14 and 17 years old who were seen for outpatient medical care. Two interventions were studied. The first consisted of a program that was tailored based on smoking status and stage of change and included clinician advice, an interactive computer program, a motivational interview, and up to two

10-minute telephone or in-person booster sessions. The control intervention was a motivational interview focused on promoting improved dietary habits. The authors reported a 2-year quit rate of 24%; however, this group included smoking experimenters and when they were removed from the analysis, the quit rate for the base-line smokers was 11%. The authors conclude that because of the high acceptance rate the relatively brief intervention during routine office visits is appropriate for smoking cessation in adolescents.

Joffe, Ash, and Sheng (2005) reported on a study that indicated the dose of a smoking cessation intervention affects the smoking cessation response. They studied 407 adolescents and compared three interventions: a single session focused on general principles of smoking cessation, a two sessions per week for 10 weeks N-O-T program, and a two sessions per week for 7.5 weeks Kickin Butts program. The authors report multi-session participants who attended 50% or more of the sessions were 2.5 times more likely than single-session participants to report quitting at the end of the program and 2.45 times more likely to report quitting one month later. The differences disappeared at three months and the authors conclude that booster programs may be needed.

Stoddard et al. (2005) studied a smoking cessation program for 308 adolescents between 15 and 18 years old who worked in grocery stores. The authors used the SMART intervention framework that focused on increasing social and behavioral skills and compared it to a control group. The result showed the intervention was moderately effective in reducing cigarette use and that these teens were more likely to report an intention to quit smoking in the next 30 days.

The authors conclude social influences should be combined with environmental interventions to address the multiple factors of youth smoking.

Tedeschi, Zhu, Anderson, Cummins, and Ribner (2005) discussed telephone counseling for adolescent smoking cessation. The authors report telephone counseling to help adolescents quit tobacco has several advantages: it is easy to access, can be tailored to individual adolescent needs, it allows for anonymity, promotes proactive counseling, and can be used with a structured counseling protocol. The protocol developed for this adolescent telephone counseling focused on developmental issues specific to adolescents: identity formation, sense of invulnerability, accountability, family dependence, peer identification, inexperience in quitting, and need for autonomy.

Chen and Yeh (2006) studied the addition of an Internet-assisted instruction (IAI) to a smoking cessation program in order to evaluate its effectiveness in changing teens' attitudes toward smoking, smoking behavior, and self-efficacy for smoking cessation. The authors studied 77 high school students and assigned them into two groups. The first group participated in the smoking cessation, which consisted of a two-hour instruction weekly for six weeks plus the IAI. The second group received no intervention and was composed of students who were not willing to use the combined program. The results of this study showed those adolescents who received the intervention combined with IAI had a significant positive change in smoking attitude indicating a lower likelihood of smoking. They also decreased their average daily number of cigarettes smoked compared to the control group (who showed an increase in average number of

cigarettes smoked per day). The smoking cessation intervention also raised the participants' self-efficacy. The authors conclude the combined smoking cessation program plus the IAI program received positive feedback from the participants and that it should be promoted to a wider group of adolescents.

McCuller, Sussman, Wapner, Dent, and Weiss (2006) studied the effectiveness of the Project EX program among 259 students from 18 schools. The authors were specifically looking to see if the success from the Project EX program was related to changing the motivation of the participants. Participants ranged in age from 15 to 20 years old. Randomization was by school and students in the school all received the same intervention. There were three interventions studied: the Project EX program, the Project EX program plus school functions to promote anti-tobacco use attitudes, and a control group. The students were given pre-tests, post-tests, and a 3-month follow-up survey. The results from this study showed changes in motivation were related to treatment and smoking cessation was 34% and 25% in the Project EX and Project EX plus school program groups (compared to 16% in the control group).

Mermelstein and Turner (2006) explored adding a Web-based support addition to the N-O-T program. The study was a two-arm study with 29 schools randomized to the standard N-O-T program or an N-O-T plus program, which included three adjuncts. The first adjunct was telephone calls to the student, the second was access to the Not Hooked Web site, and the third was access to the American Lung Association quitline. The results showed the N-O-T plus program had better abstinence rates than the standard N-O-T program at the 3-month

follow-up. The phone call adjunct did not show evidence of benefit and the quitline was only utilized by five students. The Web site usage was related to initial quit status but did not show benefit by the 3-month follow-up. The authors concluded the differences in quit rates between the two groups was related to the initial quit rates created by the Web site and that the Web-based addition should be included in smoking cessation program.

Patten et al. (2006) conducted a randomized trial of a home-based Internet smoking intervention and a clinic-based, brief office intervention in 139 adolescents between 11 and 17 years old. The authors did not find any significant differences in smoking cessation between the two groups and felt the clinic-based intervention was feasible for adolescent smoking cessation but further research was needed to test its efficacy.

Pbert et al. (2006) studied the efficacy of a school nurse-delivered smoking cessation program in 71 schools. The schools were randomized to either a four-session one-on-one school nurse-delivered smoking cessation intervention or usual smoking cessation control. The results showed the school nurse-delivered program produced increases in self-reported short-term abstinence rates as well as decreases in the amount and frequency smoked compared to the control schools. The authors conclude that because adolescents can access a school nurse-delivered smoking cessation intervention without cost, parental involvement, or transportation they have tremendous potential for being widely implemented.

The American Lung Association's N-O-T (Not On Tobacco) program is often mentioned as a successful smoking cessation program for adolescents. The

program is conducted over ten weeks and provides the participants with healthy alternatives to tobacco use and supportive counselors. The Colorado chapter of the American Lung Association provided results for the 2006-2007 school year in which over 1,500 students participated in the program (American Lung Association of Colorado, 2007). They reported 80% of the participants who completed the program (retention rate was over 70%), either quit or cut back on their smoking. Self-efficacy for quitting increased in 99% of the participants and 79% of the participants who completed the program also reported improved dietary and/or exercise habits. The 2007-2008 program (American Lung Association of Colorado, 2008) had 1,300 participants and showed similar results: 80% who completed the program either quit or cut back on smoking, 97% reported improved self-efficacy for quitting, almost half reported making better grades in school or had improved attendance, and 74% reported improved dietary and/or exercise habits.

Helstrom, Hutchison, and Bryan (2007) tested the effectiveness of motivational enhancement therapy (MET) to reduce smoking among 81 adolescents who had been given the option for a diversionary program by the courts after having been arrested or ordered to appear in court for a variety of offenses. They were randomly assigned to one of two smoking cessation interventions: one session of MET or tobacco education. The results did not show MET performed better than the tobacco education control. The authors did find adolescents who consumed less alcohol and were less impulsive responded to MET for self-reported decreases in smoking rates.

Horn, Dino, Hamilton, and Noerachmanto (2007) studied 75 adolescents between 14 and 19 years old and the effectiveness of a motivational tobacco intervention (MTI) compared to brief advice (BA) given in the Emergency Department. The authors chose this venue for the smoking cessation intervention because it is often the primary source of healthcare and long waits to be seen can be utilized for such an intervention. The quit rates at 6 months post-baseline were not statistically significant. The MTI group did have a greater reduction in number of cigarettes smoked than did the BA group.

Sun, Miyano, Rohrbach, Dent, and Sussman (2007) studied moving the Project EX smoking cessation intervention from the school clinic to the classroom in 878 students between 13 and 19 years old in 12 schools. The schools were randomized to either the treatment (Project EX-4) or standard care. Students in both groups were given a questionnaire pre-intervention and immediately after the program. The classroom-based Project EX-4 received favorable ratings from the participants and the participants showed improved knowledge specific to the program compared to the standard care. The participants in the Project EX-4 intervention reported weekly smoking decreased by about 5% compared with those in the control group. The authors report the Project EX-4 program can be successfully implemented in the classroom and that it showed immediate changes in the participants.

Sussman, Miyano, Rohrbach, Dent, and Sun (2007) reported on longer-term results from the Project EX-4 smoking cessation intervention that was reported by Sun et al. (2007). Surveys were done at six months and one-year post

intervention of the participants reported on above (865 participants for 6-months and 710 participants at one year). The results are based on self-reports and the effects seen immediately after the intervention carried through the 6-month and one year follow-ups. The authors conclude the Project EX-4 classroom-based smoking cessation intervention showed promise and may even be helpful in recruiting adolescents since it was implemented during regular class time.

Horn, Dino, Hamilton, Noerachmanto, and Zhang (2008) studied the feasibility of brief motivational intervention for smoking cessation among 74 adolescents between 14 and 19 years old. There were two arms in this study and the participants in the first arm received a brief tobacco motivational intervention (MTI). The control group received brief advice/care as usual (BA). The interventions took place in the Emergency Department (ED) from 2002 to 2004 with teens seen for any reason. The authors found they were unable to enroll the number of adolescents projected, the implementation was provided as planned, and the intervention in the ED was acceptable to the adolescents, their parents, and the ED staff.

Pbert et al. (2008) studied the efficacy of a practice-based smoking cessation intervention for 262 adolescents delivered by pediatric healthcare providers and older peer counselors. Eight pediatric offices were randomized to provide either the provider- and peer-delivered intervention (PPDI) or usual care (UC). The providers utilized the 5A model suggested by the U.S. Public Health Service in working with the adolescents who participated from their practice. The peer counselors also used the 5A model and added motivational interviewing and

behavior change counseling. Participants were followed through 12 months post intervention. For the adolescents who received PPDI, there was a 1.5-fold increase in the odds of quitting tobacco at 6-months. There was no difference seen in the smoking cessation rates between the two interventions at 12 months. The authors report good acceptance rates from the adolescents for the PPDI and found the peer counselors helpful.

Contingency Management Therapies

There were three articles found that reported on the use of contingency management (CM) therapies in treating adolescents for smoking cessation. Contingency management is behavior modification therapy that provides reinforcement for desired behavior (Krishnan-Sarin et al., 2006).

Roll (2005) reported on a small study with 22 adolescent participants who wanted to quit smoking. They were randomized to two groups; one was rewarded each time they provided a carbon monoxide (CO) sample that met the requirements for abstinence and the other received an equivalent reward for attending a group session regardless of the results of their CO sample. There was a significant difference between the two groups with the first group showing a 50% abstinence rate from cigarettes compared to a 10% abstinence rate for the second group.

Krishnan-Sarin et al. (2006) studied a combination of contingency management plus cognitive-behavioral therapy (CBT) in 28 adolescents between 14 and 18 years old that were interested in quitting smoking. At the end of four weeks of treatment, nine of 17 adolescents (53%) who received CM plus CBT

remained abstinent from tobacco compared to zero of 11 subjects who received the CBT alone. The authors conclude CM may significantly enhance quit rates for adolescent smokers.

Cavallo et al. (2007) also looked at a combination of CM with CBT. Their goal was to determine which form of CBT (standard versus frequent brief behavioral intervention) combined with CM provided the better results. Thirty-four adolescents were randomized and the study showed no significant differences in abstinence rates. An interesting result of this study was that the less frequent intervention (standard CBT) had a higher retention rate than did the frequent CBT. Their conclusions are CM in combination with CBT provides good abstinence rates for high school smokers attempting to quit.

Nicotine Replacement Therapies

There are several methods of nicotine replacement therapy (NRT) that are approved by the U.S. Food and Drug Administration (FDA): nicotine patches, nicotine gum, nicotine lozenges, nicotine inhalers, and nicotine nasal spray (American Cancer Society, 2009). The inhalers and spray are only available by prescription; the others are available over the counter. None of these therapies has been approved by the FDA for use in minors (Johnson, Klesges, Somes, Coday, & DeBon, 2004; Sussman et al., 2006); however, purchasing these products is relatively easy for an adolescent (Johnson et al., 2004).

In a study comparing the nicotine patch plus placebo to the nicotine patch plus bupropion SR (a non-nicotine pill [Zyban®]) in 211 smokers between 15 and 18 years old (Killen et al., 2004), abstinence rates were not improved and it

appeared the adolescents returned to smoking more suddenly than adults did. The authors reported that in both treatment groups, a large number of the participants reduced their cigarette intake to a few cigarettes per day or less and many had managed to avoid returning to daily smoking by the end of treatment.

O'Connell et al. (2004) tailored existing smoking cessation programs in use in Connecticut. They used focus groups to assess preferences for components of the programs and to provide opinions on suggested items to include in the tailored program. The program was revised based on feedback from the focus groups. Twenty-two adolescents in the contemplation stage of change or greater were enrolled with parental permission in the modified program that included bupropion. The authors reported that at the end of the program six out of 22 students reported being smoke free (nine students used bupropion) and the recruitment numbers for the modified program were a big improvement over previous years. The authors conclude having adolescents participate in the formulation of a smoking cessation program confers a sense of ownership and may be a recruitment tool for these programs.

Moolchan et al. (2005) reported on the safety and efficacy of the nicotine patch and gum in 120 adolescents. The study contained three-arms that compared the nicotine patch, nicotine gum, or a placebo patch and gum in 120 adolescents between 13 and 17 years old. All study participants also received cognitive-behavioral group therapy in addition to the investigational interventions. The results of this study indicated a significant positive difference in effectiveness for the nicotine patch over placebo in helping adolescent smokers achieve abstinence.

The authors concede this study did not answer the question of the effectiveness of the nicotine patch or nicotine gum in helping adolescent smokers quit tobacco. They do indicate the results of their study add more evidence to the recommendation of the U.S. Public Health Service clinical practice guideline (Fiore, 2000) in treating adolescents with the nicotine patch in combination with behavioral and counseling support.

Hanson, Zylla, Allen, Li, and Hatsukami (2008) studied NRT for reducing cigarette smoking in adolescents who were not interested in quitting. This study also used the nicotine patch, nicotine gum, and placebo but in 103 adolescents between 13 and 19 years old. The results of the study showed almost half of the participants reduced their smoking by at least 50%. The authors point out that a major concern of reducing smoking and not quitting is whether the reduction provides beneficial health effects. They concede adolescents may smoke more efficiently once they have reduced the amount of cigarettes smoked.

In the last article found on nicotine replacement therapy, Rubinstein, Benowitz, Auerback, and Moscicki (2008) reported on a study comparing eight weeks of weekly counseling alone versus eight weeks of weekly counseling plus eight weeks of nicotine nasal spray in 40 adolescents between 15 and 18 years old. The results showed no difference in quit rates between the two groups. In addition, they found more than half of the participants randomized to the nicotine nasal spray stopped using it after one week due to unpleasant adverse effects of the spray.

The articles found that reported on NRT for adolescents who want to quit smoking show the evidence for the effectiveness of any of these types of NRT is minimal (Adelman, 2004; Sussman et al., 2006) and further research is necessary before it can be recommended as part of smoking cessation programs for adolescents.

Pharmacologic Therapies

The research on pharmacologic therapies for adolescent smoking cessation is significantly less than for NRT. Only two articles and one editorial were found that addressed pharmacologic therapy without the concomitant use of NRT.

Upadhyaya, Brady, and Wang (2004) studied bupropion SR in adolescents with ADHD and nicotine dependence. They were looking at the feasibility and tolerability of this method of pharmaceutical smoking cessation. Their results showed the safety of the therapy and that it may be potentially efficacious. In the opinion of the authors, this therapy may play a role in treating adolescents for smoking cessation.

Muramoto, Leischow, Sherrill, Matthews, and Strayer (2007) studied bupropion SR in two doses (150 mg/d and 300 mg/d) against a placebo in 312 adolescents between 14 and 17 years old. All study participants also received weekly brief individual counseling. Their results showed the higher dose of bupropion SR was more effective than the placebo and like Killen et al. (2004), they saw a rapid return to smoking after the participants stopped the bupropion SR.

Colby and Gwaltney (2007) commented on the Muramoto et al. (2007) study, indicating its importance as the first randomized trial of bupropion in adolescents without concomitant NRT. The authors point out that it is difficult to determine the true efficacy of NRT or pharmacologic therapy because of the use of cognitive-behavioral therapy as an adjunct and/or the low adherence rates of adolescents to the investigational product.

Other Therapies

Hamilton, Cross, Resnicow, and Hall (2005) conducted a 4-year school-based cluster randomized control trial that explored the impact of a harm minimization smoking intervention compared to abstinence-based approaches. The authors reported the harm minimization intervention appeared to be more effective than the abstinence-based program. The authors indicated the advantage of a harm minimization intervention was that it had relevance to all students whether or not they currently smoked. They considered harm minimization an acceptable alternative to smoking cessation programs.

Kang, Shin, Kim, and Youn (2005) studied acupuncture in 238 Korean male adolescents between 15 and 19 years old. Two groups were studied, one received ear acupuncture at the 'shinmun', 'lung', 'chim', and 'oral' points, which are related to smoking cessation, on alternating ears weekly for four weeks. The other group followed the same schedule, but acupuncture needles were placed on ear points not associated with smoking cessation, i.e. the 'external ear', 'sympathetic', 'hepatic', and 'subcutaneous' points. Students were enrolled at their teachers' direction and motivation to quit smoking was low. The results of

the study showed no differences in smoking cessation between the two groups after four weeks. There were trends toward changes in taste of tobacco and decreased desire to smoke in the group that received acupuncture at the points considered related to smoking cessation.

Chen, Yeh, and Chao (2006) studied an Internet-assisted smoking cessation program in combination with auricular acupressure to enhance self-efficacy for quitting smoking in 77 adolescents (93.5% male). The authors reported results of this study showed the use of the Internet-assisted smoking cessation program in combination with auricular acupressure was more effective than auricular acupressure alone. They also report self-efficacy was significantly greater post intervention in the group receiving both interventions than in the group that only received the auricular acupressure. The authors conclude that since auricular acupressure can be self-administered, it gives adolescents a sense of self-control and may make them more confident in confronting stress associated with smoking cessation.

White, Rampes, and Campbell (2006) also did a review of acupuncture along with acupressure, laser therapy, and electrostimulation as therapies for smoking cessation. They reviewed 24 studies and concluded there was no consistent evidence that any of the techniques were effective for smoking cessation. They identified the need for further research into these types of therapies for smoking cessation.

Patten et al. (2007) studied 70 adolescents between 12 and 18 years old and an Internet-based smoking cessation intervention. The authors relied solely on

the Internet-based program and did not provide telephone or e-mail prompts, and did not provide personal interactions with the participants other than the orientation session. The authors saw a difference in the use of the different Web pages of the intervention. The interactive pages received more access and females were more likely to use the interactive pages than males were. The discussion group and quit plans were the most frequently visited pages. The authors recommend future Internet-based smoking cessation interventions contain interactive components and education materials be revised to become more interactive.

Woodruff et al. (2007) also looked at using the Internet as part of an adolescent smoking cessation program. This study combined an Internet-based, virtual reality world plus motivational interviewing and was tested on 136 adolescent smokers with a control group who only completed four on-line surveys. The results of the study showed the Internet-based, virtual reality world plus motivational interviewing was effective in helping adolescent smokers stay off cigarettes or reduce their consumption in the short-term. The authors did not see the positive effects maintained at the follow-up assessments. The authors recommend booster sessions or continued support may be necessary to reinforce the lessons learned by the adolescent attempting to quit tobacco.

Ames et al. (2008) investigated the feasibility of including parental support for smoking cessation as part of a trial examining the efficacy of a 12-week course of bupropion compared to placebo for adolescents. The authors looked at 59 adolescents between 13 and 18 years old and the study was

conducted with four arms. The arms were parental support with bupropion, parental support with placebo, minimal intervention with bupropion, and minimal intervention with placebo. The results showed the inclusion of parental support in an adolescent smoking cessation program was feasible but involving parents in the program did not affect adolescent attendance or retention in the program. The authors reported over half of the parents involved in this study used tobacco during the study.

Chan et al. (2008) reported on the establishment of a peer-led smoking cessation quitline for adolescents in Hong Kong. The authors report 949 calls were managed and about 47% came from smokers between 12 and 25 years old. They were able to follow-up on about 65.8% of the callers at six months and found that 55% reported one quit attempt and the self-reported quit rate was 22.1% for not smoking in the previous seven days and 17.5% for not smoking in the previous 30 days. Of the 187 youth who did not quit smoking, 24.1% reduced their daily cigarette intake by half or more compared to baseline. The authors conclude a peer-led smoking cessation quitline is one method that is useful in motivating adolescents to quit smoking.

Cross, Hearn, Hamilton, Resnicow, and Hall (2008) conducted a formative and efficacy trial on harm minimization in 256 randomly selected adolescents between 12 and 15 years old. The participants preferred the harm minimization messages to the standard "don't smoke" messages as they felt that it gave them the responsibility of making their own decisions. The authors followed this study with an effectiveness trial that compared the state-developed abstinence only

tobacco program to the harm minimization program in 4,636 adolescents between 13 and 14 years old. The results of this study showed the harm minimization intervention was more effective than the abstinence program for adolescents who smoked regularly or occasionally and it did not appear to increase experimentation among the students who did not currently smoke. The Phase 3 follow-up evaluation study did show the effects seen initially had decayed two years following the end of the intervention. The authors conclude any harm minimization program would have to be implemented within the context of greater tobacco control and would require a change from the abstinence-only programs. They state the continuum of tobacco use among adolescents must be addressed in school-based programs.

Fritz et al. (2008) evaluated a computer intervention to assist high school student smokers consider quitting smoking and move toward smoking cessation. The authors studied 121 adolescents between 14 and 19 years old. Participants received the computer-based intervention, which was based on the N-O-T program or they completed two questionnaires without an intervention. The authors report the participants who received the computer-based intervention had more quit attempts than did the control group. The authors also indicated students who did not quit smoking were able to reduce their cigarette consumption, thus reducing their nicotine dependence. The authors conclude there is a need to develop and evaluate smoking cessation interventions that are appealing to adolescents while being convenient and inexpensive.

Norman, Maley, Li, and Skinner (2008) used a two-group randomized control trial with 1,402 adolescents in grades nine through 11 to evaluate the impact of a classroom-based, Web-assisted tobacco intervention addressing smoking cessation. The Web-based program was called the Smoking Zine and it was used in conjunction with a paper-based journal, a small group form of motivational interviewing, and tailored e-mails. The control group evaluated the quality of Web sites offering different perspectives on climate change. The authors found the intervention can be integrated into schools to support smoking cessation and that the greatest benefit of the program to adolescents who smoked was sustaining motivation to resist further smoking and lowering future intentions of smoking.

Prokhorov et al. (2008) examined the long-term impact of A Smoking Prevention Interactive Experience (ASPIRE) curriculum on 1,574 high school students in the 10th grade who spoke and read English. This was a group-randomized study with two arms: the ASPIRE intervention, which was an interactive, multimedia smoking prevention and cessation curriculum and a standard-care intervention (receipt of the National Cancer Institute's Clearing the Air booklet). The authors found the self-reported smoking cessation rates did not differ between the intervention and the control group. The authors conclude the ASPIRE curriculum provides an efficacious computer-based preventive option for schools and that conclusions regarding the impact on smoking cessation cannot be made at this time.

Whittaker et al. (2008) piloted a youth-oriented multimedia smoking cessation intervention delivered by mobile phone. The pilot study showed interest was sufficient for the authors to proceed with development of a 6-month randomized controlled trial with more content including the use of multiple role models and the ability to personalize the program.

Smoking Cessation for Special Adolescent Populations

Adolescents who want to quit smoking are not a homogeneous group. Smoking cessation efforts that may work for one group of adolescents or adolescents from one culture may not work for another group or culture. Several articles addressed the specific needs of sub-populations of adolescents and the development of smoking cessation interventions appropriate to their situations.

Amos, Wiltshire, Bostock, Haw, and McNeill (2004) explored the relationship between cannabis use and cigarette smoking among 145 adolescents between 15 and 19 years old who smoked. The authors found through the focus group discussions that cannabis use and smoking were linked. They conclude smoking cessation treatment for this group of adolescents will have to overcome the barrier of continued cannabis use.

Barriers to tobacco cessation are unique to adolescent females in tobacco growing communities of Appalachia (Denham et al., 2004). The authors explored the cultural characteristics of this population and found community norms for tobacco, family and peer use of tobacco, school policies, youth attitudes, and logistic issues interfere with successful tobacco cessation programs for this group.

Ma, Shive, Tan, Thomas, and Man (2004) looked at developing a culturally appropriate smoking cessation program for Chinese-American youth. The authors noted that since Asian-American youth are bicultural, this made it difficult to develop culturally appropriate smoking cessation interventions because of their identification with the two cultures. The authors conclude the culturally modified smoking cessation program they developed deserved to be tested among a larger population of Chinese-American adolescents. They recommend successful smoking cessation intervention for Asian-American adolescents start earlier in their smoking history rather than later.

Myers and MacPherson (2004) described the smoking cessation efforts of substance abusing adolescents. Their report indicated cessation attempt rates were equivalent to those of non-substance abusing adolescents and the quit rates were similar. Strategies for quitting tobacco reported used the participants were stopping "cold turkey," quitting with friends, and reducing the amount smoked. Approximately one third of the 183 participants had tried NRT and only a few had used smoking cessation programs. The authors conclude that because of the high levels of smoking among youth in substance abuse programs it is important to provide smoking cessation interventions for these adolescents.

Zimmerman et al. (2004) studied asthmatic adolescents. Their study showed adolescent asthmatics who wanted to quit smoking shared similar characteristics with their non-asthmatic peers; i.e. they initiated smoking at the same age, they did not request smoking cessation assistance any sooner, and they did not engage in more quit attempts. Because of the preexisting health concerns

of asthmatic adolescents, the authors emphasize the need for targeting smoking cessation interventions toward asthmatic adolescents and preventive measures to ensure this population does not take up smoking in the first place.

Myers and Brown (2005) also studied smoking cessation interventions for substance abusing adolescents but in those who were not necessarily motivated to stop smoking. Their study was composed of 54 adolescent cigarette smokers between 13 and 18 years old who were being treated in an outpatient substance abuse program. The study was a sequential cohort design that provided weekly 1-hour sessions for six weeks to the first group. The second group continued in the group therapy for substance abuse (the same the first group received) and participated in the six week sessions after the follow-up assessments were completed for the first group. There was no significant difference seen between the two groups until the three-month time point, when the first group showed more smoking abstinence than the participants in the second group did. They conclude there is a benefit in targeting smoking cessation interventions toward substance-abusing adolescents.

Albrecht et al. (2006) looked at smoking cessation interventions for pregnant adolescents. Their study group was composed of 142 adolescents between 14 and 19 years old who were within 12 to 28 weeks gestation. They used three interventions for comparison: a modified version of the American Cancer Society's FreshStart program, the same modified FreshStart program with participants required to bring a non-smoking female buddy to the sessions, and usual care. The FreshStart program was modified by the Investigators to be more

specific for pregnant adolescents and was an eight week, group program. Short-term smoking cessation was significantly better than usual care for the group that participated with buddies, but showed no differences from the 'non-buddy' group program. Unfortunately, none of the interventions provided for long term smoking cessation post-partum.

Berman et al. (2007) looked at the special needs of deaf students in middle and high school around the use of tobacco. They interviewed 226 deaf and hard of hearing youth and although they were not looking specifically at cessation, they reported that because of social development delays found in some of these youth, the risk of future tobacco use might be high. Fortunately, the self-reported rates of current smoking among the participants interviewed when compared to their non-deaf or normal-hearing peers were significantly lower. They did see that preventive messages and school interventions around tobacco use were not getting to the deaf and hard of hearing youth.

One hundred and ninety one psychiatrically hospitalized adolescents between 13 and 17 years old were studied by MacPherson et al. (2007). The authors used a two-group design to test the effectiveness of motivational interviewing (MI) against brief advice (BA). The study showed no differences between the two treatments, but did show that making a quit attempt within the first week of hospitalization resulted in lower average rates of smoking in the follow-up period, which went for one year.

Remafedi, Jurek, and Oakes (2008) examined tobacco use in relation to sexual identity in a community-based sample of lesbian, gay, bi-sexual, and trans-

gender (LGBT) and non-LGBT adolescents between 13 and 24 years old. Although the authors found few differences between the groups in relation to tobacco usage from their interviews, there was one difference noted: the LGBT youth were less likely to want to quit smoking than were their non-LGBT peers. The authors were unclear as to why this would be so. The authors conclude that providing appropriate smoking cessation interventions to LGBT youth in youth-oriented venues may also provide benefit to non-LGBT youth.

Robinson, Emmons, Moolchan, and Ostroff (2008) addressed the issue of smoking cessation and chronically ill adolescents. The authors discussed several areas of concern when attempting smoking cessation interventions with chronically ill teens: medical complications, psychological issues, social support, and developmental losses. The article reported that chronically ill teens may be more receptive to smoking cessation messages that emphasize health issues. They are more open to discussing tobacco use with their health care providers although they may be reluctant to discuss negative health behaviors with those who have been working with them to maintain their health. The different responses adolescents have to chronic illness are also important when developing cessation programs for them – they may require training for proactive coping with stress more so than adolescents attempting to quit without chronic illnesses. The authors report that because of possible shame and fear of condemnation for smoking, chronically ill adolescents may need greater support in their cessation attempts from peers and parents. Finally, the functional role of tobacco use in their lives may make restoring peer associations and establishing independence for chronically ill

adolescents a consideration when developing appropriate smoking cessation programs. The authors conclude that specific health risks of smoking for chronically ill adolescents makes it mandatory they quit tobacco immediately and researchers must develop smoking cessation programs for this group which are adapted to their special needs.

Summary and Recommendations

Summary

The negative health consequences of smoking are well known. The U.S. Surgeon General of the Public Health Service first presented definitive documentation of the negative health effects caused by smoking four-and-a-half decades ago. Additional reports from the Surgeon General have added to the body of knowledge and have elucidated the specific negative health effects smoking causes adolescents. Smoking is the number one preventable cause of morbidity and premature death.

The prevalence of adolescent smoking has declined dramatically from the 1970s to the early 1990s but the rate of decline has slowed. Still almost one-half of high school students have tried smoking. This will lead to approximately 6.4 million premature deaths of children <18 years old today due to tobacco. Further efforts are needed to identify the best practices for adolescent smoking cessation as one method of decreasing these numbers (the other is to prevent adolescents from taking up smoking in the first place).

Characteristics of adolescent smokers vary by age within adolescence, gender, socio-economic status, cultural background, parental and peer

influence/support, age of smoking initiation, etc. This age group does not lend itself to a one-size-fits-all approach either in understanding who smokes or in providing smoking cessation interventions.

Adolescents engage in a wide variety of smoking behaviors. Early users are often experimenters. These adolescents may not smoke a whole cigarette at a time and do not have consistent patterns of smoking. They rarely identify themselves as smokers. Some adolescents smoke occasionally during the week and may smoke more frequently or smoke a greater number of cigarettes per day on the weekends. These 'social smokers' also may not identify themselves as smokers. Adult smoking behaviors are seen in some adolescents and these adolescents may benefit most directly from the adult smoking cessation research that has already been done. This may also include the use of NRT and pharmacologic therapies. Further research is needed to determine if they are safe and effective for this adolescent population, as the current indication for NRT and pharmacologic therapies does not include use in children under the age of 18.

The majority of adolescents want to quit tobacco but they do not fully understand the difficulty of the undertaking. The strongest predictor of adolescent smoking and a negative indicator for the success of cessation attempts is having close friends who smoke. Adolescents who are more frequent smokers, have less self-efficacy of quitting, and who experience peer support of their smoking are less likely to manage successful quit attempts. Including environmental factors in smoking cessation for the adolescent, as well as support of peers, family, and significant others is necessary in promoting smoking cessation for the adolescent.

Interestingly, several authors indicated that adolescents who were depressed were more likely to attempt to quit smoking. Additional indicators for attempting to quit were participation in organized sports and seeing a dentist in the previous year. High-risk sexual activity and drug use including alcohol and marijuana use before the age of 13 were negative indicators of quit attempts. Psychological and social factors must be addressed for successful support of the adolescent in smoking cessation activities. Involving the whole of the adolescent's environment in smoking cessation efforts is necessary.

Parental influences on smoking cessation for adolescents were reported as being variable: it appears that for earlier adolescence there is a positive influence that diminished as the adolescent grew older. One difficulty in engaging parents in smoking cessation support for the adolescent was identified as the reluctance of the adolescent to let their parent know they smoke. Motivating the adolescent to engage their parents in cessation efforts may be necessary for some as well as supporting parents who smoke in their cessation efforts will be necessary.

There are several difficulties in conducting research on adolescent smoking cessation interventions. As mentioned above, many adolescents do not want their parents to know they smoke and since 18 years old is considered the age at which consent can be given for participation in a research study this presents a problem. The most effective method to overcome this difficulty is to include both smokers and non-smokers in research studies to maintain the confidentiality of the adolescents who smoke.

Using the same meaning for terminology employed in smoking cessation research by both the researchers and the adolescent participants is of primary importance. Defining the meaning of terms up front will help prevent misunderstandings or lead to data that cannot be analyzed.

Recruitment and retention in research studies also presents difficulties. Utilizing school-based programs is one way to overcome these problems; however, taking time away from academic programs is difficult for many schools.

Guidelines for smoking cessation interventions have not been formulated specifically for the adolescent; however, the research done on adult smoking cessation should be used as a starting point for adolescent smoking cessation interventions.

It is important to identify the 'type' of adolescent smoker before recommending cessation interventions. Identifying those in the early stage of smoking experimentation may be most successful in preventing nicotine addiction and avoiding tobacco. Determining in which stage of the Trans-theoretical Model of change the adolescent presents for cessation intervention will help determine the best intervention strategy.

At this time, the most promising evidence-based interventions involve identifying the adolescent smoker, providing counseling, and providing motivational interventions for those not willing to quit. Cognitive-behavioral programs show good promise for adolescent smoking cessation.

Motivation-theory-related and social influences programming also provide effective adolescent smoking cessation interventions. Contingency management therapy may also play a role in adolescent smoking cessation.

Structuring adolescent smoking cessation interventions specific to adolescents and providing coping methods for stress should also be part of any program. There is not enough evidence to support pharmacologic therapy for adolescent smoking cessation, nor is there evidence of efficacy for alternative therapies. Computer-based interventions may play a role in helping adolescents quit tobacco but there is more work needed on this intervention to determine its effectiveness.

Special sub-populations of adolescents also require different smoking cessation interventions. Substance-abusing adolescents, bi-cultural adolescents, adolescents living in tobacco-growing communities, chronically ill and psychiatrically vulnerable adolescents, pregnant adolescents, deaf and hard-of-hearing adolescents, and LGBT adolescents all have unique characteristics and needs that will help determine the most appropriate intervention or interventions to assist them in quitting smoking.

Further Research

Further research is needed in all areas of adolescent smoking cessation. Improving the length of follow-up appears to be the most important issue. Studies that only looked at cessation rates for three months or less should be repeated and participants followed for a minimum of six months.

How to recruit sufficient numbers of participants and retain them over the period of follow-up should be undertaken. Different locations for smoking interventions should be studied, as should novel uses of the Internet, cell phones, telephone counseling, quitlines, and new technologies as they become available.

Optimal use and content of cognitive-behavioral therapies, contingency management therapies, and alternative therapies should be explored to provide the most effective and appropriate smoking cessation programs for adolescents. Nicotine replacement therapies and non-nicotine replacement pharmacologic therapies should be studied to determine the appropriate adolescent population for their use, including the correct dosage and frequency.

Special populations of adolescent smokers deserve to have appropriate smoking cessation programs so research on occasional smokers, pregnant adolescents, deaf and hard-of-hearing adolescents, medically vulnerable adolescents, and support for adolescent smokers with parents who smoke should be undertaken or extended.

Finally, harm reduction, even though controversial, should be researched to see if it reduces the negative effects of smoking and if it is effective in bringing about smoking cessation at some future date for the adolescent unable to attain smoking abstinence.

Program Development

Adolescent smoking cessation is a high public health priority and requires that smoking cessation programs be effective and based on the best available evidence. Several themes emerged from the literature reviewed. The first is that

any smoking cessation program for adolescents must take into account the special needs of this population, including gender differences, why adolescents smoke, withdrawal symptoms, and risk-taking behaviors. The second is that assuming what works for the adult smoker attempting to quit tobacco will work for the adolescent smoker is not based on the best evidence available.

In developing smoking cessation programs for adolescents, the planners should take into account the strong influence of peers and family and include them in the program. Adolescents will also have a stronger sense of ownership if they are a part of the planning and development process. School-based counseling programs offered during classroom hours will allow more adolescents who need assistance to access the help.

Since adolescents smoke differently from adults, smoking cessation interventions should start as soon as the adolescent begins to experiment with tobacco, should target all ages with the same intensity, and should include processes to enhance the adolescent's motivation for quitting tobacco. Programs may be needed for adolescents in different stages of change and harm reduction may be necessary for those not able to quit smoking through the cessation program.

In summary, programs should be proactive, dynamic, and tailored to the special needs of adolescents; they should provide supportive, non-judgmental counselors who respect the privacy of the adolescent; they should be available in several settings; and they should utilize different approaches and not have a 'one-size-fits-all' mentality.

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