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Primary Care Relevant Interventions for Tobacco Use Prevention and Cessation in Children and Adolescents: A Systematic Evidence Review for the U.S. Preventive Services Task Force

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Structured Abstract

Background: Interventions to prevent smoking uptake or encourage cessation among children or adolescents may help slow or halt increased tobacco-related illness.

Purpose: To systematically review evidence for the efficacy and harms of primary care interventions to prevent tobacco initiation and encourage tobacco cessation among children and adolescents.

Methods: We identified three good-quality systematic reviews published since the previous USPSTF recommendation was released; two systematic reviews addressed smoking prevention that collectively covered the relevant literature through July 2002, and one Cochrane review addressed smoking cessation that included trials through August 2009. We examined the included and excluded studies of these reviews and then searched MEDLINE, PsycINFO, the Cochrane Central Register of Controlled Trials, and the Database of Abstracts of Reviews of Effects to identify literature that was published after the search dates of the three prior systematic reviews. We also examined the references from 20 other good-quality systematic reviews and other relevant publications, searched Web sites of government agencies for grey literature (February to September 2011), and monitored health news Web sites and journal tables of contents (beginning in January 2011) to identify potentially eligible trials. Two investigators independently reviewed identified abstracts and full-text articles against a set of a priori inclusion and quality criteria. Discrepancies were resolved by consensus. One investigator abstracted data into an evidence table and a second investigator checked these data. We conducted random effects meta-analyses to estimate the effect size of smoking prevention or cessation interventions on self-reported smoking status. We grouped trials based on the focus of the trial—combined prevention and cessation, prevention, or cessation.

Results: We included 24 articles representing 19 unique studies. None of the studies examined childhood or longer-term health outcomes (e.g., respiratory health or adult smoking). Seven trials evaluating combined prevention and cessation interventions were mainly rated as fair quality and included a diverse mix of intervention components and approaches. Pooled analyses of six of the combined trials (n=8,749) resulted in a nonstatistically significant difference in the smoking prevalence among the intervention group compared with the control group at 6- to 12-months followup. Pooled analyses across all of the prevention trials suggested a small reduction in smoking initiation at 6- to 12-months followup among intervention participants compared with control group participants (risk ratio, 0.81 [95% confidence interval, 0.70 to 0.93]; k=9; n=26,624). Meta-analyses of the behavior-based cessation trials (k=7; n=2,328) and the medication (bupropion) cessation trials (k=2; n=256) did not show a statistically significant effect on self-reported smoking status among baseline smokers at 6- to 12-months followup. No trials evaluating behavior-based interventions (both prevention and cessation) reported possible harms from interventions. Some trials, however, reported a higher absolute prevalence of smoking in the intervention groups compared with the control groups, although none were statistically significant. Three studies were included that examined adverse effects related to bupropion use, and findings were mixed.

Conclusions: Interventions designed to reduce the prevalence of tobacco use among children

and adolescents represent a clinically and methodologically heterogeneous body of literature. Overall, methodological differences between the included trials limits our ability to determine if the relatively small effect found on smoking initiation in this subset of trials represents true benefit across this body of literature. In particular, the measurement of smoking status, including what constituted smoking initiation and cessation, varied across all studies. In addition, the diversity of both the components and the intensity of the interventions limit our ability to draw conclusions about common efficacious elements.

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CHAPTER 1. INTRODUCTION

Scope and Purpose

In 2003, the U.S. Preventive Services Task Force (USPSTF) issued a recommendation on screening and counseling to prevent initiation and promote cessation of tobacco use in children and adolescents.[1] This recommendation was based on evidence synthesized for the 2000 Public Health Service (PHS) "Clinical Practice Guideline on Treating Tobacco Use and Dependence."[2] The PHS report focused specifically on tobacco-use *treatment*, including a review of the effectiveness of tobacco-use interventions for adolescent smokers. In contrast, the current systematic review examines the benefits and harms of strategies designed to reduce the prevalence of tobacco use through primary care relevant prevention *and* cessation interventions in children and adolescents. The USPSTF will use this review to update its 2003 recommendation.

Most tobacco users in the United States are cigarette smokers. As a result, the majority of research in this field has focused on the assessment, prevention, and treatment of cigarette smoking. In this report, every effort has been made to describe the research according to the specific form of tobacco (e.g., cigarette smoking or all tobacco use) that was examined. In particular, the term "smoker" is used instead of "tobacco user" to indicate if the evidence comes from studies of cigarette smokers. We included trials conducted in, referred from, or potentially feasible for (or referable from) health care settings. We describe these collectively as "primary care relevant." In addition, in this report, "prevention" refers to preventing the initiation of tobacco use or maintaining abstinence among nonusers, whereas "cessation" refers to supporting a smoker or tobacco user in stopping use/quitting.

Burden of Tobacco Use

Tobacco use is the leading cause of preventable death in the United States. An estimated 443,000 deaths occur annually that are attributable to smoking, including nearly 161,000 deaths from cancer, 128,000 by cardiovascular diseases, and 103,000 by respiratory diseases (excluding deaths from secondhand smoking and residential fires).[3] Tobacco use leads to more deaths than HIV, illegal drug use, alcohol use, motor vehicle injuries, suicides, and murders combined.[4] Tobacco's toll is not only physical, but also economic, as smoking costs the United States approximately $96 billion each year in direct medical costs and $97 billion from productivity losses due to premature death.[3] While cigarette smoking is the predominant form of tobacco use in the United States, other tobacco products include cigars, pipes, and smokeless tobacco products (e.g., chewing tobacco, dipping tobacco, and snuff). Newer tobacco products include bidis, kreteks, smoking tobacco through the use of a hookah (i.e., waterpipe), snus, dissolvables, electronic nicotine delivery systems, and little cigars/cigarillos.

Prevalence and Natural History of Tobacco Use

Despite the fact that the legal age for purchasing tobacco products is 18 years,[5] nearly 90 percent of adults who have ever smoked daily smoked their first cigarette by the age of 18 (99% initiated tobacco use by the age of 26).[6] Each day in the United States, over 3,800 children and adolescents between the ages of 12 and 17 years smoke their first cigarette, and an estimated 1,000 persons younger than age 18 years begin smoking on a daily basis.[6] While the most serious health outcomes associated with adolescent tobacco use typically appear during adulthood, there are immediate adverse health effects among child and adolescent smokers, including increased negative respiratory effects such as impaired lung growth, early onset of lung function decline, respiratory and asthma-related symptoms (e.g., coughing and wheezing), and early abdominal aortic atherosclerosis.[7,8]

An individual's path to daily smoking and nicotine dependence has been described in five stages: 1) not susceptible to smoking; 2) susceptible or preparing to smoke; 3) initiation or experimentation (trying the first cigarette); 4) nondaily or irregular smoking; and 5) established or regular smoking (e.g., smoking every day or almost every day).[9,10] Although children as young as age 10 years may be susceptible to smoking, it can take up to 2 years to progress from early experimentation to addiction.[11,12] While this is the path for most adolescent smokers, some children and adolescents progress rapidly to nicotine dependence, underscoring the need to prevent initial smoking uptake.[13]

Findings from the Centers for Disease Control and Prevention's (CDC's) National Youth Tobacco Survey (NYTS), a school-based survey of middle school (grades 6–8) and high school (grades 9–12) students, indicated that prevalence of current tobacco and cigarette use and experimentation declined between 2000 and 2009; however, no declines were seen for the period of 2006 to 2009. In 2009, 8.2 percent of middle school students and 23.9 percent of high school students reported current use of any tobacco product; 5.2 percent of middle school students and 17.2 percent of high school students reported current use of cigarettes.[14] The prevalence of current use of all tobacco products by school level (i.e., middle school vs. high school) is presented in **Table 1**.

Additionally, 15.0 percent of middle school and 30.1 percent of high school students reported experimentation with cigarette smoking as defined by having ever smoked any cigarettes, even one or two puffs, but fewer than 100 cigarettes. Susceptibility to initiate cigarette smoking was 21.2 percent in middle school students and 24.0 percent in high school students. Those who were susceptible to initiate cigarette smoking were defined as never smokers (never tried smoking cigarettes, even one or two puffs) who reported being open to trying cigarette smoking.[14]

These findings are consistent with those of the national Youth Risk Behavior Survey (YRBS) for recent years.[15] Results from the 2009 YRBS found that 19.5 percent of high school students were current cigarette users, a figure well above the Healthy People 2020 objective of 16 percent or less.[16] In 2009, 26.0 percent of high school students nationwide reported current cigarette use, current smokeless tobacco use, or current cigar use. Additionally, 7.8 percent of those who reported currently smoking had smoked more than 10 cigarettes per day on the days they smoked during the 30 days before the survey, and 7.3 percent smoked frequently (on 20 or more days

during the 30 days before the survey). Overall, the prevalence of current tobacco use was higher among male (19.8%) than female (19.1%) students. The prevalence was also higher among white male (35.1%) and Hispanic male (23.6%) than white female (24.9%) and Hispanic female (18.1%) students, respectively. Among the 19.5 percent of students who currently smoked cigarettes, 50.8 percent had tried to quit smoking during the 12 months before the survey. The prevalence of trying to quit was higher among female (54.2%) than male (48.0%) students.[15]

More recently, the Monitoring the Future (MTF) Survey showed decreases in cigarette smoking from 2010 to 2011 for adolescents in grades 8, 10, and 12 (all the grades under study). The proportion reporting smoking at least 1 day in the prior 30 days fell significantly for all adolescents, from 12.8 percent in 2010 to 11.7 percent in 2011. Individually, over 6 percent of 8th grade students and nearly 12 and 19 percent of 10th and 12th grade students, respectively, reported currently smoking in 2011.[17]

Measurement of Tobacco Use in Children and Adolescents

The literature typically defines current tobacco use in children and adolescents as any tobacco use during the previous 30 days. There are several other commonly used measures, however, including tobacco use during the previous 7 days or tobacco use at any point during the person's lifetime ("ever" use).[18,19] Three large epidemiological surveys, MTF, YRBS, and NYTS, all defined adolescent lifetime smoking (i.e., ever smoked) as having had even one or two puffs. These studies defined current smoking as having smoked on 1 or 2 days during the previous 30-day period. MTF defined "daily smoking" as an average of one or more cigarettes per day during the previous 30-day period, while YRBS and NYTS measured "frequent smoking," defined as 20 or more cigarettes in the past 30 days.[18] Experimentation is often inferred from responses to questions about ever smoking or age of first use. In addition, there is no standard definition for describing smoking cessation among children and adolescents.[20] The two most common measures of cessation are "point prevalence" abstinence (i.e., not smoking at the point of followup; typically measured as no smoking for the past 7 or 30 days) and "continuous abstinence" (i.e., no smoking through the followup period).[21] **Table 2** summarizes common measures of tobacco use, including how each measure is defined and operationalized.

While self-reported smoking status is the most commonly used measure, it may not accurately measure actual tobacco use due to faulty recall and over- or underreporting bias.[20] This may be particularly true for children and adolescents who only smoke sporadically and may underreport their tobacco use or fail to identify themselves as a smoker.[22,23] Additionally, studies examining the validity of self-reported risk behaviors have found that the prevalence of tobacco use is higher when surveys are administered in school settings compared with household settings, which may reflect the fact that adolescents appear to underreport smoking behavior when they feel their confidentiality may be at risk.[22] The magnitude and extent of underreporting is unclear. Studies examining the validity of self-reported tobacco use compared with a bogus pipeline approach (e.g., threat of biological validation) have yielded mixed results.[24,25]

Biochemical measures, including measures of thiocyanate (SCN) in saliva or blood samples; cotinine in blood, urine, or saliva samples; or monitoring of carbon monoxide (CO) levels in

expired air are frequently used to substantiate self-reports. These measures, however, can also be unreliable in adolescents who may only smoke sporadically.[24] All of the biochemical measures have a relatively short half-life (e.g., cotinine has a half-life of 19 hours, CO has a half-life of 2–5 hours, and SCN has a half-life of 14 days),[23] and many cannot detect light smoking due to additional environmental sources (in the case of CO) or possible dietary sources (in the case of SCN). Additionally, studies have found that the correlation between smoking status and biochemical markers is lower for younger teens, as they may not fully inhale and metabolize tobacco smoke.[23] The Society for Research on Nicotine and Tobacco (SRNT) subcommittee on biochemical verification in clinical trials considers that verification is not necessary when a trial includes a large population with limited face-to-face contact, and where the optimal data collection methods are through the mail, telephone, or Internet.[26] However, the SRNT subcommittee recommends that biochemical verification be used in most studies of smoking cessation in special populations, including adolescents.[26]

Risk Factors

Many variables influence the likelihood of smoking initiation and continuation in children and adolescents. The risk of smoking initiation involves a complex mix of personal, social, and environmental factors. Parental smoking (including parental nicotine dependence) is among the strongest factors associated with increased risk of smoking initiation.[27-29] One study found that a child's odds of daily smoking were reduced by 71 percent when both parents never smoked versus when both parents were current smokers.[30] In addition, low parental monitoring, easy access to cigarettes, and absence of restrictions on smoking in the home are related to smoking initiation.[28,29] Children and adolescents are more likely to start smoking if they perceive a high prevalence of smoking among their peers,[31,32] in part, to gain social status or acceptability.[33] Findings from the Development and Assessment of Nicotine Dependence in Youth study indicated that the perceived ease by which children and adolescents could obtain tobacco products was associated with a higher level of smoking initiation and regular smoking.[34] In addition, exposure to tobacco promotions increases the risk for initiation or progression toward regular tobacco use.[35]

Evidence also suggests that multiple factors influence a child or adolescent's decision to continue smoking and the probability they will become nicotine dependent. Among smokers, pleasant initial sensitivity to tobacco use, parental nicotine dependence, adolescent nicotine dependence, and extensiveness of smoking at the initial interview were the strongest predictors of adolescent nicotine dependence 2 years later.[36]

Rationale for Tobacco Use Interventions in Primary Care

Given the fact that primary care clinicians have regular and ongoing contact with children and adolescents and their families, they have a unique opportunity to address smoking prevention and cessation efforts. Research establishing the effectiveness of prevention and cessation interventions in children and adolescents are needed to reduce the burden of tobacco use in adulthood and to minimize the immediate adverse health effects experienced by children and

adolescents. If effective, these interventions could help reduce the physical and economic burden of tobacco use. It has been estimated that a 26 percent decrease in adolescent smoking prevalence from community and policy interventions would result in an annual savings of more than 100,000 lives and 1.6 million years of potential life lost in the United States.[37]

Prevention and Cessation Interventions

Tobacco prevention and cessation interventions can rely on one of several theoretic approaches and frameworks, including targeting *intrapersonal* factors through strategies such as motivational interviewing, tailoring messages and activities using the transtheoretical model (i.e., stages of change), or life skills enhancement; *social/normative* factors that target the social situation, context, or norms through approaches such as improving parent/child communication or designing interventions based on social learning theory; and through targeting *environmental* factors that address cultural and environmental influences such as broad-based policy changes.[8, 38-42] For example, increasing the enforcement of existing regulations that restrict sales to minors can decrease access to tobacco products, which may impact uptake and continued use.[8,40,42] Likewise, because youths living in households with parents who have never smoked or have quit smoking have a significantly lower risk of initiating smoking, researchers have theorized that targeting parental behavior and parent-child communications and interactions can reduce tobacco use in children and adolescents.[43]

The recently released "Surgeon General's Report on Preventing Tobacco Use Among Youth and Young Adults" concluded that there is a "large, robust, and consistent" evidence base that documents known effective strategies for reducing tobacco use among youth and young adults. The evidence was organized into three sections: 1) large community environments (i.e., mass media campaigns, community interventions, and comprehensive state-level tobacco control programs); 2) legislative and regulatory approaches (i.e., taxation, policies on clean indoor air, regulations on youth access, bans on advertising, and product labeling); and 3) small social environments (i.e., the family, clinical settings, schools, and youth empowerment and activism programs). The report also included a section on youth cessation interventions. One of the major conclusions of the report states, "Coordinated, multicomponent interventions that combine mass media campaigns, price increases including those that result from tax increases, school-based policies and programs, and statewide or community-wide changes in smokefree policies and norms are effective in reducing the initiation, prevalence, and intensity of smoking among youth and young adults."[8] Earlier recommendations from the CDC[44] and the Community Preventive Services Task Force[45] similarly recommend comprehensive state- and communitywide tobacco control programs and policies that incorporate a mix of educational, clinical, regulatory, economic, and social strategies. While the Surgeon General's report states there is no clear evidence to suggest that prevention strategies delivered in health care settings are effective in reducing adolescent smoking initiation, these results should be interpreted with caution, given the limited data and the lack of replication of specific approaches.[8]

Several systematic and narrative reviews have also been conducted that examine the effects of tobacco cessation interventions in encouraging adolescent smokers to quit smoking.[39,46-62] The most recent review by Sussman and Sun, whose findings were generally consistent with previous

cessation reviews, included 64 controlled trials that targeted cessation among adolescent smokers ages 12–19 years.[61] The majority (n=40) were based in schools. Effects were estimated according to four main predictors: 1) focus (i.e., social influences, cognitive-behavioral, motivational, medical [e.g., managing the effects of withdrawal or recovery], and other); 2) modality (i.e., classroom, school clinics, medical clinics, family, systemwide, computer, sensory deprivation, court diversion, and other public settings); 3) number of sessions (i.e., one to four, five to eight, nine or more); and 4) length of followup (i.e., 0 to 3 months, 4 to 12 months, and more than 12 months). Overall, meta-analysis found a 4 percent difference in quitting among the intervention groups compared with the control groups (11.8% vs. 7.5%), although most studies were statistically underpowered to detect differences with reasonable certainty and most studies failed to use appropriate analyses (e.g., accounting for nesting in cluster randomized trials). The authors concluded that programs based on social influences, cognitive-behavioral theory, or enhancing motivation were the most effective and that cessation interventions might be best delivered in a school-based context. Interventions set in medical clinics were also found to have statistically significant effects, although it was not clear if it was the setting itself or the underlying theory used in the interventions (i.e., eight of the nine interventions that took place in a medical setting were motivation-enhancement based).

A Cochrane Collaboration review by Grimshaw and Staton included 24 good-quality trials that examined the effects of tobacco cessation interventions for young people age 19 years and younger.[39] They concluded that complex approaches, particularly those that incorporated components based on the stages of change model, motivational enhancement, and/or cognitive behavioral therapy, showed promise in promoting abstinence. However, they acknowledged that there is a need for more well-designed, adequately powered trials of cessation interventions for this age group. The use of pharmacologic adjuncts as an aid in cessation for adolescent smokers is also of interest, given the positive effects of these therapies seen among adults.[63] However, currently, there are no medications approved for tobacco cessation in adolescents and children. The Food and Drug Administration (FDA) instructs adolescents to see their doctors if they are interested in nicotine replacement therapy (NRT). Because the safety and effectiveness of these drugs in pediatric patients have not been established, bupropion hydrochloride (known as Zyban®), an aminoketone antidepressant, and varenicline tartrate (known as Chantix®) are not recommended for smoking cessation for people younger than age 18 years. In July 2009, the FDA required both bupropion and varenicline tartrate to carry boxed warnings on their labels for health care professionals citing serious risks for users taking these drugs.[64] These risks include changes in behavior, depressed mood, hostility, and suicidal thoughts or actions.

Current Clinical Practice

Few adolescents report having discussed tobacco use with a health care provider. Recent studies indicate that less than half of adolescents who visited a physician or a dentist in the past year reported receiving preventive counseling regarding tobacco use.[65] According to the 2000 NYTS, 33 percent of children and adolescents in grades 6–12 who visited a physician in the past year reported that they were counseled about the dangers of tobacco use; 20 percent reported that a dentist provided such counseling. Among children and adolescents who smoked in the past year, 16.4 and 11.6 percent reported receiving advice to quit from a physician or dentist, respectively.

Those defined as current smokers (i.e., reported smoking in the past 30 days) were significantly more likely to have received advice to quit when visiting a physician or dentist than individuals who had smoked in the past year but not in the past 30 days. This advice to quit was positively related to one or more quit attempts during that period.[65] More recent data from the 2009 NYTS found that only 21 percent of adolescents recalled that a doctor, dentist, or nurse asked them whether they smoked in the past 12 months, and of those who did smoke, only 7 percent reported that their provider told them to stop smoking.[66]

Another recent study of 16- to 19-year-olds found that 43.4 percent of adolescents surveyed reported ever being asked by their physician whether they smoked and 42.1 percent reported ever being counseled by their physician not to smoke; 28.8 percent reported receiving both screening and counseling. Among those adolescents who reported current smoking, 79.3 percent reported that they would admit that they smoked if their physician asked.[67]

A recent survey of pediatricians found that less than half (44%) of practicing pediatricians who responded to the survey felt confident in their ability to help adolescents quit smoking.[68] Additionally, few of the pediatricians who were surveyed reported referring their adolescent patients to smoking cessation programs (10%) or prescribing NRT (2%). A separate national survey of female pediatricians found similar results—only 41 percent of survey respondents reported providing smoking cessation counseling to their smoking patients at least once a year.[69]

Recommendations of Other Groups

In May 2008, the PHS updated its 2000 clinical practice guidelines and presented its recommendations in "Treating Tobacco Use and Dependence: Clinical Practice Guideline, 2008 Update."[63] The PHS guideline panel reviewed the effectiveness of tobacco-use interventions for adolescent smokers. As a result of this review, the panel made the following recommendations (p. 157):

- Recommendation 1: Clinicians should ask pediatric and adolescent patients about tobacco use and provide a strong message regarding the importance of totally abstaining from tobacco use (Strength of Evidence = C).
- Recommendation 2: Counseling has been shown to be effective in treatment of adolescent smokers. Therefore, adolescent smokers should be provided with counseling interventions to aid them in quitting smoking (Strength of Evidence = B).
- Recommendation 3: Secondhand smoke is harmful to children. Cessation counseling delivered in pediatric settings has been shown to be effective in increasing cessation among parents who smoke. Therefore, to protect children from secondhand smoke, clinicians should ask parents about tobacco use and offer them cessation advice and assistance (Strength of Evidence =B).

Due to a lack of evidence on the effectiveness of pharmacologic therapy in adolescents, a previous recommendation was eliminated from the updated 2008 PHS guideline (p. 245):

- PHS 2000, Recommendation: When treating adolescents, clinicians may consider

prescriptions for bupropion SR or NRT when there is evidence of nicotine dependence and desire to quit tobacco use (Strength of Evidence = C).

In 2009, the American Academy of Pediatrics (AAP) published a policy statement on tobacco use.[70] While the policy statement recommended pharmacotherapy for parents of pediatric patients, it stopped short of recommending nicotine replacement or other medications for children or adolescents. AAP recommended that all pediatricians should counsel patients against initiating tobacco and provide counseling on tobacco cessation. This policy statement also recommended that pediatricians should include initial guidance regarding tobacco use to patients as young as age 5 years. Further, AAP recommended that pediatricians should advise all families to make their homes and cars smoke free.

Previous USPSTF Recommendation

In 2003, the USPSTF updated its 1996 recommendation and concluded there was insufficient evidence to recommend for or against routine screening for tobacco use or interventions to prevent and treat tobacco use and dependence among children or adolescents (I statement).[1]

CHAPTER 2. METHODS

Key Questions and Analytic Framework

Using the methods of the USPSTF,[71] we developed an analytic framework (**Figure 1**) and key questions (KQs) to guide our literature search, in consultation with liaisons from the USPSTF. This review examined the benefits and harms of primary care relevant interventions designed to both prevent tobacco use in children and adolescents and help child and adolescent tobacco users stop using tobacco. The KQs we examined were:

KQ 1. Do interventions in primary care designed to prevent tobacco use or improve tobacco cessation rates in children and adolescents improve health outcomes in children and adolescents (i.e., respiratory health, dental/oral health) and reduce the likelihood of adult smoking?

KQ 2. Do interventions in primary care prevent tobacco use in children and adolescents or improve tobacco cessation rates in children and adolescents who use tobacco? What are elements of efficacious interventions? Are there differences in outcomes in different subgroups, as defined by age, sex, race, socioeconomic status, type or pattern of tobacco use, urban versus rural, depressed versus nondepressed?

KQ 3. What adverse effects are associated with interventions to improve tobacco cessation rates or prevent tobacco use in children and adolescents?

Data Sources and Searches

The previous USPSTF recommendation was based on a 2000 report from the PHS.[2] This report was subsequently updated in 2008.[72] As such, we began by identifying and evaluating all trials included in the 2008 updated report for possible inclusion in the current review. Additionally, we evaluated all trials that were included or excluded (where available) in three previous reviews.[39, 43,73] These reviews addressed issues that were applicable to the KQs in our review and had inclusion/exclusion criteria consistent with (or broader than) the current review. We also judged the search methods employed in these three reviews to be acceptable. For tobacco prevention, we identified two relevant systematic reviews that collectively covered the literature relevant to our inclusion/exclusion criteria through July 2002. For tobacco cessation, we identified a Cochrane review that searched for cessation trials through August 2009. We then searched MEDLINE, PsycINFO, the Cochrane Central Register of Controlled Trials, and the Database of Abstracts of Reviews of Effects for trials of tobacco use prevention starting in January 2002, and for trials of tobacco cessation starting in January 2009, ending all searches on September 14, 2012. See **Appendix A** for a sample search strategy. We also searched bibliographies of 20 additional relevant reviews;[47-58,60-62,74-78] solicited expert input; searched Web sites of government agencies such as Agency for Healthcare Quality and Research (AHRQ), Institute of Medicine, Office of the Surgeon General, FDA, and National Institute of Clinical Excellence for relevant grey literature (February to September 2011); searched bibliographies of other relevant publications; and used news and table-of-contents alerts beginning in January 2011 to help us identify

potentially eligible trials.

Study Selection

Two investigators independently reviewed 2,453 abstracts against prespecified inclusion and exclusion criteria; of those, 111 articles were subsequently evaluated for inclusion (**Appendix B**). Articles that were excluded are listed in **Appendix C**, along with their reason for exclusion. Disagreements were resolved by discussion or consultation with the larger project team. Detailed inclusion and exclusion criteria are provided in **Appendix D**.

We examined trials of interventions designed to prevent tobacco use in children or adolescents, or trials that promoted the cessation of tobacco use (with or without the adjunctive use of medication) published in or after 1980. Included interventions were targeted at children or adolescents (either tobacco users or nonusers) or their parents and were delivered individually or in small groups in a health care or comparable setting. Included trials had control arms that offered minimal or no treatment, or an attention control arm, and had to report tobacco use prevalence or a comparable outcome at least 6 months after the baseline assessment. We only considered controlled trials for questions related to benefits of treatment (KQs 1–2). We considered controlled trials and comparative observational studies for harms of pharmacotherapy (KQ 3).

While we sought to include trials that addressed both cigarettes and other forms of tobacco, all of the trials that met our inclusion criteria focused primarily or exclusively on cigarette smoking. We included trials conducted in, referred from, or potentially feasible for (or referable from) health care settings. We describe these collectively as "primary care relevant." We excluded trials that were conducted in schools or other settings in which participants would be interacting with people in their existing social network as part of the intervention, because the social influence exerted by peers could not normally be replicated in a health care setting. Trials that recruited participants from schools but whose intervention was in a different setting could be included if participants were unlikely to be part of each other's pre-existing social networks (e.g., small numbers of students from multiple schools). In addition, a trial was included if it was conducted in a school setting but was feasible for primary care (e.g., school health nurse intervention or after school hours), provided we judged it unlikely that participants would be part of each other's pre-existing social networks. We excluded trials of broad community-based interventions (e.g., media campaigns, public policy changes, legislation). A comparison of the included trials in the current review with four previous systematic reviews[39,43,61,73] is provided in **Appendix E**.

Quality Assessment and Data Extraction

Two independent investigators conducted quality assessments of all trials meeting our inclusion criteria, resulting in a rating of "good," "fair," or "poor" (see **Appendix F** for quality criteria). Briefly, for benefits of treatment (KQs 1–2), we assessed the validity of the randomization and measurement procedures (including blinding and consistency between groups), comparability of

the groups in baseline characteristics, overall and group-specific attrition, intervention fidelity, and statistical methods. Generally, good-quality trials blinded assessment and intake staff to participant group assignment, had followup data on 90 percent or more of participants, used reliable measures of tobacco use, reported group-specific followup with differences of less than 10 percentage points between groups, and used conservative data-substitution methods if missing data were imputed. Trials were rated as "poor" if attrition was greater than 40 percent, attrition in the treatment and control groups differed by more than 20 percentage points, or there were other important flaws. Poor-quality trials were excluded from the review. All trials meeting quality criteria for benefits of treatment (KQs 1–2) were also examined for harms of treatment (KQ 3). We did not require a minimum followup for harms of pharmacotherapy, since harms could potentially occur immediately after beginning use of a medication and may be a cause of high or differential attrition. Differences in quality ratings were resolved by discussion or consultation with the larger review team. One reviewer abstracted data from studies that were rated as "fair" or "good," and this work was checked by another reviewer. Elements abstracted included information on study population, setting, recruitment methods, followup, intervention and control conditions, and outcomes.

Data Synthesis and Analysis

We conducted random effects meta-analyses to estimate the effect size of smoking prevention or cessation interventions on smoking status for trials reporting sufficient data. Our primary outcome was self-reported smoking status at followup. We chose self-reported smoking status rather than biochemically verified status because biochemical verification was not used consistently and is often not a reliable measure of smoking in adolescents due to sporadic tobacco use.[23] Behavior-based and medication trials were analyzed separately.

While all of the medication trials were limited to smokers and targeted smoking cessation, the behavior-based trials varied in their target populations. Some behavior-based trials were limited to nonsmokers, focusing on primary prevention of smoking, and others were limited to smokers, addressing only smoking cessation (secondary prevention). Several trials included both smokers and nonsmokers at baseline and either delivered the same message to everyone (regardless of smoking status) or tailored the intervention to the smoking status of each participant. We examined smoking prevalence at followup separately for baseline smokers and baseline nonsmokers, and also analyzed combined samples that included both smokers and nonsmokers. Thus, some trials that reported outcomes for all three sets of participants (smokers only, nonsmokers only, and both groups combined) were included in all three analyses.

We entered the raw number of events (smokers, as defined by the study) in each group and the total number of participants in the analysis for each group at the pertinent followup into random effects meta-analysis to calculate pooled risk ratio estimates, using Stata 11.2 (StataCorp, College Station, TX). The meta-analysis was also adjusted for the cluster randomization of three trials[79-81] by dividing the sample sizes in these studies by a design effect, which is based on average cluster size and the estimated intraclass correlation (ICC).[82] We estimated the ICC to be 0.01, based on previously published literature.[83] We generated forest plots that ordered the trials in alphabetical order by first author of the main outcomes publication within each of the three

groups (combined, nonsmokers, smokers). We did not conduct statistical analyses for publication bias because we had fewer than 10 trials in all analyses. Statistical heterogeneity was assessed with the I^2 statistic.[84] We applied Cochrane Collaboration rules of thumb for interpreting I^2: less than 40 percent likely represents unimportant heterogeneity, 30–65 percent represents moderate heterogeneity, 50–90 percent represents substantial heterogeneity, and more than 75 percent indicates considerable heterogeneity among the studies.[82]

Clinical and methodological heterogeneity were substantial, but were judged to be acceptable within the prevention, cessation, and combination subgroups to justify a meta-analysis of relative benefit (i.e., risk ratio). Because of the heterogeneity, however, we present qualitative synthesis and summary as well as quantitative, and view the quantitative pooling as adjunctive information.

There were too few trials and too much variability in a number of factors to statistically examine whether study or treatment characteristics influenced effect size in any of the analyses. Within each group, however, we did qualitatively explore patterns of association between effect size and the following factors: number of intervention sessions, time spent interacting with the interventionist, whether the intervention was tailored according to smoking status, whether there was a group component to the intervention, whether the intervention explicitly involved motivational interviewing, whether the primary treatment person targeted by the intervention was the youth, the parent, or both, theoretical basis, the measure of tobacco use, the type of control group used, study quality rating, average age of the participants, and sex distribution of the participants.

USPSTF Involvement

We worked with three USPSTF liaisons at key points throughout this review, particularly when developing the analytic framework, KQs, and scope of the review. AHRQ funded this review under a contract to support the work of the USPSTF. An AHRQ medical officer provided oversight of the project, reviewed the draft report, and assisted in the external review of the report.

CHAPTER 3. RESULTS

We identified 19 trials examining the effects and harms of interventions designed to prevent the initiation of tobacco use and/or promote cessation among children and adolescents.[11,79-81,85-98] These trials' results were reported in 24 publications.[11,79-81,85-104] All of the trials were considered primary care relevant interventions, as they were conducted in primary care or were judged to be feasible for or applicable to primary care. Seven trials examined interventions that included both prevention and cessation (hereafter referred to as "combined" trials),[79,86,91,93,95,97,98] six additional trials only examined the benefits of prevention interventions among baseline nonsmokers,[11,81,85,88,90,92] and five additional trials examined the benefits of cessation interventions among baseline smokers.[80,87,94,96,104] Two of the cessation studies included a medication-based intervention.[94,96] Of the seven combined trials that included both smokers and nonsmokers, four reported the effect of the intervention among baseline nonsmokers and smokers separately and are discussed in the "Prevention" and "Cessation" sections below.[79,86,91,95,99,100] **Table 3** displays the overall structure of the trials as defined by their intervention focus. **Table 4** presents study characteristics of all of the included studies.

Key Question 1. Do Interventions in Primary Care Designed to Prevent Tobacco Use or Improve Tobacco Cessation Rates in Children and Adolescents Improve Health Outcomes in Children and Adolescents and Reduce the Likelihood of Adult Smoking?

We identified no primary care relevant trials designed to prevent tobacco use or improve tobacco cessation rates that assessed health outcomes in children and adolescents or examined subsequent rates of adult smoking. None of the included studies assessed the intervention's impact on other potential positive outcomes (e.g., improved mental health, reduced alcohol and drug use). We do not discuss outcomes that are primarily psychosocial mediators of behavior (e.g., beliefs, motivation to quit, parent-child communication, perception of peer smoking), although these measures were reported in many of our included studies.

Key Question 2. Do Interventions in Primary Care Prevent Tobacco Use in Children and Adolescents or Improve Tobacco Cessation Rates in Children and Adolescents Who Use Tobacco? What Are Elements of Efficacious Interventions? Are There Differences in Outcomes in Different Subgroups?

Combined Prevention and Cessation Interventions

General characteristics of the trials. Seven trials included both nonsmokers and smokers at baseline and therefore were considered *combined* primary prevention and cessation interventions (n=12,769 randomized).[79,86,91,93,95,97,98] The majority of the trials were conducted in the United States, with one trial conducted in Finland.[93] Five of the studies were individual randomized, controlled trials (RCTs),[86,91,93,95,97] whereas the remaining two were cluster randomized trials (CRTs) with randomization of pediatric practices.[79,98]

Intervention approaches, settings, intensities, and components were very heterogeneous across these studies (**Table 5** and **Appendix G**). Four of the trials[79,91,93,95] targeted their intervention messages to the youths' baseline smoking status (i.e., nonsmokers vs. smokers), while the remaining three trials implemented the same intervention with all youth regardless of whether they were nonsmokers or smokers at baseline.[86,97,98] These three trials were also the only trials in this group that targeted additional behaviors beyond tobacco use, including alcohol and other substance use,[86,98] unsafe sexual behaviors, and parental involvement.[97] Two of these interventions[86,97] generally focused on messages regarding parent-child communication and family management skills (e.g., monitoring, limit setting, problem solving) rather than tobacco use directly. Additionally, these trials either primarily targeted parents[86,97] or included intervention components for both youth and their parents.[98] The remaining four trials targeted youth directly. Of these four targeted trials, three tailored their interventions to individual participants.[79,91,95] That is, intervention messages via motivational interviewing, counseling, or computer programs were individualized according to youths' reports regarding their stage of smoking initiation or cessation or relevant to their specific barriers or attitudes toward smoking.

Five of the interventions were conducted in a primary care setting[79,91,98] or dental practice[93,95] and included face-to-face interaction with a health care provider (e.g., primary care clinicians, dental hygienists, dentists, pediatricians, nurse practitioners, physician's assistants, and pediatric residents). Provider interaction included brief advice to quit smoking or to remain abstinent[91,93,95] or a single counseling session based on the 5A model (i.e., ask, advise, assess, assist, and arrange followup).[79] In three of the trials, trained health counselors continued more in-depth counseling and followup phone calls with participants after interaction with the primary health care provider.[79,91,95] In one study, the health counselors were female college students ages 21–25 years who had smoked as adolescents and had successfully quit (termed as "peer" counselors).[79]

The most provider-intensive intervention, by Stevens and colleagues, included optional physician-delivered messages for participating youth and parents at all office visits over 36 months. In addition, the child, parent, and pediatrician signed a contract stating that the family would talk about the risks of tobacco (and alcohol) use at home and develop a family policy. Approximately 10 days after the visit, families received a signed letter from their clinician reinforcing the agreement. Families also received printed materials sent to their home on a quarterly basis and biannual telephone calls over the course of the 3-year trial. All pediatricians, nurse practitioners, and practice staff received intensive training according to their practices' treatment condition (i.e., tobacco and alcohol vs. safety) and ongoing practice support. Training included general education and role playing with feedback and ongoing support, including a "message of the month," feedback from chart audits, and regular office visits to touch base about

any problems encountered.[98]

The two studies that were not conducted in a primary care or dental office setting were considered primary care feasible or referable, as they consisted of mailed print materials, phone calls to the participants' homes, or group sessions for parents and parent-child pairs.[86,97] While they were not conducted in a primary care setting or linked with the health care system, it is conceivable that the interventions themselves could be feasibly implemented in such settings or be referred to, if widely available.

The samples for all of the trials were recruited directly by study staff. Potential participants were approached in person at the clinics or by recruitment phone calls or letters. Most of the studies identified age-eligible children through clinic medical records and subsequently sent letters or approached youth in the clinic's waiting room before their appointment or during the actual dental or well-child visit. One study also included posted signs in the waiting rooms of clinics,[79] thus allowing participants to self-elect to enroll.

The majority of the trials included fairly minimal personal interaction (i.e., an hour or less of interventionist contact) and the combinations of intervention modes varied considerably. All but one intervention included some form of face-to-face contact; this trial[86] used print materials in addition to telephone followup. Four studies included brief counseling sessions with a health care provider and/or trained health counselor in addition to followup phone counseling.[79,91,95,98] Three studies employed motivational interviewing conducted by health counselors, peer counselors, or other study staff.[79,91,95] One study incorporated an interactive computer program[91] and another study included group sessions for parents.[97]

The study with the highest amount of interventionist contact (49 hours) was designed to increase parental involvement, positive parenting, and family support among Hispanic families.[97] The assumption was that increased family functioning would lead to lower prevalence of substance use among adolescents. Both intervention and control groups also incorporated intervention messages focused on increasing parent-child communication about sex and HIV risk. Hence, while one of the intervention's objectives was to decrease tobacco use among adolescents in the intervention group, the hours of contact with an interventionist that specifically focused on tobacco use and communication regarding tobacco use was presumably only a fraction of the total time spent interacting with an interventionist.

All of the studies relied on self-reported smoking or cigarette use as the primary outcome (**Table 6**). Three of the trials measured lifetime or "ever" use,[86,93,98] two trials examined the proportion of youth smoking in the past 30 days,[91,95] one evaluated the past 90 days,[97] and one examined the proportion of youth reporting "regular or occasional" use.[79] Three trials included secondary measures of additional tobacco products, including chewing tobacco, cigars, and pipes.[86,91,93] No studies used a measure of biochemical verification (e.g., CO or cotinine levels) to confirm self-reported smoking status. However, one study showed participants a CO monitor and told them that they might use it to confirm their self-reported smoking status (i.e., a bogus pipeline approach)[79]—presumably to increase the validity of the self-report measures.

The overall weighted average age in all of the combined trials was 14 years. All of the trials

included a fairly even distribution of males and females. Most of the participants in these trials were white, while the one group-based trial with high interventionist contact specifically targeted Hispanic youth.[97]

Quality of included trials. Two of the seven trials were rated as good quality,[91,98] while the remaining five trials were rated as fair quality due to varying threats to validity (see **Appendix F** for quality criteria). **Table 7** presents the main quality concerns for each trial. Among the fair-quality trials, randomization methods were not reported or not appropriate (e.g., based on participants' birth dates) in several trials. In addition, allocation concealment was commonly not reported or uncertain leading to potential selection bias. One study suffered from high attrition, with only 65 percent of the sample retained at 12-months followup.[95] Participant compliance and/or intervention completion were also relatively low in this study. Only 70 percent of the intervention group actually received the face-to-face components (i.e., brief provider advice and motivational interviewing), and only one third of the sample received at least one (of potentially six) followup counseling telephone call.

Summary of findings. A meta-analysis combining six of the seven studies that reported overall smoking prevalence found a nonstatistically significant pooled risk ratio (RR) of smoking for youth assigned to the intervention compared with the control group of 0.91 at 6- to 12-months followup (RR, 0.91 [95% confidence interval (CI), 0.81 to 1.01]; I^2=29.4%; k=6; n=8,749) (**Figure 2**). The absolute risk reduction for these trials was 2 percentage points, which translates into a number needed to treat (NNT) of 50 (pooled risk difference [RD], -0.02 [95% CI, -0.05 to 0.01]). In a sensitivity analysis of the four studies[79,91,95,97] that had similar outcome measures (e.g., *current* smoking in the past 30 or 90 days), the effect was similar in magnitude.

Examined individually, two of the seven trials showed a statistically significant effect on the overall prevalence of smoking at 6- to 12-months followup, with a decreased risk of smoking in favor of the intervention groups over the control groups (**Table 7**).[86,91] The most relevant study to primary care in the United States was the Teen Reach program (Research Approaches to Cancer in a Health Maintenance Organization) by Hollis and colleagues.[91] In this study, adolescents ages 14–17 years who were members of Kaiser Permanente Northwest were recruited through their pediatric and family practice clinics. Youth randomized to the intervention group (n=1,254) received brief clinician advice (i.e., 30 to 60 seconds), the Pathways to Change (PTC) interactive computer program (10–12 minutes), and brief motivational counseling by a trained health counselor immediately after the clinic visit (3–5 minutes). All intervention components were highly individualized and tailored to the youths' smoking status and stage of readiness to begin smoking (for nonsmokers) or stage of change to quit smoking (for smokers). In addition, the intervention group received two booster sessions with the PTC computer program and health counselor (primarily by phone) during the remaining 11 months of the study. Adolescents allocated to the control group (n=1,272) received brief health counseling and print materials promoting increased consumption of fruits and vegetables. At 12-months followup, there was a 16 percent statistically significant reduced risk of smoking during the past 30 days among all youth in the intervention group compared with the control group (RR, 0.84 [95% CI, 0.73 to 0.96]). The absolute risk reduction was 4 percentage points, or a NNT of 25. Although data was not shown, the authors also report a consistent pattern of results when the outcome included other forms of tobacco (i.e., pipes, cigars, and smokeless tobacco).

This study was rated as high quality and was strengthened by relatively high retention (93.7% after 1 year) and its approach for handling missing smoking outcome data (multiple imputations).

None of the remaining five trials showed a statistically significant difference between the intervention and control group at 6- to 12-months followup. However, one trial had a consistent positive effect, although not statistically significant (RR, 0.80 [95% CI, 0.64 to 1.00]).[79] The remaining three trials showed a slight[52,93,95] or relatively large[97] increased risk of smoking among the intervention groups compared with the control groups, although none of these studies were statistically significant. In the family-based trial by Prado and colleagues that targeted multiple behaviors among Hispanic youth, the risk of smoking among the intervention group was almost two times that of the control group at 12 months, although the CI for this effect was very wide, likely given the small sample size (RR, 1.90 [95% CI, 0.49 to 7.32]).[97]

We were unable to include one trial in the meta-analysis due to the limited data presented (we contacted the author of this study requesting the data needed but did not receive the data).[52] This study, however, was among the most applicable interventions to the U.S. primary care setting, as it was conducted in 12 pediatric primary care practices serving a diverse population. Families of children in the 5th or 6th grade visiting their primary care providers for a well-child visit were recruited directly to participate. Consenting families were randomized to either the intervention group (focused on alcohol and tobacco use) or attention control (focused on safety behaviors, including bicycle helmet and seatbelt use and safe gun storage). The intervention began during the well-child visit, during which the clinician discussed the risks of tobacco and alcohol use with both the child and parent. At all subsequent office visits over 3 years, clinicians reinforced the intervention's messages, offered help, and answered any questions. The child, parent, and pediatric clinician also signed a contract that the family would talk about the risks at home and develop a family policy about alcohol and tobacco use. About 10 days later, the family received a letter signed by their clinician reinforcing the agreement. Over the next 36 months, children and parents were reminded of the importance of family communication regarding alcohol and tobacco use at all subsequent office visits. After adjusting for child and family baseline characteristics, there was no effect of the intervention on ever smoking (odds ratio [OR], 1.05 [95% CI, 0.80 to 1.39]) or ever using smokeless tobacco (OR, 1.00 [95% CI, 0.39 to 2.54]) at 12 months.

Five of the seven studies presented outcomes beyond 12 months.[86,91,93,97,98] One study presented additional data at 16 months,[86] four presented outcomes at 24 months,[91,93,97,98] and one measured outcomes again at 36 months.[98] This intervention by Stevens and colleagues was the only intervention that spanned the full duration of the assessment period (i.e., the intervention lasted 36 months and followup measurements occurred at 12, 24, and 36 months). The remaining studies did not include any intervention components beyond 12 months. Among all of the studies, the long-term findings generally mirrored the effects seen at 6 or 12 months. In the trial by Hollis and colleagues, the statistically significant treatment effect found at 12 months diminished somewhat at 24-months followup, but remained statistically significant.[91] In the trial by Pbert and co-authors, outcomes were presented at both 6 and 12 months.[79] We included the outcomes at 12 months in the meta-analysis to be consistent with the other studies in this group. At 6 months, a relatively large statistically significant effect was seen; the intervention decreased the risk of smoking by almost 50 percent (RR, 0.51 [95% CI, 0.31 to 0.84]). However, the effect

attenuated at 12 months and was no longer statistically significant (RR, 0.80 [95% CI, 0.64 to 1.00]). The remaining trials did not find any statistically significant differences between the intervention and control groups at 24 or 36 months.[86,91,93,97,98] One of these studies found a statistically significant effect of the intervention at 7 months, but not 16 months.[50]

Common elements of efficacious interventions. We qualitatively examined a number of specific intervention characteristics (e.g., face-to-face interaction, hours of contact, role of primary care, individual targeted) and study design issues (e.g., measurement of the primary outcome) to see if they were associated with effect size. The components examined were based on expert advice and our ability to robustly identify that component in the published trials. Despite this effort, however, no clear pattern emerged that explained why some trials had beneficial effects and others did not.

Differences in patient subgroups. No data were found to explore whether some subpopulations benefited more from tobacco-use interventions than others.

Prevention Interventions

General characteristics of the trials. Five trials included a behavior-based intervention designed to prevent the initiation of tobacco use among children and adolescents,[11,81,88,90,92] and one additional trial[85] with a broad-based approach also reported a prevention effect among nonsmoking children and adolescents (total n=22,401). This last trial did not meet inclusion criteria for the combined and cessation groups, however, and did not present adequate data to be included in the meta-analysis.[85] In addition to these six trials, four of the combined trials described above analyzed baseline nonsmokers separately to evaluate the effect of the intervention on smoking initiation (n=5,135).[79,91,95,100]

We identified a large variation in the types and intensities of interventions, which ranged from no interaction with an interventionist (i.e., zero "sessions") to seven group sessions totaling over 15.5 hours (**Table 5**). As in the combined trials listed above, the one trial[90] with high amount of interventionist contact (15.5 hours) was the only study in this group to target multiple behaviors (i.e., "universal" substance abuse and problem behaviors). Six of the 10 studies in this group targeted youth directly,[79,81,85,88,91,95] three included intervention components for both youth and their parents,[11,90,92] and one trial primarily targeted parents.[100]

Two of the 10 trials of prevention effects were conducted outside of the United States, one was conducted in the Netherlands,[85] and one was conducted in the United Kingdom.[88] The two interventions conducted outside of the United States were similar and both targeted youth directly and consisted primarily of mailed print materials to the youths' homes. Children in the Ausems study were recruited from elementary schools and were sent tailored materials according to their baseline smoking status.[85] In the Fidler study, children and adolescents ages 10–15 years were recruited from 14 health centers serving a mix of urban "deprived," city center, suburban, and rural areas; participants were sent materials largely about the advantages of remaining a nonsmoker.[88]

In total, two studies were conducted in a primary care setting (Hollis 2005[91] and Pbert 2008[79])

and two were conducted in a dental care setting (Lando 2007[95] and the prevention study by Hovell and colleagues[81]). In the study by Hovell and colleagues, orthodontic clinics with at least 75 active patients ages 11–18 years were randomized to implement a minimal tobacco prevention intervention or usual care.[81] For the intervention group, clinic staff gave an antitobacco "prescription" to their patient, briefly discussed the prescription message, and requested that the patient not start smoking. Clinics were offered modest monetary incentives ($0.50) for every prescription dispensed. Children and adolescents in this trial received zero to more than seven unique prescriptions over 2 years, although it was not clear how this was measured. The remaining six studies that were not conducted directly in a primary care or dental office setting were primarily home-based studies and primarily included mailed print materials and/or followup phone counseling.[11,85,88,90,92,100] One study included two intervention arms in addition to a no treatment control group.[90] One intervention arm consisted of a self-administered intervention (i.e., video and workbook activities) with telephone support and the other, more intensive arm, consisted of family group sessions focused on multiple forms of substance use and problem behavior in general. None of the five prevention-only focused trials included the use of motivational interviewing.

One prevention study relied on a volunteer sample of youth.[92] For this study, recruitment letters were sent home with all 3rd grade youth within 28 school districts; interested parents could enroll in the study with their child by mailing a signed consent form to the project office. Interestingly, in this family-based study, parents and children were only eligible if the parents reported current smoking at baseline. The remaining nine studies all contacted participants directly through study staff (although one study, as described above, also posted signs in the waiting rooms of clinics[79]).

The primary outcome for smoking initiation in all of the trials was based on self-report (**Table 6**). One study used a measure that included all forms of tobacco use (i.e., cigarettes, pipes, cigars, or smokeless tobacco)[81] and the remaining nine studies only reported cigarette use. The one study in the United Kingdom reported smoking initiation as "starting to smoke" at 12 months, although the specific measure was not reported.[88] Ever smoking or smoking within the past 30 days among baseline nonsmokers and/or former smokers were the primary outcome measures reported in the remaining trials. One study only reported ever smoking since the posttest.[90] That is, it did not capture any smoking initiation that occurred during the intervention (7–10 weeks in duration), an important limitation that we discuss below.

The weighted average age of the samples in all 10 prevention studies was 14 years. However, the age range of the six prevention-only studies included slightly younger participants overall (e.g., as young as age 7 years in one trial) (**Table 4**). The weighted average does not include data from two prevention-only studies (Jackson 2006,[92] whose participants ranged in age from 10–15 years, and Fidler 2001,[88] with participants ages 7–8 years) that did not report the average age of their participants. All 10 of the trials included a fairly even distribution of males and females. The sample in the only family-based prevention study by Haggerty and colleagues was approximately half African American families and half white families.[90]

Quality of included trials. The body of included studies was generally of fair quality, with two of the 10 studies rated as good quality.[81,91] The one good-quality trial that focused on only

prevention was published in 1996 and was a CRT of orthodontist clinics.[81] Office compliance was relatively high in delivering the intervention, and participant followup was 92.8 and 92.3 percent for the intervention and control groups, respectively.

Among trials rated as fair quality, randomization procedures were frequently not reported or uncertain, including allocation concealment. Blinding of outcome assessment was not reported in all but one trial.[92] However, the lack of blinding for outcome assessors was unlikely to produce bias in those studies using standardized data collection tools such as computer-assisted telephone interviewing.[11] Three studies did not report baseline values of the intervention and control groups, respectively,[88,92,95] making it difficult to determine if the groups were comparable at baseline. As stated above, one study relied on self-reported smoking initiation from the posttest immediately following the intervention rather than baseline.[90] The authors report that 28.7 percent of the sample initiated some substance use prior to the posttest. These youth, however, are not included among those that initiated smoking. The authors' rationale was that "this initiation in the interim may or may not have occurred before exposure to the intervention." However, this omission may have led to reporting bias and is a noted limitation to this study's internal validity.

Summary of findings. A meta-analysis of the data from nine of the 10 studies examining smoking initiation among baseline nonsmokers showed a statistically significant pooled effect of the intervention in reducing the risk of smoking initiation among youth at 6- to 36-months followup (RR, 0.81 [95% CI, 0.70 to 0.93]; I^2=37.8%; k=9; n=26,624) (**Figure 2**) compared with the control. That is, the interventions reduced the risk of smoking initiation at followup by 19 percent. The pooled absolute RD was 2 percentage points (pooled RD, -0.02 [95% CI, -0.03 to 0.00]), resulting in a NNT of 50. We also conducted a sensitivity analysis, in which we excluded two studies[92,100] that both operationalized smoking initiation as "ever" smoking postbaseline assessment, as we felt this may be an overly sensitive measure of smoking uptake. The pooled intervention effect remained statistically significant (RR, 0.83 [95% CI, 0.71 to 0.98]; I^2=42.8%; k=7; n=25,020).

Two of the trials that focused exclusively on prevention in nonsmoking youth[88,92] and one of the combined trials that tailored the intervention according to smoking status[91] found statistically significant effects of the intervention relative to the control groups for smoking initiation (**Table 8 Figure 2**). The two prevention-focused trials with statistically significant effects included minimal interventions that only consisted of mailed print materials,[88,92] one of which was conducted outside the United States.[88] This study in the United Kingdom found that 5 percent of the intervention group initiated smoking at 12-months followup (RR, 0.65 [95% CI, 0.47 to 0.90]) compared with 7.8 percent of the control group. The trial by Hollis and colleagues was the only trial conducted in a primary care setting that included face-to-face interaction with a clinician or other health counselor and showed a statistically significant intervention effect among baseline nonsmokers at 12 months (RR, 0.76 [95% CI, 0.59 to 0.99]). As discussed later, this effect diminished at 2 years and was no longer statistically significant. In this trial, 91 percent of the baseline nonsmokers reported that they were not thinking about smoking in the future. Interestingly, the trial by Jackson and colleagues only included longer-term outcomes measured at 36 months and found a statistically significant difference among groups—11.9 percent of participants in the intervention group initiated smoking at 36 months compared with

19.3 percent of the control group (RR, 0.62 [95% CI, 0.47 to 0.90]).[92] This study included the youngest sample among this group of studies (ages 7–8 years at baseline). The intervention consisted of four mailed activity guides over 10 weeks in addition to one mailed activity guide within 12 months.

All but two[11,90] of the remaining seven trials found positive effects of the intervention on smoking initiation compared with the control groups, although none of these effects were statistically significant. The broad family-based intervention by Haggerty and colleagues showed a nonsignificant negative effect of the intervention.[90] They found a 31 percent higher risk of initiating smoking at 12 months among participants in the intervention group compared with controls (RR, 1.31 [95% CI, 0.52 to 3.28]).

Three of the 10 studies only presented long-term smoking initiation outcomes (i.e., longer than 12 months), including one study with 20-month outcomes,[11] one with 24-month outcomes,[81] and the study by Jackson and colleagues with only 36-month outcomes.[92] Three trials presented additional effects beyond 12 months, including one trial with 16-month outcomes[86] and two studies with 24-month outcomes.[90,91] Results in all of the trials remained consistent over time, except in the trial by Hollis.[91] Among the nonsmokers in this study, the intervention significantly reduced smoking initiation at 12 months, but the prevention effect was no longer statistically significant at 2 years (RR, 0.84 [95% CI, 0.69 to 1.04]). Again, in the study by Pbert and colleagues,[79] a statistically significant effect of the intervention was seen on smoking initiation at 6 months (RR, 0.51 [95% CI, 0.31 to 0.84]), but the effect attenuated at the 12-month followup (RR, 0.70 [95% CI, 0.47 to 1.05]).

Common elements of efficacious interventions. After qualitative examination of the studies in this group, there did not appear to be any clear relationship between any of the specific intervention characteristics or methods and the effects seen within this group of studies. As mentioned previously, two out of the three trials that found statistically significant effects on smoking initiation were very minimal interventions that consisted exclusively of mailed print materials to the participants' homes.[88,92] Other factors such as the population targeted (i.e., youth vs. parent vs. both), sample characteristics, followup time, and measurement of smoking initiation did not appear to be related to the intervention's effects.

Differences in patient subgroups. There were insufficient indicators reported on participant characteristics to be able to conduct subgroup analyses.

Cessation Interventions

General characteristics of the trials. Five trials focused on smoking cessation among child and adolescent smokers (n=1,554 randomized).[80,87,94,96,104] An additional four of the combined studies presented outcomes for baseline smokers separately (n=1,060).[79,91,95,99] Two of the cessation-focused trials included the use of medication (i.e., sustained-release [SR] bupropion hydrochloride) in addition to a behavioral counseling component (n=256).[94,96] We did not identify any trials that estimated the independent effect of NRT or included the use of varenicline (Chantix) that met our eligibility criteria. These trials were primarily excluded because they included followup assessments of less than 6 months postbaseline.

Eligibility criteria and the definition of what constituted a smoker at baseline differed among all of the cessation trials (**Table 6**), with the two medication trials using the most selective criteria. For instance, youth were only eligible in a trial comparing the use of a nicotine patch and 150 mg bupropion versus a nicotine patch plus a placebo pill if they reported: 1) currently smoking 10 or more cigarettes a day; 2) smoking for 6 months or more; 3) had at least one failed quit attempt; and 4) high nicotine dependence scores.[94] The three behavior-based interventions that focused exclusively on smoking cessation included youth if they reported *daily* smoking for the past 30 days,[87] smoked at least once per week for the past month,[104] or if they reported any smoking in the past 30 days and were interested in quitting in the next 2 weeks.[80] The majority of the combined prevention and cessation trials considered youth to be smokers at baseline if they reported smoking at least one cigarette during the previous 30 days. In the four combined trials, baseline smoking prevalence ranged from 9.7 to 36.1 percent (100% of the samples in the cessation-only trials were smokers) (**Table 4**).

Four of the trials[87,94,96,104] used 7-day point prevalence abstinence as the primary outcome. Four studies used 30-day point prevalence abstinence,[80,91,95,99] and the remaining trial reported "occasional or regular" smoking at followup.[79] All five of the trials that were exclusively designed to help smokers quit smoking included a biochemical measure of smoking via exhaled CO levels or saliva or urinary cotinine levels, including the two medication trials. Three of these five trials[87,94,104] used these measures as biological confirmation (vs. as a secondary measure) of abstinence (**Table 6**).

Within this group of trials, all but one targeted youth directly and included face-to-face contact with an interventionist, such as a clinician, health counselor, or other study personnel. This same trial was the only trial that did not tailor the intervention messages according to the youths' baseline smoking status (**Table 5**).[99] Two of the studies were CRTs,[79,80] while the remaining included randomization at the individual level. One study[80] randomized high schools and the other randomized pediatric primary care clinics.[79]

Three of the behavioral counseling trials were specifically designed to encourage quitting among smoking adolescents. The most recent cessation trial by Colby and colleagues[104] built off of their previous trial,[87] described below. In this study, 162 adolescents ages 14–18 years who smoked at least once per week for the past 30 days were randomized to receive one 45-minute motivational interviewing session, with a 15- to 20-minute booster phone call to reinforce progress toward their goals. Parents of the intervention participants were also asked to participate in a 15- to 20-minute discussion focused on increasing parent support for the adolescent's goals for changing their smoking behavior. Control group participants received brief advice. Another recent cessation trial by Pbert and co-authors consisted of a counseling intervention delivered by a school health nurse based on the 5A model ("Calling It Quits").[80] In this study, 35 high schools were randomized to either a counseling intervention or an attention control condition. Students who had smoked within the past 30 days and were interested in quitting in the next 2 weeks were eligible to participate (n=1,068). The intervention consisted of four weekly private one-on-one sessions over 1 month in the school health clinic. Two of the sessions were held prior to the self-elected quit date and two sessions were conducted after the scheduled quit date. Attention-control subjects also received four weekly visits with the school nurse where they delivered informational pamphlets and checked smoking status and efforts to quitting. The other behavior-

based cessation intervention by Colby and colleagues[87] was conducted at an urban hospital among 85 daily smokers ages 12–19 years, many of whom reported having psychosocial risk factors (e.g., substance use, mental health problems, and parental estrangement). Most of the sample (81%) reported having no immediate plans to quit smoking. The intervention consisted of a 35-minute motivational interview session with a booster telephone call at 1 week. Control subjects received one session that only included brief advice (5 minutes).

The two medication trials[94,96] both evaluated the use of bupropion SR in addition to behavioral counseling to encourage smokers to quit smoking. In the trial by Killen and colleagues,[94] adolescent smokers ages 15–18 years were recruited from nine high schools. Youth (n=211) were randomized to one of two treatment groups: 1) a nicotine patch plus 150 mg bupropion (intervention group) or 2) a nicotine patch plus a placebo pill (control group). Both groups took part in weekly group skills-based training sessions led by trained counselors that lasted 45 minutes. Sessions focused on self-regulatory skills, including modeling high-risk situations and developing action plans designed to promote nonsmoking in self-identified, high-risk situations. This intervention was of 9 weeks duration and followup assessment took place at 6 months postbaseline assessment. Similarly, in the trial by Muramoto et al,[96] a volunteer sample of 312 youth ages 14–17 years was recruited and randomized to one of three groups: 1) 150 mg bupropion SR, 2) 300 mg bupropion SR, or 3) a placebo pill. In addition, all groups included weekly individual cessation counseling sessions (10–20 minutes each) for the duration of the intervention (9–10 weeks). Counseling addressed skills related to identifying social support, identifying motivators and barriers to quitting smoking, managing cravings and withdrawal symptoms, and stress management. This trial conducted followup measures at 6 months postbaseline. Both of the medication trials excluded youth with current major depression or a history or current diagnosis of panic disorder, psychosis, bipolar disorder, eating disorder, current clinical depression, or attention deficit hyperactivity disorder, presumably because of the negative behavioral symptoms reported by adults while taking bupropion to stop smoking (Zyban), including changes in behavior, hostility, agitation, depressed mood, and suicidal thoughts.[64]

The average weighted age of participants was 15.9 and 16.7 years in the behavior-based cessation and medication cessation trials, respectively. In general, the five trials that exclusively focused on smoking cessation (vs. the four combined trials) included older participants (average age, 16–17 years). The percent of females in each study ranged from 31.3 percent in one of the medication trials[94] to 61.0 percent in one of the behavioral trials.[87] Nearly half of the samples in both of these two trials were of nonwhite race (**Table 4**).

Quality of included trials. Across all nine studies that examined cessation among baseline smokers, two studies were rated as good quality,[80,91] while the remaining trials were rated as fair quality (**Table 9**). The two good-quality studies include the trial by Hollis and colleagues that is included in all three sections and the recent behavior-based trial conducted by Pbert and colleagues, which was designed specifically as a cessation trial among high school students.[80] This study was well designed, included a relatively large sample (n=1,068), used valid randomization methods, possessed good intervention fidelity, and had high participant compliance to the intervention. The main quality concern with this study was that there were statistically significant baseline differences in intentions to quit between the intervention and

treatment groups—66 percent of the intervention group participants versus 57 percent of the control group participants planned to quit smoking within the next 12 months. The main threats to internal validity of the remaining behavior-based cessation trials include unclear randomization methods and retention below 90 percent (**Table 9**). The majority of studies took a conservative approach to missing outcome data and assumed that all participants lost to followup remained smokers.

The two cessation trials that included a pharmacological component were both rated as fair quality.[94,96] Both of these trials had high attrition, with only 63.5[94] and 61.9 percent[96] of the sample retained after 6 months. Participant compliance was also a concern in both studies. For example, in the trial by Killen and colleagues, only 22 percent of participants reported taking all their pills (i.e., 150 mg bupropion or placebo pill) in at least six of nine treatment weeks, and 44 percent reported that they only used all their pills in two treatment weeks or less.[94]

Summary of findings: behavior-based trials. A meta-analysis of the seven behavior-based trials that included an examination of smoking cessation at 6 to 12 months showed a small, but not statistically significant, pooled effect on quitting smoking favoring the intervention (RR, 0.96 [95% CI, 0.90 to 1.02]; I^2=48.7%; k=7; n=2,328) (**Figure 2**). A sensitivity analysis only including the four trials that included tailored intervention components for baseline smokers, 12-month followup, and similar definitions of baseline smoking[79,80,91,95] yielded a consistent result (RR, 0.98 [95% CI, 0.91 to 1.05]; I^2=57.3%; k=4; n=2,043).

When viewed individually, two of the seven behavior-based trials found statistically significant effects of the intervention on smoking cessation among baseline smokers compared with the control group at 6- or 12-months followup (**Table 9**).[87,91] For instance, the trial by Colby and co-authors in 2005 that was specifically designed to promote quitting among daily smokers ages 12–19 years showed a 21 percent reduced risk of smoking in the previous 7 days among the intervention group (primarily motivational interviewing) versus the brief advice control group.[87] At 6 months, 23 percent (n=8) of the intervention group versus 3 percent (n=1) of the control group reported 7-day abstinence. However, half of those self-reported abstinent smokers were reclassified as smokers based on their biomarker data. Based on biochemical data, abstinence rates were 9 percent (vs. 23%) and 2 percent (vs. 3%) in the intervention and control groups, respectively (a nonsignificant difference). In this study, if biochemical data were not obtained or participants were not followed up, they were classified as smokers at followup.

In the trial by Hollis and colleagues, adolescents were considered smokers at baseline if they reported smoking one or more cigarettes in the past 30 days. This included those who self-described themselves as "experimenters," "smokers," and "recent quitters." Although the intervention had a statistically significant effect among all past-30-day smokers, the intervention had no effect on the small subgroup (n = 140) of youth who self-described themselves as experimenters at baseline. In contrast, a large, statistically significant effect of the intervention was found among those who *considered themselves* to be smokers at baseline (OR, 2.45 [95% CI, 1.43 to 4.20]). Results were similar when the outcome was defined as no tobacco (as opposed to just cigarette smoking) in the past 30 days. Eighty-two percent of adolescents who had smoked one or more cigarettes in the previous 30 days reported that they were thinking about quitting.

The recent good-quality study by Pbert and colleagues found statistically significant effects of the intervention among boys in the short term (3 months), but failed to find statistically significant effects at 12 months among both boys and girls.[80] At the 12-month followup, both conditions produced fairly equal 30-day abstinence rates in both boys and girls (13.9% and 16.6%, respectively, in the intervention group; 13.2% and 15.5%, respectively, in the control group). It is plausible that the attention-control condition that also included ongoing support from the school nurse was too intensive to show a difference between the two groups. More youth in the attention control group reported using NRT than youth in the intervention group, although NRT use was still generally low (19.0% vs. 13.7% in the control group vs. the intervention group; p=0.04). In addition, the control group received written materials on pharmacotherapy, whereas the intervention group did not. When comparing the three behavioral trials that exclusively focused on cessation, the 2005 study by Colby[87] that found statistically significant effects in self-reported behavior included a sample of daily smokers who were generally not motivated to quit, whereas the study by Pbert and colleagues that did not find a statistically significant effect purposefully recruited youth who expressed an interest in quitting within the 2 weeks following baseline assessments. However, youth in this study were considered smokers if they smoked at all during the past 30 days. The other trial by Colby[104] included adolescents who reported smoking at least once a week for the past month and were generally motivated to quit.

Additional long-term outcomes were presented at 16 months[99] or 24 months[91] for two of the behavior-based trials. Outcomes were similar to the first followup time points. In the Hollis study, among all those who had smoked one or more cigarettes in the past 30 days at baseline, the intervention produced statistically significant effects at both 12 and 24 months (RR, 0.89 [95% CI, 0.81 to 0.98]).[91] Similar to the combined and prevention-only analyses of the Pbert 2008 study,[79] a statistically significant effect of the intervention was found at 6 months among baseline occasional or regular smokers (RR, 0.84 [95% CI, 0.71 to 0.99]); however, this effect was not statistically significant at 12 months.

Common elements of efficacious interventions. We investigated the relationship between various intervention and population characteristics on intervention effects by visual inspection of the forest plots, and none helped explain any pattern of effects.

Differences in patient subgroups. Very little data were found to explore whether some subpopulations benefited more from tobacco cessation messages than others. In the combined trial by Hollis and colleagues, posthoc analyses of baseline smokers found that the intervention compared with the control produced a statistically significant effect of not smoking among nonwhite youth.[91] The effect on nonwhite youth was nearly double that seen for white youth, although the CI of the two groups overlapped. As mentioned above, the large study by Pbert and colleagues found significant effects of the intervention on smoking prevalence among boys at 3 months, but not girls.[80] In this same study, however, there were no statistically significant effects or differences among boys or girls at 12 months.

Summary of findings: medication-based trials. Neither of the two trials examining the effect of bupropion compared with a placebo showed a benefit of bupropion. In the trial by Killen, 12.5 percent of youth (n=8) in the intervention group and 10 percent (n=7) of the youth in the control group reported 7-day abstinence at 6 months.[94] Similarly, in the trial by Muramoto, 6.3 percent

of adolescents in the intervention group receiving 150 mg/d bupropion (n=4) and 10.3 percent of adolescents in the control group (n=6) reported 7-day abstinence at 6 months (**Table 9**).[96] Among those assigned 300 mg/d of bupropion, 16.9 percent reported 7-day abstinence. Results were similar when examining rates of abstinence via biological confirmation through expired CO. There were no statistically significant differences in either self-reported or biologically-confirmed 30-day prevalence abstinence rates and no outcomes were presented for the medication trials beyond 6 months.

Key Question 3. What Adverse Effects Are Associated With Interventions to Improve Tobacco Cessation Rates or Prevent Tobacco Use in Children and Adolescents?

None of the trials of behavior-based interventions explicitly reported on harms of treatment. Some trials reported higher absolute prevalence of smoking in the intervention than the control groups after completing the interventions, but none were statistically significant.[11,90,93,95,97] In most of these cases, the risk of smoking was increased by less than 10 percent, but in one case, the risk of being a smoker was almost doubled in the intervention group compared with the control group (RR, 1.90 [95% CI, 0.49 to 7.32]).[97] This study provided the greatest number of intervention contacts of all included trials (25 contacts over 49 hours). It was a smaller trial (n=175) limited to Miami-area 7th graders with at least one parent born in a Spanish-speaking county in the Americas. It focused primarily on parent-child communication, positive parenting, and family support, with minimal focus on smoking prevention or cessation specifically. Again, however, there was not a statistically significant difference between groups.

Both of the bupropion trials that were included for benefits of treatment (KQ 2) reported on harms,[94,96] and one additional trial of bupropion also met inclusion criteria for harms (KQ 3) (**Table 10**).[89] This trial was not included in KQ 2 because it only reported outcomes at 6 weeks, and a minimum of 6 months of followup was required for KQ 2. Altogether, these three trials included 385 youth taking 150 to 300 mg of bupropion daily and 272 youth taking a placebo medication. All trials were conducted in the United States among youth smoking at least 5–10 cigarettes per day. In one trial, all participants used a nicotine patch in addition to taking either bupropion or a placebo.[94]

In one trial, a greater proportion of bupropion users (64%) reported an adverse effect than those taking the placebo (48%).[89] The other two studies, however, reported no increased risk of a number of specific adverse effects with bupropion use, such as high blood pressure, increased heart rate, nausea, throat symptoms, sleep disturbance, headache, and cough.[94,96] Two trials reported that approximately 4 percent of participants discontinued bupropion due to adverse effects or tolerability concerns.[89,96] In one of these two trials, the control group reported a similar level of withdrawal due to adverse effects (4.1% among those taking bupropion, 4.9% among those taking placebo),[89] but withdrawals due to adverse effects were not reported for the control group in the other trial.[96]

CHAPTER 4. DISCUSSION

We evaluated 19 trials conducted in 39,958 children and adolescents (ages 7 to 19 years) that examined the effects of primary care relevant tobacco use interventions on smoking initiation and/or cessation. Seven of these trials examined an intervention's effects on overall smoking prevalence, 10 trials reported an intervention's effects on smoking initiation among nonsmokers, and nine trials examined smoking cessation among smokers. Two of the nine cessation trials included the adjunctive use of bupropion to help smokers quit smoking. All of the studies varied widely in terms of methodological quality, sample size, and the types of interventions tested. None of the included trials assessed health outcomes (beyond tobacco use) in children and adolescents or examined subsequent rates of adult smoking. While we sought to include interventions that addressed all the forms of tobacco use, this body of evidence primarily included studies focused specifically on cigarette smoking.

Effects of Tobacco Use Interventions

A summary of evidence for benefits and harms of all interventions is presented in **Table 11**. Meta-analyses showed that behavior-based interventions reduced smoking initiation among nonsmoking youth, but failed to show a statistically significant effect of smoking cessation among children and adolescents who already smoked. The studies included were generally of fair methodological quality, with various threats to internal validity. While no factors were clearly related to effect size in the included trials, high variability in the interventions' approaches may have masked important relationships.

Meta-analysis was not statistically significant among the *combined* prevention and cessation trials. The absolute prevalence of smoking among 12- to 18-year-olds at 7- to 12-months followup ranged from approximately 6 percent to almost 48 percent, where the absolute difference between intervention and control groups was generally modest (i.e., 1% to 7% difference). While a few studies[93,95,97] showed negative effects (i.e., where the intervention group smoked more than the control group at followup), none of these differences reached statistical significance. Longer-term effects (i.e., at 2 years) generally mirrored the results seen at 12 months. The effect of these combined trials appears to be largely influenced by preventing smoking initiation among nonsmokers rather than inducing current smokers to quit, though some cessation-specific trials show promise.

Prevention Interventions

Our review of 10 trials that examined the effectiveness of interventions aimed at preventing smoking uptake among nonsmoking children and adolescents found a statistically significant pooled intervention effect at around 1 year (range, 6 to 36 months followup); the percent of nonsmoking children and adolescents initiating smoking ranged from 2 percent to nearly 20 percent, with an average absolute difference between the treatment groups of 3 percent, in favor of the intervention (range, 8 percentage points in favor of the intervention group to 3 percentage points in favor of the control group). The variability in effects appears to be driven, in part, by

how the trials determined smoking status. In the trial by Bauman and colleagues,[100] for example, approximately 19 and 28.5 percent of the nonsmoking 12- to 14-year-olds in this sample were considered to have initiated smoking at 7- and 16-months followup, respectively (with nonsignificant differences between groups). In this study, youth were classified as smokers if they reported ever smoking "even a puff" at followup (**Table 6**). On the other hand, in the trial by Curry and co-authors,[11] only 2.4 and 2.3 percent of 10- to 12-year-olds in the intervention and control groups, respectively, were considered to have initiated smoking at 20-months followup (again, a nonsignificant difference between groups). However, in this trial, youth were considered to be smokers if they had smoked in the past 30 days at followup (i.e., *current* smoking). It may be that the measure of "ever smoking" (i.e., *lifetime* use) may be overly sensitive and offer little prognostic value in distinguishing "true" smokers.

A meta-analysis combining nine of the 10 prevention trials found a statistically significant pooled relative risk reduction of the intervention of 19 percent, or an NNT of 50. While two trials found more youth in the intervention group starting to smoke at 12- to 20-months followup,[11,90] these individual results were not statistically significant.

Our findings are generally consistent with previous reviews examining the effects of provider-, family-, community-, and school-based prevention interventions.[38,43,73,105] To date, most of the results have been mixed and the reported effects are relatively small. Overall, there is limited research examining the effects of primary care relevant interventions on the risk of smoking initiation among children and adolescents. Our review found a 19 percent reduced risk of starting to smoke among intervention participants versus control participants around 1-year followup. There is little evidence demonstrating the long-term effectiveness of such interventions.

Cessation Interventions

Our review failed to find statistically significant effects of either behavior-based or behavior-plus-medication-based smoking cessation interventions among child and adolescent smokers. A pooled meta-analysis of seven behavior-based trials found the interventions had no effect when compared with controls at 6- to 12-months followup (RR, 0.96 [95% CI, 0.90 to 1.02]). Absolute quit rates ranged from 7 percent to over 40 percent in the intervention groups and from 3 to 37.5 percent in the control groups in the behavior-based trials (**Table 9**). The largest difference between the intervention and control groups was seen in the fair-quality trial by Colby, which found that 23.5 percent of daily smokers in the intervention group versus 2.9 percent of daily smokers in the control group reported 7-day abstinence at 6-months followup, although this difference was reduced and deemed nonsignificant using biochemical confirmation (9% vs. 2% in the intervention and control groups, respectively).[87] While two trials[79,95] found more youth in the intervention groups still smoked at 12-months followup, the differences were not statistically significant.

Previous reviews on tobacco cessation interventions for children and adolescents[39,60] have generally found more positive effects of interventions than we found in this review. These reviews included cessation trials conducted in a variety of settings, including complex school- and community-based programs. In our review, smoking cessation rates in both intervention and control groups were generally higher than previous reports (**Table 9**). The review by Sussman

and colleagues,[60] for example, found average quit rates of 9 percent among intervention participants and 6 percent among control participants.

The lack of effect seen across the cessation trials may reflect the limited number of studies that targeted regular, established smokers or presented stratified data to examine the effects among these youth. Hollis and colleagues, for example, found strong cessation effects at 1 and 2 years for self-identified "smokers," but no effect on self-described "experimenters" at baseline.[91] It was beyond our resources to request unpublished results that may have stratified participants by the quantity or frequency with which they smoked. In several of the included studies, an adolescent would have been considered a smoker at baseline if they reported smoking only one cigarette in the 30 days prior to the intervention. After the intervention, that same adolescent may again have reported that they smoked one cigarette in the past 30 days. The cessation effect of the intervention on that adolescent, compared with a similar adolescent in the control group, would have been null. However, if you asked those adolescents (as was done in the Hollis study) if they considered themselves to be "smokers" at baseline, those who said "no" might have impacted a cessation analysis based on their self-identified smoking status. Smoking acquisition is complex, and complicates the interpretation of cessation trials in youth. Given the opportunity, these youth may have described themselves as someone who tries smoking now and again or someone who only smokes in social situations. As such, the participants may have felt the messages of "quitting smoking" did not apply to them, because they do not feel that they are true smokers. The intervention strategies and messages for these so-called experimenters and the measures for capturing any change may have to be much more sensitive to detect true cessation. A logical next step would be to replicate the few studies that have targeted established smokers[87] or those that tailor their interventions according to youths' stages of acquisition and/or cessation and stratify study results as such.[91] For instance, although the recent good-quality trial by Pbert and colleagues[80] included smokers if they smoked at least once during the previous 30 days, youth in this study were smoking an average of nearly seven cigarettes a day (slightly lower than the average of 10 per day that adolescents in the Colby trial were smoking[87]). Overall, this study found no effect among all youth. Examining the effects of this trial according to the amount that youth smoked, however, may have led to different findings.

Our review included only two studies that explored the adjunctive use of medication to assist smokers in quitting. One study tested bupropion as an adjunct to NRT and one evaluated bupropion alone at two different dosages—the standard adult dose of 300 mg or a single daily dose of 150 mg. This evidence suggested that bupropion alone (in addition to a behavior-based intervention) was not effective in getting youth smokers to quit smoking at 6-months followup, although medication compliance was generally low. Both trials included relatively intense behavior-based interventions for both the intervention and control groups. In most cases, these behavioral interventions were more intense and of greater duration than many behavior-only interventions.

NRT is another treatment approach for which we did not find any eligible studies, despite reports that approximately 17 percent of pediatricians have prescribed NRT to their adolescent patients.[68] We reviewed one article that examined the effects of the use of a nicotine patch on adolescent smokers.[106] This study, however, did not meet our inclusion criteria because outcomes were reported at less than 6 months. In this study, 100 adolescents ages 13 to 19 years

who smoked at least 10 cigarettes per day for at least 6 months and were motivated to quit smoking were randomized to receive an active nicotine patch or a placebo patch. Both groups received 10–15 minutes of individual cognitive behavioral counseling during each visit over the course of 10 weeks of the intervention. Both 7-day and 30-day point prevalence rates revealed no statistically significant differences between treatment groups at 10-weeks followup.

Similarly, we reviewed two articles that examined the effects of acupuncture or acupressure for the treatment of smoking cessation among adolescents that did not meet our eligibility criteria because of the short followup time (i.e., less than 6 months).[107,108] Neither study found a statistically significant effect of acupuncture on smoking cessation among adolescents at 4-weeks and 3-months followup. Among adults, there is no consistent evidence that acupuncture is more effective than sham acupuncture on smoking cessation in the short- (less than 6 months) or long-term (6- to 12-months followup).[109]

Effectiveness of Specific Prevention and Cessation Intervention Strategies

The interventions included in this review were very heterogeneous in their focus (e.g., prevention, cessation, or both), intensity, primary mode of contact (e.g., face-to-face, print, telephone), level of family involvement, and time spent interacting with a health care provider. Of those interventions that included interaction with a health care provider, the least provider-intensive strategy consisted of brief advice (i.e., 30–60 seconds) during a routine office visit. Several trials included one to six booster sessions or telephone calls with other study staff or trained health counselors within the 6 to 12 months following the intervention period. Only three studies included provider advice during subsequent health care visits, although the extent to which this followup actually occurred in practice was minimal. One study showed a dose-response relationship between the amount of smoking advice from orthodontic staff (through the use of written "prescriptions") and the percent of youth initiating smoking. Youth who received four or more advice prescriptions over 2 years were more likely to remain smokefree than youth who received zero to three messages. However, more open or compliant youths may have been the ones to receive prolonged advice. The three nonU.S. studies were all of very minimal intensity: one study included one brief advice message from dental providers, while the other two consisted of a series of mailed print materials to participants' homes over 9 weeks to 12 months.

We did not find a clear association between including parents or families in the intervention and the interventions' effects on preventing smoking initiation or cessation. We did not include literature that examined the effects of primary care interventions designed to decrease tobacco use among parents as a secondary strategy for reducing youth tobacco use or exposure to environmental (secondhand) tobacco smoke. However, parental smoking can have a significant impact on youth smoking initiation;[30,110,111] children and adolescents who are exposed to smokers in their household are three times more likely to initiate smoking themselves.[29] Therefore, encouraging and assisting parents to quit smoking may be another important strategy to preventing adolescent smoking.

Primary care well-child visits and other ongoing pediatric care may provide an ideal setting to intervene directly with parents, particularly given that, for many parents, their encounters with primary care may be limited to the visits they make with their children. For parents without their own primary care provider, their child's doctor may be the only access they have for ongoing smoking cessation counseling, including medication advice and prescriptions. A recent review by Rosen and colleagues[112] included 18 trials that focused on parental smoking cessation that took place in hospitals, pediatric clinical settings, well-baby clinics, and homes. Quit rates averaged 23.1 percent in the intervention group and 18.4 percent in the control group, resulting in a 4 percent absolute difference between parental quit rates in the intervention and control groups. A good example of this approach is a study conducted by Curry and colleagues[113] that randomized 303 low-income women to a smoking-cessation intervention or usual care as they accompanied their children to a pediatric clinic visit. During the clinic visit, women received a motivational message from the child's clinician (usually lasting 1–5 minutes), a guide to smoking cessation, a 10-minute motivational interview with a nurse or study interventionist, and up to three outreach counseling telephone calls during the 3 months following the visit. At the 12-month followup, 7-day abstinence rates were 13.5 percent among the intervention group compared with 6.9 percent in the control group. This resulted in a statistically significant adjusted OR of 2.77 (95% CI, 1.24 to 6.60). While outcomes related to children's uptake of smoking or quit attempts are not included in these evaluations, it is plausible that establishing abstinence among parents could have measurable impacts on the rate at which youth experiment with and transition to regular smoking.

Harms of Prevention and Cessation Interventions

There were no explicit harms reported in any of the behavior-based trials of prevention or cessation. Some trials reported higher absolute prevalence of smoking in the intervention than the control groups after completing the intervention, but none were statistically significant. Possible harms related to the use of bupropion include increased risk of high blood pressure, increased heart rate, nausea, throat symptoms, sleep disturbance, headache, and cough. The extent to which participants experienced these side effects appears to be mixed in the literature.

Assessment of Youth Tobacco Use

Distinguishing between children and adolescents who are "potential" or susceptible smokers, experimenters, and regular or established users is often difficult. The continuum of smoking acquisition consists of several stages: 1) not open to smoking; 2) open to smoking, when youth think about smoking but do not engage in any smoking behavior; 3) experimentation, which may include trying a puff of a cigarette or inconsistent, yet repeated smoking; 4) nondaily smoking, when youth smoke only in certain situations, such as at parties or with certain friends; and 5) established smoking, when youth smoke every day or almost every day.[10] However, this behavioral acquisition sequence may not closely mimic the development of nicotine addiction.[13, 114] Recent work emphasizes that 50 percent of youth who ever try smoking eventually become addicted and that smoking frequency is correlated with, but not predictive of addictive symptoms.[13] Nonetheless, most research has used smoking behaviors to categorize adolescent

smokers rather than addiction, so we focus on it here.

Youth who are at different stages along the behavior continuum may be at different levels of risk for becoming established smokers and thus, require different intervention approaches. Low- and moderate-risk children might include youth that have never smoked and are not open to smoking (low risk) or are open to smoking in the future (moderate risk). High-risk youth might experiment with smoking or smoke occasionally, often depending on the social context. Understanding the different stages along the progression to regular, established smoking and subsequent levels of nicotine dependence is critical in identifying at-risk youth and tailoring intervention messages.

As seen in this review, there are several different definitions of a smoker used in this body of research, and how studies operationalized these definitions varied greatly. Such variation makes it difficult to make concrete comparisons and to generalize the results. Smoking status at a given moment in time depends on the complex interaction of previous experiments, starts, and quits. From a clinical and public health standpoint, the measure of lifetime or "ever" smoking, even a single puff, may not be a meaningful endpoint and may never lead to regular use. Future research should consider using measures that reflect more regular use (e.g., smoking in the past 30 days), or the frequency or quantity smoked.

In terms of *prevention* interventions, it is unclear if measures of "ever" smoking only one or two puffs is a meaningful measure of true smoking "initiation," as opposed to experimentation or a trial behavior. Including measures of self-reported susceptibility and/or stage of acquisition may help further delineate the various stages that many youth, particularly younger children, are in.[12, 115] Identifying children and adolescents who are at greatest risk for smoking may help clinicians target them for more intensive prevention. In addition, there is likely a need for *ongoing* assessment to ensure that any counseling intervention is not merely deferring smoking initiation, but rather, strengthening or establishing a solid resolve not to experiment with or start regular smoking. Again, this may be particularly true for younger children. Youth who initiate smoking when they are younger (e.g., age 12 years) are more likely to go on to be daily smokers in later adolescence than those who initiate or experiment with smoking during older adolescence.[116]

One of the critical issues for smoking *cessation* research in children and adolescents is how baseline smoking and subsequent quitting are defined and verified. In our review, how each study defined a smoker at baseline varied from "regular or occasional" use, at least 1 day or one cigarette in the previous 30 days, at least one cigarette a week for the past 30 days, daily use for the past 30 days, to currently smoking 10 or more cigarettes a day and had done so for 6 or more months (for the medication trials). Our review was more inclusive than at least one previous review on smoking cessation in terms of the criteria used for defining baseline smokers. In the Cochrane review by Grimshaw and colleagues,[39] for example, a regular smoker was defined as a young person who smokes an average of at least one cigarette per week, and had done so for at least 6 months. Their review excluded cessation trials that targeted young people who did not meet this smoking threshold. Our review included cessation studies or cessation outcomes that involved youth smokers, no matter how that was defined, which is a similar approach to that taken by Sussman and colleagues in their most recent review.[60,61]

In the 2006 Sussman review, among the 48 studies included, the average level of baseline smoking (the sum of the averages across studies divided by 48) was 10.44 cigarettes per day, with a range of 0.11 to 18.44 cigarettes per day. In our review, of the six behavior-based cessation trials, four[79,80,87,99] presented the frequency (e.g., mean number of days or percent smoking daily) or quantity (e.g., mean number of cigarettes) smoked. For instance, adolescent smokers in the cessation trial by Colby and colleagues[87] reported smoking an average of 10.5 cigarettes a day and on 6.6 days of the week. In the recent cessation trial by Pbert and co-authors,[80] adolescents were included if they reported any smoking in the past 30 days. While this inclusion criteria may have allowed adolescents who are not yet regular, established smokers to participate in the study, on average, youth in this study were smoking almost seven cigarettes a day and on nearly 27 of the past 30 days. Two of the combined trials[79,99] also reported frequency, quantity, and/or recency of smoking. In these studies, nearly all past-30-day smokers smoked daily[99] and almost half smoked the day of the survey.[79] In the trial by Hollis and colleagues,[91] 76.2 percent of adolescents who had smoked in the past 30 days considered themselves "smokers" rather than "experimenters." As stated earlier, a large, positive effect of the intervention was found at 1 and 2 years among those self-described smokers and not among those who considered themselves experimenters. These examples demonstrate that while our criteria for including baseline smokers may have captured youth who are not generally established smokers, several of the studies also examined the quantity or frequency with which youth smoked and demonstrated relatively regular smoking among youth. As stated earlier, examining the intervention effect among youth who smoke at various levels is an obvious next step in this area of research.

In our review, studies used various definitions of smoking cessation. The most common outcome measure used by studies in this review was 30-day point prevalence, which is the recommended measure of cessation for youth trials.[90] None of our studies used a measure of continuous cessation from the point of intervention.[20] Point prevalence abstinence was used in the majority of studies and ranged from cessation for 7 to 30 days at followup. Because youth often engage in smoking patterns that are highly variable on a day-to-day basis, standard adult measures of abstinence, such as 7-day point prevalence, may not discriminate true quitters from temporary abstainers, which would inflate the true smokefree rate. One trial included the use of a bogus pipeline to increase the validity of youths' self-reports and five studies (the five studies exclusively designed as cessation trials) included biochemical measures (e.g., expired CO and saliva cotinine) to verify youths' self-reports or to analyze as secondary measures of quitting.

Applicability

Of the 19 trials included in this review, five of the interventions were conducted in a U.S. primary care setting[79,80,91,98] or dental practice.[81,95] The majority of these studies included relatively brief face-to-face interaction with a health care provider, such as a 30- to 60-second advice message to encourage adolescents to quit smoking or not to start smoking. In addition, the brief advice from clinicians was supported with subsequent face-to-face or telephone counseling sessions with other trained study staff and print materials and/or the use of an interactive computer program. One intervention included a provider-delivered component based on the 5A model.[79] The intervention incorporated a patient-centered approach in which the providers asked

about smoking, advised cessation or continued abstinence, and referred the patient to a peer counselor to develop a personalized strategy for cessation or maintained abstinence. This study found relatively large, statistically significant intervention effects on overall smoking prevalence, smoking initiation, and smoking cessation at 6 months; however, none of these effects were statistically significant at 1 year. The most provider-intensive of the primary care interventions[98] showed no significant effects on smoking or smokeless tobacco use among children (average age, 11 years) at 12-, 24-, or 36-months followup.

Only one trial conducted in primary care[91] found a statistically significant intervention effect on the overall prevalence of smoking, initiation among nonsmokers, and cessation among smokers at 12 months. In this sample, 77.2 percent of youth in the intervention group were smokefree at 12 months versus 72.8 percent of youth in the control group. This effect remained significant at 2 years (72.8% of the intervention group vs. 68.6% of the control group were smokefree). Among baseline nonsmokers, only 9.2 percent of the intervention group compared with 12.1 percent of the control group initiated smoking at 1 year (although, this effect attenuated at 2 years). Among adolescents who had smoked one or more cigarettes during the previous 30 days at baseline, the intervention produced significant effects at both the 1- and 2-year assessments. The intervention, however, had no effect on the small subgroup of self-described baseline experimenters.

The other included studies that found statistically significant effects on overall smoking prevalence, initiation, and cessation that were not conducted in a primary care setting may still be applicable to primary care, as they primarily included the use of mailed print materials to participants' homes. Neither of the trials that included the use of bupropion recruited participants from or took place in a health care setting.

Importantly, although a number of interventions included face-to-face interaction with a health care provider, treatment participants were only moderately more likely than control subjects to report that their clinician discussed tobacco during the visit in several cases.[11,79,91,98] In the trial by Hollis and colleagues,[91] for example, 41 percent of the intervention participants reported that their clinician talked with them about tobacco use versus 28 percent of the control participants. Similarly, Pbert and colleagues (2008) found that participants in the intervention group reported that their provider only spent approximately a minute and a half more discussing smoking than participants in the usual care condition (4.3 vs. 2.9 minutes).[79] In the trial by Stevens and colleagues, the rates of discussion about alcohol and tobacco reported by youth were not significantly different between the intervention and attention control groups after 1 year.[98] Such modest differences could reflect the poor ability children and adolescents may have to recall what was discussed by their provider, the extent to which providers discuss tobacco and other related substance use issues as part of usual care, or the salience of the specific messages discussed in the intervention conditions.

Limitations in the Body of Evidence

Most of the studies reviewed included a number of threats to internal validity, including inadequate or unclear randomization procedures, uncertain or no allocation concealment and blinding of outcome assessors, and relatively high attrition. In addition, several studies did not

report baseline values for all youth randomized or by treatment group to allow us to evaluate baseline comparability. Participation in the interventions and compliance varied, with some trials demonstrating very low adherence. For example, in an intervention consisting of four mailed booklets followed by counseling phone calls, only 61.8 percent of parents completed all four sessions.[50] In another study held in dental clinics, only 70 percent of adolescents actually received the planned face-to-face counseling (primarily because of missed appointments) and only one third of those participants received a planned followup phone call.[54]

There were inconsistent definitions and measurement of baseline smoking status, prevalence, initiation, and abstinence. In addition, there was limited use of biochemical validation of self-reported smoking status. As demonstrated in one trial,[87] several of those self-reported "abstinent" smokers were reclassified as smokers based on their biomarker data. Analysis of the biomarker data showed a nonsignificant effect, underscoring the need for more research on the use of biochemical measures among children and adolescents. However, it was not clear from this trial if these results reflected only those participants who completed biochemical verification or if it also included those lost to followup and those for whom biochemical data were not obtained (who were subsequently recoded as smokers at followup).

Very few of the included studies evaluated other forms of tobacco use beyond cigarette smoking. However, other tobacco products, including smokeless tobacco and newer products such as bidis, kreteks, or use of a hookah (i.e., waterpipe) are highly available in the U.S. market. These other tobacco products are increasingly being promoted as cigarette alternatives, with claims of being potentially less harmful. While this report aimed to examine interventions to prevent tobacco use in general, the majority of the included trials focused on cigarette smoking.

We were unable to include two studies[85,98] in our meta-analyses due to the limited data presented. The study by Stevens and colleagues[98] was highly applicable to primary care, as it took place in 12 pediatric clinics serving a diverse population. The intervention took place over 3 years and included materials and messages for both children (including both baseline smokers and nonsmokers) and parents. After adjustment for important characteristics, the authors found a nonsignificant effect of the intervention on ever smoking and ever using smokeless tobacco at 12, 24, and 36 months. In the trial by Ausems conducted in the Netherlands, 156 elementary schools were randomized into one of four conditions: 1) in-school (curriculum-based), 2) out-of-school (three tailored letters mailed to participants' homes), 3) in-school and out-of-school, or 4) control.[85] We only included the out-of-school condition (vs. control). Among the baseline "never smokers," the authors reported that 10.4 percent (95% CI, 6.8 to 14.0) of children in the out-of-school condition versus 18.1 percent (95% CI, 12.5 to 23. 7) of the control condition participants initiated smoking at 6-months followup.

With the exception of three trials (two by the same author),[79,80,104] all of the included studies were published in 2007 or earlier. In recent years, there has been a substantial emphasis placed on tobacco-related legislation, environmental changes, and countermarketing. While these public health efforts are imperative in reducing tobacco use,[45] continuing to reach children and adolescents on a more personal level through behavior-based interventions remains an important strategy.[8] In addition, recently there has been a considerable discrepancy between funding for research on tobacco use and funding for research on the etiology, prevention, and treatment of

obesity. Funding estimates from the National Institutes of Health during the previous 5 years (2007–2012) show that funding for obesity research was or is estimated to be nearly two to three times that for tobacco-related research.[117] In 2012, over $800 million is expected to go toward obesity research, whereas only approximately $350 million will go toward tobacco research. Although the prevalence of youth tobacco use has experienced a stalled decline during this time period, nearly 4,000 children and adolescents initiate and experiment with tobacco products each day. As such, interventions designed to reduce the number of young children experimenting with and regularly using tobacco products must remain a priority.

Limitations in Our Approach

One limitation in our approach is that we combined studies that used different measures of smoking prevalence. That is, our meta-analyses combined studies that defined smoking status according to youths' lifetime use or current use, as defined by the last 30 or 90 days. This variability in outcomes (often described as clinical diversity) can lead to heterogeneity if the intervention effect was affected by the way in which the outcome was measured. However, we performed sensitivity analyses to evaluate this hypothesis (i.e., removing studies with inconsistent measures) and the results remained stable.

Among the combined trials and those focused on prevention, another potential limitation to our approach was in combining interventions that exclusively focused on cigarette smoking with those that targeted multiple behaviors (e.g., alcohol and other substance use, sexual behaviors, and other problem behaviors). These unrelated aims may have caused "noise" that masked the basic message to prevent smoking and may have led to null effects. In fact, two of the trials[97,98] that included broader aims than reducing smoking saw the largest negative effect of the intervention on total smoking prevalence and in reducing smoking initiation. Because of the variability in intervention approaches and populations, as well as inconsistencies in measurement, meta-analysis results should be interpreted with caution.

As stated previously, we did not include interventions that were designed to decrease tobacco use among parents as a secondary strategy for reducing smoking or secondhand tobacco smoke exposure among youth. Similarly, we did not include interventions designed to restrict smoking in homes or cars as a strategy to reduce youths' exposure to or use of tobacco. However, research has shown that having a strict smokefree policy in the home is associated with fewer smoking youth than in households with unrestricted or partial policies (i.e., for only certain members of the household).[29,118] More primary research is needed that includes a focus on parental smoking and smokefree policies to understand the effect they might have on youth tobacco use.

We did not identify any prevention or cessation trials that met our inclusion criteria that assessed health outcomes in children and adolescents or examined subsequent rates of adult smoking (KQ 1). Our review only included interventions that were conducted within a health care or comparable setting. However, trials in other settings (e.g., schools), and particularly those that span several years, have shown positive effects on regular smoking in young adulthood.[119]

Future Research

We have several recommendations for future research in tobacco use prevention and cessation among children and adolescents. In general, there are a small number of methodologically rigorous trials that examined the effectiveness of primary care relevant behavior-based interventions to prevent tobacco use and/or to help tobacco users quit. There are even fewer good-quality trials that evaluate the use of medication to aid adolescents in their cessation efforts. Unfortunately, there are also very few trials in press or in progress that may address these gaps in the literature (**Appendix H**). The need to replicate promising interventions and specific intervention components in well-controlled trials is significant. This research would include incorporating longer-term outcomes to examine the extent to which results hold over time, involving more diverse samples of children and adolescents, including those at various stages of risk, estimating intervention effects in real-world settings, and determining their feasibility and sustainability in a health care setting. While 30- to 60-second brief advice messages or counseling using the 5A model may be feasible in primary care settings, it is not clear whether the additional components that many of the trials included (e.g., in-person counseling following the provider encounter, tailored computer programming, and booster telephone calls and mailed print materials) could be easily replicated in a real-world setting unless other resources (e.g., centralized phone counselors) were employed. Similarly, understanding the important components of these interventions is also necessary, including determining whether specific behavioral theories or models produce more favorable outcomes and the extent to which the addition of family-focused or parent-delivered intervention components (including an emphasis on parental cessation and policies on smokefree homes and cars) might affect outcomes. Including comparative effectiveness trials of different behavioral- and medication-based interventions may also help define essential elements of effective interventions.

One intervention strategy that may hold promise, particularly for smoking cessation, is the use of tailored computer-based programs and other electronic media channels.[55,120,121] This strategy has been a key part of effective prevention and cessation interventions among both youth[91] and adults.[122] In these interventions, interactive programs are used to deliver highly tailored messages about remaining abstinent or quitting according to the individual's risk, needs, and preferences (e.g., stage of acquisition or cessation, level of nicotine dependence, and self-identified barriers to remaining abstinent or quitting). If offered on a Web-based platform, clinicians could refer their patients to the program and then use their face-to-face time to check in and see what the youth had learned and/or applied and reinforce important messages.

In addition, there is a need for more studies that involve diverse samples of children and adolescents, including those of various racial/ethnic and socioeconomic backgrounds and at various stages of initiation and/or readiness to quit. Most of the studies in this review included fairly homogeneous samples, which limited our ability to determine whether the effects of the interventions varied by population subgroup. Disparities in tobacco use among children and adolescents in the United States exist along racial/ethnic, gender, and socioeconomic lines. Thus, evaluating the effectiveness of interventions among different population subgroups should also be of high priority. As previously stated, there is also a need to recruit and/or stratify samples based on where participants fall on the behavioral continuum (i.e., susceptible, tried smoking, daily smoking). As shown, the few cessation interventions that found positive effects were

among adolescents considered (either by the amount smoked or self-descriptors) to be more "established" smokers. However, given the large number of children and adolescents who have experimented with, yet not become regular smokers, there is a need to evaluate interventions and messages designed to reach this group.

We need more research examining the reliability and validity of self-reported measures and specific forms of biochemical verification among children and adolescents. Additionally, these measures should be standardized across intervention research. Future research should also consider including additional measures to evaluate the use of other forms of tobacco use beyond cigarette smoking to see the full effects on tobacco use and to make sure there are no substitution effects (e.g., quitting one type of tobacco, but starting another).

Finally, to facilitate systematic reviews and meta-analyses of both prevention and cessation studies, methodological and intervention details need to be reported as comprehensively as possible. The Youth Tobacco Cessation Collaborative evidence review panel emphasized the importance of reporting the following components in any published youth tobacco cessation study: 1) theoretical framework; 2) content and components; 3) intensity and duration; 4) site(s); 5) timing (e.g., time of day and year); 6) implementation (including intervention fidelity); 7) provider characteristics; 8) design; 9) inclusion/exclusion criteria; 10) sample size; 11) followup; 12) outcome measures; and 13) confirmation of self-report.[54] These recommendations are applicable to both general tobacco reduction programs and prevention efforts.

Conclusions

Despite the substantial resources committed to reducing childhood and adolescent tobacco use over recent decades, approximately 10 percent of middle school students and nearly a quarter of high school students currently use tobacco in the United States. Consequently, child and adolescent tobacco users are a group at risk for the negative health outcomes associated with tobacco use, including becoming regular users as adults. Our findings suggest that primary care relevant interventions designed to reduce cigarette smoking among children and adolescents can have small, positive effects on smoking initiation among children and adolescents who have not yet become regular smokers. The evidence on the effectiveness of cessation interventions for youth who have experimented with cigarettes or are regular smokers is limited. Health care settings provide an opportunity to reach children and adolescents who are at risk of initiating tobacco use as well as those who have already begun experimenting with, or are regular users of, tobacco products. Ongoing policy and social changes associated with tobacco use will likely increase the pressure on youths to quit, in addition to health care clinicians providing counseling to remain abstinent and help them quit. Primary care interventions are an essential part of a comprehensive tobacco control program that complements broader school-based, community-based, media, and policy interventions.[8,44]

References

1. U.S.Preventive Services Task Force. Counseling to Prevent Tobacco Use and Tobacco-Caused Disease: Recommendation Statement. Rockville, MD: Agency for Healthcare Quality and Research; 2003.
2. Fiore MC, Bailey WC, Cohen SJ, et al. Treating Tobacco Use and Dependence: Clinical Practice Guideline. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service; 2000.
3. Centers for Disease Control and Prevention. Smoking-attributable mortality, years of potential life lost, and productivity losses—United States, 2000–2004. *MMWR Morb Mortal Wkly Rep*. 2008;57(45):1226-8.
4. Centers for Disease Control and Prevention. Fact Sheet: Youth and Tobacco Use. Atlanta: Centers for Disease Control and Prevention; 2012. Accessed at http://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/index.htm on 30 November 2012.
5. FDA issues final rule restricting access and marketing of cigarettes and smokeless tobacco products to youth [news release]. Washington, DC: U.S. Department of Health and Human Services; March 18, 2010. Accessed at http://www.hhs.gov/news/press/2010pres/03/20100318a.html on 30 November 2012.
6. Substance Abuse and Mental Health Services Administration. Results From the 2010 National Survey on Drug Use and Health: Summary of National Findings. NSDUH Series H-41. HHS Publication No. (SMA) 11-4658. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2011. Accessed at http://www.samhsa.gov/data/nsduh/2k10nsduh/2k10results.htm on 30 November 2012.
7. U.S. Department of Health and Human Services. The Health Consequences of Smoking: A Report of the Surgeon General. Atlanta: Centers for Disease Control and Prevention; 2004. Accessed at http://www.surgeongeneral.gov/library/reports/smokingconsequences/index.html on 30 November 2012.
8. U.S. Department of Health and Human Services. Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General, 2012. Atlanta: Centers for Disease Control and Prevention; 2012. Accessed at http://www.surgeongeneral.gov/library/reports/preventing-youth-tobacco-use/index.html on 30 November 2012.
9. Vickers KS, Thomas JL, Patten CA, et al. Prevention of tobacco use in adolescents: review of current findings and implications for healthcare providers. *Curr Opin Pediatr*. 2002;14(6):708-12.
10. Mowery PD, Brick PD, Farrelly MC. Pathways to Established Smoking: Results From the 1999 National Youth Tobacco Survey. Washington, DC: American Legacy Foundation; 2000. Accessed at http://www.legacyforhealth.org/4184.aspx on 30 November 2012.
11. Curry SJ, Hollis J, Bush T, et al. A randomized trial of a family-based smoking prevention intervention in managed care. *Prev Med*. 2003;37(Pt 1):617-26.
12. Pierce JP, Choi WS, Gilpin EA, et al. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychol*. 1996;15(5):355-61.

13. DiFranza J, Wellman RJ, Mermelstein R, et al. The natural history and diagnosis of nicotine addiction. *Curr Pediatr Rev*. 2011;7:88-96.
14. Centers for Disease Control and Prevention. Tobacco use among middle and high school students—United States, 2000–2009. *MMWR Morb Mortal Wkly Rep*. 2010;59(33):1063-8.
15. Eaton DK, Kann L, Kinchen S, et al; Centers for Disease Control and Prevention. Youth risk behavior surveillance—United States, 2009. *MMWR Surveill Summ*. 2010;59(5):1-142.
16. U.S. Department of Health and Human Services. Healthy People 2020: Tobacco Use Objectives. Washington, DC: U.S. Department of Health and Human Services; 2012. Accessed at http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=41 on 30 November 2012.
17. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. Monitoring the Future National Results on Adolescent Drug Use: Overview of Key Findings, 2011. Ann Arbor, MI: Institute for Social Research, The University of Michigan; 2012. Accessed at http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2011.pdf on 30 November 2012.
18. Giovino GA. Epidemiology of tobacco use in the United States. *Oncogene*. 2002;21(48):7326-40.
19. Centers for Disease Control and Prevention. Cigarette use among high school students—United States, 1991–2009. *MMWR Morb Mortal Wkly Rep*. 2010;59(26):797-801.
20. Mermelstein R, Colby SM, Patten C, et al. Methodological issues in measuring treatment outcome in adolescent smoking cessation studies. *Nicotine Tob Res*. 2002;4(4):395-403.
21. West R, Hajek P, Stead L, et al. Outcome criteria in smoking cessation trials: proposal for a common standard. *Addiction*. 2005;100(3):299-303.
22. Brener ND, Billy JO, Grady WR. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. *J Adolesc Health*. 2003;33(6):436-57.
23. Dolcini MM, Adler NE, Lee P, Bauman KE. An assessment of the validity of adolescent self-reported smoking using three biological indicators. *Nicotine Tob Res*. 2003;5(4):473-83.
24. Dolcini MM, Alder NE, Ginsberg D. Factors influencing agreement between self-reports and biological measures of smoking among adolescents. *J Res Adolesc*. 1996;6(4):515-42.
25. Adams J, Parkinson L, Sanson-Fisher RW, et al. Enhancing self-report of adolescent smoking: the effects of bogus pipeline and anonymity. *Addict Behav*. 2008;33(10):1291-6.
26. SRNT Subcommittee on Biochemical Verification. Biochemical verification of tobacco use and cessation. *Nicotine Tob Res*. 2002;4(2):149-59.
27. Bricker JB, Peterson AV Jr, Andersen MR, et al. Parents' and older siblings' smoking during childhood: changing influences on smoking acquisition and escalation over the course of adolescence. *Nicotine Tob Res*. 2007;9(9):915-26.
28. Hill KG, Hawkins JD, Catalano RF, et al. Family influences on the risk of daily smoking initiation. *J Adolesc Health*. 2005;37(3):202-10.
29. Farkas AJ, Gilpin EA, White MM, et al. Association between household and workplace smoking restrictions and adolescent smoking. *JAMA*. 2000;284(6):717-22.
30. Bricker JB, Leroux BG, Peterson AV Jr, et al. Nine-year prospective relationship between parental smoking cessation and children's daily smoking. *Addiction*. 2003;98(5):585-93.

31. Smith BN, Bean MK, Mitchell KS, et al. Psychosocial factors associated with non-smoking adolescents' intentions to smoke. *Health Educ Res*. 2007;22(2):238-47.
32. Tyc VL, Hadley W, Allen D, et al. Predictors of smoking intentions and smoking status among nonsmoking and smoking adolescents. *Addict Behav*. 2004;29(6):1143-7.
33. Barton J, Chassin L, Presson CC, et al. Social image factors as motivators of smoking initiation in early and middle adolescence. *Child Dev*. 1982;53(6):1499-511.
34. Doubeni CA, Li W, Fouayzi H, et al. Perceived accessibility as a predictor of youth smoking. *Ann Fam Med*. 2008;6(4):323-30.
35. DiFranza JR, Wellman RJ, Sargent JD, et al. Tobacco promotion and the initiation of tobacco use: assessing the evidence for causality. *Pediatrics*. 2006;117(6):e1237-48.
36. Hu MC, Griesler P, Schaffran C, Kandel D. Risk and protective factors for nicotine dependence in adolescence. *J Child Psychol Psychiatry*. 2011;52(10):1063-72.
37. Rivara FP, Ebel BE, Garrison MM, et al. Prevention of smoking-related deaths in the United States. *Am J Prev Med*. 2004;27(2):118-25.
38. Carson KV, Brinn MP, Labiszewski NA, et al. Community interventions for preventing smoking in young people. *Cochrane Database Syst Rev*. 2011(7):CD001291.
39. Grimshaw GM, Stanton A. Tobacco cessation interventions for young people. *Cochrane Database Syst Rev*. 2006(4):CD003289.
40. Stead LF, Lancaster T. Interventions for preventing tobacco sales to minors. *Cochrane Database Syst Rev*. 2005(1):CD001497.
41. Brinn MP, Carson KV, Esterman AJ, et al. Mass media interventions for preventing smoking in young people. *Cochrane Database Syst Rev*. 2010;(11):CD001006.
42. DiFranza JR. Which interventions against the sale of tobacco to minors can be expected to reduce smoking? *Tob Control*. 2012;21(4):436-42.
43. Thomas RE, Baker P, Lorenzetti D. Family-based programmes for preventing smoking by children and adolescents. *Cochrane Database Syst Rev*. 2007;(1):CD004493.
44. Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs—2007. Atlanta: Centers for Disease Control and Prevention; 2007. Accessed at http://www.cdc.gov/tobacco/stateandcommunity/best_practices/index.htm on 30 November 2012.
45. Task Force on Community Preventive Services. Tobacco. In: The Guide to Community Preventive Services: What Works to Promote Health? New York: Oxford University Press; 2005. p. 3-79.
46. Backinger CL, McDonald P, Ossip-Klein DJ, et al. Improving the future of youth smoking cessation. *Am J Health Behav*. 2003;27(Suppl 2):S170-84.
47. Curry SJ, Mermelstein RJ, Sporer AK. Therapy for specific problems: youth tobacco cessation. *Annu Rev Psychol*. 2009;60:229-55.
48. Garrison MM, Christakis DA, Ebel BE, et al. Smoking cessation interventions for adolescents: a systematic review. *Am J Prev Med*. 2003;25(4):363-7.
49. Gervais A, O'Loughlin J, Dugas E, et al. A systematic review of randomized controlled trials of youth smoking cessation interventions. *Drogues Sante Societe*. 2007;6(Suppl 2):1-26.
50. Grenard JL, Ames SL, Pentz MA, et al. Motivational interviewing with adolescents and young adults for drug-related problems. *Int J Adolesc Med Health*. 2006;18(1):53-67.
51. Heckman CJ, Egleston BL, Hofmann MT. Efficacy of motivational interviewing for smoking cessation: a systematic review and meta-analysis. *Tob Control*. 2010;19(5):410-6.

52. Hutton HE, Wilson LM, Apelberg BJ, et al. A systematic review of randomized controlled trials: web-based interventions for smoking cessation among adolescents, college students, and adults. *Nicotine Tob Res*. 2011;13(4):227-38.
53. Kim Y, Myung SK, Jeon YJ, et al. Effectiveness of pharmacologic therapy for smoking cessation in adolescent smokers: meta-analysis of randomized controlled trials. *Am J Health Syst Pharm*. 2011;68(3):219-26.
54. McDonald P, Colwell B, Backinger CL, et al. Better practices for youth tobacco cessation: evidence of review panel. *Am J Health Behav*. 2003;27(Suppl 2):S144-58.
55. Myung SK, McDonnell DD, Kazinets G, et al. Effects of web- and computer-based smoking cessation programs. *Arch Intern Med*. 2009;169(10):929-37.
56. Rooke S, Thorsteinsson E, Karpin A, et al. Computer-delivered interventions for alcohol and tobacco use: a meta-analysis. *Addiction*. 2010;105(8):1381-90.
57. Schepis TS, Rao U. Smoking cessation for adolescents: a review of pharmacological and psychosocial treatments. *Curr Drug Abuse Rev*. 2008;1(2):142-55.
58. Sussman S, Lichtman K, Ritt A, et al. Effects of thirty-four adolescent tobacco use cessation and prevention trials on regular users of tobacco products. *Subst Use Misuse*. 1999;34(11):1469-503.
59. Sussman S. Effects of sixty six adolescent tobacco use cessation trials and seventeen prospective studies of self-initiated quitting. *Tob Induc Dis*. 2002;1(1):35-81.
60. Sussman S, Sun P, Dent CW. A meta-analysis of teen cigarette smoking cessation. *Health Psychol*. 2006;25(5):549-57.
61. Sussman S, Sun P. Youth tobacco use cessation: 2008 update. *Tob Induc Dis*. 2009;5:3.
62. Warnakulasuriya S. Effectiveness of tobacco counseling in the dental office. *J Dent Educ*. 2002;66(9):1079-87.
63. Fiore M. A clinical practice guideline for treating tobacco use and dependence: 2008 update. *Am J Prev Med*. 2008;35(2):158-76.
64. U.S. Food and Drug Administration. Public Health Advisory: FDA Requires New Boxed Warnings for the Smoking Cessation Drugs Chantix and Zyban. Rockville, MD: U.S. Food and Drug Administration; 2009. Accessed at http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/DrugSafetyInformationforHeathcareProfessionals/PublicHealthAdvisories/ucm169988.htm on 30 November 2012.
65. Shelley D, Cantrell J, Faulkner D, et al. Physician and dentist tobacco use counseling and adolescent smoking behavior: results from the 2000 National Youth Tobacco Survey. *Pediatrics*. 2005;115(3):719-25.
66. Centers for Disease Control and Prevention. 2009 National Youth Tobacco Survey: Dataset, Format Library, and Codebook. Atlanta: Centers for Disease Control and Prevention; 2011. Accessed at http://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm on 30 November 2012.
67. Alfano CM, Zbikowski SM, Robinson LA, et al. Adolescent reports of physician counseling for smoking. *Pediatrics*. 2002;109(3):e47.
68. Price JH, Jordan TR, Dake JA. Pediatricians' use of the 5 A's and nicotine replacement therapy with adolescent smokers. *J Community Health*. 2007;32(2):85-101.
69. Malarcher A, Easton A, Husten C, et al. Smoking cessation counseling: training and practice among women pediatricians. *Clin Pediatr (Phila)*. 2002;41(5):341-9.

70. Committee on Environmental Health, Committee on Substance Abuse, Committee on Adolescence, and Committee on Native American Child Health. From the American Academy of Pediatrics: policy statement—tobacco use: a pediatric disease. *Pediatrics*. 2009;124(5):1474-87.
71. U.S. Preventive Services Task Force. Procedure Manual. Rockville, MD: Agency for Healthcare Quality and Research; 2011. Accessed at http://www.uspreventiveservicestaskforce.org/uspstf08/methods/procmanual.htm on 30 November 2012.
72. U.S. Department of Health and Human Services Public Health Service. Treating Tobacco Use and Dependence: 2008 Update. Washington, DC: U.S. Department of Health and Human Services; 2008. Accessed at http://www.ncbi.nlm.nih.gov/books/NBK63952/ on 30 November 2012.
73. Christakis DA, Garrison MM, Ebel BE, et al. Pediatric smoking prevention interventions delivered by care providers: a systematic review. *Am J Prev Med*. 2003;25(4):358-62.
74. Civljak M, Sheikh A, Stead LF, et al. Internet-based interventions for smoking cessation. *Cochrane Database Syst Rev*. 2010(9):CD007078.
75. Hopkins DP, Briss PA, Ricard CJ, et al. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med*. 2001;20(2 Suppl):16-66.
76. Muller-Riemenschneider F, Bockelbrink A, Reinhold T, et al. Long-term effectiveness of behavioural interventions to prevent smoking among children and youth. *Tob Control*. 2008;17(5):301-2.
77. Petrie J, Bunn F, Byrne G. Parenting programmes for preventing tobacco, alcohol or drugs misuse in children <18: a systematic review. *Health Educ Res*. 2007;22(2):177-91.
78. Skara S, Sussman S. A review of 25 long-term adolescent tobacco and other drug use prevention program evaluations. *Prev Med*. 2003;37(5):451-74.
79. Pbert L, Flint AJ, Fletcher KE, et al. Effect of a pediatric practice-based smoking prevention and cessation intervention for adolescents: a randomized, controlled trial. *Pediatrics*. 2008;121(4):e738-47.
80. Pbert L, Druker S, DiFranza JR, et al. Effectiveness of a school nurse-delivered smoking-cessation intervention for adolescents. *Pediatrics*. 2011;128(5):926-36.
81. Hovell MF, Slymen DJ, Jones JA, et al. An adolescent tobacco-use prevention trial in orthodontic offices. *Am J Public Health*. 1996;86(12):1760-6.
82. Higgins JP, Green S, eds. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. Oxford, England: The Cochrane Collaboration; 2011. Accessed at http://handbook.cochrane.org/ on 30 November 2012.
83. Murray DM, Short BJ. Intraclass correlation among measures related to tobacco use by adolescents: estimates, correlates, and applications in intervention studies. *Addict Behav*. 1997;22(1):1-12.
84. Higgins JP, Thompson SG, Deeks JJ, et al. Measuring inconsistency in meta-analyses. *BMJ*. 2003;327(7414):557-60.
85. Ausems M, Mesters I, van Breukelen G, et al. Short-term effects of a randomized computer-based out-of-school smoking prevention trial aimed at elementary schoolchildren. *Prev Med*. 2002;34(6):581-9.
86. Bauman KE, Ennett ST, Foshee VA, et al. Influence of a family program on adolescent smoking and drinking prevalence. *Prev Sci*. 2002;3(1):35-42.

87. Colby SM, Monti PM, O'Leary TT, et al. Brief motivational intervention for adolescent smokers in medical settings. *Addict Behav*. 2005;30(5):865-74.
88. Fidler W, Lambert TW. A prescription for health: a primary care based intervention to maintain the non-smoking status of young people. *Tob Control*. 2001;10(1):23-6.
89. Gray KM, Carpenter MJ, Baker NL, et al. Bupropion SR and contingency management for adolescent smoking cessation. *J Subst Abuse Treat*. 2011;40(1):77-86.
90. Haggerty KP, Skinner ML, MacKenzie EP, et al. A randomized trial of parents who care: effects on key outcomes at 24-month follow-up. *Prev Sci*. 2007;8(4):249-60.
91. Hollis JF, Polen MR, Whitlock EP, et al. Teen reach: outcomes from a randomized, controlled trial of a tobacco reduction program for teens seen in primary medical care. *Pediatrics*. 2005;115(4):981-9.
92. Jackson C, Dickinson D. Enabling parents who smoke to prevent their children from initiating smoking: results from a 3-year intervention evaluation. *Arch Pediatr Adolesc Med*. 2006;160(1):56-62.
93. Kentala J, Utriainen P, Pahkala K, et al. Can brief intervention through community dental care have an effect on adolescent smoking? *Prev Med*. 1999;29(2):107-11.
94. Killen JD, Robinson TN, Ammerman S, et al. Randomized clinical trial of the efficacy of bupropion combined with nicotine patch in the treatment of adolescent smokers. *J Consult Clin Psychol*. 2004;72(4):729-35.
95. Lando HA, Hennrikus D, Boyle R, et al. Promoting tobacco abstinence among older adolescents in dental clinics. *J Smok Cessat*. 2007;2(1):23-30.
96. Muramoto ML, Leischow SJ, Sherrill D, et al. Randomized, double-blind, placebo-controlled trial of 2 dosages of sustained-release bupropion for adolescent smoking cessation. *Arch Pediatr Adolesc Med*. 2007;161(11):1068-74.
97. Prado G, Pantin H, Briones E, et al. A randomized controlled trial of a parent-centered intervention in preventing substance use and HIV risk behaviors in Hispanic adolescents. *J Consult Clin Psychol*. 2007;75(6):914-26.
98. Stevens MM, Olson AL, Gaffney CA, et al. A pediatric, practice-based, randomized trial of drinking and smoking prevention and bicycle helmet, gun, and seatbelt safety promotion. *Pediatrics*. 2002;109(3):490-7.
99. Bauman KE, Ennett ST, Foshee VA, et al. Influence of a family-directed program on adolescent cigarette and alcohol cessation. *Prev Sci*. 2000;1(4):227-37.
100. Bauman KE, Foshee VA, Ennett ST, et al. The influence of a family program on adolescent tobacco and alcohol use. *Am J Public Health*. 2001;91(4):604-10.
101. Huang M, Hollis J, Polen M, et al. Stages of smoking acquisition versus susceptibility as predictors of smoking initiation in adolescents in primary care. *J Smok Cessat*. 2005;30(6):1183-94.
102. Jackson C, Dickinson D. Can parents who smoke socialise their children against smoking? Results from the Smoke-free Kids intervention trial. *Tob Control*. 2003;12(1):52-9.
103. Jaszyna-Gasior M, Schroeder JR, Moolchan ET. Alcohol use and tobacco abstinence among adolescents in cessation treatment: preliminary findings. *Addict Behav*. 2007;32(3):617-21.
104. Colby SM, Nargiso J, Tevyaw TO, et al. Enhanced motivational interviewing versus brief advice for adolescent smoking cessation: results from a randomized clinical trial. *J Smok Cessat*. 2012;37(7):817-23.

105. Thomas R, Perera R. School-based programmes for preventing smoking. *Cochrane Database Syst Rev*. 2006;(3):CD001293.
106. Hanson K, Allen S, Jensen S, et al. Treatment of adolescent smokers with the nicotine patch. *Nicotine Tob Res*. 2003;5(4):515-26.
107. Kang HC, Shin KK, Kim KK, et al. The effects of the acupuncture treatment for smoking cessation in high school student smokers. *Yonsei Med J*. 2005;46(2):206-12.
108. Yiming C, Changxin Z, Ung WS, et al. Laser acupuncture for adolescent smokers: a randomized double-blind controlled trial. *Am J Chin Med*. 2000;28(3-4):443-9.
109. White AR, Rampes H, Campbell JL. Acupuncture and related interventions for smoking cessation. *Cochrane Database Syst Rev*. 2006;(1):CD000009.
110. Chassin L, Presson C, Rose J, et al. Parental smoking cessation and adolescent smoking. *J Pediatr Psychol*. 2002;27(6):485-96.
111. Farkas AJ, Distefan JM, Choi WS, et al. Does parental smoking cessation discourage adolescent smoking? *Prev Med*. 1999;28(3):213-8.
112. Rosen LJ, Noach MB, Winickoff JP, et al. Parental smoking cessation to protect young children: a systematic review and meta-analysis. *Pediatrics*. 2012;129(1):141-52.
113. Curry SJ, Ludman EJ, Graham E, et al. Pediatric-based smoking cessation intervention for low-income women: a randomized trial. *Arch Pediatr Adolesc Med*. 2003;157(3):295-302.
114. Kandel DB, Hu MC, Griesler PC, et al. On the development of nicotine dependence in adolescence. *Drug Alcohol Depend*. 2007;91(1):26-39.
115. Pallonen UE, Prochaska JO, Velicer WF, et al. Stages of acquisition and cessation for adolescent smoking: an empirical integration. *Addict Behav*. 1998;23(3):303-24.
116. Escobedo LG, Marcus SE, Holtzman D, et al. Sports participation, age at smoking initiation, and the risk of smoking among US high school students. *JAMA*. 1993;269(11):1391-5.
117. National Institutes of Health. Estimates of Funding for Various Research, Condition, and Disease Categories. Bethesda, MD: National Institutes of Health; 2011. Accessed at http://report.nih.gov/categorical_spending.aspx on 30 November 2012.
118. Wakefield MA, Chaloupka FJ, Kaufman NJ, et al. Effect of restrictions on smoking at home, at school, and in public places on teenage smoking: cross sectional study. *BMJ*. 2000;321(7257):333-7.
119. Kellam SG, Brown CH, Poduska JM, et al. Effects of a universal classroom behavior management program in first and second grades on young adult behavioral, psychiatric, and social outcomes. *Drug Alcohol Depend*. 2008;95(Suppl 1):S5-28.
120. Abroms LC, Padmanabhan N, Thaweethai L, et al. iPhone apps for smoking cessation: a content analysis. *Am J Prev Med*. 2011;40(3):279-85.
121. Abroms LC, Windsor R, Simons-Morton B. Getting young adults to quit smoking: a formative evaluation of the X-Pack Program. *Nicotine Tob Res*. 2008;10(1):27-33.
122. Strecher VJ, Shiffman S, West R. Randomized controlled trial of a web-based computer-tailored smoking cessation program as a supplement to nicotine patch therapy. Addiction. 2005;100(5):682-8.
123. Adelman WP, Duggan AK, Hauptman P, et al. Effectiveness of a high school smoking cessation program. *Pediatrics*. 2001;107(4):e50.
124. Ary DV, Biglan A, Glasgow R, et al. The efficacy of social-influence prevention programs versus "standard care": are new initiatives needed? *J Behav Med*. 1990;13(3):281-96.

125. Audrey S, Holliday J, Campbell R. It's good to talk: adolescent perspectives of an informal, peer-led intervention to reduce smoking. *Soc Sci Med*. 2006;63(2):320-34.
126. Aveyard P, Sherratt E, Almond J, et al. The change-in-stage and updated smoking status results from a cluster-randomized trial of smoking prevention and cessation using the transtheoretical model among British adolescents. *Prev Med*. 2001;33(4):313-24.
127. Baskerville B, Hotte A, Dunkley G. Evaluation of a High School Quit and Win Smoking Cessation Program. Ottawa, Ontario: University of Ottawa; 1993.
128. Beaglehole R, Brough D, Harding W, et al. A controlled smoking intervention programme in secondary schools. *N Z Med J*. 1978;87(610):278-80.
129. Biglan A, Glasgow R, Ary D, et al. How generalizable are the effects of smoking prevention programs? Refusal skills training and parent messages in a teacher-administered program. *J Behav Med*. 1987;10(6):613-28.
130. Bloor M, Frankland J, Langdon NP, et al. A controlled evaluation of an intensive, peer-led, schools-based, anti-smoking programme. *Health Educ J*. 1999;58(1):17-25.
131. Brown RA, Ramsey SE, Strong DR, et al. Effects of motivational interviewing on smoking cessation in adolescents with psychiatric disorders. *Tob Control*. 2003;12(Suppl 4): 3-10.
132. Chan CW, Witherspoon JM. Health risk appraisal modifies cigarette smoking behavior among college students. *J Gen Intern Med*. 1988;3(6):555-9.
133. Charlton A. Smoking cessation help for young people: the process observed in two case studies. *Health Educ Res*. 1992;7(2):249-57.
134. Cinnomin D, Sussman S. Unpublished study. In: Sussman S, Dent CW, Burton D, et al, eds. Developing School Based Tobacco Use Prevention and Cessation Programs. Thousand Oaks, CA: Sage Publications; 1995.
135. Coleman-Wallace D, Lee JW, Montgomery S, et al. Evaluation of developmentally appropriate programs for adolescent tobacco cessation. *J Sch Health*. 1999;69(8):314-9.
136. Connell AM, Dishion TJ, Yasui M, et al. An adaptive approach to family intervention: linking engagement in family-centered intervention to reductions in adolescent problem behavior. *J Consult Clin Psychol*. 2007;75(4):568-79.
137. Cullen KJ, Cullen AM. Long-term follow-up of the Busselton six-year controlled trial of prevention of children's behavior disorders. *J Pediatr*. 1996;129(1):136-9.
138. DiGuisto E. Pros and cons of cessation interventions for adolescent smokers at school. In: Richmond R, ed. Interventions for Smokers: An International Perspective. Baltimore: Williams & Wilkins; 1994.
139. Dino GA, Horn KA, Meit H. A pilot study of Not On Tobacco: a stop smoking programme for adolescents. *Health Educ*. 1998;98(6):230-41.
140. Dino G, Horn K, Goldcamp J, et al. A 2-year efficacy study of Not On Tobacco in Florida: an overview of program successes in changing teen smoking behavior. *Prev Med*. 2001;33(6):600-5.
141. Dino GA, Horn KA, Goldcamp J, et al. Statewide demonstration of Not On Tobacco: a gender-sensitive teen smoking cessation program. *J Sch Nurs*. 2001;17(2):90-7.
142. Dishion TJ, Andrews DW. Preventing escalation in problem behaviors with high-risk young adolescents: immediate and 1-year outcomes. *J Consult Clin Psychol*. 1995;63(4):538-48.
143. Elder JP, Perry CL, Stone EJ, et al. Tobacco use measurement, prediction, and intervention in elementary schools in four states: the CATCH Study. *Prev Med*. 1996;25(4):486-94.

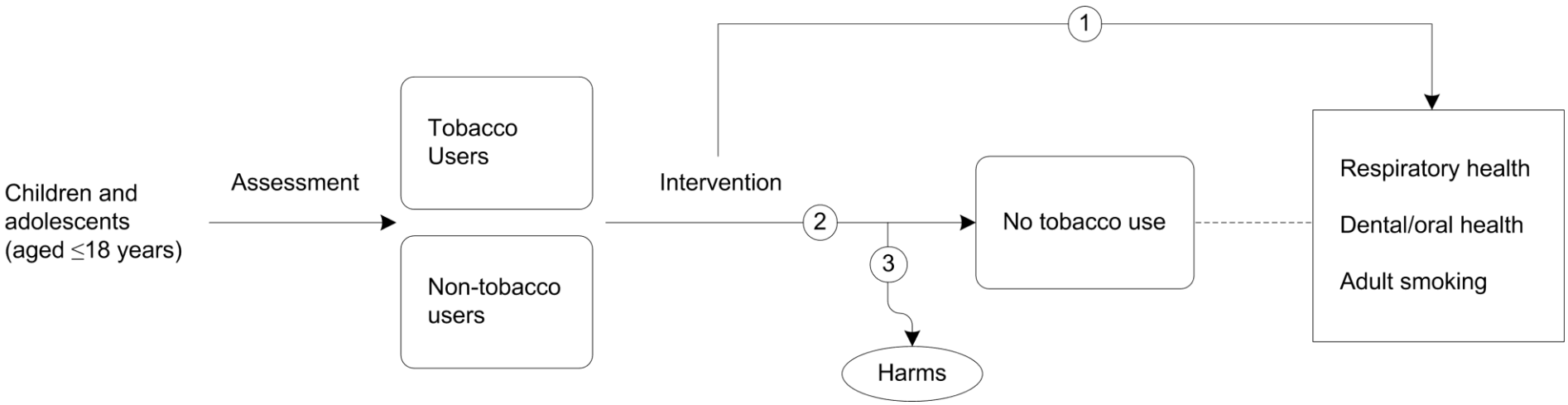
144. Etter JF, Ronchi A, Perneger T. Short-term impact of a university based smoke free campaign. *J Epidemiol Community Health*. 1999;53(11):710-5.
145. Forman SG, Linney JA, Brondino MJ. Effects of coping skills training on adolescents at risk for substance use. *Psychol Addict Behav*. 1990;4(2):67-76.
146. Forster JL, Murray DM, Wolfson M, et al. The effects of community policies to reduce youth access to tobacco. *Am J Public Health*. 1998;88(8):1193-8.
147. Glasgow RE, Strycker LA, Eakin EG, et al. Concern about weight gain associated with quitting smoking: prevalence and association with outcome in a sample of young female smokers. *J Consult Clin Psychol*. 1999;67(6):1009-11.
148. Greenberg JS, Deputat Z. Smoking intervention: comparing three methods in a high school setting. *J Sch Health*. 1978;48(8):498-502.
149. Hamilton G, Cross D, Resnicow K, et al. A school-based harm minimization smoking intervention trial: outcome results. *Addiction*. 2005;100(5):689-700.
150. Hancock L, Sanson-Fisher R, Perkins J, et al. The effect of a community action intervention on adolescent smoking rates in rural Australian towns: the CART Project. *Prev Med*. 2001;32(4):332-40.
151. Hoffman J, Nemes S, Weil J, et al. Evaluation of the ASCENT smoking cessation program for adolescents. *J Smok Cessat*. 2008;3(1):2-8.
152. Horn K, Dino G, Gao X, et al. Feasibility evaluation of Not On Tobacco: the American Lung Association's new stop smoking programme for adolescents. *Health Educ*. 1999;99(5):192-207.
153. Horn KA, Dino GA, Kalsekar ID, et al. Appalachian teen smokers: Not On Tobacco 15 months later. *Am J Public Health*. 2004;94(2):181-4.
154. Horn K, Dino G, Kalsekar I, et al. The impact of Not on Tobacco on teen smoking cessation. *J Adolesc Res*. 2005;20(6):640-61.
155. Horn K, McGloin T, Dino G, et al. Quit and reduction rates for a pilot study of the American Indian Not On Tobacco (N-O-T) program. *Prev Chronic Dis*. 2005;2(4):a13.
156. Horn K, Dino G, Hamilton C, et al. Efficacy of an emergency department-based motivational teenage smoking intervention. *Prev Chronic Dis*. 2007;4(1):a08.
157. Horswell L, Horton S. Telling Our Story: "PITS"—Pack In Those Smokes: A Team Support Group Quit Smoking Program. A report presented to the Community Action Initiatives Program, Tobacco Demand Reduction Strategy. Ottawa, Ontario: Health Canada; 1997.
158. Hotte A, Ellis E, Lindsay L, et al. Dissemination and Evaluation of the Quit-4-Life Cessation Program for Teenagers in Ottawa-Carleton High Schools. A report presented to the Community Action Initiatives Program, Tobacco Demand Reduction Strategy. Ottawa, Ontario: Health Canada; 1997.
159. Jason LA, Mollica M, Ferrone L. Evaluating an early secondary smoking prevention intervention. *Prev Med*. 1982;11(1):96-102.
160. Josendal O, Aaro LE, Bergh IH. Effects of a school-based smoking prevention program among subgroups of adolescents. *Health Educ Res*. 1998;13(2):215-24.
161. Kelly AB, Lapworth K. The HYP program: targeted motivational interviewing for adolescent violations of school tobacco policy. *Prev Med*. 2006;43(6):466-71.
162. Killen JD, Telch MJ, Robinson TN, et al. Cardiovascular disease risk reduction for tenth graders: a multiple-factor school-based approach. *JAMA*. 1988;260(12):1728-33.

163. Schoenberger Y, Kohler C, Kawamura Y. Relationship between session attendance and smoking related variables in students attending a smoking cessation program. Paper presented at: 11th Annual Meeting of the Society for Research on Nicotine and Tobacco; March 2005; Prague.
164. Knutsen SF, Knutsen R. The Tromso Survey: the family intervention study—the effect of intervention on some coronary risk factors and dietary habits, a 6-year follow-up. *Prev Med*. 1991;20(2):197-212.
165. Kohler CL, Schoenberger YM, Beasley TM, et al. Effectiveness evaluation of the N-O-T smoking cessation program for adolescents. *Am J Health Behav*. 2008;32(4):368-79.
166. Lazovich D, Ford J, Forster J, et al. A pilot study to evaluate a tobacco diversion program. *Am J Public Health*. 2001;91(11):1790-1.
167. Lipkus IM, McBride CM, Pollak KI, et al. A randomized trial comparing the effects of self-help materials and proactive telephone counseling on teen smoking cessation. *Health Psychol*. 2004;23(4):397-406.
168. Lotecka L, MacWhinney M. Enhancing decision behavior in high school "smokers." *Int J Addict*. 1983;18(4):479-90.
169. Moolchan ET, Robinson ML, Ernst M, et al. Safety and efficacy of the nicotine patch and gum for the treatment of adolescent tobacco addiction. *Pediatrics*. 2005;115(4):e407-14.
170. Murray DM, Prokhorov A, Harty KC. Effects of a statewide antismoking campaign on mass media messages and smoking beliefs. *Prev Med*. 1994;23(1):54-60.
171. Myers MG, Brown SA. A controlled study of a cigarette smoking cessation intervention for adolescents in substance abuse treatment. *Psychol Addict Behav*. 2005;19(2):230-3.
172. Nutbeam D, Macaskill P, Smith C, et al. Evaluation of two school smoking education programmes under normal classroom conditions. *BMJ*. 1993;306(6870):102-7.
173. Olds D, Henderson CR Jr, Cole R, et al. Long-term effects of nurse home visitation on children's criminal and antisocial behavior: 15-year follow-up of a randomized controlled trial. *JAMA*. 1998;280(14):1238-44.
174. Patten CA, Croghan IT, Meis TM, et al. Randomized clinical trial of an Internet-based versus brief office intervention for adolescent smoking cessation. *Patient Educ Couns*. 2006;64(1-3):249-58.
175. Pbert L, Osganian SK, Gorak D, et al. A school nurse-delivered adolescent smoking cessation intervention: a randomized controlled trial. *Prev Med*. 2006;43(4):312-20.
176. Perry C, Killen J, Telch M, et al. Modifying smoking behavior of teenagers: a school-based intervention. *Am J Public Health*. 1980;70(7):722-5.
177. Peterson AJ, Clark AW. Using group decision to reduce adolescent girls' smoking. *Psychol Rep*. 1986;58(1):179-85.
178. Peterson AV Jr, Kealey KA, Mann SL, et al. Group-randomized trial of a proactive, personalized telephone counseling intervention for adolescent smoking cessation. *J Natl Cancer Inst*. 2009;101(20):1378-92.
179. Quinlan KB, McCaul KD. Matched and mismatched interventions with young adult smokers: testing a stage theory. *Health Psychol*. 2000;19(2):165-71.
180. Reddy KS, Arora M, Perry CL, et al. Tobacco and alcohol use outcomes of a school-based intervention in New Delhi. *Am J Health Behav*. 2002;26(3):173-81.
181. Rigotti NA, DiFranza JR, Chang Y, et al. The effect of enforcing tobacco-sales laws on adolescents' access to tobacco and smoking behavior. *N Engl J Med*. 1997;337(15):1044-51.

182. Robinson LA, Vander Weg MW, Riedel BW, et al. "Start to stop": results of a randomised controlled trial of a smoking cessation programme for teens. *Tob Control*. 2003;12(Suppl 4): 26-33.
183. Rodgers A, Corbett T, Bramley D, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control*. 2005;14(4):255-61.
184. Salminen M, Vahlberg T, Ojanlatva A, et al. Effects of a controlled family-based health education/counseling intervention. *Am J Health Behav*. 2005;29(5):395-406.
185. Schinke SP, Schwinn TM, Di Noia J, et al. Reducing the risks of alcohol use among urban youth: three-year effects of a computer-based intervention with and without parent involvement. *J Stud Alcohol*. 2004;65(4):443-9.
186. Sherbot NA. The use of motivational enhancement therapy and the Quit 4 Life program as a means to facilitate adolescent smoking cessation. *Dissert Abstr Int B Sci Eng*. 2005;66(1-B):574.
187. Spoth RL, Redmond C, Shin C. Randomized trial of brief family interventions for general populations: adolescent substance use outcomes 4 years following baseline. *J Consult Clin Psychol*. 2001;69(4):627-42.
188. Spoth RL, Redmond C, Trudeau L, et al. Longitudinal substance initiation outcomes for a universal preventive intervention combining family and school programs. *Psychol Addict Behav*. 2002;16(2):129-34.
189. Stoddard AM, Fagan P, Sorensen G, et al. Reducing cigarette smoking among working adolescents: results from the SMART study. *Cancer Causes Control*. 2005;16(10):1159-64.
190. Storr CL, Ialongo NS, Kellam SG, et al. A randomized controlled trial of two primary school intervention strategies to prevent early onset tobacco smoking. *Drug Alcohol Depend*. 2002;66(1):51-60.
191. Suedfeld P, Landon PB, Pargament R, et al. An experimental attack on smoking. (Attitude manipulation in restricted environments, 3). *Int J Addict*. 1972;7(4):721-33.
192. Sussman S, Dent C, Burton D, et al, eds. Developing School-Based Tobacco Use Prevention and Cessation Programs. Thousand Oaks, CA: Sage Publications; 1995.
193. Sussman S, Dent CW, Lichtman KL. Project EX: outcomes of a teen smoking cessation program. *Addict Behav*. 2001;26(3):425-38.
194. Sussman S, Dent CW, Stacy AW. Project towards no drug abuse: a review of the findings and future directions. *Am J Health Behav*. 2002;26(5):354-65.
195. Sussman S, Miyano J, Rohrbach LA, et al. Six-month and one-year effects of project EX-4: a classroom-based smoking prevention and cessation intervention program. *Addict Behav*. 2007;32(12):3005-14.
196. Winkleby MA, Feighery E, Dunn M, et al. Effects of an advocacy intervention to reduce smoking among teenagers. *Arch Pediatr Adolesc Med*. 2004;158(3):269-75.
197. Woodruff SI, Conway TL, Edwards CC, et al. Evaluation of an Internet virtual world chat room for adolescent smoking cessation. *Addict Behav*. 2007;32(9):1769-86.
198. Wu Y, Stanton BF, Galbraith J, et al. Sustaining and broadening intervention impact: a longitudinal randomized trial of 3 adolescent risk reduction approaches. *Pediatrics*. 2003;111(1):e32-8.
199. Zack SL, Hoffman J, Nemes S, et al. Participation in a successful and multifaceted teen cessation program. Paper presented at: 2005 National Conference on Tobacco or Health; May 2005; Chicago.

200. Zavela KJ, Harrison LR, Owens S. Factors related to smokeless tobacco cessation in young adults. Poster presented at: 119th Meeting of the American Public Health Association; November 1991; Atlanta.
201. Zheng H, Sussman S, Chen X, et al. Project EX: a teen smoking cessation initial study in Wuhan, China. *Addict Behav*. 2004;29(9):1725-33.

Figure 1. Analytic Framework



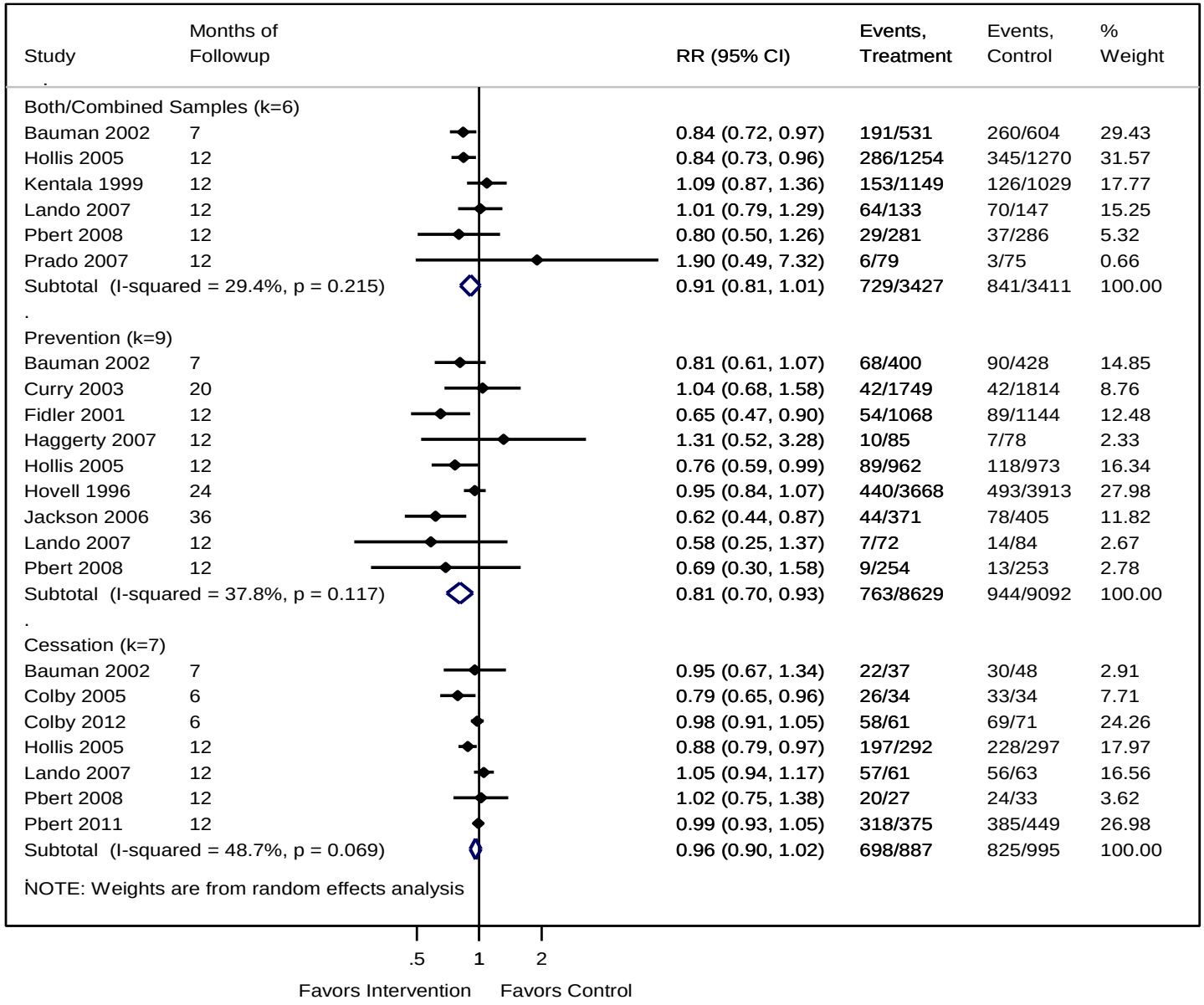
Key Questions (KQs)

KQ 1. Do interventions in primary care designed to prevent tobacco use or improve tobacco cessation rates in children and adolescents improve health outcomes in children and adolescents (i.e., respiratory health, dental/oral health) and reduce the likelihood of adult smoking?

KQ 2. Do interventions in primary care prevent tobacco use in children and adolescents or improve tobacco cessation rates in children and adolescents who use tobacco? What are elements of efficacious interventions? Are there differences in outcomes in different subgroups, as defined by age, sex, race, socioeconomic status, type or pattern of tobacco use, urban versus rural, depressed versus nondepressed?

KQ 3. What adverse effects are associated with interventions to improve tobacco cessation rates or prevent tobacco use in children and adolescents?

Figure 2. Forest Plot of Smoking for Intervention Group Compared With Control Group, Study Target Combined Prevention and Cessation, Prevention, or Cessation, All Behavioral Trials



Note: Due to the clustering adjustment, the denominators for Hovell,[81] Pbert,[79] and Pbert[80] and the subtotal denominators do not match what is reported in the text and tables.

Table 1. Percentage of Middle and High School Students Who Currently Use* Tobacco, by Product and School Level—National Youth Tobacco Survey, United States, 2009

School level	Any tobacco† % (95% CI)	Cigarettes % (95% CI)	Cigars % (95% CI)	Smokeless tobacco % (95% CI)	Pipes % (95% CI)	Bidis % (95% CI)	Kreteks % (95% CI)
Middle school	8.2 (7.2 to 9.2)	5.2 (4.3 to 6.1)	3.9 (3.4 to 4.4)	2.6 (2.0 to 3.2)	2.3 (1.8 to 2.8)	1.6 (1.2 to 2.0)	1.2 (0.9 to 1.5)
High school	23.9 (21.1 to 26.7)	17.2 (15.0 to 19.4)	3.7 (3.2 to 4.2)	10.9 (8.9 to 12.9)	2.9 (2.5 to 3.3)	2.4 (1.9 to 2.9)	2.4 (2.0 to 2.8)

* Current use of cigarettes was determined by asking, "During the past 30 days, on how many days did you smoke cigarettes?"; current use of cigars was determined by asking, "During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?; current use of smokeless tobacco was determined by asking, "During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip?"; current use of pipe was determined by asking, "During the past 30 days, on how many days did you smoke tobacco in a pipe?"; current use of bidis was determined by asking, "During the past 30 days, on how many days did you smoke bidis?"; current use of kreteks was determined by asking, "During the past 30 days, on how many days did you smoke kreteks?" Current use = use on ≥1 day.
† Any tobacco use = use of cigarettes, cigars, smokeless tobacco, tobacco pipes, bidis, or kreteks on at least 1 day in the past 30 days.

Table 2. Common Tobacco Use Measures

Tobacco use term	Common measures and definitions
Susceptible	Defined as the absence of a firm resolve to not smoke in the future. Operationally determined with three questions: 1) Do you think you will try a cigarette soon [yes/no]? 2) If one of your best friends were to offer you a cigarette, would you smoke it [definitely yes/probably yes/probably not/definitely not]? 3) Do you think you will be smoking 1 year from now [definitely yes/probably yes/probably not/definitely not]? Youths are susceptible if they answer "yes" to the first question or if they fail to answer "definitely not" to the second or third question, or if they had smoked a cigarette in the past 30 days
Experimentation	Often measured as ever smoking, even one or two puffs, or inferred from age at first smoking or youth's self-description of being an experimenter
Lifetime ("ever") use	Ever smoked, even one or two puffs
Former use	Ever smoked, but not in the past 30 days (some studies also use ever smoked, but not in the past year)
Current use	Any tobacco/cigarette use (even a puff) during the previous 30 days or 1 or more days in the past 30 days; this is also referred to as "monthly smoking" in some studies. Some studies consider current use to be in the past 7 or 90 days.
Daily smoking	Average of one or more cigarettes per day during the previous 30-day period
Frequent smoking	20 or more cigarettes in the past 30 days
Point prevalence abstinence	Not smoking at the point of followup; often measured as the past 7 or 30 days
Continuous abstinence	No smoking through the followup period, also referred to as "sustained" abstinence

Table 3. Included Studies by Group/Primary Outcome

Trial	Combined	Prevention	Cessation (Behavior)	Cessation (Bupropion)
	Prevalence	Initiation	Cessation	Cessation
Ausems 2002[85]		X		
Bauman 2002[86]	X	X	X	
Colby 2005[87]			X	
Colby 2012[104]			X	
Curry 2003[11]		X		
Fidler 2001[88]		X		
Gray 2011[89]				X
Haggerty 2007[90]		X		
Hollis 2005[91]	X	X	X	
Hovell 1996[81]		X		
Kentala 1999[93]	X			
Killen 2004[94]				X
Jackson 2006[92]		X		
Lando 2007[95]	X	X	X	
Muramoto 2007[96]				X
Pbert 2008[79]	X	X	X	
Pbert 2011[80]			X	
Prado 2007[97]	X			
Stevens 2002[98]	X			
Total Number of Studies	**7**	**10**	**7**	**3**

Table 4. Study Characteristics of Included Trials

Trial, Quality Rating	Focus	Location, Intervention Setting	IG N*	CG N*	Months to Followup	% Followup	Age Range (Mean), Years	% Female	% Nonwhite
Bauman 2002[86] Fair	Combined, Prevention, Cessation	U.S., home	658	658	7‡, 16	81.2	12–14 (13.9)	50.7	26.6
Hollis 2005[91] Good	Combined, Prevention, Cessation	U.S., medical office	1254	1272	12‡, 24	93.7	14–17 (15.4)	59.2	21.8
Kentala 1999[93] Fair	Combined	Finland, dental clinic	1348	1238	12‡, 24	84.2	NR (13.1)	49.0	NR
Lando 2007[95] Fair	Combined, Prevention, Cessation	U.S., dental clinic	175	169	12	65.4	14–17 (15.4)	52.0	19.0
Pbert 2008[79] Fair	Combined, Prevention, Cessation	U.S., pediatric clinic	1346	1365	6, 12‡	99.2	13–17 (16.9)	54.1	8.6
Prado 2007[97] Fair	Combined	U.S., home and community	91	84	12‡, 24, 36	88.0	NR (13.4)	53.7	100
Stevens 2002#[98] Good	Combined	U.S., pediatric office	1780	1331	12‡, 24, 36	95.5	NR (11.0)	48.3	NR
Ausems 2002#[85] Fair	Prevention	The Netherlands, home	871	793	6	91.5	NR (11.7)	50.6	NR
Curry 2003[11] Fair	Prevention	U.S., home (optional primary care)	2020	2006	20	88.5	10–12 (11.0)	52.0	NR
Fidler 2001[88] Fair	Prevention	United Kingdom, home	1456	1486	12	75.3	10–15 (NR)	55.3	NR
Haggerty 2007[90] Fair	Prevention	U.S., home (IG1), after school (IG2)†	IG1: 107 IG2: 118†	83	12‡, 24	92.5	NR (13.7)	48.6	50.8
Hovell 1996[81] Good	Prevention	U.S., orthodontic office	7149	7626	24	92.5	11–19 (14.4)	54.0	27.0
Jackson 2006[92] Fair	Prevention	U.S., home	426	447	36	87.5	7–8 (NR)	52.6	23.7
Colby 2005[87] Fair	Cessation	U.S., NR	43	42	6	80.0	12–19 (16.3)	61.0	45.0
Colby 2012[104] Fair	Cessation	U.S., NR	79	83	6	81.5	14-18 (16.2)	47.5	27.8
Pbert 2011[80] Good	Cessation	U.S., school health clinic	486	582	12	88.4	NR (16.9)	47.7	7.4
Killen 2004[94] Fair	Cessation (medication)	US, NR	103	108	6	63.5	15–18 (17.3)	31.3	49.8
Muramoto 2007[96] Fair	Cessation (medication)	U.S., research clinic	IG1: 105† IG2: 104	103	6	61.9	14–17 (16.0)	45.8	26.0

* Randomized.
† Intervention group utilized in the meta-analysis.
‡ Data from this followup point used.
§ Calculated based on presented data.
‖ Calculated based on data requested from the author.
¶ Includes "experimenters," smokers, and recent quitters/former smokers.
# Study not included in meta-analysis.

Abbreviations: CG = control group; IG = intervention group; N = number; NR = not reported; U.S. = United States.

Table 5. Intervention Characteristics of Included Trials

Trial	Focus	Targeted According to Smoking Status (Y/N)	Included Multiple Behaviors (Y/N)	Person Targeted (Youth, Parent, Both)	Role of PC	Mode of Intervention	Duration of Intervention	Estimated Hours of Contact With Interventionist	Included Group Sessions (Y/N)	Included MI (Y/N)	Control Group Description
Bauman 2002[86]	Combined, Prevention, Cessation	N	Y	Parent	None	Phone, print	15 weeks	0.96	N	N	Not described
Hollis 2005[91]	Combined, Prevention, Cessation	Y	N	Youth	Conducted in PC, provider delivered part	Face, computer	1 visit + 2 booster sessions within 12 months	0.25	N	Y	Attention control
Kentala 1999[93]	Combined	Y	N	Youth	Conducted in dental, provider delivered most	Face	1 visit	0.08	N	N	Usual care
Lando 2007[95]	Combined, Prevention, Cessation	Y	N	Youth	Conducted in dental, provider delivered part	Face, phone	1 visit + 3–6 booster calls within 6 months	1.2	N	Y	Low intensity
Pbert 2008[79]	Combined, Prevention, Cessation	Y	N	Youth	Conducted in PC, provider delivered part	Face, phone	1 visit + 4 booster calls over 21 weeks	1.1	N	Y	Usual care
Prado 2007[97]	Combined	N	Y	Parent	None	Face	12 months	49	Y	N	Attention control
Stevens 2002[98]	Combined	N	Y	Both	Conducted in PC, provider delivered part	Face, phone, print	36 months	NR	N	N	Attention control
Ausems 2002[85]	Prevention	Y	N	Youth	None	Print	9 weeks	0	N	N	Not described
Curry 2003[11]	Prevention	Y	N	Both	Recruitment only, optional PC	Print, phone	6 weeks + 1 booster call within 14 months	NR	N	N	Usual care
Fidler 2001[88]	Prevention	Y	N	Youth	Recruitment only	Print	12 months	0	N	N	Usual care
Haggerty 2007[90]	Prevention	Y	Y	Both	None	Face	7 weeks	15.5	Y	N	No interaction
Hovell 1996[81]	Prevention	Y	N	Youth	Conducted in dental, provider delivered most	Face, print	2 years	NR	N	N	Usual care
Jackson 2006[92]	Prevention	Y	N	Both	None	Print	10 weeks + 1 booster guide within 12 months	0	N	N	Low intensity
Colby 2005[87]	Cessation	Y	N	Youth	Recruitment only	Face, phone, print	1 visit + 1 booster call within 1 week	0.875	N	Y	Low intensity
Colby 2012[104]	Cessation	Y	N	Both	Recruitment only	Face, phone, print	1 visit + 1 booster call within 1 week + 1 parent discussion	1.25	N	Y	Low intensity
Pbert 2011[80]	Cessation	Y	N	Youth	None	Face	4 weeks	1.5	N	N	Low intensity
Killen 2004[94]	Cessation (Medication)	Y	N	Youth	None	Face	10 weeks	7.5	Y	N	Placebo
Muramoto 2007[96]	Cessation (Medication)	Y	N	Youth	None	Face	7 weeks	2.25	N	N	Placebo

Abbreviations: Face = face-to-face; MI = motivational interviewing; NR = not reported; PC = primary care.

Table 6. Measurement of Tobacco Use

Study	Focus	Smoking-Related Eligibility Criteria	Primary Smoking Outcome	N Analyzed	Biochemical Measures	Additional Tobacco-Related Measures
Bauman 2002[86]	Combined	None	% of full sample reporting ever smoking (even one puff) at posttest	1,135	None	Ever use of chewing tobacco or snuff
Hollis 2005[91]	Combined	None	% of full sample reporting smoking ≥1 cigarettes in the past 30 days at posttest†	2,524	None	30-day use of cigarettes, cigars, pipes, and chewing tobacco; susceptibility; stage of acquisition; stage of cessation
Kentala 1999[93]	Combined	None	% of full sample reporting ever smoking (assumed) at posttest	2,178	None	Ever use of chewing tobacco or snuff; number of cigarettes smoked per day; number of cigarettes smoked per week
Lando 2007[95]	Combined	Included those who smoked in previous 30 days, were former smokers (smoked in past, not past 30 days), or nonsmokers with an inclination to start (i.e., "susceptible smokers")	% of full sample reporting smoking in past 30 days	280	None	None
Pbert 2008[79]	Combined	None	% of smokers (smoke "occasionally or regularly") and nonsmokers (never smoked or 1–2 puffs but not in the past year) not abstinent at posttest (specific measure NR)	2,478	Patients were shown a CO monitor and told it might be used to confirm their self-reported smoking status	None
Prado 2007[97]	Combined	None	% of full sample reporting smoking in the past 90 days at posttest	154	None	None
Stevens 2002[98]	Combined	None	% of full sample reporting ever smoked at posttest	3,070	None	Ever use of smokeless tobacco
Ausems 2002[85]	Prevention	None	% of baseline nonsmokers (not even one puff) reporting ever smoking or smoking in the past 30 days at posttest	912	None	Intention to smoke
Bauman 2001[100]	Prevention	None	% of baseline nonsmokers (not ever smoking, even one puff) reporting ever smoking (even one puff) at posttest	828	None	Ever use of chewing tobacco or snuff
Curry 2003[11]	Prevention	None	% of full sample* reporting smoking (even a puff) in past 30 days at posttest	3,552	None	Susceptibility; experimenting (ever smoking)
Fidler 2001[88]	Prevention	Excluded those who smoked one or more cigarette a week	% of full sample reporting "starting to smoke" at posttest (specific measure NR)	2,212	None	None
Haggerty 2007[90]	Prevention	None	% of baseline nonsmokers (specific measure NR) reporting initiating smoking postintervention (specific measure NR)	241	None	None
Hollis 2005[91]	Prevention	None	% of baseline nonsmokers (no smoking in past 30 days) reporting smoking ≥1 cigarettes in the past 30 days at posttest†	1,935	None	30-day use of cigarettes, cigars, pipes, and chewing tobacco; susceptibility; stage of acquisition; stage of cessation
Hovell 1996[81]	Prevention	None	% of baseline nonusers (no 30-day tobacco use or having ever used tobacco more than 100 times)‡ reporting tobacco use in the past 30 days at posttest	14,775	None	Ever used any form of tobacco more than 100 times

Table 6. Measurement of Tobacco Use

Study	Focus	Smoking-Related Eligibility Criteria	Primary Smoking Outcome	N Analyzed	Biochemical Measures	Additional Tobacco-Related Measures
Jackson 2006[92]	Prevention	Excluded ever smokers, even one puff	% of full sample reporting ever smoking (even a puff) at posttest	776	None	None
Lando 2007[95]	Prevention	Included those who smoked in previous 30 days, were former smokers (smoked in past, not past 30 days), or nonsmokers with an inclination to start (i.e., "susceptible smokers")	% of baseline nonsmokers (never smoked but susceptible) and baseline former smokers (ever smoked, but not in past 30 days) reporting smoking in the past 30 days at posttest	156	None	None
Pbert 2008[79]	Prevention	None	% of baseline nonsmokers (never smoked or 1–2 puffs but not in the past year) abstinent at posttest (specific measure NR)	2,216	Patients were shown a CO monitor and told it might be used to confirm their self-reported smoking status	None
Bauman 2000[99]	Cessation	None	% of baseline smokers (≥1 days in the past 30 days) reporting having smoked ≥1 days in past 30 days at posttest	85	None	Ever use of chewing tobacco or snuff; average number of days smoked in past 30 days
Colby 2005[87]	Cessation	Included only those who reported daily smoking for the past 30 days	% of full sample reporting 7-day abstinence at posttest	68	Expired CO level; saliva cotinine level	Average cigarettes per day
Colby 2012[104]	Cessation	Included those who reported smoking at least once per week in the past 30 days	% of full sample reporting 7-day abstinence and biochemically confirmed expired CO <9 ppm and saliva cotinine <14 ng/mL	132	Expired CO and saliva cotinine levels	None
Hollis 2005[91]	Cessation	None	% of baseline smokers (smoking ≥1 cigarettes in the past 30 days) reporting smoking ≥1 cigarettes in the past 30 days at posttest†	589	None	30-day use of cigarettes, cigars, pipes, and chewing tobacco; susceptibility; stage of acquisition; stage of cessation
Lando 2007[95]	Cessation	Included those who smoked in previous 30 days, were former smokers (smoked in past, not past 30 days), or nonsmokers with an inclination to start (i.e., "susceptible smokers")	% of baseline smokers (smoked in past 30 days) reporting smoking in past 30 days at posttest	124	None	None
Pbert 2008[79]	Cessation	None	% of baseline smokers (smoke "occasionally or regularly") abstinent at posttest (specific measure NR)	262	Patients were shown a CO monitor and told it might be used to confirm their self-reported smoking status	None
Pbert 2011[80]	Cessation	Included those who reported smoking in past 30 days and were interested in quitting in next 2 weeks	% full sample reporting 30-day abstinence at posttest	1,068	Saliva cotinine level (secondary analysis among those reporting 3-day abstinence)	Number of cigarettes smoked per day and number of smoking days
Killen 2004[94]	Cessation (Medication)	Included those who currently smoked at least 10 cigarettes per day, smoked for at least 6 months, had made one or more failed attempts to quit, and scored ≥10 on the mFTQ	% of full sample reporting 7-day abstinence (not even a puff) and biochemically confirmed saliva cotinine level <20 ng/mL at posttest	134	Saliva cotinine level	Number of cigarettes smoked per day

Table 6. Measurement of Tobacco Use

Study	Focus	Smoking-Related Eligibility Criteria	Primary Smoking Outcome	N Analyzed	Biochemical Measures	Additional Tobacco-Related Measures
Muramoto 2007[96]	Cessation (Medication)	Included those who reported smoking at least 6 cigarettes per day, had an exhaled CO level ≥10 ppm, and had at least 2 previous quit attempts and were motivated to quit; excluded those using other tobacco products	% of baseline smokers (≥6 cigarettes per day, exhaled CO level ≥10 ppm, ≥2 previous quit attempts, and were motivated to quit) reporting 7-day abstinence at posttest	122	Expired CO level (secondary analysis)	30-day prolonged abstinence

* An estimated 1.2% of the sample had smoked in the past 30 days at baseline.
† Originally reported as the percentage of participants reporting no smoking; reversed for consistency.
‡ Tobacco use includes the use of cigarettes, pipes, cigars, or smokeless tobacco.
§ Baseline ever smokers are not included in this analysis.

Abbreviations: CO = carbon monoxide; Face = face-to-face; mFTQ = modified Fagerström Tolerance Questionnaire; MI = motivational interviewing; NA = not applicable; PC = primary care.

Table 7. Results of Interventions, Combined Primary Prevention and Cessation

Study	Targeted Multiple Behaviors (Y/N)	Person Targeted (Youth, Parent, Both)	Role of Primary Care	Mode of Intervention	Months to Followup	Primary Outcome Measure	% Smoking at BL, IG†	% Smoking at BL, CG†	% Smoking at Followup, IG‡	% Smoking at Followup, CG‡	Relative Risk (95% CI)	Quality Rating, Main Quality Concerns
Bauman 2002[86]	Y	Parent	None	Phone, print	7	Ever smoked even 1 puff of a cigarette	19.3§	24.8§	36.0	43.0	0.84 (0.72 to 0.97)	Fair, randomization methods NR; blinding of outcomes assessment uncertain; retention <90% in CG; baseline differences between groups not presented (although controlled for in analysis)
Hollis 2005[91]	N	Youth	Conducted in PC, provider delivered part	Face, computer	12	Smoked ≥1 cigarettes in the past 30 days	23.3‖	23.4‖	22.8	27.2	0.84 (0.73 to 0.96)	Good, no concerns
Kentala 1999[93]	N	Youth	Conducted in dental, provider delivered most	Face	12	NR (ever smoked assumed)	5.5	6.0	13.3	12.2	1.09 (0.87 to 1.36)	Fair, no description of how smoking was measured or defined; randomization based on birth date, so allocation concealment and outcomes assessment unlikely to be blind; retention <90% in both groups; NR proportion received intervention; smokers more likely to drop out
Lando 2007[95]	N	Youth	Conducted in dental, provider delivered part	Face, phone	12	Smoked in past 30 days	34.9§	37.3§	48.1	47.6	1.01 (0.79 to 1.29)	Fair, retention <70% in both groups; allocation concealment and blinding of outcome assessment NR; no information on baseline comparability; poor adherence to intervention; ITT only among current smokers
Pbert 2008[79]	N	Youth	Conducted in PC, provider delivered part	Face, phone	12	Smoked occasionally or regularly	8.7	10.6	9.4	11.7	0.80 (0.50 to 1.26)	Fair, detail about how random number generated NR; allocation concealment and blinding of outcomes assessment NR
Prado 2007[97]	Y	Parent	None	Face	12	Smoked cigarettes in past 90 days	3.3	1.2	7.6	4.0	1.90 (0.49 to 7.32)	Fair, participant adherence NR (e.g., number of sessions attended); retention <90% in all groups
Stevens 2002*[98]	Y	Both	Conducted in PC, provider delivered part	Face, phone, print	12	Ever smoked (specific measure NR)	5.3§	4.5§	NR	NR	NR**	Good, blinding of outcome assessors NR

* Not included in meta-analysis.
† Among those randomized.
‡ Among those analyzed at followup.
§ Calculated based on presented data.
‖Calculated based on data requested from the author.
** The adjusted odds ratio for having ever smoked for the intervention group compared with the control group was 1.05 (95% CI, 0.80 to 1.39).

Abbreviations: BL = baseline; CG = control group; CI = confidence interval; Face = face-to-face; IG = intervention group; ITT = intention to treat; NR = not reported; OR = odds ratio; PC = primary care.

Table 8. Results of Interventions, Prevention Interventions

Study	Person Targeted (Youth, Parent, Both)	Role of Primary Care	Mode of Intervention	Months to Followup	Primary Outcome Measure	% Initiating Smoking at Followup, IG	% Initiating Smoking at Followup, CG	Relative Risk (95% CI)	Quality Rating, Main Quality Concerns
Ausems 2002[85]	Youth	None	Print	6	Ever smoked even 1 puff of a cigarette or smoked in past 30 days	10.4†	18.0†	NR†	Fair, randomization methods and allocation concealment NR; eligibility criteria not specified
Bauman 2001[100]	Parent	None	Phone, print	7	Ever smoked even 1 puff of a cigarette	17.0	21.0	0.81 (0.61 to 1.07)	Fair, randomization methods NR; blinding of outcomes assessment uncertain; retention <90% in CG; baseline differences between groups not presented (although controlled for in analysis)
Curry 2003[11]	Both	Recruitment only	Phone, print	20	Smoked in past 30 days	2.4‡	2.3‡	1.04 (0.68 to 1.58)	Fair, randomization methods uncertain; retention <90% in IG; among assessment cohort, more children in the IG than CG report smoking in prior 30 days; smokers included in randomization
Fidler 2001[88]	Youth	Recruitment only	Print	12	"Started to smoke" postbaseline	5.1	7.8	0.65 (0.47 to 0.90)	Fair, randomization based on birth date; allocation likely not concealed; relatively high attrition with completers analysis only; no information on baseline comparability; no measure of adherence to intervention; smokers included in randomization
Haggerty 2007[90]	Both	None	Face	12	"Started to smoke" postintervenetion	11.8§	9.0§	1.31 (0.52 to 3.28)	Fair, randomization methods, allocation concealment, blinding of outcome assessors NR; smokers included in randomization
Hollis 2005[91]	Youth	Conducted in PC, provider delivered part	Face, computer	12	Smoked ≥1 cigarettes in past 30 days	9.3	12.1	0.76 (0.59 to 0.99)	Good, no concerns
Hovell 1996[81]	Youth	Conducted in dental, provider delivered most	Face, print	24	Used tobacco* in past 30 days	12.0‖	12.6‖	0.95 (0.84 to 1.07)	Good, randomization methods and allocation concealment uncertain
Jackson 2006[92]	Both	None	Print	36	Ever smoked even 1 puff	11.9	19.3	0.62 (0.44 to 0.87)	Fair, randomization methods and allocation concealment NR; do not report baseline values for all youth randomized; do not present number randomized to each group; adherence to intervention unknown
Lando 2007[95]	Youth	Conducted in dental, provider delivered part	Face, phone	12	Smoked in past 30 days	9.7	16.7	0.58 (0.25 to 1.37)	Fair, retention <70% in both groups; allocation concealment and blinding of outcome assessment NR; no information on baseline comparability; poor adherence to intervention; ITT only among current smokers
Pbert 2008[79]	Youth	Conducted in PC, provider delivered part	Face, phone	12	Smoked occasionally or regularly	3.2	4.5	0.69 (0.30 to 1.58)	Fair, detail about how random number generated NR; allocation concealment and blinding of outcomes assessment NR

* Tobacco use includes the use of cigarettes, pipes, cigars, or smokeless tobacco.
† The number of baseline nonsmokers and the number of children initiating smoking at followup were not reported. The percentage of children initiating smoking at followup (as reported in the article) were 10.4% (95% CI, 6.9% to 14.0%) in the intervention group and 18.1% (95% CI, 12.5% to 23.7%) in the control group.
‡ Among the assessment cohort (n=492), 2.5% of the IG and 0% of the CG reported smoking in the past 30 days at baseline. Author does not report whether baseline smokers were included in the followup,
§ At baseline, 22.0% of the IG and 21.7% of the CG reported smoking at baseline; these individuals were excluded from the analysis at followup.
‖ Baseline smokers were excluded from the analysis (specific numbers not reported).

Abbreviations: CG = control group; CI = confidence interval; Face = face-to-face; IG = intervention group; ITT = intention to treat; NR = not reported; PC = primary care.

Table 9. Results of Interventions, Cessation Interventions

Study	Role of Primary Care	Mode of Intervention	Months to Followup	Definition of Smoker at Baseline	Primary Outcome Measure	% Smoking at Followup, IG	% Smoking at Followup, CG	% Quitting at Followup, IG	% Quitting at Followup, CG	Relative Risk (95% CI)	Quality Rating, Main Quality Concerns
Bauman 2000[99]	None	Phone, print	7	Smoked ≥1 days in past 30 days	Smoked ≥1 days in past 30 days	59.5	62.5	40.5	37.5	0.95 (0.67 to 1.34)	Fair, randomization methods NR; blinding of outcomes assessment uncertain; retention <90% in CG; baseline differences between groups not presented (although controlled for in analysis)
Colby 2005[87]	Recruitment only	Face, phone, print	6	Daily smoking for the past 30 days	Smoked in past 7 days	76.5	97.1	23.5	2.9	0.79 (0.65 to 0.96)	Fair, randomization methods and allocation concealment NR; followup not presented by group (although states there were no significant differences); overall retention only 80% with completers-only analysis; possible selective reporting
Colby 2012[104]	Recruitment only	Face, phone, print	6	Smoked ≥1 time a week for past 30 days	Smoked in past 7 days	95.1	97.2	4.9	2.8	0.98 (0.91 to 1.05)	Fair, CO levels higher among IG participants than CG participants at baseline; retention <80% in IG; overall retention 81.5%
Hollis 2005[91]	Conducted in PC, provider delivered part	Face, computer	12	Smoked ≥1 cigarettes in past 30 days	Smoked ≥1 cigarettes in past 30 days	67.5*	76.8*	32.5*	23.2*	0.88 (0.79 to 0.97)	Good, no concerns
Lando 2007[95]	Conducted in dental, provider delivered part	Face, phone	12	Smoked in past 30 days	Smoked in past 30 days	93.4	88.9	6.6	11.1	1.05 (0.94 to 1.17)	Fair, low retention overall, very low in some subgroups; allocation concealment and blinding of outcome assessment NR; no information on baseline comparability; poor adherence to intervention; ITT only among current smokers
Pbert 2008[79]	Conducted in PC, provider delivered part	Face, phone	12	Smoked occasionally or regularly	Smoked occasionally or regularly	74.4	72.4	25.6	27.6	1.02 (0.75 to 1.38)	Fair, detail about how random number generated NR; allocation concealment and outcomes assessment NR
Pbert 2011[80]	None	Face	12	Smoked in past 30 days and interested in quitting in next 2 weeks	Smoked in past 30 days	84.8	85.7	15.2	14.3	0.99 (0.93 to 1.05)	Good, followup slightly below 90%; IG significantly more likely to want to quit at baseline
Killen 2004[94] (Med)	None	Face	6	Smoked ≥10 cigarettes per day, smoked ≥6 months, had made one or more failed quit attempts, and scored ≥10 on mFTQ	Smoked in past 7 days and biochemically confirmed saliva cotinine level <20 ng/mL	87.5	90.0	12.5	10.0	0.97 (0.86 to 1.10)	Fair, randomization methods NR; very low compliance; retention <70% in both groups but conservative methods for handling missing data
Muramoto 2007[96] (Med)	None	Face	6	Smoked ≥6 cigarettes per day, had an exhaled CO level ≥10 ppm, and had at least 2 previous quit attempts and motivated to quit; excluded those using other tobacco products	Smoked in past 7 days	93.8	89.7	6.3	10.3	1.05 (0.94 to 1.16)	Fair, retention <70% in all groups; intervention adherence NR; baseline differences between IG and CG in previous quit attempts and amount smoked; unclear analysis and data substitution

* Includes self-described experimenters and smokers.

Abbreviations: CG = control group; CI = confidence interval; CO = carbon monoxide; Face = face-to-face; IG = intervention group; ITT = intention to treat; Med = medication; NR = not reported; mFTQ = modified Fagerström Tolerance Questionnaire; PC = primary care.

Table 10. Bupropion Harms Summary Table

Trial	N Randomized	Participants	Daily Dose, Duration	Adverse Effects Summary
Muramoto 2007[96]	IG1: 105 IG2: 104 CG: 103	Ages 14–17 years smoking at least 6 cigarettes per day, recruited through media and from multiple other sources	IG1: 150 mg IG2: 300 mg 6 weeks	Discontinued medication due to adverse effects/concerns: IG: 3.8% (specific complaints were feeling depressed, irritable, or angry; sleep disturbance; headache; urticaria; anxiety; heart palpitations; suicide attempt; anticholinergic crisis related to recreational drug use; and pregnancy) CG: NR No group differences in throat symptoms, sleep disturbance, nausea (only reported adverse events that were reported by at least 4% of participants). Greater proportion of CG reported headache, cough than IG.
Killen 2004[94]	IG: 103 CG: 108	Ages 18 years and younger smoking at least 10 cigarettes per day with ≥1 previous quit attempts, recruited from high schools	150 mg 9 weeks (plus both groups used nicotine patch)	Proportion discontinuing bupropion or placebo due to adverse effect NR. Adverse events warranting followup with study staff: IG: 22 CG: 25 0 events judged severe No group differences in blood pressure, heart rate, 10 other specific adverse effects or "other" adverse effects.
Gray 2011[89]	IG: 73 CG: 61	Ages 12–21 years smoking at least 5 cigarettes per day and interested in quitting, recruited through media and schools/universities	300 mg 6 weeks	Discontinued medication due to adverse effects: IG: 4.1% CG: 4.9% Any adverse effect: IG: 64% CG: 48% (*p*=0.05) Reports of dream disturbance only in IG (n=9); other adverse events most commonly reported were headache, insomnia, and irritability; unclear if greater frequency in IG than CG

Abbreviations: CG = control (placebo) group; IG = intervention group; N = number; NR = not reported.

Table 11. Summary of Evidence for Benefits and Harms of Tobacco Use Interventions

Outcome	Intervention Type Specific Outcome (if applicable)	Trials, *n*	Quality Ratings	Summary of Findings
Health*	NA	0	NA	No trials assessed health outcomes
Behavior	*Behavior-based interventions* Smoking prevalence: combined nonsmokers and smokers	7†	Good: 2 Fair: 5	12 months of followup: Pooled absolute RD, −0.02 (95% CI, −0.05 to 0.01); I^2 = 57.6%; k = 6; *n* = 8,749 Range of effects: smoking prevalence rates 7 percentage points lower to 4 percentage points higher in the intervention group Pooled relative RR, 0.91 (95% CI, 0.81 to 1.01); I^2 = 29.4%
	Behavior-based interventions Smoking initiation: prevention among nonsmokers	10	Good: 2 Fair: 8	6 to 36 months of followup: Pooled absolute RD, −0.02 (95% CI, −0.03 to 0.00); I^2 = 57.1%; k = 9; *n* = 26,624 Range of effects: initiation rates 8 percentage points lower to 3 percentage points higher in the intervention group Pooled relative RR, 0.81 (95% CI, 0.70 to 0.93); I^2 = 37.8%
	Behavior-based interventions Smoking cessation: cessation among smokers	7	Good: 2 Fair: 5	6 to 12 months of followup: Pooled absolute RD, −0.04 (95% CI, −0.09 to 0.01); I^2 = 46.1%; k = 7; *n* = 2,328 Range of effects: quit rates 21 percentage points higher to 5 percentage points lower in the intervention group Pooled relative RR, 0.96 (95% CI, 0.90 to 1.02); I^2 = 48.7% Lack of effect may reflect limited number of studies targeting regular, established smokers
	Bupropion interventions Smoking cessation	2	Fair: 2	No statistically significant benefit of bupropion at 6 months
Harms	Behavior-based interventions	0	NA	No trials explicitly reported on harms of behavior-based interventions
	Bupropion interventions	3	Fair: 3	Mixed results

* Health outcomes included child respiratory health, dental/oral health, and subsequent rates of adult smoking.
† Four of these trials were also included in the behavior-based smoking initiation and cessation categories (i.e., the categories are not mutually exclusive).

Abbreviations: CI = confidence interval; NA = not applicable; RD = risk difference; RR = risk ratio.

Appendix A. Original Search Strategies

Key

/ = MeSH (MEDLINE) subject heading
ti = word in title
ab = word in abstract
* = truncation
adj = adjacent
adj# = adjacent within x number of words
pt = publication type
fs = MeSH subheading
hw = word in subject heading (PsycINFO)
id = key concept (PsycINFO)

Smoking Cessation in General

Ovid MEDLINE Without Revisions 1996 to June Week 2 2011,* Ovid MEDLINE Daily Update June 15, 2011, Ovid MEDLINE In-Process and Other Nonindexed Citations June 15, 2011

#	Searches	Results
1	smoking cessation/	13813
2	"Tobacco Use Disorder"/	5208
3	tobacco.ti,ab.	38831
4	smoking.ti,ab.	84323
5	cigarette*.ti,ab.	25508
6	3 or 4 or 5	113276
7	cessation.ti,ab.	27297
8	quit*.ti,ab.	51398
9	"stop*".ti,ab.	50675
10	7 or 8 or 9	122072
11	6 and 10	16487
12	1 or 2 or 11	23682
13	adolescent/ or child/	887220
14	children.ti,ab.	336279
15	adolescen*.ti,ab.	91418
16	child.ti,ab.	109223
17	childhood.ti,ab.	79525
18	teen*.ti,ab.	11300
19	youth*.ti,ab.	22371
20	13 or 14 or 15 or 16 or 17 or 18 or 19	1048657
21	12 and 20	5711
22	(clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.	389844
23	clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/	137571
24	clinical trial*.ti,ab.	126298
25	(control* adj3 trial*).ti,ab.	88513
26	random*.ti,ab.	418740
27	placebo*.ti,ab.	87129
28	22 or 23 or 24 or 25 or 26 or 27	796180
29	21 and 28	1181
30	limit 29 to english language	1115
31	limit 30 to yr="2009 -Current"	263

* Search results were updated January 31, 2012.

PsycINFO 2002 to June Week 2 2011,* via Ovid

#	Searches	Results
1	tobacco.ti,ab,hw,id.	13110
2	smoking.ti,ab,hw,id.	17136
3	cigarette*.ti,ab,hw,id.	5912
4	1 or 2 or 3	19512

5	cessation.ti,ab,hw,id.	7153
6	quit*.ti,ab,hw,id.	13902
7	"stop*".ti,ab,hw,id.	7199
8	5 or 6 or 7	24953
9	4 and 8	6467
10	(adolescence 13 17 yrs or school age 6 12 yrs).ag.	145956
11	(child$ or adolescen$ or teen$ or youth$).ti,ab,hw,id.	219211
12	10 or 11	266560
13	9 and 12	1441
14	experiment controls/	266
15	controlled trial$.ti,ab,id,hw.	11159
16	clinical trial$.ti,ab,id,hw.	12933
17	random$.ti,ab,id,hw.	56753
18	meta analy*.ti,ab,hw,id.	8372
19	metaanaly*.ti,ab,hw,id.	177
20	placebo*.ti,ab,id,hw.	12091
21	14 or 15 or 16 or 17 or 18 or 19 or 20	75404
22	13 and 21	233
23	limit 22 to english language	230
24	limit 23 to yr="2009 -Current"	56

* Search results were updated January 31, 2012.

Smoking Cessation Pharmacotherapy

Ovid MEDLINE Without Revisions 1996 to June Week 2 2011,* Ovid MEDLINE Daily Update June 15, 2011, Ovid MEDLINE In-Process and Other Nonindexed Citations June 15, 2011

#	Searches	Results
1	smoking cessation/	13813
2	"Tobacco Use Disorder"/	5208
3	tobacco.ti,ab.	38831
4	smoking.ti,ab.	84323
5	cigarette*.ti,ab.	25508
6	3 or 4 or 5	113276
7	cessation.ti,ab.	27297
8	quit*.ti,ab.	51398
9	"stop*".ti,ab.	50675
10	7 or 8 or 9	122072
11	6 and 10	16487
12	1 or 2 or 11	23682
13	(administration dosage or drug effects or drug therapy or pharmacology).fs.	2065538
14	Bupropion/	1665
15	Nicotinic Agonists/	4433
16	Bupropion.ti,ab.	2011
17	Zyban.ti,ab.	108
18	varenicline.ti,ab.	461
19	Chantix.ti,ab.	26
20	nicotine replacement*.ti,ab.	1565
21	nrt.ti,ab.	870
22	pharmacotherap*.ti,ab.	13750
23	pharmacologic*.ti,ab.	108055
24	13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	2112112
25	12 and 24	6301

Appendix A. Original Search Strategies

26	"Tobacco Use Disorder"/dt [Drug Therapy]	574
27	25 or 26	6301
28	adolescent/ or child/	887220
29	children.ti,ab.	336279
30	adolescen*.ti,ab.	91418
31	child.ti,ab.	109223
32	childhood.ti,ab.	79525
33	teen*.ti,ab.	11300
34	youth*.ti,ab.	22371
35	28 or 29 or 30 or 31 or 32 or 33 or 34	1048657
36	27 and 35	865
37	(clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.	389844
38	case-control studies/ or retrospective studies/ or cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/	854724
39	clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/	137571
40	clinical trial*.ti,ab.	126298
41	(control* adj3 trial*).ti,ab.	88513
42	random*.ti,ab.	418740
43	placebo*.ti,ab.	87129
44	case control*.ti,ab.	47703
45	cohort.ti,ab.	144411
46	longitudinal.ti,ab.	75788
47	follow up.ti,ab.	348066
48	followup.ti,ab.	9614
49	prospective*.ti,ab.	261358
50	retrospective*.ti,ab.	227199
51	comparison group*.ti,ab.	6979
52	control group*.ti,ab.	161396
53	observational.ti,ab.	45221
54	nonrandom*.ti,ab.	8318
55	database*.ti,ab.	120808
56	population*.ti,ab.	602047
57	37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56	2325589
58	36 and 57	539
59	limit 58 to english language	507
60	limit 59 to yr="2009 -Current"	131

* Search results were updated January 31, 2012.

PsycINFO 2002 to June Week 2 2011,* via Ovid

#	Searches	Results
1	tobacco.ti,ab,hw,id.	13110
2	smoking.ti,ab,hw,id.	17136
3	cigarette*.ti,ab,hw,id.	5912
4	1 or 2 or 3	19512
5	cessation.ti,ab,hw,id.	7153
6	quit*.ti,ab,hw,id.	13902
7	"stop*".ti,ab,hw,id.	7199
8	5 or 6 or 7	24953
9	4 and 8	6467
10	Drug Therapy/	41176
11	bupropion.ti,ab,hw,id.	913
12	zyban.ti,ab,hw,id.	27

13	varenicline.ti,ab,hw,id.	185
14	chantix.ti,ab,hw,id.	9
15	nicotine replacement*.ti,ab,hw,id.	693
16	nrt.ti,ab,hw,id.	350
17	pharmacotherap*.ti,ab,hw,id.	4891
18	pharmacologic*.ti,ab,hw,id.	13884
19	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	53349
20	9 and 19	1340
21	(adolescence 13 17 yrs or school age 6 12 yrs).ag.	145956
22	(child$ or adolescen$ or teen$ or youth$).ti,ab,hw,id.	219211
23	21 or 22	266560
24	20 and 23	122
25	limit 24 to english language	118
26	limit 25 to yr="2009 -Current"	30

* Search results were updated January 31, 2012.

Smoking Prevention

Ovid MEDLINE Without Revisions 1996 to June Week 2 2011,* Ovid MEDLINE Daily Update June 15, 2011, Ovid MEDLINE In-Process and Other Nonindexed Citations June 15, 2011

#	Searches	Results
1	Smoking/	56913
2	"Tobacco Use Disorder"/	5208
3	smoking.ti,ab.	84323
4	tobacco.ti,ab.	38831
5	cigarette*.ti,ab.	25508
6	1 or 2 or 3 or 4 or 5	127321
7	prevention & control.fs.	535454
8	prevent*.ti,ab.	513098
9	initiat*.ti,ab.	225479
10	(start* adj3 smok*).ti,ab.	891
11	behavio?r* change*.ti,ab.	10366
12	behavio?r* intervention*.ti,ab.	3367
13	7 or 8 or 9 or 10 or 11 or 12	1093967
14	6 and 13	32475
15	adolescent/ or child/	887220
16	children.ti,ab.	336279
17	adolescen*.ti,ab.	91418
18	child.ti,ab.	109223
19	childhood.ti,ab.	79525
20	teen*.ti,ab.	11300
21	youth*.ti,ab.	22371
22	15 or 16 or 17 or 18 or 19 or 20 or 21	1048657
23	14 and 22	9518
24	(clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.	389844
25	clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/	137571
26	clinical trial*.ti,ab.	126298
27	(control* adj3 trial*).ti,ab.	88513
28	random*.ti,ab.	418740
29	24 or 25 or 26 or 27 or 28	785887
30	23 and 29	1630
31	limit 30 to english language	1504
32	limit 31 to yr="2002 -Current"	1092

* Search results were updated January 31, 2012.

Appendix A. Original Search Strategies

PsycINFO 2002 to June Week 2 2011,* via Ovid

#	Searches	Results
1	tobacco.ti,ab,hw,id.	13110
2	smoking.ti,ab,hw,id.	17136
3	cigarette*.ti,ab,hw,id.	5912
4	1 or 2 or 3	19512
5	prevent*.ti,ab,hw,id.	65623
6	initiat*.ti,ab,hw,id.	32176
7	(start* adj3 smok*).ti,ab,hw,id.	274
8	behavio?r* change*.ti,ab,hw,id.	8074
9	behavio?r* intervention*.ti,ab,hw,id.	3394
10	5 or 6 or 7 or 8 or 9	103292
11	4 and 10	5277
12	(adolescence 13 17 yrs or school age 6 12 yrs).ag.	145956
13	(child$ or adolescen$ or teen$ or youth$).ti,ab,hw,id.	219211
14	12 or 13	266560
15	11 and 14	2463
16	experiment controls/	266
17	controlled trial$.ti,ab,id,hw.	11159
18	clinical trial$.ti,ab,id,hw.	12933
19	random$.ti,ab,id,hw.	56753
20	meta analy*.ti,ab,hw,id.	8372
21	metaanaly*.ti,ab,hw,id.	177
22	16 or 17 or 18 or 19 or 20 or 21	71305
23	15 and 22	314
24	limit 23 to english language	306
25	limit 24 to yr="2002 -Current"	306

* Search results were updated January 31, 2012.

All Questions

PubMed, June 16, 2011, "Publisher" Subset of Articles That Are Not in Ovid

#	Search	Result
11	#6 OR #8 Limits: English, Publication Date from 2002 to 2012	138
10	#6 OR #8 Limits: English	166
9	#6 OR #8	175
8	#4 AND #7	141
7	prevent*[tiab] OR initiat*[tiab]	1070466
6	#4 AND #5	55
5	cessation[tiab] OR quit*[tiab] OR stop*[tiab]	124030
4	#3 AND publisher[sb]	421
3	#1 AND #2	17492
2	children[tiab] OR child[tiab] OR adolescen*[tiab] OR childhood[tiab] OR youth*[tiab] OR teen*[tiab]	916707
1	tobacco[tiab] OR smoking[tiab] OR cigarette*[tiab]	167060

Cochrane Central Register of Controlled Trials (Central), Issue 2 of 4, April 2011, via Wiley

#	Search	Hits
1	tobacco:ti,ab,kw in Clinical Trials	2172
2	smoking:ti,ab,kw in Clinical Trials	10557
3	cigarette*:ti,ab,kw in Clinical Trials	2833
4	(#1 OR #2 OR #3)	11171
5	child*:ti,ab,kw in Clinical Trials	54883
6	adolescen*:ti,ab,kw in Clinical Trials	72149
7	teen*:ti,ab,kw in Clinical Trials	597
8	youth*:ti,ab,kw in Clinical Trials	1311
9	(#5 OR #6 OR #7 OR #8)	104866
10	(#4 AND #9)	2138

Appendix A. Original Search Strategies

11	cessation:ti,ab,kw in Clinical Trials	5752
12	quit*:ti,ab,kw in Clinical Trials	2666
13	stop*:ti,ab,kw in Clinical Trials	5720
14	(#11 OR #12 OR #13)	12328
15	(#10 AND #14), from 2009 to 2011	111
16	prevent*:ti,ab,kw in Clinical Trials	86321
17	initiat*:ti,ab,kw in Clinical Trials	11410
18	(start* NEAR smok*):ti,ab,kw in Clinical Trials	86
19	(behavio* NEAR chang*):ti,ab,kw in Clinical Trials	2964
20	(behavio* NEAR intervention*):ti,ab,kw in Clinical Trials	3013
21	(#16 OR #17 OR #18 OR #19 OR #20)	98777
22	(#10 AND #21), from 2002 to 2011	597
23	(#15 OR #22)	659

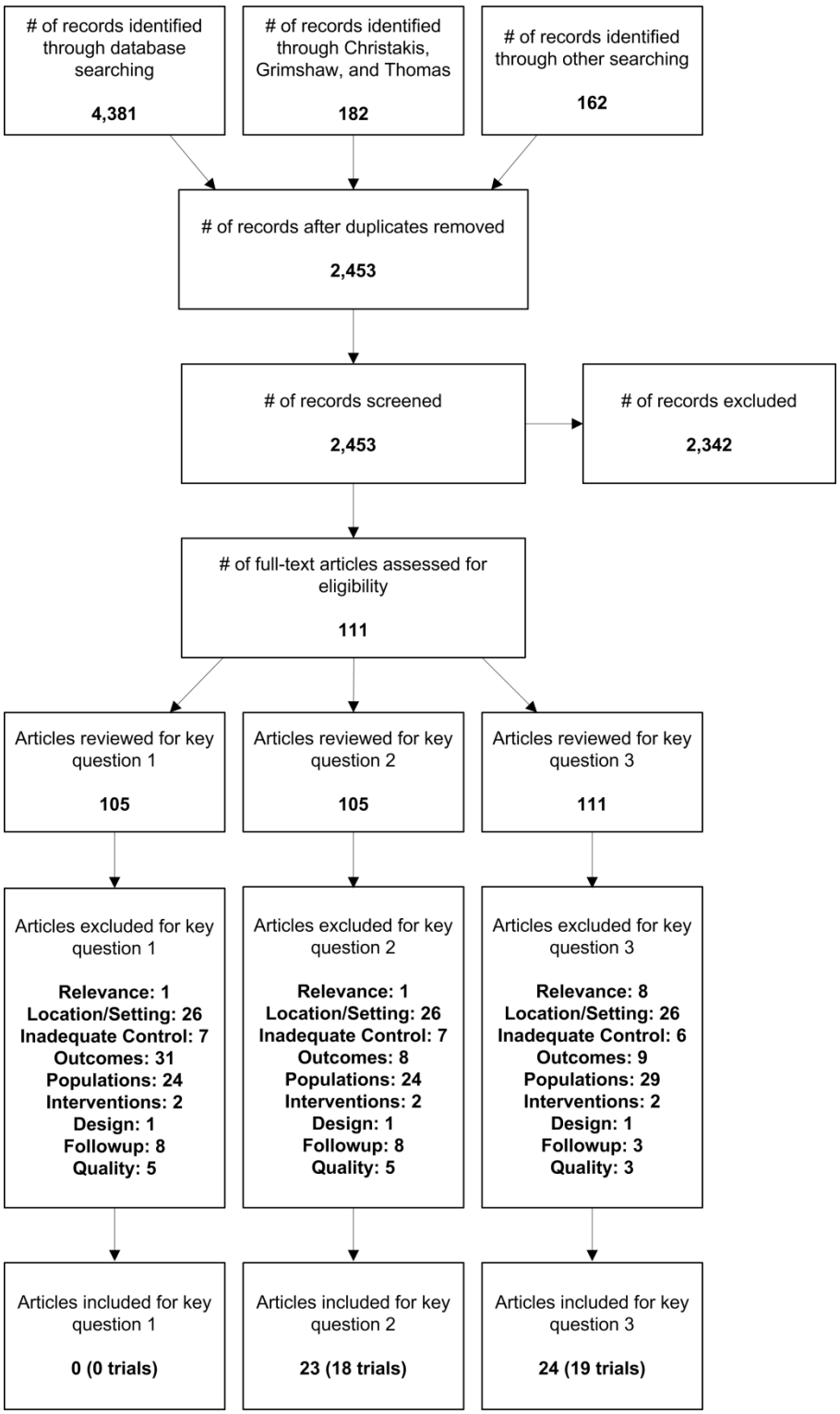
DARE (Database of Abstracts of Reviews of Effects) June 16, 2011, via Centre for Reviews and Dissemination

#	Search	Hits
1	(smoking) OR (tobacco) OR (cigarette*) IN DARE	515
2	((child*) OR (adolescen*) OR (youth*) OR (teen*)) and (Systematic review:ZDT and Bibliographic:ZPS) IN DARE FROM 2002 TO 2011	499
3	((child*) OR (adolescen*) OR (youth*) OR (teen*)) and (Systematic review:ZDT and Abstract:ZPS) IN DARE FROM 2002 TO 2011	1539
4	#2 OR #3	2038
5	#1 AND #4	75

Cochrane Database of Systematic Reviews, Issue 6 of 12, June 2011, via Wiley

#	Search	Hits
1	tobacco:ti,ab,kw in Cochrane Reviews	60
2	smoking:ti,ab,kw in Cochrane Reviews	124
3	cigarette*:ti,ab,kw in Clinical Trials in Cochrane Reviews	21
4	(#1 OR #2 OR #3)	127
5	child*:ti,ab,kw in Cochrane Reviews	1451
6	adolescen*:ti,ab,kw in Cochrane Reviews	290
7	teen*:ti,ab,kw in Cochrane Reviews	18
8	youth*:ti,ab,kw in Cochrane Reviews	23
9	(#5 OR #6 OR #7 OR #8)	1513
10	(#4 AND #9)	24

Appendix B. Search Results and Progression of Article Inclusion



Appendix C. Excluded Studies

Exclusion Codes

E1. Study relevance
E1b. No efficacy data for intervention approach examined
E2a. Location: Not a country with a very high HDI ranking
E2b. Setting: Schools (classroom-based); inpatient; institutional/residential; workplace; churches; other closed social networks
E3. Control group received active intervention
E4. No relevant outcomes
E5a. Population: Adults (age >18 years) or average age of study sample >18 years
E5b. Population: Children or adolescents with cognitive, substance abuse, mental health, or other health issues; pregnant adolescents
E6a. Interventions: Not one of the specified interventions
E6b. Tobacco use is not a primary target of intervention
E7. Study design: Not an included study design
E8a. Followup: Behavioral trial followup from baseline <6 months (24 weeks)
E8b. Followup: Pharmacological trial followup <6 months (24 weeks) but otherwise likely meets inclusion criteria
E9a. Study quality: High or differential attrition
E9b. Study quality: Other quality issue

Key Question 1

Ames SC, Werch CE, Ames GE, et al. Integrated smoking cessation and binge drinking intervention for young adults: a pilot investigation. *Ann Behav Me*d. 2010;40(3):343-49. PMID: 20730517. **E5a**

Armitage CJ. A volitional help sheet to encourage smoking cessation: a randomized exploratory trial. *Health Psychol*. 2008;27(5):557-66. PMID: 18823182. **E5a**

Audrain-McGovern J, Stevens S, Murray PJ, et al. The efficacy of motivational interviewing versus brief advice for adolescent smoking behavior change. *Pediatrics*. 2011;128(1):e101-11. PMID: 21690120. **E3a**

Ausems M, Mesters I, van Breukelen G, et al. Short-term effects of a randomized computer-based out-of-school smoking prevention trial aimed at elementary schoolchildren. *Prev Med*. 2002;34(6):581-89. PMID: 12052017. **E4**

Aveyard P, Johnson C, Fillingham S, et al. Nortriptyline plus nicotine replacement versus placebo plus nicotine replacement for smoking cessation: pragmatic randomised controlled trial. *BMJ*. 2008;336(7655):1223-27. PMID: 18441375. **E5b**

Aycicegi-Dinn A, Dinn W. Efficacy of an alternative smoking cessation treatment. *J Addict Dis*. 2011;30:368-81. PMID: 22026529. **E2a**

Bauman KE, Foshee VA, Ennett ST, et al. Family Matters: a family-directed program designed to prevent adolescent tobacco and alcohol use. *Health Promot Pract*. 2004;2(1):81-96. **E4**

Bauman KE, Ennett ST, Foshee VA, et al. Influence of a family-directed program on adolescent cigarette and alcohol cessation. *Prev Sci*. 2000;1(4):227-37. PMID: 11523750. **E4**

Bauman KE, Ennett ST, Foshee VA, et al. Influence of a family program on adolescent smoking and drinking prevalence. *Prev Sci*. 2002;3(1):35-42. PMID: 12002557. **E4**

Bauman KE, Foshee VA, Ennett ST, et al. The influence of a family program on adolescent tobacco and alcohol use. *Am J Public Health*. 2001;91(4):604-10. PMID: 11291373. **E4**

Bowen DJ, Henderson PN, Harvill J, Buchwald D. Short-term effects of a smoking prevention website in American Indian youth. *J Med Internet Res*. 2012;14:e81. PMID: 22659390. **E8a**

Bramley D, Riddell T, Whittaker R, et al. Smoking cessation using mobile phone text messaging is as effective in Maori as non-Maori. *N Z Med J*. 2005;118(1216):U1494. PMID: 15937529. **E5a**

Buffels J, Degryse J, Decramer M, et al. Spirometry and smoking cessation advice in general practice: a randomised clinical trial. *Respir Med*. 2006;100(11):2012-17. PMID: 16580189. **E5a**

Buller DB, Borland R, Woodall WG, et al. Randomized trials on Consider This, a tailored, internet-delivered smoking prevention program for adolescents. *Health Educ Behav*. 2008;35(2):260-81. PMID: 18442345. **E2b**

Cabezas C, Martin C, Granollers S, et al. Effectiveness of a stepped primary care smoking cessation intervention (ISTAPS study): design of a cluster randomised trial. *BMC Public Health*. 2009;9:48. PMID: 19193233. **E4**

Cabezas C, Advani M, Puente D, et al. Effectiveness of a stepped primary care smoking cessation intervention: cluster randomized clinical trial (ISTAPS study). *Addiction*. 2011;106(9):1696-706. PMID: 21561497. **E5a**

Chan CW, Witherspoon JM. Health risk appraisal modifies cigarette smoking behavior among college students. *J Gen Intern Med*. 1988;3(6):555-59. PMID: 3230458. **E2b**

Cohen DA, Rice JC. A parent-targeted intervention for adolescent substance use prevention: lessons learned. *Eval Rev*. 1995;19(2):159-80. PMID: 20871746. **E2b**

Colby SM, Monti PM, O'Leary TT, et al. Brief motivational intervention for adolescent smokers in medical settings. *Addict Behav*. 2005;30(5):865-74. PMID: 15893085. **E4**

Coleman T, Bauld L. Preventing adolescents' uptake of smoking. *Thorax*. 2011;66(10):842-4. PMID: 21502104. **E1**

Curry SJ, Hollis J, Bush T, et al. A randomized trial of a family-based smoking prevention intervention in managed care. *Prev Med*. 2003;37(6 Pt 1):617-26. PMID: 14636795. **E4**

Dishion TJ, Andrews DW. Preventing escalation in problem behaviors with high-risk young adolescents: immediate and 1-year outcomes. *J Consult Clin Psychol*. 1995;63(4):538-48. PMID: 7673531. **E4**

Dixon AL, Yabiku ST, Okamoto SK, et al. The efficacy of a multicultural prevention intervention among urban American Indian youth in the southwest U.S. *J Prim Prev*. 2007;28(6):547-68. PMID: 18058235. **E2b**

Elder JP, Litrownik AJ, Slymen DJ, et al. Tobacco and alcohol use-prevention program for Hispanic migrant adolescents. *Am J Prev Med*. 2002;23(4):269-75. PMID: 12406481. **E2b**

Etter JF. Comparing computer-tailored, internet-based smoking cessation counseling reports with generic, untailored reports: a randomized trial. *J Health Comm*. 2009;14(7):646-57. PMID: 19851916. **E5b**

Fidler W, Lambert TW. A prescription for health: a primary care based intervention to maintain the non-smoking status of young people. *Tob Control*. 2001;10(1):23-6. PMID: 11226356. **E4**

Franken FH, Pickworth WB, Epstein DH, et al. Smoking rates and topography predict adolescent smoking cessation following treatment with nicotine replacement therapy. *Cancer Epidemiol Biomarkers Prev*. 2006;15(1):154-57. PMID: 16434603. **E9a**

Gray KM, Carpenter MJ, Baker NL, et al. Bupropion SR and contingency management for adolescent smoking cessation. *J Subst Abuse Treat*. 2011;40(1):77-86. PMID: 20934835. **E8b**

Griffin KW, Botvin GJ, Nichols TR, et al. Effectiveness of a universal drug abuse prevention approach for youth at high risk for substance use initiation. *Prev Med*. 2003;36(1):1-7. PMID: 12473419. **E2b**

Haggerty KP, Skinner ML, MacKenzie EP, et al. A randomized trial of Parents Who Care: effects on key outcomes at 24-month follow-up. *Prev Sci*. 2007;8(4):249-60. PMID: 17987388. **E4**

Hansen WB, Malotte CK, Fielding JE. Tobacco and alcohol prevention: preliminary results of a four-year study. *Adolesc Psychiatry*. 1987;14:556-75. PMID: 3618940. **E2b**

Hanson K, Allen S, Jensen S, et al. Treatment of adolescent smokers with the nicotine patch. *Nicotine Tob Res*. 2003;5(4):515-26. PMID: 12959789. **E8b**

Hellmann R, O'Shea RM, Kunz ML, et al. University health service physician intervention with cigarette smokers. *J Am Coll Health*. 1988;37(2):91-3. PMID: 3241031. **E5a**

Helstrom A, Hutchison K, Bryan A. Motivational enhancement therapy for high-risk adolescent smokers. *Addict Behav*. 2007;32(10):2404-10. PMID: 17428617. **E5b**

Hiemstra M, Ringlever L, Otten R, et al. Efficacy of smoking prevention program "Smoke-free Kids": study protocol of a randomized controlled trial. *BMC Public Health*. 2009;9:477. PMID: 20025727. **E4**

Higgs PE, Edwards D, Harbin RE, et al. Evaluation of a self-directed smoking prevention and cessation program. *Pediatr Nurs*. 2000;26(2):150-3. PMID: 12026268. **E2b**

Hollis JF, Polen MR, Whitlock EP, et al. Teen Reach: outcomes from a randomized, controlled trial of a tobacco reduction program for teens seen in primary medical care. *Pediatrics*. 2005;115(4):981-9. PMID: 15805374. **E4**

Holt S, Timu-Parata C, Ryder-Lewis S, et al. Efficacy of bupropion in the indigenous Maori population in New Zealand. *Thorax*. 2005;60(2):120-3. PMID: 15681499. **E5a**

Horn K, Dino G, Hamilton C, et al. Efficacy of an emergency department-based motivational teenage smoking intervention. *Prev Chronic Dis*. 2007;4(1):A08. PMID: 17173716. **E9a**

Hovell MF, Slymen DJ, Jones JA, et al. An adolescent tobacco-use prevention trial in orthodontic offices. *Am J Public Health*. 1996;86(12):1760-6. PMID: 9003134. **E4**

Huang M, Hollis J, Polen M, et al. Stages of smoking acquisition versus susceptibility as predictors of smoking initiation in adolescents in primary care. *J Smok Cessat*. 2005;30(6):1183-94. PMID: 15925127. **E4**

Jackson C, Dickinson D. Can parents who smoke socialise their children against smoking? Results from the Smoke-free Kids intervention trial. *Tob Control*. 2003;12(1):52-9. PMID: 12612363. **E4**

Jackson C, Dickinson D. Enabling parents who smoke to prevent their children from initiating smoking: results from a 3-year intervention evaluation. *Arch Pediatr Adolesc Med*. 2006;160(1):56-62. PMID: 16389212. **E4**

Jason LA, Mollica M, Ferrone L. Evaluating an early secondary smoking prevention intervention. *Prev Med*. 1982;11(1):96-102. PMID: 7079250. **E2b**

Jaszyna-Gasior M, Schroeder JR, Moolchan ET. Alcohol use and tobacco abstinence among adolescents in cessation treatment: preliminary findings. *Addict Behav*. 2007;32(3):617-21. PMID: 16814935. **E4**

Kang HC, Shin KK, Kim KK, et al. The effects of the acupuncture treatment for smoking cessation in high school student smokers. *Yonsei Med J*. 2005;46(2):206-12. PMID: 15861492. **E8b**

Kelleher CC, Fallon UB, Mc Carthy E, et al. Feasibility of a lifestyle cardiovascular health promotion programme for 8–15-year-olds in Irish general practice: results of the Galway Health Project. *Health Promot Int*. 1999;14(3):221-30. **E3**

Kelly AB, Lapworth K. The HYP Program: targeted motivational interviewing for adolescent violations of school tobacco policy. *Prev Med*. 2006;43(6):466-71. PMID: 16920183. **E3**

Kentala J, Utriainen P, Pahkala K, et al. Can brief intervention through community dental care have an effect on adolescent smoking? *Prev Med*. 1999;29(2):107-11. PMID: 10446036. **E4**

Killen JD, Robinson TN, Ammerman S, et al. Randomized clinical trial of the efficacy of bupropion combined with nicotine patch in the treatment of adolescent smokers. *J Consult Clin Psychol*. 2004;72(4):729-35. PMID: 15301658. **E4**

Kim S, Nam KA, Seo M, et al. Effectiveness of a smoking cessation program for adolescents. *Taehan Kanho Hakhoe Chi*. 2004;34(4):646-54. PMID: 15502430. **E2b**

Knishkowy B, Verbov G, Amitai Y, et al. Reaching Jewish ultra-orthodox adolescents: results from a targeted smoking prevention trial. *Int J Adolesc Med Health*. 2012;24:173-9. PMID: 22909927. **E8a**

Knutsen SF, Knutsen R. The Tromso Survey: the Family Intervention study—the effect of intervention on some coronary risk factors and dietary habits, a 6-year follow-up. *Prev Med*. 1991;20(2):197-212. PMID: 2057468. **E6b**

Lando HA, Hennrikus D, Boyle R, et al. Promoting tobacco abstinence among older adolescents in dental clinics. *J Smok Cessat*. 2007;2(1):23-30. **E4**

Lindenberg CS, Solorzano RM, Bear D, et al. Reducing substance use and risky sexual behavior among young, low-income, Mexican-American women: comparison of two interventions. *Appl Nurs Res*. 2002;15(3):137-48. PMID: 12173165. **E5a**

Lipkus IM, McBride CM, Pollak KI, et al. A randomized trial comparing the effects of self-help materials and proactive telephone counseling on teen smoking cessation. *Health Psychol*. 2004;23(4):397-406. PMID: 15264976. **E3**

Litrownik AJ, Elder JP, Campbell NR, et al. Evaluation of a tobacco and alcohol use prevention program for Hispanic migrant adolescents: promoting the protective factor of parent-child communication. *Prev Med*. 2000;31(2 Pt 1):124-33. PMID: 10938212. **E4**

McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction*. 2004;99(1):39-52. PMID: 14678061. **E5b**

McCambridge J, Hunt C, Jenkins RJ, et al. Cluster randomised trial of the effectiveness of motivational interviewing for universal prevention. *Drug Alcohol Depend*. 2011;114(2-3):177-84. PMID: 21075562. **E2b**

Molyneux A, Lewis S, Leivers U, et al. Clinical trial comparing nicotine replacement therapy (NRT) plus brief counselling, brief counselling alone, and minimal intervention on smoking cessation in hospital inpatients. *Thorax*. 2003;58(6):484-8. PMID: 12775857. **E5a**

Moolchan ET, Robinson ML, Ernst M, et al. Safety and efficacy of the nicotine patch and gum for the treatment of adolescent tobacco addiction. *Pediatrics*. 2005;115(4):e407-14. PMID: 15805342. **E9a**

Muramoto ML, Leischow SJ, Sherrill D, et al. Randomized, double-blind, placebo-controlled trial of 2 dosages of sustained-release bupropion for adolescent smoking cessation. *Arch Pediatr Adolesc Med*. 2007;161(11):1068-74. PMID: 17984409. **E4**

Nides M, Glover ED, Reus VI, et al. Varenicline versus bupropion SR or placebo for smoking cessation: a pooled analysis. *Am J Health Behav*. 2008;32(6):664-75. PMID: 18442345. **E5a**

Niederhofer H, Huber M. Bupropion may support psychosocial treatment of nicotine-dependent adolescents: preliminary results. *Pharmacotherapy*. 2004;24(11):1524-8. PMID: 15537557. **E8b**

Nishiokai N, Kawabata T, Minagawa KH, et al. Three-year follow-up on the effects of a smoking prevention program for elementary school children with a quasi-experimental design in Japan. *Jpn J Public Health*. 2005;52(11):971-8. **E2b**

Nohlert E, Tegelberg A, Tillgren P, et al. Comparison of a high and a low intensity smoking cessation intervention in a dentistry setting in Sweden: a randomized trial. *BMC Public Health*. 2009;9:121. PMID: 19405969. **E5a**

Norman CD, Maley O, Li X, et al. Using the internet to assist smoking prevention and cessation in schools: a randomized, controlled trial. *Health Psychol*. 2008;27(6):799-810. PMID: 19025276. **E2b**

Pbert L, Flint AJ, Fletcher KE, et al. Effect of a pediatric practice-based smoking prevention and cessation intervention for adolescents: a randomized, controlled trial. *Pediatrics*. 2008;121(4):e738-47. PMID: 18381502. **E4**

Pbert L, Druker S, DiFranza JR, et al. Effectiveness of a school nurse-delivered smoking-cessation intervention for adolescents. *Pediatrics*. 2011;128(5):926-36. PMID: 22007015. **E4**

Peterson AV Jr, Kealey KA, Mann SL, et al. Group-randomized trial of a proactive, personalized telephone counseling intervention for adolescent smoking cessation. *J Natl Cancer Inst*. 2009;101(20):1378-92. PMID: 19822836. **E2b**

Prado G, Pantin H, Briones E, et al. A randomized controlled trial of a parent-centered intervention in preventing substance use and HIV risk behaviors in Hispanic adolescents. *J Consult Clin Psychol*. 2007;75(6):914-26. PMID: 18085908. **E4**

Prokhorov AV, Kelder SH, Shegog R, et al. Impact of A Smoking Prevention Interactive Experience (ASPIRE), an interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high-school students. *Nicotine Tob Res*. 2008;10(9):1477-85. PMID: 19023839. **E2b**

Robinson LA, Vander Weg MW, Riedel BW, et al. "Start to Stop": results of a randomised controlled trial of a smoking cessation programme for teens. *Tob Control*. 2003;12(Suppl 4):iv26-33. PMID: 14645937. **E5b**

Roddy E, Romilly N, Challenger A, et al. Use of nicotine replacement therapy in socioeconomically deprived young smokers: a community-based pilot randomised controlled trial. *Tob Control*. 2006;15(5):373-6. PMID: 16998171. **E2b**

Rodgers A, Corbett T, Bramley D, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control.* 2005;14(4):255-61. PMID: 16046689. **E5a**

Roll JM. Assessing the feasibility of using contingency management to modify cigarette smoking by adolescents. *J Appl Behav Anal*. 2005;38(4):463-7. PMID: 16463527. **E8a**

Rubinstein ML, Benowitz NL, Auerback GM, et al. A randomized trial of nicotine nasal spray in adolescent smokers. *Pediatrics.* 2008;122(3):e595-600. PMID: 18762494. **E3b**

Salminen M, Vahlberg T, Ojanlatva A, et al. Effects of a controlled family-based health education/counseling intervention. *Am J Health Behav.* 2005;29(5):395-406. PMID: 16201856. **E9a**

Schinke SP, Cole KC, Fang L. Gender-specific intervention to reduce underage drinking among early adolescent girls: a test of a computer-mediated, mother-daughter program. *J Stud Alcohol Drugs*. 2009;70(1):70-7. PMID: 19118394. **E4**

Schinke SP, Orlandi MA, Botvin GJ, et al. Preventing substance abuse among American-Indian adolescents: a bicultural competence skills approach. *J Couns Psychol*. 1988;35(1):87-90. PMID: 17392927. **E2b**

Schinke SP, Fang L, Cole KC. Preventing substance use among adolescent girls: 1-year outcomes of a computerized, mother-daughter program. *J Smok Cessat.* 2009;34(12):1060-4. **E4**

Schinke SP, Schwinn TM, Di Noia J, et al. Reducing the risks of alcohol use among urban youth: three-year effects of a computer-based intervention with and without parent involvement. *J Stud Alcohol*. 2004;65(4):443-9. PMID: 15376818. **E6b**

Schuurmans MM, Diacon AH, van Biljon X, et al. Effect of pre-treatment with nicotine patch on withdrawal symptoms and abstinence rates in smokers subsequently quitting with the nicotine patch: a randomized controlled trial. *Addiction*. 2004;99(5):634-40. PMID: 15078238. **E5a**

Seidman DF, Westmaas JL, Goldband S, et al. Randomized controlled trial of an interactive internet smoking cessation program with long-term follow-up. *Ann Behav Med*. 2010;39(1):48-60. PMID: 20177844. **E5a**

Smith PM, Reilly KR, Houston MN, et al. Application of a nurse-managed inpatient smoking cessation program. *Nicotine Tob Res*. 2002;4(2):211-22. PMID: 12096707. **E7**

Soria R, Legido A, Escolano C, et al. A randomised controlled trial of motivational interviewing for smoking cessation. *Br J Gen Pract*. 2006;56(531):768-74. **E5b**

Spoth RL, Redmond C, Shin C. Randomized trial of brief family interventions for general populations: adolescent substance use outcomes 4 years following baseline. *J Consult Clin Psychol*. 2001;69(4):627-42. PMID: 11550729. **E2b**

Stanton B, Cole M, Galbraith J, et al. Randomized trial of a parent intervention: parents can make a difference in long-term adolescent risk behaviors, perceptions, and knowledge. *Arch Pediatr Adolesc Med*. 2004;158(10):947-55. PMID: 15466681. **E3**

Stevens MM, Olson AL, Gaffney CA, et al. A pediatric, practice-based, randomized trial of drinking and smoking prevention and bicycle helmet, gun, and seatbelt safety promotion. *Pediatrics.* 2002;109(3):490-7. PMID: 11875146. **E4**

Stormshak EA, Connell AM, Veronneau MH, et al. An ecological approach to promoting early adolescent mental health and social adaptation: family-centered intervention in public middle schools. *Child Dev*. 2011;82(1):209-25. PMID: 21291438. **E2b**

Sussman S, Dent CW, Lichtman KL. Project EX: outcomes of a teen smoking cessation program. *Addict Behav*. 2001;26(3):425-38. PMID: 11436934. **E2b**

Tonstad S. Smoking cessation efficacy and safety of varenicline, an alpha4beta2 nicotinic receptor partial agonist. *J Cardiovasc Nurs*. 2006;21(6):433-6. PMID: 17293731. **E5b**

Trudeau L, Spoth R, Randall G, et al. Longitudinal effects of a universal family-focused intervention on growth patterns of adolescent internalizing symptoms and polysubstance use: gender comparisons. *J Youth Adolesc*. 2007;36(6):725-40. **E2b**

Ussher M, Chambers M, Adams R, et al. Evaluation of a nationally disseminated self-help intervention for smoking cessation ("Quit Kit"). *Tob Control*. 2011;20(5):380-2. PMID: 21415063. **E5a**

Walker Z, Townsend J, Oakley L, et al. Health promotion for adolescents in primary care: randomised controlled trial. *BMJ (Clin Res)*. 2002;325(7363):524. **E9a**

Walsh MM, Langer TJ, Kavanagh N, et al. Smokeless tobacco cessation cluster randomized trial with rural high school males: intervention interaction with baseline smoking. *Nicotine Tob Res*. 2010;12(6):543-50. PMID: 20439384. **E2b**

Walsh MM, Hilton JF, Ellison JA et al. Spit (smokeless) tobacco intervention for high school athletes: results after 1 year. *J Smok Cessat*. 2003;28:1095-113. PMID: 12834653. **E2b**

Werch CE, Young M, Clark M, et al. Effects of a take-home drug prevention program on drug-related communication and beliefs of parents and children. *J Sch Health*. 1991;61(8):346-50. PMID: 1787697. **E4**

Whittaker R, Dorey E, Bramley D, et al. A theory-based video messaging mobile phone intervention for smoking cessation: randomized controlled trial. *J Med Internet Res*. 2011;13(1):e10. PMID: 21371991. **E5a**

Woodruff SI, Conway TL, Edwards CC, et al. Evaluation of an Internet virtual world chat room for adolescent smoking cessation. *Addict Behav.* 2007;32(9):1769-86. PMID: 17173716. **E2b**

Wu Y, Stanton BF, Galbraith J, et al. Sustaining and broadening intervention impact: a longitudinal randomized trial of 3 adolescent risk reduction approaches. *Pediatrics.* 2003;111(1):e32-8. PMID: 12509592. **E3**

Yiming C, Changxin Z, Ung WS, et al. Laser acupuncture for adolescent smokers: a randomized double-blind controlled trial. *Am J Chin Med*. 2000;28(3-4):443-9. PMID: 11154059. **E8b**

Key Question 2

Ames SC, Werch CE, Ames GE, et al. Integrated smoking cessation and binge drinking intervention for young adults: a pilot investigation. *Ann Behav Med.* 2010;40(3):343-9. PMID: 20730517. **E5a**

Armitage CJ. A volitional help sheet to encourage smoking cessation: a randomized exploratory trial. *Health Psychol*. 2008;27(5):557-66. PMID: 18823182. **E5a**

Audrain-McGovern J, Stevens S, Murray PJ, et al. The efficacy of motivational interviewing versus brief advice for adolescent smoking behavior change. *Pediatrics.* 2011;128(1):e101-11. PMID: 21690120. **E3a**

Aveyard P, Johnson C, Fillingham S, et al. Nortriptyline plus nicotine replacement versus placebo plus nicotine replacement for smoking cessation: pragmatic randomised controlled trial. *BMJ*. 2008;336(7655):1223-7. PMID: 18441375. **E5b**

Aycicegi-Dinn A, Dinn W. Efficacy of an alternative smoking cessation treatment. *J Addict Dis*. 2011;30:368-81. PMID: 22026529. **E2a**

Bauman KE, Foshee VA, Ennett ST, et al. Family Matters: a family-directed program designed to prevent adolescent tobacco and alcohol use. *Health Promot Pract*. 2004;2(1):81-96. **E4**

Bowen DJ, Henderson PN, Harvill J, Buchwald D. Short-term effects of a smoking prevention website in American Indian youth. *J Med Internet Res*. 2012;14:e81. PMID: 22659390. **E8a**

Bramley D, Riddell T, Whittaker R, et al. Smoking cessation using mobile phone text messaging is as effective in Maori as non-Maori. *N Z Med J*. 2005;118(1216):U1494. PMID: 15937529. **E5a**

Buffels J, Degryse J, Decramer M, et al. Spirometry and smoking cessation advice in general practice: a randomised clinical trial. *Respir Med*. 2006;100(11):2012-7. PMID: 16580189. **E5a**

Buller DB, Borland R, Woodall WG, et al. Randomized trials on Consider This, a tailored, internet-delivered smoking prevention program for adolescents. *Health Educ Behav*. 2008;35(2):260-81. PMID: 18442345. **E2b**

Cabezas C, Martin C, Granollers S, et al. Effectiveness of a stepped primary care smoking cessation intervention (ISTAPS study): design of a cluster randomised trial. *BMC Public Health*. 2009;9:48. PMID: 19193233. **E4**

Cabezas C, Advani M, Puente D, et al. Effectiveness of a stepped primary care smoking cessation intervention: cluster randomized clinical trial (ISTAPS study). *Addiction*. 2011;106(9):1696-706. PMID: 21561497. **E5a**

Chan CW, Witherspoon JM. Health risk appraisal modifies cigarette smoking behavior among college students. *J Gen Intern Med*. 1988;3(6):555-9. PMID: 3230458. **E2b**

Cohen DA, Rice JC. A parent-targeted intervention for adolescent substance use prevention: lessons learned. *Eval Rev*. 1995;19(2):159-80. PMID: 20871746. **E2b**

Coleman T, Bauld L. Preventing adolescents' uptake of smoking. *Thorax.* 2011;66(10):842-4. PMID: 21502104. **E1**

Dishion TJ, Andrews DW. Preventing escalation in problem behaviors with high-risk young adolescents: immediate and 1-year outcomes. *J Consult Clin Psychol.* 1995;63(4):538-48. PMID: 7673531. **E4**

Dixon AL, Yabiku ST, Okamoto SK, et al. The efficacy of a multicultural prevention intervention among urban American Indian youth in the southwest U.S. *J Prim Prev*. 2007;28(6):547-68. PMID: 18058235. **E2b**

Elder JP, Litrownik AJ, Slymen DJ, et al. Tobacco and alcohol use-prevention program for Hispanic migrant adolescents. *Am J Prev Med.* 2002;23(4):269-75. PMID: 12406481. **E2b**

Etter JF. Comparing computer-tailored, internet-based smoking cessation counseling reports with generic, untailored reports: a randomized trial. *J Health Comm*. 2009;14(7):646-57. PMID: 19851916. **E5b**

Franken FH, Pickworth WB, Epstein DH, et al. Smoking rates and topography predict adolescent smoking cessation following treatment with nicotine replacement therapy. *Cancer Epidemiol Biomarkers Prev*. 2006;15(1):154-7. PMID: 16434603. **E9a**

Gray KM, Carpenter MJ, Baker NL, et al. Bupropion SR and contingency management for adolescent smoking cessation. *J Subst Abuse Treat*. 2011;40(1):77-86. PMID: 20934835. **E8b**

Griffin KW, Botvin GJ, Nichols TR, et al. Effectiveness of a universal drug abuse prevention approach for youth at high risk for substance use initiation. *Prev Med*. 2003;36(1):1-7. PMID: 12473419. **E2b**

Hansen WB, Malotte CK, Fielding JE. Tobacco and alcohol prevention: preliminary results of a four-year study. *Adolesc Psychiatry*. 1987;14:556-75. PMID: 3618940. **E2b**

Hanson K, Allen S, Jensen S, et al. Treatment of adolescent smokers with the nicotine patch. *Nicotine Tob Res.* 2003;5(4):515-26. PMID: 12959789. **E8b**

Hellmann R, O'Shea RM, Kunz ML, et al. University health service physician intervention with cigarette smokers. *J Am Coll Health*. 1988;37(2):91-3. PMID: 3241031. **E5a**

Helstrom A, Hutchison K, Bryan A. Motivational enhancement therapy for high-risk adolescent smokers. *Addict Behav.* 2007;32(10):2404-10. PMID: 17428617. **E5b**

Hiemstra M, Ringlever L, Otten R, et al. Efficacy of smoking prevention program "Smoke-free Kids": study protocol of a randomized controlled trial. *BMC Public Health.* 2009;9:477. PMID: 20025727. **E4**

Higgs PE, Edwards D, Harbin RE, et al. Evaluation of a self-directed smoking prevention and cessation program. *Pediatr Nurs*. 2000;26(2):150-3. PMID: 12026268. **E2b**

Holt S, Timu-Parata C, Ryder-Lewis S, et al. Efficacy of bupropion in the indigenous Maori population in New Zealand. *Thorax.* 2005;60(2):120-3. PMID: 15681499. **E5a**

Horn K, Dino G, Hamilton C, et al. Efficacy of an emergency department-based motivational teenage smoking intervention. *Prev Chronic Dis*. 2007;4(1):A08. PMID: 17173716. **E9a**

Jason LA, Mollica M, Ferrone L. Evaluating an early secondary smoking prevention intervention. *Prev Med.* 1982;11(1):96-102. PMID: 7079250. **E2b**

Kang HC, Shin KK, Kim KK, et al. The effects of the acupuncture treatment for smoking cessation in high school student smokers. *Yonsei Med J*. 2005;46(2):206-12. PMID: 15861492. **E8b**

Kelleher CC, Fallon UB, Mc Carthy E, et al. Feasibility of a lifestyle cardiovascular health promotion programme for 8–15-year-olds in Irish general practice: results of the Galway Health Project. *Health Promot Int*. 1999;14(3):221-30. **E3**

Kelly AB, Lapworth K. The HYP Program: targeted motivational interviewing for adolescent violations of school tobacco policy. *Prev Med.* 2006;43(6):466-71. PMID: 16920183. **E3**

Kim S, Nam KA, Seo M, et al. Effectiveness of a smoking cessation program for adolescents. *Taehan Kanho Hakhoe Chi*. 2004;34(4):646-54. PMID: 15502430. **E2b**

Knishkowy B, Verbov G, Amitai Y, et al. Reaching Jewish ultra-orthodox adolescents: results from a targeted smoking prevention trial. *Int J Adolesc Med Health*. 2012;24:173-9. PMID: 22909927. **E8a**

Knutsen SF, Knutsen R. The Tromso Survey: the Family Intervention study—the effect of intervention on some coronary risk factors and dietary habits, a 6-year follow-up. *Prev Med.* 1991;20(2):197-212. PMID: 2057468. **E6b**

Lindenberg CS, Solorzano RM, Bear D, et al. Reducing substance use and risky sexual behavior among young, low-income, Mexican-American women: comparison of two interventions. *Appl Nurs Res*. 2002;15(3):137-48. PMID: 12173165. **E5a**

Lipkus IM, McBride CM, Pollak KI, et al. A randomized trial comparing the effects of self-help materials and proactive telephone counseling on teen smoking cessation. *Health Psychol.* 2004;23(4):397-406. PMID: 15264976. **E3**

Litrownik AJ, Elder JP, Campbell NR, et al. Evaluation of a tobacco and alcohol use prevention program for Hispanic migrant adolescents: promoting the protective factor of parent-child communication. *Prev Med.* 2000;31(2 Pt 1):124-33. PMID: 10938212. **E4**

McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction*. 2004;99(1):39-52. PMID: 14678061. **E5b**

McCambridge J, Hunt C, Jenkins RJ, et al. Cluster randomised trial of the effectiveness of motivational interviewing for universal prevention. *Drug Alcohol Depend*. 2011;114(2-3):177-84. PMID: 21075562. **E2b**

Molyneux A, Lewis S, Leivers U, et al. Clinical trial comparing nicotine replacement therapy (NRT) plus brief counselling, brief counselling alone, and minimal intervention on smoking cessation in hospital inpatients. *Thorax.* 2003;58(6):484-8. PMID: 12775857. **E5a**

Moolchan ET, Robinson ML, Ernst M, et al. Safety and efficacy of the nicotine patch and gum for the treatment of adolescent tobacco addiction. *Pediatrics.* 2005;115(4):e407-14. PMID: 15805342. **E9a**

Nides M, Glover ED, Reus VI, et al. Varenicline versus bupropion SR or placebo for smoking cessation: a pooled analysis. *Am J Health Behav*. 2008;32(6):664-75. PMID: 18442345. **E5a**

Niederhofer H, Huber M. Bupropion may support psychosocial treatment of nicotine-dependent adolescents: preliminary results. *Pharmacotherapy*. 2004;24(11):1524-8. PMID: 15537557. **E8b**

Nishiokai N, Kawabata T, Minagawa KH, et al. Three-year follow-up on the effects of a smoking prevention program for elementary school children with a quasi-experimental design in Japan. *Jpn J Public Health*. 2005;52(11):971-8. **E2b**

Nohlert E, Tegelberg A, Tillgren P, et al. Comparison of a high and a low intensity smoking cessation intervention in a dentistry setting in Sweden: a randomized trial. *BMC Public Health.* 2009;9:121. PMID: 19405969. **E5a**

Norman CD, Maley O, Li X, et al. Using the internet to assist smoking prevention and cessation in schools: a randomized, controlled trial. *Health Psychol.* 2008;27(6):799-810. PMID: 19025276. **E2b**

Peterson AV Jr, Kealey KA, Mann SL, et al. Group-randomized trial of a proactive, personalized telephone counseling intervention for adolescent smoking cessation. *J Natl Cancer Inst*. 2009;101(20):1378-92. PMID: 19822836. **E2b**

Prokhorov AV, Kelder SH, Shegog R, et al. Impact of A Smoking Prevention Interactive Experience (ASPIRE), an interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high-school students. *Nicotine Tob Res.* 2008;10(9):1477-85. PMID: 19023839. **E2b**

Robinson LA, Vander Weg MW, Riedel BW, et al. "Start to Stop": results of a randomised controlled trial of a smoking cessation programme for teens. *Tob Control.* 2003;12(Suppl 4):iv26-33. PMID: 14645937. **E5b**

Roddy E, Romilly N, Challenger A, et al. Use of nicotine replacement therapy in socioeconomically deprived young smokers: a community-based pilot randomised controlled trial. *Tob Control.* 2006;15(5):373-6. PMID: 16998171. **E2b**

Rodgers A, Corbett T, Bramley D, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control.* 2005;14(4):255-61. PMID: 16046689. **E5a**

Roll JM. Assessing the feasibility of using contingency management to modify cigarette smoking by adolescents. *J Appl Behav Anal*. 2005;38(4):463-7. PMID: 16463527. **E8a**

Rubinstein ML, Benowitz NL, Auerback GM, et al. A randomized trial of nicotine nasal spray in adolescent smokers. *Pediatrics.* 2008;122(3):e595-600. PMID: 18762494. **E3b**

Salminen M, Vahlberg T, Ojanlatva A, et al. Effects of a controlled family-based health education/counseling intervention. *Am J Health Behav.* 2005;29(5):395-406. PMID: 16201856. **E9a**

Schinke SP, Cole KC, Fang L. Gender-specific intervention to reduce underage drinking among early adolescent girls: a test of a computer-mediated, mother-daughter program. *J Stud Alcohol Drugs*. 2009;70(1):70-7. PMID: 19118394. **E4**

Schinke SP, Orlandi MA, Botvin GJ, et al. Preventing substance abuse among American-Indian adolescents: a bicultural competence skills approach. *J Couns Psychol*. 1988;35(1):87-90. PMID: 17392927. **E2b**

Schinke SP, Schwinn TM, Di Naio J, et al. Reducing the risks of alcohol use among urban youth: three-year effects of a computer-based intervention with and without parent involvement. *J Stud Alcohol*. 2004;65(4):443-9. PMID: 15376818. **E6b**

Schinke SP, Fang L, Cole KC. Preventing substance use among adolescent girls: 1-year outcomes of a computerized, mother-daughter program. *J Smok Cessat.* 2009;34(12):1060-4. **E4**

Schuurmans MM, Diacon AH, van Biljon X, et al. Effect of pre-treatment with nicotine patch on withdrawal symptoms and abstinence rates in smokers subsequently quitting with the nicotine patch: a randomized controlled trial. *Addiction*. 2004;99(5):634-40. PMID: 15078238. **E5a**

Seidman DF, Westmaas JL, Goldband S, et al. Randomized controlled trial of an interactive internet smoking cessation program with long-term follow-up. *Ann Behav Med.* 2010;39(1):48-60. PMID: 20177844. **E5a**

Smith PM, Reilly KR, Houston MN, et al. Application of a nurse-managed inpatient smoking cessation program. *Nicotine Tob Res.* 2002;4(2):211-22. PMID: 12096707. **E7**

Soria R, Legido A, Escolano C, et al. A randomised controlled trial of motivational interviewing for smoking cessation. *Br J Gen Pract*. 2006;56(531):768-74. **E5b**

Spoth RL, Redmond C, Shin C. Randomized trial of brief family interventions for general populations: adolescent substance use outcomes 4 years following baseline. *J Consult Clin Psychol.* 2001;69(4):627-42. PMID: 11550729. **E2b**

Stanton B, Cole M, Galbraith J, et al. Randomized trial of a parent intervention: parents can make a difference in long-term adolescent risk behaviors, perceptions, and knowledge. *Arch Pediatr Adolesc Med*. 2004;158(10):947-55. PMID: 15466681. **E3**

Stormshak EA, Connell AM, Veronneau MH, et al. An ecological approach to promoting early adolescent mental health and social adaptation: family-centered intervention in public middle schools. *Child Dev*. 2011;82(1):209-25. PMID: 21291438. **E2b**

Sussman S, Dent CW, Lichtman KL. Project EX: outcomes of a teen smoking cessation program. *Addict Behav.* 2001;26(3):425-38. PMID: 11436934. **E2b**

Tonstad S. Smoking cessation efficacy and safety of varenicline, an alpha4beta2 nicotinic receptor partial agonist. *J Cardiovasc Nurs*. 2006;21(6):433-6. PMID: 17293731. **E5b**

Trudeau L, Spoth R, Randall G, et al. Longitudinal effects of a universal family-focused intervention on growth patterns of adolescent internalizing symptoms and polysubstance use: gender comparisons. *J Youth Adolesc*. 2007;36(6):725-40. **E2b**

Ussher M, Chambers M, Adams R, et al. Evaluation of a nationally disseminated self-help intervention for smoking cessation ("Quit Kit"). *Tob Control*. 2011;20(5):380-2. PMID: 21415063. **E5a**

Walker Z, Townsend J, Oakley L, et al. Health promotion for adolescents in primary care: randomised controlled trial. *BMJ (Clin Res)*. 2002;325(7363):524. **E9a**

Walsh MM, Langer TJ, Kavanagh N, et al. Smokeless tobacco cessation cluster randomized trial with rural high school males: intervention interaction with baseline smoking. *Nicotine Tob Res.* 2010;12(6):543-50. PMID: 20439384. **E2b**

Walsh MM, Hilton JF, Ellison JA et al. Spit (smokeless) tobacco intervention for high school athletes: results after 1 year. *J Smok Cessat*. 2003;28:1095-113. 12834653. **E2b**

Werch CE, Young M, Clark M, et al. Effects of a take-home drug prevention program on drug-related communication and beliefs of parents and children. *J Sch Health*. 1991;61(8):346-50. PMID: 1787697. **E4**

Whittaker R, Dorey E, Bramley D, et al. A theory-based video messaging mobile phone intervention for smoking cessation: randomized controlled trial. *J Med Internet Res*. 2011;13(1):e10. PMID: 21371991. **E5a**

Woodruff SI, Conway TL, Edwards CC, et al. Evaluation of an Internet virtual world chat room for adolescent smoking cessation. *Addict Behav.* 2007;32(9):1769-86. PMID: 17173716. **E2b**

Wu Y, Stanton BF, Galbraith J, et al. Sustaining and broadening intervention impact: a longitudinal randomized trial of 3 adolescent risk reduction approaches. *Pediatrics.* 2003;111(1):e32-8. PMID: 12509592. **E3**

Yiming C, Changxin Z, Ung WS, et al. Laser acupuncture for adolescent smokers: a randomized double-blind controlled trial. *Am J Chin Med*. 2000;28(3-4):443-9. PMID: 11154059. **E8b**

Key Question 3

Ames SC, Werch CE, Ames GE, et al. Integrated smoking cessation and binge drinking intervention for young adults: a pilot investigation. *Ann Behav Med.* 2010;40(3):343-9. PMID: 20730517. **E5a**

Armitage CJ. A volitional help sheet to encourage smoking cessation: a randomized exploratory trial. *Health Psychol.* 2008;27(5):557-66. PMID: 18823182. **E5a**

Audrain-McGovern J, Stevens S, Murray PJ, et al. The efficacy of motivational interviewing versus brief advice for adolescent smoking behavior change. *Pediatrics.* 2011;128(1):e101-11. PMID: 21690120. **E3a**

Aveyard P, Johnson C, Fillingham S, et al. Nortriptyline plus nicotine replacement versus placebo plus nicotine replacement for smoking cessation: pragmatic randomised controlled trial. *BMJ*. 2008;336(7655):1223-7. PMID: 18441375. **E5b**

Aycicegi-Dinn A, Dinn W. Efficacy of an alternative smoking cessation treatment. *J Addict Dis*. 2011;30:368-81. PMID: 22026529. **E2a**

Balmford J, Borland R, Hammond D, et al. Adherence to and reasons for premature discontinuation from stop-smoking medications: data from the ITC Four-Country Survey. *Nicotine Tob Res.* 2011;13(2):94-102. PMID: 21147894. **E5a**

Bauman KE, Foshee VA, Ennett ST, et al. Family Matters: a family-directed program designed to prevent adolescent tobacco and alcohol use. *Health Promot Pract*. 2004;2(1):81-96. **E4**

Biazzo LL, Froshaug DB, Harwell TS, et al. Characteristics and abstinence outcomes among tobacco quitline enrollees using varenicline or nicotine replacement therapy. *Nicotine Tob Res.* 2010;12(6):567-73. PMID: 20378640. **E5a**

Bowen DJ, Henderson PN, Harvill J, Buchwald D. Short-term effects of a smoking prevention website in American Indian youth. *J Med Internet Res*. 2012;14:e81. PMID: 22659390. **E8a**

Bramley D, Riddell T, Whittaker R, et al. Smoking cessation using mobile phone text messaging is as effective in Maori as non-Maori. *N Z Med J*. 2005;118(1216):U1494. PMID: 15937529. **E5a**

Buffels J, Degryse J, Decramer M, et al. Spirometry and smoking cessation advice in general practice: a randomised clinical trial. *Respir Med*. 2006;100(11):2012-7. PMID: 16580189. **E5a**

Buller DB, Borland R, Woodall WG, et al. Randomized trials on Consider This, a tailored, internet-delivered smoking prevention program for adolescents. *Health Educ Behav*. 2008;35(2):260-81. PMID: 18442345. **E2b**

Cabezas C, Martin C, Granollers S, et al. Effectiveness of a stepped primary care smoking cessation intervention (ISTAPS study): design of a cluster randomised trial. *BMC Public Health.* 2009;9:48. PMID: 19193233. **E4**

Cabezas C, Advani M, Puente D, et al. Effectiveness of a stepped primary care smoking cessation intervention: cluster randomized clinical trial (ISTAPS study). *Addiction*. 2011;106(9):1696-706. PMID: 21561497. **E5a**

Chan CW, Witherspoon JM. Health risk appraisal modifies cigarette smoking behavior among college students. *J Gen Intern Med*. 1988;3(6):555-9. PMID: 3230458. **E2b**

Cohen DA, Rice JC. A parent-targeted intervention for adolescent substance use prevention: lessons learned. *Eval Rev*. 1995;19(2):159-80. PMID: 20871746. **E2b**

Coleman T, Bauld L. Preventing adolescents' uptake of smoking. *Thorax.* 2011;66(10):842-4. PMID: 21502104. **E1**

Dishion TJ, Andrews DW. Preventing escalation in problem behaviors with high-risk young adolescents: immediate and 1-year outcomes. *J Consult Clin Psychol.* 1995;63(4):538-48. PMID: 7673531. **E4**

Dixon AL, Yabiku ST, Okamoto SK, et al. The efficacy of a multicultural prevention intervention among urban American Indian youth in the southwest U.S. *J Prim Prev*. 2007;28(6):547-68. PMID: 18058235. **E2b**

Elder JP, Litrownik AJ, Slymen DJ, et al. Tobacco and alcohol use-prevention program for Hispanic migrant adolescents. *Am J Prev Med.* 2002;23(4):269-75. PMID: 12406481. **E2b**

Etter JF. Comparing computer-tailored, internet-based smoking cessation counseling reports with generic, untailored reports: a randomized trial. *J Health Comm*. 2009;14(7):646-57. PMID: 19851916. **E5b**

Faessel H, Ravva P, Williams K. Pharmacokinetics, safety, and tolerability of varenicline in healthy adolescent smokers: a multicenter, randomized, double-blind, placebo-controlled, parallel-group study. *Clin Ther*. 2009;31(1):177-89. PMID: 19243716. **E1b**

Fang CY, Ma GX, Miller SM, et al. A brief smoking cessation intervention for Chinese and Korean American smokers. *Prev Med*. 2006;43(4):321-4. **E5b**

Franken FH, Pickworth WB, Epstein DH, et al. Smoking rates and topography predict adolescent smoking cessation following treatment with nicotine replacement therapy. *Cancer Epidemiol Biomarkers Prev*. 2006;15(1):154-7. PMID: 16434603. **E1b**

Griffin KW, Botvin GJ, Nichols TR, et al. Effectiveness of a universal drug abuse prevention approach for youth at high risk for substance use initiation. *Prev Med*. 2003;36(1):1-7. PMID: 12473419. **E2b**

Hansen WB, Malotte CK, Fielding JE. Tobacco and alcohol prevention: preliminary results of a four-year study. *Adolesc Psychiatry*. 1987;14:556-75. PMID: 3618940. **E2b**

Hanson K, Allen S, Jensen S, et al. Treatment of adolescent smokers with the nicotine patch. *Nicotine Tob Res.* 2003;5(4):515-26. PMID: 12959789. **E1b**

Hellmann R, O'Shea RM, Kunz ML, et al. University health service physician intervention with cigarette smokers. *J Am Coll Health*. 1988;37(2):91-3. PMID: 3241031. **E5a**

Helstrom A, Hutchison K, Bryan A. Motivational enhancement therapy for high-risk adolescent smokers. *Addict Behav.* 2007;32(10):2404-10. PMID: 17428617. **E5b**

Hiemstra M, Ringlever L, Otten R, et al. Efficacy of smoking prevention program "Smoke-free Kids": study protocol of a randomized controlled trial. *BMC Public Health.* 2009;9:477. PMID: 20025727. **E4**

Higgs PE, Edwards D, Harbin RE, et al. Evaluation of a self-directed smoking prevention and cessation program. *Pediatr Nurs*. 2000;26(2):150-3. PMID: 12026268. **E2b**

Holt S, Timu-Parata C, Ryder-Lewis S, et al. Efficacy of bupropion in the indigenous Maori population in New Zealand. *Thorax.* 2005;60(2):120-3. PMID: 15681499. **KE5a**

Horn K, Dino G, Hamilton C, et al. Efficacy of an emergency department-based motivational teenage smoking intervention. *Prev Chronic Dis*. 2007;4(1):A08. PMID: 17173716. **E9a**

Jason LA, Mollica M, Ferrone L. Evaluating an early secondary smoking prevention intervention. *Prev Med.* 1982;11(1):96-102. PMID: 7079250. **E2b**

Kang HC, Shin KK, Kim KK, et al. The effects of the acupuncture treatment for smoking cessation in high school student smokers. *Yonsei Med J*. 2005;46(2):206-12. PMID: 15861492. **E4**

Kelleher CC, Fallon UB, Mc Carthy E, et al. Feasibility of a lifestyle cardiovascular health promotion programme for 8–15-year-olds in Irish general practice: results of the Galway Health Project. *Health Promot Int*. 1999;14(3):221-30. **E3**

Kelly AB, Lapworth K. The HYP Program: targeted motivational interviewing for adolescent violations of school tobacco policy. *Prev Med.* 2006;43(6):466-71. PMID: 16920183. **E3**

Kim S, Nam KA, Seo M, et al. Effectiveness of a smoking cessation program for adolescents. *Taehan Kanho Hakhoe Chi*. 2004;34(4):646-54. PMID: 15502430. **E2b**

Knishkowy B, Verbov G, Amitai Y, et al. Reaching Jewish ultra-orthodox adolescents: results from a targeted smoking prevention trial. *Int J Adolesc Med Health*. 2012;24:173-9. PMID: 22909927. **E8a**

Knutsen SF, Knutsen R. The Tromso Survey: the Family Intervention study—the effect of intervention on some coronary risk factors and dietary habits, a 6-year follow-up. *Prev Med.* 1991;20(2):197-212. PMID: 2057468. **E6b**

Lindenberg CS, Solorzano RM, Bear D, et al. Reducing substance use and risky sexual behavior among young, low-income, Mexican-American women: comparison of two interventions. *Appl Nurs Res*. 2002;15(3):137-48. PMID: 12173165. **E5a**

Lipkus IM, McBride CM, Pollak KI, et al. A randomized trial comparing the effects of self-help materials and proactive telephone counseling on teen smoking cessation. *Health Psychol.* 2004;23(4):397-406. PMID: 15264976. **E3**

Litrownik AJ, Elder JP, Campbell NR, et al. Evaluation of a tobacco and alcohol use prevention program for Hispanic migrant adolescents: promoting the protective factor of parent-child communication. *Prev Med.* 2000;31(2 Pt 1):124-33. PMID: 10938212. **E4**

McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction*. 2004;99(1):39-52. PMID: 14678061. **E5b**

McCambridge J, Hunt C, Jenkins RJ, et al. Cluster randomised trial of the effectiveness of motivational interviewing for universal prevention. *Drug Alcohol Depend*. 2011;114(2-3):177-84. PMID: 21075562. **KQ3E2b**

Molyneux A, Lewis S, Leivers U, et al. Clinical trial comparing nicotine replacement therapy (NRT) plus brief counselling, brief counselling alone, and minimal intervention on smoking cessation in hospital inpatients. *Thorax.* 2003;58(6):484-8. PMID: 12775857. **E5a**

Moolchan ET, Robinson ML, Ernst M, et al. Safety and efficacy of the nicotine patch and gum for the treatment of adolescent tobacco addiction. *Pediatrics.* 2005;115(4):e407-14. PMID: 15805342. **E1b**

Nides M, Glover ED, Reus VI, et al. Varenicline versus bupropion SR or placebo for smoking cessation: a pooled analysis. *Am J Health Behav*. 2008;32(6):664-75. PMID: 18442345. **E5a**

Nishiokai N, Kawabata T, Minagawa KH, et al. Three-year follow-up on the effects of a smoking prevention program for elementary school children with a quasi-experimental design in Japan. *Jpn J Public Health*. 2005;52(11):971-8. **E2b**

Nohlert E, Tegelberg A, Tillgren P, et al. Comparison of a high and a low intensity smoking cessation intervention in a dentistry setting in Sweden: a randomized trial. *BMC Public Health.* 2009;9:121. PMID: 19405969. **E5a**

Norman CD, Maley O, Li X, et al. Using the internet to assist smoking prevention and cessation in schools: a randomized, controlled trial. *Health Psychol.* 2008;27(6):799-810. PMID: 19025276. **E2b**

Ossip DJ, Abrams SM, Mahoney MC, et al. Adverse effects with use of nicotine replacement therapy among quitline clients. *Nicotine Tob Res.* 2009;11(4):408-17. PMID: 19325134. **E5a**

Peterson AV Jr, Kealey KA, Mann SL, et al. Group-randomized trial of a proactive, personalized telephone counseling intervention for adolescent smoking cessation. *J Natl Cancer Inst*. 2009;101(20):1378-92. PMID: 19822836. **E2b**

Prokhorov AV, Kelder SH, Shegog R, et al. Impact of A Smoking Prevention Interactive Experience (ASPIRE), an interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high-school students. *Nicotine Tob Res.* 2008;10(9):1477-85. PMID: 19023839. **E2b**

Ravva P, Gastonguay MR, French JL, et al. Quantitative assessment of exposure-response relationships for the efficacy and tolerability of varenicline for smoking cessation. *Clin Pharmacol Ther*. 2010;87(3):336-44. PMID: 20107434. **E5a**

Robinson LA, Vander Weg MW, Riedel BW, et al. "Start to stop": results of a randomised controlled trial of a smoking cessation programme for teens. *Tob Control.* 2003;12(Suppl 4):iv26-33. PMID: 14645937. **E5b**

Roddy E, Romilly N, Challenger A, et al. Use of nicotine replacement therapy in socioeconomically deprived young smokers: a community-based pilot randomised controlled trial. *Tob Control.* 2006;15(5):373-6. PMID: 16998171. **E2b**

Rodgers A, Corbett T, Bramley D, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control.* 2005;14(4):255-61. PMID: 16046689. **E5a**

Roll JM. Assessing the feasibility of using contingency management to modify cigarette smoking by adolescents. *J Appl Behav Anal*. 2005;38(4):463-7. PMID: 16463527. **E8a**

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Tonstad S. Smoking cessation efficacy and safety of varenicline, an alpha4beta2 nicotinic receptor partial agonist. *J Cardiovasc Nurs*. 2006;21(6):433-6. PMID: 17293731. **E5b**

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Walker Z, Townsend J, Oakley L, et al. Health promotion for adolescents in primary care: randomised controlled trial. *BMJ (Clin Res)*. 2002;325(7363):524. **E9a**

Walsh MM, Langer TJ, Kavanagh N, et al. Smokeless tobacco cessation cluster randomized trial with rural high school males: intervention interaction with baseline smoking. *Nicotine Tob Res.* 2010;12(6):543-50. PMID: 20439384. **E2b**

Walsh MM, Hilton JF, Ellison JA et al. Spit (smokeless) tobacco intervention for high school athletes: results after 1 year. *J Smok Cessat*. 2003;28:1095-113. PMID: 12834653. **E2b**

Werch CE, Young M, Clark M, et al. Effects of a take-home drug prevention program on drug-related communication and beliefs of parents and children. *J Sch Health*. 1991;61(8):346-50. PMID: 1787697. **E4**

Whittaker R, Dorey E, Bramley D, et al. A theory-based video messaging mobile phone intervention for smoking cessation: randomized controlled trial. *J Med Internet Res.* 2011;13(1):e10. PMID: 21371991. **E5a**

Woodruff SI, Conway TL, Edwards CC, et al. Evaluation of an Internet virtual world chat room for adolescent smoking cessation. *Addict Behav.* 2007;32(9):1769-86. PMID: 17173716. **E2b**

Wu Y, Stanton BF, Galbraith J, et al. Sustaining and broadening intervention impact: a longitudinal randomized trial of 3 adolescent risk reduction approaches. *Pediatrics.* 2003;111(1):e32-8. PMID: 12509592. **E3**

Yiming C, Changxin Z, Ung WS, et al. Laser acupuncture for adolescent smokers: a randomized double-blind controlled trial. *Am J Chin Med*. 2000;28(3-4):443-9. PMID: 11154059. **E1b**

Appendix D. Inclusion/Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Condition Definition	▪ Use of tobacco, including cigarettes, smokeless tobacco, cigars, and pipes. ▪ A standard definition of tobacco use in adolescents is any use in the past 30 days. However, we will accept different definitions used in included trials, such as any use in the past 7 days, daily users, etc. ▪ Categories of users include never users (never used tobacco at all), former users, experimental or episodic users, and regular users	
Population	▪ Humans, all races, ethnicities, cultural groups ▪ Adolescents (ages 13–18 years) and children (ages <13 years) ▪ More than 50% of participants ages 18 years or younger OR subgroup of participants ages 18 years or younger are analyzed and reported separately from adults	▪ Adults (ages >18 years), unless adolescent subgroup results reported separately from adult results ▪ Trials limited to children or adolescents with cognitive, substance abuse, mental health, or other health issues that would limit generalizability to general primary care patients ▪ Pregnant adolescents
Interventions	▪ Primary care-relevant* behavioral counseling interventions, including individual, group, phone, or computer-based, including quitlines and health care system-level interventions ▪ May include adjunctive use of nicotine replacement therapy or buproprion (Zyban) or varenicline tartrate (Chantix) ▪ Complementary and alternative medicine treatments, such as acupuncture, hypnosis * Conducted in primary care or judged to be feasible or applicable to primary care: ▪ involves individual-level identification ▪ usually involves primary care staff (primary care physicians, other physicians, nurses, nurse practitioners, physician assistants, or related clinical staff [e.g., health educators, other counselors]), or the intervention is seen as connected to the health care system by participant ▪ delivered to individuals or small groups (15 or less participants, generally no more than 8 group sessions over 12 months) ▪ located anywhere, as long as linked to primary care OR primary care referable such that the intervention is conducted as part of a health care setting, or is widely available in the community at a national level	▪ Broad public health or policy interventions ▪ Trials to reduce environmental tobacco exposure as a means for preventing future smoking in children ▪ Trials using peer counseling where individuals are likely to know one another ▪ Trials where participants are highly likely to know one another (i.e., closed social groups) and participant interaction is likely
Comparisons	▪ Usual care ▪ Minimal care (no more than one single brief contact per year, or brief written materials such as pamphlets) ▪ No intervention ▪ Attention control ▪ Wait list	Active intervention (more intensive than a single, brief contact per year or brief written materials)
Outcomes	**KQ 1** ▪ Prevalence or severity of asthma, chronic bronchitis, or other respiratory disorders ▪ Dental/oral health ▪ Adult smoking rate, incidence, or prevalence **KQ 2** ▪ Smoking rate, incidence, or prevalence ▪ Smoking cessation **KQ 3** ▪ Paradoxical increase in smoking rate, incidence, or prevalence ▪ Demoralization due to failed quit attempt ▪ Depression ▪ Adverse effects of pharmacotherapy or other physical intervention (e.g., acupuncture)	▪ Reduction in amount smoked ▪ Attitudes or knowledge about tobacco

Appendix D. Inclusion/Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Outcome Assessment	▪ Self-report ▪ Biochemically verified	Population-based smoking rates (i.e., not based on study sample, but on underlying population)
Time Period	Published from 1980 to present	Published prior to 1980
Setting	Primary care, other health care, research clinic/office, dental clinics, school-based health clinics	▪ Schools (other than health clinics delivering primary care) ▪ Inpatient ▪ Institutional/residential
Study Geography	Developed countries, rated "very high" using HDI 2010 methodology (http://hdr.undp.org/en/statistics/), including: Andorra, Australia, Austria, Bahrain, Barbados, Belgium, Brunei Darussalam, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, China (SAR), Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea (Republic of), Liechtenstein, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States	All other countries
Publication Language	English	All other languages
Study design	**KQs 1–3 (behaviorally-based only)** ▪ RCT, GRT, CCT ▪ Minimum 6-month followup postbaseline (24 weeks) **KQ 3 (pharmacotherapy or other physical intervention only)** ▪ RCT, GRT, CCT, comparative observational designs ▪ No minimum followup	**KQs1–3 (behaviorally-based only)** ▪ All other study designs ▪ Less than 6-month followup postbaseline (24 weeks) **KQs 1, 2 (pharmacotherapy or other physical intervention only)** ▪ Nonplacebo controlled **KQ 3 (pharmacotherapy or other physical intervention only)** ▪ All other study designs
Quality	Fair or Good quality	▪ Poor quality ▪ <60% retention overall

Abbreviations: CCT = case controlled trial; GRT = group randomized trial; HDI = Human Development Index; KQ = key question; RCT = randomized controlled trial.

Appendix E. Comparison of Included Studies

Study	USPSTF Review, 2012	Prevention		Cessation			
		Christakis, 2003[73]	Thomas, 2007[43]	PHS, 2008[63]	Grimshaw, 2009[39]	Sussman, 2009[61]	Reason for Exclusion in Current USPSTF Review†
Adelman, 2001[123]						X	Classroom based intervention
Ary, 1990[124]			X			X	Classroom based intervention
Audrey, 2006[125]						X	Classroom based intervention
Ausems, 2002[85]	X						NA
Aveyard, 2001[26]					X	X*	Classroom based intervention
Baskerville, 1993[127]						X	Quasi-experimental
Bauman, 2001[100]	X		X			X*	NA
Beaglehole, 1978[128]						X	Classroom based intervention
Biglan, 1987[129]			X				Classroom based intervention
Bloor, 1999[130]						X	Classroom based intervention
Brown, 2003[131]				X	X	X	Adolescents with psychiatric disorders
Chan, 1988[132]					X	X	Freshman dorms
Charlton, 1992[133]						X	Classroom based intervention
Cinnomin, 1995[134]						X	Classroom based intervention
Colby, 2005[87]	X			X	X	X	NA
Colby, 2012[104]	X						NA
Coleman-Wallace, 1999[135]						X	Quasi-experimental
Connell, 2007[136]			X				Classroom based intervention
Cullen, 1996[137]			X				Long-term followup for child behavior disorders
Curry, 2003[11]	X		X				NA
Diguisto, 1994[138]						X	Quasi-experimental
Dino, 1998[139]						X	Quasi-experimental
Dino, 2001 (*Prev Med*)[140]					X	X	Quasi-experimental
Dino, 2001 (*J School Nurs*)[141]						X	Quasi-experimental
Dishion, 1995[142]			X				No relevant outcomes
Elder, 1996[143]			X				School policy intervention
Etter, 1999[144]						X	Quasi-experimental
Fidler, 2001[88]	X	X					NA
Forman, 1990[145]			X				Classroom based intervention
Forster, 1998[146]						X	Community intervention
Glasgow, 1999[147]						X	Mean age >18 years
Gray, 2011[89]	X						NA
Greenberg, 1978[148]					X	X	Quasi-experimental
Haggerty, 2007[90]	X						NA
Hamilton, 2005[149]						X	Classroom based intervention
Hancock, 2001[150]						X	Community intervention
Hoffman, 2008[151]					X		School intervention
Hollis, 2005[91]	X				X	X	NA
Horn, 1999[152]						X	School intervention
Horn, 2004[153]					X	X	Quasi-experimental
Horn, 2005[154]					X	X	Quasi-experimental
Horn, 2005 (*Prev Chronic Dis*)[155]						X	Quasi-experimental
Horn, 2007[156]				X	X	X	High or differential attrition
Horswell, 1997[157]						X	Quasi-experimental

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Study	USPSTF Review, 2012	Prevention		Cessation			
		Christakis, 2003[73]	Thomas, 2007[43]	PHS, 2008[63]	Grimshaw, 2009[39]	Sussman, 2009[61]	Reason for Exclusion in Current USPSTF Review†
Hotte, 1997[158]						X	Quasi-experimental
Hovell, 1996[81]	X	X					NA
Jackson, 2006[92]	X		X				NA
Jason, 1982[159]						X	Classroom based intervention
Josendal, 1998[160]			X				Excluded at abstract stage
Kelly, 2006[161]					X		Control group received active intervention
Kentala, 1999[93]	X	X				X	NA
Killen, 1988 [162]						X	Classroom based intervention
Killen, 2004[94]	X				X		NA
Kohler, 2005[163]						X	Quasi-experimental
Knutsen, 1991[164]			X				Tobacco use not primary target
Kohler, 2008[165]					X	X*	Quasi-experimental
Lando, 2007[95]	X					X*	NA
Lazovich, 2001[166]						X	Contingency-based court diversion
Lipkus, 2004[167]					X	X	Control group received active intervention
Lotecka, 1983[168]						X	Quasi-experimental
Moolchan, 2005[169]					X		High attrition
Muramoto, 2007[96]	X				X		NA
Murray, 1994[170]						X	Quasi-experimental
Myers, 2005[171]				X	X	X	Quasi-experimental
Nutbeam, 1993[172]			X				Classroom based intervention
Olds, 1998[173]			X				Early childhood home visitation targeting children's antisocial behavior
Patten, 2006[174]					X		Control group received active intervention
Pbert, 2006[175]						X	Quasi-experimental
Pbert, 2008[79]	X						NA
Pbert, 2011[80]	X						NA
Perry, 1980[176]						X	Classroom based
Peterson, 1986[177]						X	Quasi-experimental
Peterson, 2009[178]					X		Setting
Prado, 2007[97]	X						NA
Quinlan, 2000[179]						X	Mean age >18 years
Reddy, 2002[180]			X				School intervention
Rigotti, 1997[181]						X	Quasi-experimental
Robinson, 2003[182]				X	X	X	Population (students violating smoking policy at school)
Rodgers, 2005[183]						X	Mean age >18 years
Salminen, 2005[184]			X				High or differential attrition
Schinke, 2004[185]			X				Tobacco use is not primary target
Sherbot, 2005[186]					X		Followup <6 months
Spoth, 2001[187]			X				School intervention
Spoth, 2002[188]			X				School intervention
Stevens, 2002[98]	X	X	X				NA
Stoddard, 2005[189]						X	Work site intervention
Storr, 2002[190]			X				Classroom based intervention

Appendix E. Comparison of Included Studies

Study	USPSTF Review, 2012	Prevention		Cessation			
		Christakis, 2003[73]	Thomas, 2007[43]	PHS, 2008[63]	Grimshaw, 2009[39]	Sussman, 2009[61]	Reason for Exclusion in Current USPSTF Review†
Suedfeld, 1972[191]						X	Followup <6 months
Sussman, 1995[192]						X	School intervention
Sussman, 2001[193]				X	X		Classroom based
Sussman, 2002[194]						X	Classroom based
Sussman, 2007[195]						X	Classroom based
Winkleby, 2004[196]						X	Classroom based
Woodruff, 2007[197]					X		Setting
Wu, 2003[198]			X				Control group received active intervention
Yiming, 2000[108]						X	Followup <6 months
Zack, 2005[199]						X	School intervention
Zavela, 1991[200]						X	School intervention
Zheng, 2004[201]						X	School intervention
Total	19	4	22	7	24	59‡	

* Cited a publication associated with the same trial.
† Other reasons for exclusion could have applied; only one reason was noted in this table.
‡ The Sussman review had 64 citations in the meta-analysis. One citation was listed six times (once for each cohort presented in the study) and is only listed in this table once.

Abbreviations: NA = not applicable; USPSTF = U.S. Preventive Services Task Force.

Appendix F. U.S. Preventive Services Task Force Quality Criteria and Ratings

Criteria	Good Rating	Fair Rating	Poor Rating
Initial assembly of comparable groups (adequate randomization, including first concealment and whether potential confounders were distributed equally among groups)	Met all criteria: comparable groups were assembled initially and maintained throughout the study (overall followup at least 90% and difference in followup between groups no greater than 10 percentage points); reliable and valid measurement instruments were used and applied equally to the groups; interventions were spelled out clearly; all important outcomes were considered; appropriate attention to confounders in analysis; and participants were analyzed in the groups to which they were randomized. Conservative data substitution methods were used, such as baseline observation carried forward or multiple imputation, where data substitution is used.	Studies were graded “fair” if any or all of the following problems occurred, without the fatal flaws noted in the "poor" category: generally comparable groups were assembled initially but some question remained whether some (although not major) differences occurred with followup; measurement instruments were acceptable (although not the best) and generally applied equally; some but not all important outcomes were considered; and some but not all potential confounders were accounted for. Participants were analyzed in the groups to which they were randomized.	Studies were graded "poor" if any of the following fatal flaws existed: groups assembled initially were not close to being comparable or maintained throughout the study; unreliable or invalid measurement instruments were used or not applied at all equally among groups (including not masking outcome assessment); key confounders were given little or no attention; or participants were analyzed according to intervention received, rather than an intention-to-treat approach.
Maintenance of comparable groups (includes attrition, cross-overs, adherence, contamination)			
Important differential loss to followup or overall high loss to followup			
Equal, reliable, and valid measurements (includes masking of outcome assessment)			
Clear definition of interventions			
All important outcomes considered			
Analysis (analyzed according to randomization status [intention-to-treat] rather than intervention received)			

Appendix G. Behavioral Intervention Details

Focus	Study	Behavioral Intervention Description	Behavioral Intervention Duration
Combined Prevention and Cessation	Bauman, 2002[86]	Successive mailings of four booklets and health educator telephone discussions with parents 2 weeks after each mailing. Booklets focused on family motivation to participate and engage, family characteristics known to influence adolescents not specific to alcohol and tobacco use, tobacco- and alcohol-specific predictors that originate in the family, and predictors that originate outside the family. Booklets all had specific activities to reinforce content that the families completed on their own. Health educators encouraged participation of all family members, answered parents' questions, and recorded information. Adolescent was reached through family members and was not contacted directly by health educator.	Four booklets and related activities completed by family members over 15 weeks (total time ~4 hours and 25 minutes), ~8 phone calls with health educator over 15 weeks discussing program and completing standard protocol (total time ~57.5 minutes per family); for families that completed all four units, it required an average of nearly 6 months (173.2 days [SD, 71.3]) between booklet one and completion of the fourth unit.
	Hollis, 2005[91]	Teen Reach (Research Approaches to Cancer in a Health Maintenance Organization). Staff provided primary care clinicians with a 30- to 60-second suggested advice message to encourage teens to stop smoking or to not start. Clinicians were asked to encourage the patient to talk briefly with a health counselor immediately after the visit. Teens had a 10- to 12-minute session on the computer with the PTC expert system, which assessed their stage of readiness to begin smoking or their stage of change to quit smoking and then delivered tailored advice and encouragement. The program included testimonial movies and graphics. Teens had 3 to 5 minutes of post-PTC motivational counseling. Handouts included a synopsis of stage-relevant advice and small quit kits. There were two booster sessions with the PTC and health counselor over the remaining 11 months.	One 30- to 60-second advice message from PCP; one to three 3- to 5-minute sessions with health counselor over 12 months; one 10- to 12-minute computer session.
	Kentala, 1999[93]	Nonsmokers were given positive feedback regarding smoking abstinence. After the dental exam, all patients were shown photos showing effects of smoking on teeth. Smokers were given a mirror to assess signs of smoking on their own teeth. Smokers and nonsmokers received the usual dental exam.	Brief part of annual dental visit (only a couple minutes).
	Lando, 2007[95]	Brief advice on smoking cessation and prevention during dental exam. Videos from the CDC and Massachusetts Department of Public Health. Motivational interviewing to either encourage cessation or encourage prevention. Brief supportive telephone calls.	60 seconds of advice from dental hygienist or dentist; one 15- to 20-minute session of motivational interviewing; 3–6 phone calls over 6 months (estimated 10 minutes per call).
	Pbert, 2008[79]	Providers asked about smoking, advised cessation or continued abstinence, and referred the patient to a peer counselor. Peer counseling combined the 5A model with motivational interviewing and behavior change counseling.	Advice from the pediatrician given during normal clinic visit (assumed brief). 15- to 30-minute session with peer counselor at the clinic. Four 10-minute phone calls over 21 weeks.
	Prado, 2007[97]	Familias Unidas aimed to increase parental involvement, positive parenting, parent-adolescent communication, and family support. Parent-centered intervention, majority of components were delivered to parents (adolescent participation limited to family visits and discussion circles). Parents were placed in positions of leadership and expertise and built on panHispanic values, such a primacy of family, sanctity of parental authority, and roles of parents as the family's leaders and educators. Hispanic-specific cultural issues were integrated in all aspects of the intervention, from the underlying theoretical model, to the specific content of the intervention, to the format of the activities. Also included Parent Preadolescent Training for HIV (PATH), which focused on increasing parent-adolescent communication about sex and HIV risks. Intervention was delivered in Spanish.	15 group sessions, eight family visits, and two parent-adolescent circles. Approximately 49 hours over 1 year.
	Stevens, 2002[98]	Dartmouth Prevention Cohort Study. Primary care clinician focused on alcohol and tobacco use. Discussed risks with the child and parent. Signed a contract that the family would talk about risks at home and develop a family policy about alcohol and tobacco. Family received signed letter by their clinician reinforcing the agreement and a refrigerator magnet to post the contract. Reminded of the importance of family communication regarding alcohol and tobacco at subsequent office visits for 36 months. Clinician's role was to provide risk behavior information, encourage family communication, and offer help. Brochure on effective communication. 12 newsletters for each of the parents and children mailed to reinforce messages. Biannual telephone calls.	1 baseline session with PCP; 24 newsletters over 36 months; six phone calls over 36 months; additional PCP encouragement if additional office visits.

Appendix G. Behavioral Intervention Details

Focus	Study	Behavioral Intervention Description	Behavioral Intervention Duration
	Curry, 2003[11]	Five intervention components addressed important individual, interpersonal, and environmental factors known to influence the smoking onset process: the child's attitudes, beliefs, and knowledge; dispositional factors such as high risk taking; the beliefs, attitudes, and behaviors of parents and peers; and tobacco marketing and availability. Families received a packet with materials for parents and children and a video with viewing guide. Parents received two counseling telephone calls and a mailed newsletter. Parent handbook provided information to encourage, motivate, and reinforce parent-child communication about tobacco. Children's packet included a pen and stickers with antitobacco messages and a comic book that described the dangers of tobacco, advertising deceptiveness, and how to resist peer pressure to smoke. Could receive motivational message during any routine primary care appointments. (22% of IG and 15% of CG said their provider discussed tobacco with their child; 17% of IG and 3% of CG said the provider mentioned the Steering Clear project.)	One counseling call 3–6 weeks after receipt of written materials, additional call 14 months after enrollment. 28-minute video.
Prevention Only	Ausems, 2002[85]	Three tailored newsletters mailed at 3-week intervals addressed to the student. Included essential components of successful social influence programs. Contents of letters were individualized. The first letter contained information regarding students' beliefs about smoking and the short-term consequences of smoking. The second letter focused on the influence of the social environment and intentions to not smoke in the future. The third letter described refusal techniques and included an exercise about cigarette refusal.	Three newsletters mailed at 3-week intervals (Intervention ran from November 1997 to early February 1998).
	Fidler, 2001[88]	Age-related materials about the advantages of remaining a nonsmoker. Some materials addressed other smoking-related issues and only incidentally referred to the dangers and health effects of smoking. Sent certificates affirming their nonsmoking decision and status and were encouraged to contact the project team if they wished.	Four mailings over 12 months.
	Haggerty, 2007[90]	Universal substance abuse and problem behavior preventive intervention for families (at least one parent and their teen together) including parenting, youth, and family components. The workbook includes the following components: roles (relating to your teen), risks (identifying and reducing them), protection (bonding with your teen to strengthen resilience), tools (working with your family to solve problems), involvement (allowing everyone to contribute), policies (setting family policies on health and safety issues), and supervision (supervising without invading).	IG1: Completed activities at home within 10 weeks. Contacted by phone once per week. IG2: Seven group and family sessions over 7 weeks, 2.5 hours for sessions 1, 4, and 7; 2 hours for sessions 2, 3, 5, and 6. Home practice encouraged.
	Hovell, 1996[81]	Staff created a tobacco-free environment by formalizing a nonsmoking office policy, removing tobacco ads, discontinuing magazines with such ads, and displaying tobacco prevention information. Patients received antitobacco "prescriptions" with a specific antitobacco message preprinted on the form (topics: announcement of tobacco-free office, tobacco advertising, tobacco and sports, smokeless tobacco, nicotine and tobacco addiction, passive smoking, tobacco and teeth, and negative consequences of tobacco use), a space for their name to be filled in, and a place to sign the prescription. Assume there was also a brief counseling session with the orthodontist.	Zero to more than seven prescriptions delivered individually over 2 years.
	Jackson, 2006[92]	Participants received five core activity guides mailed to their homes at approximate 2-week intervals (one additional booster guide was received 1 year after baseline). Delivery of newsletters, tip sheets, and incentives was timed as appropriate to complement or reinforce each program guide.	Five activity guides mailed at 2-week intervals; one booster guide received 1 year after baseline.
Cessation Only	Colby, 2005[87]	Motivational interviewing. Pros and cons of smoking and quitting, highlighted ambivalence and identified salient aspects of smoking. Personalized feedback sheet that summarized information from baseline assessment. Corrective normative feedback; personalized information about health effects, CO, and dependence level; and financial costs. Detailed action plan, anticipation of barriers, strategizing methods to overcome barriers. Enhanced self-efficacy. Same handouts as CG, feedback sheet, goal sheet, and information about strategies for quitting and coping with withdrawal. Telephone booster call to reinforce initial progress toward goals, emphasized personal choice for change, discussed coping skills and problem-solving, and promoted self-efficacy.	One baseline session (35 minutes); one 15- to 20-minute telephone booster session at 1 week.

Appendix G. Behavioral Intervention Details

Focus	Study	Behavioral Intervention Description	Behavioral Intervention Duration
	Colby, 2012[104]	Same intervention as Colby 2005. One motivational interviewing session plus one booster phone call, as well as print materials. Additional component where parents of intervention participants were asked to participate in one session that focused on increasing parent support for the adolescent's goals for changing smoking, increasing clear communication, and establishing home smoking rules. Parents in both conditions were mailed informational materials on helping adolescents quit smoking.	One baseline session (45 minutes), one 15- to 20-minute telephone booster session at 1 week, and one 15- to 20-minute discussion with parents.
	Pbert, 2011[80]	Based on the 5A model and adapted to be developmentally appropriate for adolescents. Advised the student to stop smoking. Assessed motivation to quit. Assisted the adolescent to quit by addressing pros/cons of smoking, personal reasons for quitting, anticipated problems, previous quit attempts, nicotine addiction, quit methods, setting a quit date, triggers, and strategies. Assisted the adolescent to quit by addressing managing triggers, handling social situations, withdrawal symptoms and their management, managing cravings, managing stress, minimizing weight gain, gaining support, taking control of one's environment, and rewarding oneself. Assisted in maintaining abstinence if the adolescent quit. Nurse asked open-ended questions to actively engage adolescent.	Weekly private one-on-one sessions for 4 weeks (two 30-minute sessions, two 15-minute sessions).
Cessation Only (Medication)	Killen, 2004[94]	Both IG and CG received the behavioral intervention. Group-based skills training. Groups met weekly and were supervised by trained counselors. Counselors demonstrated the use of specific, concrete, self-regulatory skills for coping with risky situations without resorting to smoking and helped participants develop action plans to promote nonsmoking in self-identified, high-risk situations. (Medication: IG: 150 mg bupropion + NRT; CG: placebo + NRT)	Weekly group sessions (~8 participants/group) for 10 weeks (assumed), 45 minutes each.
	Muramoto, 2007[96]	Both IG and CG received the behavioral intervention. Brief individual counseling sessions standardized to address a series of topics addressing teaching skills related to changing smoking behaviors (e.g., identifying social support, identifying motivations and barriers to quitting, recognition of triggers for smoking, management of nicotine craving and withdrawal symptoms, and stress management). Telephone number for state quit line provided for additional behavioral support. (Medication: IG1: 150 mg bupropion; IG2: 300 mg bupropion; CG: placebo)	Seven individual sessions over 7 weeks, 10- to 20-minutes each.

Abbreviations: 5A = Ask, Advise, Assess, Assist, Arrange Followup; CDC = Centers for Disease Control and Prevention; CG = control group; CO = carbon monoxide; IG = intervention group; NRT = nicotine replacement therapy; PCP = primary care practitioner; PTC – Pathways to Change.

Appendix H. Trials Pending Assessment

Study Reference	Study Name	Aim	Location	Number of Participants	Intervention Description	Relevant Outcomes	2012 Status
Cremers HP, Mercken L, Oenema A, de Vries H. A web-based computer-tailored smoking prevention programme for primary school children: intervention design and study protocol. *BMC Public Health*. 2012;12:277. PMID: 22490110	Fun Without Smokes	Prevention	The Netherlands	3,240 (estimated enrollment)	Personalized feedback including information about nonsmoking, positive attitudes toward nonsmoking, negative attitudes toward smoking, and skills and plans to refuse cigarettes. Email and SMS messages will be used as prompts to promote visits to the intervention Web site.	Self-reported smoking status	Protocol
Fellows JL, Hollis JF, Laferriere D, et al. Proactive Recruitment for Teen Tobacco Cessation: The Power of the Teachable Moment. Paper presented at: 16th Annual Meeting of the Society for Research on Nicotine and Tobacco; Baltimore; February 24–27, 2010.	Quithelper	Cessation	United States	266	Five proactive telephone counseling calls. Highly-interactive Web site to assess readiness, barriers, confidence, quit plans, triggers, relapse prevention, peer support, and information. Coach-Web interaction enhanced tailoring.	30-day abstinence	Baseline data; manuscript in preparation
Hiemstra M, Ringlever L, Otten R, et al. Efficacy of smoking prevention program "Smoke-free Kids": study protocol of a randomized controlled trial. *BMC Public Health*. 2009;9:477. PMID: 20025727.	Smoke-free Kids	Prevention	The Netherlands	1,479	Five printed activity modules at 4-week intervals. Each module aims to modify different socialization variables (general communication about smoking, influence of smoking messages, setting rules about smoking, creating a smokefree house, increased awareness of peer influence). Three emailed newsletters. Booster module on staying smokefree and motivational information throughout high school years.	Initiation of cigarette smoking; asthma symptoms	Protocol
Klein JD. Adolescent smoking cessation in pediatric primary care. 2011.	Smokebusters	Cessation	United States	8,160 (estimated enrollment)	5A model: ask if the patient smokes; advise every patient to quit; assess readiness to quit; assist in quitting and finding services; arrange for cessation services and followup.	Self-reported smoking status	Recruiting participants
Pierce JP, James LE, Messer K, et al. Telephone counseling to implement best parenting practices to prevent adolescent problem behaviors. *Contemp Clin Trials*. 2008;29:324-34. PMID: 17964223.	Parenting to Prevent Problem Behaviors	Prevention	United States	1,036	Self-help manual on best parenting practice mailed to participating families with assistance working through the manual provided by phone calls with a lay facilitator. Scheduled quarterly telephone calls during which the facilitator follows a computer-assisted structured counseling script (including motivational interviewing).	Tobacco use	Protocol; baseline data
Schepis TS, Warren KA, Rao U. Evaluation of a cognitive-behavioral smoking cessation treatment for adolescents and young adults (POS2-53). Paper presented at 12th Annual Meeting of Society for Research on Nicotine and Tobacco; Orlando; February 15–18, 2006.	NR	Cessation	NR	NR	Cognitive-behavioral treatment (Modified Brief Office Intervention) and bupropion	Smoking status	4-week results presented at a meeting