Interventions for Prevention and Treatment of Tobacco Smoking in School-aged Children and Adolescents: Systematic Review and Meta-analysis

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Abstract

Background: This systematic review was produced for the Canadian Task Force on Preventive Health Care (CTFPHC) to inform the development of new guidelines on the prevention and treatment of tobacco smoking by school-aged children and adolescents.

Purpose: To systematically review evidence on the efficacy and harms of interventions to prevent and treat tobacco smoking in school-aged children and adolescents in primary health care or related settings, as well as evidence on child/youth/parent preferences for such interventions and child/youth preferences for being asked about personal smoking behaviours.

Data Sources: For key questions on efficacy and harms this systematic review considered studies included in a recent (2012) United States Preventive Services Task Force (USPSTF) review on the same topic. We adapted and updated the USPSTF's search to April 2015. We searched MEDLINE, PsycINFO, Embase, PubMed, Cochrane Central, Cochrane Database of Systematic Reviews, and the Database of Abstracts of Reviews of Effects for citations in English and French. A manual search of recent on-topic systematic reviews was conducted to look for potentially eligible trials not captured by the database search. A separate search was conducted for contextual questions on participants' preferences using three databases (MEDLINE, Embase and PsycINFO) looking for evidence published in English or French over the last 10 years (2005-2015), and through a web-based grey literature search using the Canadian Agency for Drugs and Technologies in Health Grey Matters search tool and Google advanced search looking for recent on-topic sources providing Canadian specific data.

Study Selection: Titles and abstracts of papers considered for the key questions were reviewed independently by two reviewers; any article marked for inclusion by either reviewer went on to full-text screening. Full-text review was done independently by two reviewers with consensus required for inclusion or exclusion. For the efficacy questions we included randomized controlled trials (RCTs) that recruited young people, aged 5 to 18 and/or their families, into behavioural tobacco smoking prevention programs or into behavioural, alternative, or complimentary tobacco smoking treatment programs, delivered in primary health care or related settings by health care professionals, in very high human development index countries. The outcomes were incidence of tobacco smoking or incidence of stopping tobacco smoking assessed at least six months after the start of the intervention, and prevalence of tobacco smoking in adulthood. For the harms questions we included RCTs and studies using any comparative observational design that reported any harms of treatment, at any point following the start of the intervention. For the contextual questions, title and abstract screening was performed by two independent raters; full-text relevance screening was done by one person. Published or grey literature studies were included if they provided data on participants' preferences regarding tobacco smoking prevention and treatment interventions for school-aged children and youth, or if they reported on child/youth preferences for being asked about smoking behaviour, and if they were relevant to the Canadian context.

Data Extraction and Quality Assessment: Review team members extracted data about the population, study design, intervention, analysis and results for outcomes of interest. All RCTs were assessed using the Cochrane Risk of Bias Tool. For each study, one team member

completed full extraction and a second team member verified all extracted data and ratings. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was used to assess the strength and quality of the evidence. Data extraction for the articles selected to address the contextual questions was performed by one team member. No assessment of the methodological quality of these studies was conducted.

Analysis: We performed meta-analyses for binary outcomes utilizing the number of events, proportion or percentage data to generate the summary measures of effect in the form of risk ratios (RRs). Some adjustments were made to the data to account for clustering or design effects and baseline smoking prevalence. Supplementing the GRADE analyses, for outcomes that showed significant effects we calculated absolute risk reduction (ARR) or absolute risk increase (ARI) and number needed to treat (NNT). Data were available to conduct several subgroup analyses [based on baseline age (5-12 years, 13-18 years), baseline tobacco smoking status (regular, occasional), intervention intensity (low, high), and study risk of bias rating (unclear, high)] to evaluate statistical stability and potential differences in intervention effect. When studies did not provide data necessary for pooling (i.e., when sample sizes, baseline data, and follow-up data were not reported separately for intervention and control groups), the results were described narratively. Key features of all interventions that showed a significant prevention or treatment benefit were identified. Data from studies included to answer the contextual questions were summarized descriptively.

Results: After screening 2,118 records, we included nine RCTs to answer the key questions. The mostly moderate quality evidence suggested targeted behavioural interventions can prevent smoking and assist with cessation. Meta-analysis of seven trials (N=15,545) showed intervention participants were 18% less likely to report having initiated smoking at the end of intervention relative to controls (RR 0.82, 95% CI 0.72, 0.94; ARR 1.92%; NNT 52, 95% CI 33, 161). Tests for subgroup differences were not significant. For cessation, meta-analysis of three trials (N=741) showed intervention participants were 34% or 1.3 times more likely to report having stopped smoking at the end of intervention relative to controls (RR 1.34, 95% CI 1.05, 1.69; ARI 7.98%; NNT 13, 95% CI 6, 77). Data from a single treatment trial (N=588) showed the intervention effect (incidence of cessation) was statistically significantly greater (P=0.0002) in regular smokers as compared to occasional smokers (regular smokers relative to controls RR 2.06, 95% CI 1.40, 3.04; experimental/occasional smokers relative to controls RR 0.91, 95% CI 0.65, 1.29). Treatment harms were not mentioned in the literature and no data were available to assess the long-term effectiveness of the interventions. Two studies observed statistically significant intervention effects; these interventions shared some features (e.g., focused only on tobacco, targeted individual youth, education/information components, lasted 12 months) but differed in other ways (e.g., intensity, setting, delivery mode, interventionists, personal contact). With regards to the contextual questions, no studies were found that provided data on school-aged children's and youth's preferences regarding how and under what conditions they are asked about their personal tobacco smoking history. Ten papers (nine studies) were found that addressed the question of participants' preferences regarding interventions. Data from the two tobacco prevention studies indicated parents had favourable attitudes toward offering their children and youth interventions to prevent tobacco use, and they preferred convenient and interactive strategies. Seven studies provided data, mostly from current and former teen smokers recruited from schools, emergency departments, dental offices and youth clubs, about their

preferences for tobacco smoking treatments. Youth were receptive to participating in smoking interventions that are convenient, carried out confidentially, and provided by practitioners who relate well with youth.

Limitations: All of the included studies had unclear or high risk of bias. Smoking behaviour was measured using self-report strategies which may reflect underreporting of tobacco use. Study participants may have been more health conscious than the general population, and some treatment participants may have been more motivated to quit smoking than typical adolescent smokers. There were too few studies to investigate publication bias. We did not consider interventions for preventing or treating the use of smokeless tobacco products or e-cigarettes, nor did we examine the impact of second-hand smoke exposure. We did not investigate the effectiveness of drug or nicotine replacement therapies. We only looked at studies that evaluated primary care relevant interventions. Studies not conducted in very high human development index countries were excluded, as were papers published in languages other than English or French.

Conclusion: This review synthesized current research on the effectiveness of primary care relevant interventions for preventing and treating tobacco smoking by school-aged children and adolescents. Results, which included mostly moderate GRADE quality evidence, suggest that targeted behavioural interventions can help keep young people from trying or taking up tobacco smoking and can assist adolescents who have already started smoking to quit, without any reported harms. However, the available evidence does not provide clarity regarding ideal intervention strategies, nor does it examine the long-term impact of these interventions for preventing smoking during adulthood.

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List of Acronyms

AMSTAR	Assessing the Methodological Quality of Systematic Reviews
ARI	Absolute Risk Increase
ARR	Absolute Risk Reduction
CI	Confidence Interval
CQ	Contextual Question
CTFPHC	Canadian Task Force on Preventive Health Care
ES	Evidence Set
GRADE	Grading of Recommendations Assessment, Development and Evaluation
KQ	Key Question
NNT	Number Needed to Treat
NRT	Nicotine Replacement Therapy
PRESS	Peer Review Electronic Search Strategies
PROSPERO	International Prospective Register of Systematic Reviews
RCT	Randomized Controlled Trial
RR	Risk Ratio
SES	Socioeconomic Status
UK	United Kingdom
US	United States
USPSTF	United States Preventive Services Task Force

Chapter 1: Introduction

Purpose and Background

In Health Canada's 2012-2013 Youth Smoking Survey, 24% of youth in grades 6 to 12 reported that they had tried a cigarette at least once, with the prevalence ranging from 3% among 6th graders to 43% among 12th graders.[1] Among survey participants, 4% had smoked in the last 30 days and half of these youth reported they had smoked at least one cigarette daily. The average age for smoking a whole cigarette for the first time was 13.6 years. Prevalence of ever trying cigarette smoking by province ranged from 19% in British Columbia to 33% in Saskatchewan.[1] The majority of adult smokers in Canada report that they began smoking in their teenage years.[2]

Our aim was to systematically review published research evidence on the benefits and harms of interventions relevant to Canadian primary care that are designed to prevent school-aged children and youth from trying or taking up tobacco smoking, and to help school-aged children and adolescents who currently smoke tobacco to stop smoking. The review products will be used by the Canadian Task Force on Preventive Health Care (CTFPHC) to inform development of clinical practice guidelines on tobacco smoking prevention and treatment for children and youth.

Previous CTFPHC Recommendations and Other Guidelines

The CTFPHC has not published any recommendations on prevention or treatment of tobacco smoking for school-aged children and youth. In 2003 the United States Preventive Services Task Force (USPSTF) determined that there was insufficient evidence to recommend for or against the use of interventions to prevent and treat tobacco use in children and youth.[3] In 2013 the USPSTF released an updated B-grade recommendation encouraging primary care clinicians to provide interventions, such as education or brief counseling, to prevent tobacco use by school-aged children and adolescents[4]; recommendations were not made for or against treatment. Building from recommendations and supporting evidence found in high-quality pre-existing clinical guidelines (e.g.,[5-7]), in 2011, the Canadian Action Network for the Advancement, Dissemination and Adoption of Practice-informed Tobacco Treatment published a guideline that included summary statements specifically related to children and adolescents.[8] Canadian health care providers who worked with young people were encouraged to routinely ask them about their tobacco use (strong recommendation based on high-quality evidence), and to provide counseling to prevent children and adolescents from trying or taking up tobacco or to help them stop using tobacco products (weak recommendation based on low quality evidence).

Scan of Clinical Practice

In the absence of national or provincial/territorial guidelines or programs, current practice for prevention and treatment of child and adolescent tobacco smoking in Canada is left to the discretion of individual practitioners.

Chapter 2: Methods

The protocol is registered with the International Prospective Register of Systematic Reviews (PROSPERO) (Registration #CRD42015019051).

Analytic Framework, Key Questions and Contextual Questions

The analytic framework, presented in Figure 1, includes both prevention and treatment of child and youth tobacco smoking.

Key Questions (KQs)

Prevention

KQ1. Are behaviourally-based interventions relevant to the Canadian primary care setting that are designed to prevent tobacco smoking effective in preventing school-aged children and youth from trying or taking up tobacco smoking?

> a. Are there differences in the incidence of tobacco smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking status [never, former (e.g., have tried smoking tobacco in past but not in last 30 days)], (iii) intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a half-day or full-day workshop), low (e.g., 1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?
>
> b. What are the elements of efficacious interventions designed for preventing tobacco smoking in school-aged children and youth?

KQ2. Are behaviourally-based interventions relevant to Canadian primary care that are designed to prevent tobacco smoking in school-aged children and youth effective in reducing future tobacco smoking during adulthood?

Treatment

KQ3. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in achieving smoking cessation?

> a. Are there differences in the incidence of stopping smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking status [current regular (daily or weekly), current occasional], (iii) intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a half-day or full-day workshop), low (e.g., 1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?

b. What are the elements of efficacious interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

KQ4. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in reducing future tobacco smoking in adulthood?

KQ5. What, if any, adverse effects are associated with behaviourally-based and non-pharmacological alternative and complementary interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

Contextual Questions (CQs)

CQ1. What are school-aged children's and youth's preferences and values regarding how and under what conditions they are asked about their personal tobacco smoking history?

CQ2. What are participants' (children's, adolescents', parents') preferences and values regarding interventions designed to prevent or treat tobacco smoking by children and youth?

Search Strategy

For the key questions on benefits of interventions for preventing tobacco smoking and benefits and harms of interventions for treating tobacco smoking among school-aged children and youth we updated the search done for the 2012 USPSTF review on this same topic.[9] The USPSTF review,[9] ranked by the Evidence Review and Synthesis Centre as a high-quality review with an Assessing the Methodological Quality of Systematic Reviews (AMSTAR)[10] rating of 10/11 (Appendix A), evaluated trials considered and included in three previous reviews[11-13] that covered the tobacco prevention literature through July 2002 and the tobacco cessation literature through August 2009 (the USPSTF only considered studies published in or after 1980). The USPSTF then searched for English citations in MEDLINE, PsycINFO, the Cochrane Central Register of Controlled Trials, the Cochrane Database of Systematic Reviews, PubMed and the Database of Abstracts of Reviews of Effects starting January 2002 to September 14, 2012 for smoking prevention and starting January 2009 to September 14, 2012 for smoking cessation. Following peer review of the USPSTF strategy using the Peer Review Electronic Search Strategies (PRESS) methodology and checklist[14] (Appendix B) and peer review of a draft protocol for this review, we used an adapted strategy to update the search for the period from January 30, 2012 to April 15, 2015. For this update search we included an additional database (Embase) and allowed for citations in both English and French. Since no pharmaceuticals or nicotine replacement therapies (NRTs) are currently approved in Canada for use by children and adolescents for smoking cessation we did not update the USPSTF's search for smoking cessation pharmacotherapy. The USPSTF's search for studies of behavioural or other non-pharmacological interventions was limited to randomized controlled trials (RCTs). We performed a separate harms search that was not limited by study type. This search was undertaken in the same databases and with the same dates as the other treatment searches. We also conducted a manual

search of recent on-topic systematic reviews to look for relevant primary studies not captured by our electronic database search.

A separate search was performed to seek evidence to answer the contextual questions. This strategy included three databases (MEDLINE, Embase and PsycINFO) and looked for relevant citations in English and French from 2005 to March 11, 2015. In addition, a focused web-based grey literature search was undertaken using the Canadian section of the Canadian Agency for Drugs and Technologies in Health Grey Matters search tool[15] and Google advanced search (limited to Canada) to look for recent on-topic sources providing Canadian specific information.

Appendix C provides our search strategies for the key and contextual questions.

Other Sources of Potential Evidence

We evaluated the 19 studies included in the 2012 USPSTF review[9] and the five studies the USPSTF excluded due to study quality issues for eligibility based on our inclusion criteria.

Study Selection

After removing all duplicates, citations found through our updated search, as well as citations from the USPSTF review[9] were uploaded to a web-based systematic review software program (DistillerSR[16]) for screening. The titles and abstracts of papers considered for the key questions were reviewed independently by two raters. Any citations selected for inclusion by either team member went on to full-text review. Full-text screening was done independently by two reviewers with consensus required for inclusion or exclusion. All conflicts were discussed by the respective reviewers, and a third team member was consulted to resolve any disagreements.

As per the CTFPHC methods manual (http://canadiantaskforce.ca/methods/methods-manual/) contextual questions were addressed through a literature review rather than a formal systematic review. The process for selecting studies to answer the contextual questions involved title and abstract screening by two independent raters (citations selected for inclusion by either team member moved on to full-text review), full-text relevance screening by two independent raters (with consensus required for exclusion), and data extraction by one review team member.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria that were used to select studies to answer the key questions are summarized separately for prevention and for treatment in Tables 1 and 2 respectively. Our criteria are generally consistent with the conditions set forth in the USPSTF's 2012 review[9] but in some cases were narrowed. For example, the USPSTF included smokeless tobacco products but we limited to combustible tobacco products; the USPSTF included nicotine replacement therapies but we did not; and the USPSTF accepted a single, brief contact per year or brief written materials as acceptable comparisons while we considered this as low intensity intervention and required comparison groups to have no content specifically designed or intended to prevent or treat tobacco smoking in school-aged children and youth.

Data Extraction and Quality Assessments

For each study used to answer the key questions, review team members extracted data about the population, study design, intervention, analysis and results for outcomes of interest. We assessed all RCTs using the Cochrane Risk of Bias Tool[17] which resulted in low, unclear, or high study risk of bias ratings (see Table 3 for summary). For each study, one team member completed full extraction (study characteristics, risk of bias assessment, outcome data) using standardized forms located on the DistillerSR platform,[16] and a second team member verified all extracted data and ratings. Any disagreements were resolved through discussion with third party consultation if consensus could not be reached. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system[18, 19] was used to assess the strength and quality of the evidence for all outcomes ranked by the CTFPHC working group members as critical or important. The GRADE system rates the quality of a body of evidence as high, moderate, low or very low. Each of the four levels reflects a different assessment of the likelihood that further research will impact the estimate of effect (i.e., high-quality=further research is unlikely to change confidence in the estimate of effect; moderate-quality=further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate; low-quality=further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate; very low-quality=the estimate of effect is very uncertain). A GRADE quality rating is based on an assessment of five conditions: (1) risk of bias (limitations in study designs), (2) inconsistency (statistical heterogeneity) in the direction and/or size of the estimates of effect, (3) indirectness of the body of evidence to the populations, interventions, comparators and/or outcomes of interest, (4) imprecision of results (few participants, events or observations; wide confidence intervals or including null value), and (5) indications of reporting or publication bias. The body of RCT evidence begins with a high-quality rating which may be downgraded if there are serious or very serious concerns across the evidence related to one or more of the five conditions.

Data extraction for the articles selected to address the contextual questions was performed by one team member. There was no assessment of the methodological quality of these studies.

Data Analysis

To perform meta-analyses for the binary outcomes of benefit (incidence of smoking, incidence of stopping smoking) we utilized the number of events, proportion or percentage data from included RCTs to generate the summary measures of effect in the form of risk ratios (RRs) using the DerSimonian and Laird random effects model with Mantel-Haenszel method.[20] The data from cluster-randomized trials were further adjusted for clustering or design effect before inclusion in meta-analyses (see Chapter 16, Section 16.3.4 in the *Cochrane Handbook for Systematic Reviews of Interventions*).[21] The intracluster correlation coefficient was obtained from existing literature.[9] The data from smoking prevention studies were also adjusted for baseline smoking prevalence if the overall sample included a proportion of smokers at baseline in each arm. In addition, for the benefits that showed significant effects, we calculated absolute risk reduction (ARR) or absolute risk increase (ARI) and number needed to treat (NNT) and added these values to the GRADE tables. The NNTs were calculated using the absolute numbers presented in the GRADE tables estimated using the control group event rate and RR with the 95% confidence interval (CI) obtained from the meta-analysis (see Chapter 12, Section 12.5.4.2 in the *Cochrane Handbook for*

Systematic Reviews of Interventions).[22] The analyses were performed using Review Manager Version 5.3[23] and GRADEpro[19] software packages. When studies did not provide data necessary for pooling (i.e., when sample sizes, baseline data, and follow-up data were not reported separately for intervention and control groups), the results were described narratively.

For outcomes of benefit, further subgroup analyses based on baseline age (5-12 years, 13-18 years), baseline tobacco smoking status [never, former, regular (daily or weekly), occasional], intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a half-day or full-day workshop), low (e.g., 1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and study risk of bias rating (high, unclear, low) were conducted where possible to evaluate statistical stability and potential differences in intervention effect. The Cochran's Q (α=0.05) was employed to detect statistical heterogeneity and the I^2 statistic was used to quantify the magnitude of statistical heterogeneity between studies (a rough guide for interpretation, with overlapping thresholds, suggests I^2 of 0-40% might not be important, 30-60% may represent moderate heterogeneity, 50-90% may represent substantial heterogeneity, and 75-100% suggests considerable heterogeneity[24]).

For the questions about features of efficacious interventions, we identified these interventions from studies included in the incidence of smoking and incidence of stopping smoking meta-analyses that showed statistically significant effects in favour of the intervention group. For all studies that met this criterion we summarized key features of the target populations (e.g., age, sex, baseline smoking status) and the interventions (e.g., components, modes of delivery, role of primary care, intensity, duration).

Chapter 3: Results

Key Questions

Search Results

After removing duplicates, we identified 2,118 citations (2,094 from our search and 24 from the USPSTF review[9]) for screening. We excluded 1,938 articles at title and abstract, leaving 180 to be reviewed at the full-text level. At this level we identified 31 systematic reviews (11 were on-topic and recent) and excluded 171 studies (excluded studies list available on the CTFPHC website http://canadiantaskforce.ca/). We identified no additional studies through a hand-search of the included studies lists of the on-topic and recent systematic reviews. At the end of the search and selection process nine studies[25-33] met the inclusion criteria for this review. Of these nine studies, seven[25-31] appeared in the 2012 USPSTF review[9] and two[32, 33] were located by our updated search. The flow diagram for the search and selection process is presented in Figure 2.

Summary of Included Studies

We included nine RCTs.[25-33] All nine studies were used to answer KQ1 regarding the effectiveness of interventions to prevent tobacco smoking in school-aged children and youth, and four of these studies[27, 29, 30, 33] also helped answer KQ3 about the effectiveness of interventions to treat tobacco smoking. No studies were found that provided data to answer KQ2 or KQ4 about reducing future tobacco smoking during adulthood. Likewise, no studies were found that reported any harms of treatment interventions (KQ5). A brief overview of the body of evidence included in this review is offered below. Tables 4 through 6 highlight key features of the populations, interventions and design elements across the nine RCTs. Each study is described in more detail in Table 7.

Across the nine studies, most (n=8) included mixed gender samples; one included only girls.[33] Three studies focused exclusively on younger children (≤12 years),[25, 31, 32] four studies targeted older youth (≥13 years),[27, 29, 30, 33] and two studies[26, 28] included both younger and older participants. Of the studies that reported race,[25, 27, 28, 30, 32, 33] five included primarily white participants (73-92%) and one[33] included mostly black youth (85%). Five studies provided information related to socioeconomic status (SES); one study[25] reported more than two-thirds of participants had annual family incomes ≥$45K and more than three-quarters of parents had post-secondary education, another study[32] reported a majority (75%) of middle to high SES participants, 70% of participants in a third study[28] had at least one parent who completed post-secondary education, more than half of the participants in another study[31] had annual family incomes ≥$50K, and the fifth study[33] was conducted in economically disadvantaged communities.

In terms of baseline smoking status, the preventive intervention samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined across studies, e.g., smoke less than once a week or no smoking in past 30 days). Four of the studies had a combined focus on prevention and treatment of tobacco smoking.[27, 29, 30, 33] As per our inclusion criteria, in all of these combined studies the delivery of intervention messages, contents and/or components was tailored to participants' baseline smoking status, and outcomes were reported separately for non-smokers and current smokers. Participants

in the treatment programs were all considered current smokers, though studies variably defined this status (e.g., smoked in past 30 days, smoke regularly or occasionally, smoke more than weekly).

Most interventions (n=6) were delivered to individual youth; three[25, 31, 32] were delivered to families. Primary care settings and professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in five studies,[25-27, 30, 31] two studies were conducted in dental offices by orthodontists, dentists and other clinic staff,[28, 29] one study was conducted in family planning clinics using health counselors as delivery agents,[33] and in one study families were recruited mostly through primary schools and researchers facilitated postal delivery of intervention materials to participants' homes.[32]

In terms of general components, seven interventions provided education or information,[25-28, 31-33] seven offered counseling or advice,[25, 27-31, 33] two used motivational interviewing,[27, 30] three included booster sessions,[25, 27, 30] and one featured changes in the clinic environment.[28] Most interventions (n=7) relied on face-to-face interactions between interventionists and participants,[25, 27-31, 33] four used the telephone to communicate,[25, 27, 30, 31] three used postal mail,[26, 31, 32] three incorporated an interactive computer program in the intervention strategy[25, 27, 33] and seven used printed materials or photos.[25-29, 31, 32] Six interventions[25, 27, 28, 30, 31, 33] were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants and the other three interventions[26, 29, 32] received a low intensity rating due to a lack of or very minimal (approximately five minutes over two years) personal contact. The length of interventions varied; one lasted six months,[30] one went for nine months,[33] three were 12 months long,[26, 27, 32] one was 14 months long,[25] two lasted for 24 months,[28, 29] and one went for 36 months.[31]

The majority of studies[25, 28-30, 32, 33] used a usual care control group; two studies used an attention control group (diet intervention[27] or safety behaviours[31]); and the remaining study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for all studies except for two that provided data on smoking outcomes assessed three months[33] or six months[25] after program completion. Smoking behaviour was variably defined and measured; three studies[29, 31, 32] asked participants if they had ever smoked which was similar to three studies[26, 30, 33] that asked if youth had maintained abstinence since the baseline assessment, and three studies[25, 27, 28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour, although in one study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. Six of the studies[25, 27, 28, 30, 31, 33] were conducted in the United States (US) and the other three studies[26, 29, 32] took place in Europe. Two of the studies[32, 33] were published in 2014, one study[30] was published in 2008, and the rest of the studies[25-29, 31] were published more than 10 years ago (between 1996 and 2005).

KQ1. Are behaviourally-based interventions relevant to the Canadian primary care setting that are designed to prevent tobacco smoking effective in preventing school-aged children and youth from trying or taking up tobacco smoking?

All nine included RCTs addressed the question on the effectiveness of interventions to prevent school-aged children and youth from trying or taking up tobacco smoking.[25-33] Data from seven of the studies, with a combined sample of 15,545 participants (7,673 Intervention; 7,872

Control), could be pooled.[26-30, 32, 33] Meta-analysis showed that intervention participants were 18% less likely to report having initiated smoking at the end of intervention, relative to controls (RR 0.82; 95% CI 0.72, 0.94; I^2=26%), the absolute effect between groups for smoking initiation was 1.92%, and the NNT to prevent one child or youth from smoking was 52 (95% CI 33, 161). The overall quality of this evidence was rated as moderate; downgrading occurred due to serious concerns regarding risk of bias. See Evidence Set (ES) 1 for the GRADE tables (ES Tables 1.1, 1.2, 1.3) and the forest plot (ES Forest Plot 1.1) based on this body of evidence.

Two studies[25, 31] provided outcome data for incidence of tobacco smoking that could not be combined with the other evidence. Curry et al.[25] could not be pooled because this prevention-focused study included some youth who reported recent/current smoking, but baseline smoking status was available for only 14% of the youth who were assessed post-intervention; therefore we could not appropriately adjust the data. Stephens et al.[31] only reported their calculated and adjusted odds ratio for ever smoking; they did not provide the specific data for the intervention and control groups that were required for inclusion in the meta-analysis. Both studies were conducted in the US more than 10 years ago and both had large samples (n>3,000) that included younger (aged 9-12 years), mixed gender (approximately 50% female), mostly (about 95%) never smoking participants. One of the studies[25] reported 84% of participants were white, whereas the other study did not report data related to race. Information about participants' SES was similar for both studies; one reported that more than two-thirds of participants had annual family incomes ≥$45K and more than three-quarters of parents had post-secondary education,[25] and more than half of the participants in the other study had annual family incomes ≥$50K.[31] In addition to having similar target populations, the interventions were alike in that both offered a high intensity, multi-component, primary care and home-based tobacco smoking prevention program providing education/information and counseling/advice to individual families using face-to-face and phone interactions and printed materials. The interventions differed in a few ways. In the Curry et al. study[25] health counselors also acted as delivery agents, the strategy included a multi-media interactive computer program as well as booster sessions, and the intervention lasted 14 months. The intervention in the Stevens et al. study[31] lasted 36 months and used postal deliveries as another approach to share information with families. Assessment of smoking outcomes also differed between studies. Six months after the intervention was completed, Curry et al.[25] asked youth if they had smoked, even a puff in the past 30 days and compared these data with a usual care control group. Immediately following the intervention, Stevens et al.[31] asked youth if they had ever smoked and compared these data with an attention control group focused on safety behaviours. Both studies received an overall high risk of bias rating; Curry et al.[25] received unclear or high risk ratings for sequence generation, allocation concealment, blinding, incomplete reporting, and other potential risks including inclusion of current smokers and significant baseline differences in smoking in past 30 days (P=0.02); Stevens et al.[31] received unclear or high risk ratings for sequence generation, allocation concealment, blinding, and other potential risks including no mention of power calculations and inclusion of some youth who had already tried smoking. Neither study showed an intervention benefit in terms of a reduced risk of trying or taking up tobacco smoking. Curry et al.[25] found no significant differences between groups on any outcomes. At baseline, 6.7% of the assessment cohort (14% of the youth who completed post-intervention assessment) reported ever smoking and 1.2% had smoked in the past 30 days. Six months after completing the intervention 13% of all participants reported ever having tried smoking (13.6% Intervention, 12.1% Control) and

more than 2% of the youth (2.4% Intervention, 2.3% Control) had smoked in the last month. As reflected in our risk of bias assessment for this study (Table 3), it is important to note that an unexplained difference in baseline smoking status was observed in the assessment cohort, with significantly more intervention participants reporting recent smoking as compared to children in the control group (2.5% vs 0%, P=0.02). Stevens et al.[31] also found no significant difference between the tobacco (and alcohol) prevention group and the safety behaviour group in terms of ever smoking (odds ratio 0.97; 95% CI 0.79, 1.20; adjusted for: child's age, gender and relationships with friends who drink; parent's education, marital status, having high stress, low self-esteem, drinking problem; family income).

KQ1a. Are there differences in the incidence of tobacco smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking status [never, former (e.g., have tried smoking tobacco in past but not in last 30 days)], (iii) intervention intensity [high (e.g., ≥2 meetings or interactions with a health professional of any length or one long session, such as a half-day or full-day workshop), low (e.g., 1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?

Data were available to perform subgroup analyses based on baseline age (5-12 years, 13-18 years), intervention intensity (low, high), and study risk of bias rating (unclear, high); see ES 1 for the GRADE tables (ES Tables 1.1, 1.2, 1.3) and forest plots (ES Forest Plots 1.2, 1.3, 1.4) for these analyses. None of the tests for subgroup differences was statistically significant.

A subgroup analysis based on the 5-12 year age group was done using three studies[26, 28, 32] with an overall moderate-quality rating. There was a significant difference in incidence of smoking for intervention participants as compared to controls (RR 0.69; 95% CI 0.48, 0.98; I^2=0%) (ES Forest Plot 1.2). A subgroup analysis based on the 13-18 year age group was done using six studies[26-30, 33] with an overall moderate-quality rating. There was a significant difference in effect favouring the intervention group over the control group for incidence of smoking (RR 0.87; 95% CI 0.78, 0.96; I^2=6%) (ES Forest Plot 1.2).

Three studies, with an overall moderate-quality rating, contributed to the subgroup analysis for low intervention intensity.[26, 29, 32] There was a significant difference in effect for incidence of smoking in intervention participants as compared to controls (RR 0.75; 95% CI 0.61, 0.92; I^2=7%) (ES Forest Plot 1.3). Four studies with an overall low-quality rating were included in the subgroup analysis for high intervention intensity.[27, 28, 30, 33] There was no significant difference in effect between intervention and control groups (RR 0.88; 95% CI 0.77, 1.02; I^2=12%) (ES Forest Plot 1.3).

There were four studies with an overall low-quality rating included in the subgroup analysis for unclear risk of bias.[27, 28, 30, 32] There was no significant difference in effect between intervention and control groups (RR 0.85; 95% CI 0.70, 1.03; I^2=33%) (ES Forest Plot 1.4). Three studies with an overall low-quality rating were included in the subgroup analysis for high risk of bias.[26, 29, 33] There was a significant difference in effect in incidence of smoking for intervention participants as compared to controls (RR 0.77; 95% CI 0.64, 0.93; I^2=0%) (ES Forest Plot 1.4).

Findings from the two studies[25, 31] described above that could not be pooled for KQ1 should be considered alongside results for the subgroup analyses based on the younger age group (5-12 years), the high intensity interventions, and the high risk of bias studies.

Only one study provided outcome data based on baseline smoking status (i.e., never smokers and former smokers).[33] The overall results from the trial showed no difference in effect between the intervention and control groups for incidence of smoking (RR 0.69; 95% CI 0.39, 1.21) and a test of subgroup difference based on baseline smoking status was also non-significant (P=0.63), (ES Forest Plot 1.5).

KQ1b. What are the elements of efficacious interventions designed for preventing tobacco smoking in school-aged children and youth?

Only two of the nine studies showed a significant intervention effect for the prevention of tobacco smoking among youth participants (ES Forest Plot 1.1).[26, 27] In the Fidler et al. study,[26] relative to youth in the no intervention control group, youth who received the prevention program were 35% less likely to report having smoked at any point during the 12 month intervention (RR 0.65; 95% CI 0.47, 0.90). For the outcome of initiating smoking, Hollis et al.[27] observed that youth in the tobacco prevention group were 24% less likely to have smoked in the past 30 days relative to their counterparts in the control group (RR 0.76; 95% CI 0.59, 0.99). ES Table 1.4 summarizes the elements of these two interventions.

KQ2. Are behaviourally-based interventions relevant to Canadian primary care that are designed to prevent tobacco smoking in school-aged children and youth effective in reducing future tobacco smoking during adulthood?

None of the included studies reported results for the effectiveness of interventions to prevent school-aged children and youth from trying or taking up tobacco smoking for the long-term benefit of reduced future tobacco smoking during adulthood.

KQ3. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in achieving smoking cessation?

Four of the nine included RCTs addressed the question on the effectiveness of treatment interventions to help school-aged children and youth stop tobacco smoking.[27, 29, 30, 33] Data from three of the studies with a combined sample of 741 participants (365 Intervention; 376 Control) could be pooled. The pooled estimate showed that intervention participants were 34% or 1.3 times more likely to report having quit smoking at the post intervention assessment (immediately following a six month intervention,[30] immediately following a 12 month intervention,[27] and three months after completion of a nine month intervention[33]), relative to controls (RR 1.34; 95% CI 1.05, 1.69; I^2=0%), the absolute effect between groups was 7.98% for smoking cessation, and the NNT for one youth to quit smoking was 13 (95% CI 6, 77).[27, 30, 33] The overall quality of this evidence was rated as moderate; downgrading occurred due to serious concerns regarding risk of

bias. See ES 2 for GRADE tables (ES Tables 2.1, 2.2, 2.3) and the forest plot (ES Forest Plot 2.1) based on this body of evidence.

One study provided outcome data for incidence of tobacco smoking that could not be combined with the other evidence.[29] This study, which was conducted in Finland and published in 1999, included a mixed gender (49% female) sample of youth (mean age 13 years). During routine visits over 24 months dentists asked patients if they smoked. If a youth said yes [at the initial visit 74 (5.5%) of the intervention group and 74 (6%) of the control group reported they were smokers], the dentist advised against smoking, showed the patient photos of teeth stained from smoking and offered a mirror for the youth to examine his/her teeth for discolouration. Study authors reported a 3% reduction in smoking for the intervention group; no details were provided for the control group and hence the comparative treatment effect could not be determined.

KQ3a. Are there differences in the incidence of stopping smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking status [current regular (daily or weekly), current occasional], (iii) intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a half day or entire day workshop), low (e.g., 1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?

Data were available to perform subgroup analyses based on baseline smoking status and risk of bias ratings; see ES 2 for the GRADE tables (ES Tables 2.1, 2.2, 2.3) and forest plots (ES Forest Plots 2.2, 2.3) for these analyses. All of the studies that included a treatment focus targeted youth (aged ≥13 years) and provided high intensity interventions; therefore we could not perform subgroup analyses based on age group or intensity rating.

One study provided data according to baseline smoking status (regular, experimental/occasional).[27] The test for subgroup differences was statistically significant (P=0.002); greater intervention benefits in terms of reported cessation were observed for regular smokers relative to controls (RR 2.06; 95% CI 1.40, 3.04) than for experimental or occasional smokers relative to controls (RR 0.91; 95% CI 0.65, 1.29) (ES Forest Plot 2.2)

Three studies were included in the subgroup analysis based on risk of bias, two with an unclear rating[27, 30] and one with a high risk rating.[33] The test for subgroup differences based on study risk of bias rating was not significant (P=0.18). The two studies with an unclear rating and a combined sample of 649 youth showed a significant difference in effect favouring the intervention group over the control group (RR 1.41; 95% CI 1.10, 1.82; I^2=0%). The study with a high risk of bias rating and a sample of 92 youth showed no significant difference in effect between intervention and control groups (RR 0.83; 95% CI 0.40, 1.73) (ES Forest Plot 2.3).

KQ3b. What are the elements of efficacious interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

Only one study showed a significant intervention effect for treatment of tobacco smoking among youth participants (ES Forest Plot 2.1).[27] For the outcome of smoking cessation, Hollis et al.[27]

observed that youth in the treatment group were 40% or 1.4 times more likely to have not smoked tobacco in the past 30 days relative to their control group counterparts (RR 1.40; 95% CI 1.07, 1.82). ES Table 2.4 summarizes the elements of this intervention.

KQ4. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in reducing future tobacco smoking in adulthood?

None of the included studies reported results for the effectiveness of interventions designed to help school-aged children and youth stop ongoing tobacco smoking for the long-term benefit of reduced future tobacco smoking during adulthood.

KQ5. What if any, adverse effects are associated with behaviourally-based and non-pharmacological alternative and complementary interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

None of the included studies reported any results for adverse effects associated with behaviourally-based and non-pharmacological alternative and complementary interventions designed to help school-aged children and youth stop ongoing tobacco smoking.

Contextual Questions

Search Results

The electronic database search located 776 unique citations. Using titles and abstracts, two independent screeners identified 68 records that required further investigation. Based on full-text assessment by two independent reviewers, nine articles (representing eight studies) were selected that addressed the contextual questions.[34-42] Our focused web-based search for relevant grey literature specific to the current Canadian context found only one report.[43]

CQ1. What are school-aged children's and youth's preferences and values regarding how and under what conditions they are asked about their personal tobacco smoking history?

No studies were found that provided information related to school-aged children's and youth's preferences and values regarding how and under what conditions they are asked about their personal tobacco smoking history.

CQ2. What are participants' (children's, adolescents', parents') preferences and values regarding interventions designed to prevent or treat tobacco smoking by children and youth?

In this section we first present a profile of the included evidence. Next we summarize the findings related to interventions designed to prevent tobacco smoking. Finally we describe the results from studies that included a treatment focus, using sub-sections to look at this evidence in more detail.

Profile of the Evidence

A total of nine studies (10 papers) were found that addressed the question of participants' preferences and values regarding interventions (e.g., content, timing, approach, agents, setting, acceptability, recruitment) to prevent or treat tobacco smoking by children and youth.[34-43] All of the studies used observational (primarily surveys) and/or qualitative (primarily focus groups) methods. Almost all of the studies[34-39, 41, 43] focused on cessation interventions; two studies[40, 42] considered prevention strategies. Seven studies[34-37, 39, 41, 43] reported only adolescents' perspectives, one study[38] included both teens and their parents, and two studies[40, 42] sought input solely from parents. Two studies that involved youth[34-36] included both smokers and non-smokers, otherwise the youth samples were limited to current smokers and former smokers.[37-39, 41, 43] In terms of age, youth samples ranged between 13 and 19 years old. All studies included mixed gender samples. Four studies[34-36, 38, 41] reported the ethnicity of their samples; most were multi-ethnic with a greater percentage of white participants. Participants were recruited from a variety of settings including schools,[34, 35, 37, 39-41, 43] emergency departments,[36, 38] dental offices,[42] and youth clubs.[39] Finally, only one study[43] was conducted in Canada; most studies[34-36, 38, 41, 42] (n=5) were conducted in the US, two studies[37, 39] were carried out in the United Kingdom (UK), and one study was conducted in Australia.[40]

Preferences Regarding Interventions to Prevent Tobacco Smoking

Two studies[40, 42] were found that explored parents' attitudes and preferences regarding the design and delivery of interventions to prevent tobacco use. Australian parents of 11-12 year old children provided opinions regarding their involvement in alcohol, tobacco and other drug educational programs,[40] ranking home-based programs (e.g., helping children with homework) during the academic year as the most popular option. Parents were also open to receiving weekly packages, with the most popular program components being materials for parents and children to read together, materials for parents to read on their own, and family activities. Specifically, developing effective communication skills was a key priority. A US-based study[42] assessed parental acceptability of pediatric dentists providing tobacco education and counseling to their patients. Almost all of the parents (91%) thought it was appropriate for dentists to talk to children about the dangers of using and the benefits of not using tobacco products.

Preferences Regarding Interventions to Treat Tobacco Smoking

Seven studies[34-39, 41, 43] explored adolescents' (and in one study[38] also parents') attitudes and preferences regarding the design and delivery of interventions to treat tobacco use. While trials

that incorporated NRTs were excluded from the review for key questions we opted to include data on youth preferences related to these cessation aids.

Intervention Components and Contents

Four studies[37, 39, 41, 43] provided data about youth's preferences regarding intervention components and contents. A needs assessment conducted by the public health unit in Guelph, Ontario, Canada, asked youth smokers what methods they would be interested in using to help them quit smoking.[43] The most popular strategies were (free or low-cost) NRTs and quitting cold turkey (both options were selected by 53% of the youth); 24% said they would consider exercise-based interventions, prescription medications (21%), quit contests (21%) and seeking help from family members who also smoke (21%). Least interested strategies included individual counseling (15%), group coaching sessions (9%), self-help materials (9%), smokers' helplines (3%) and social media programs (3%). To inform development of an adolescent-targeted smoking cessation video, one study[41] surveyed American high school students who were all current regular smokers. Results suggested the messages should emphasize the long-term health effects of smoking; consequences of smoking for athletic performance and appearance were the next most endorsed reasons for quitting. Youth overwhelmingly (52%) preferred a reality show format with actors portraying current and former smokers' experiences. Another study[37] involved focus groups of UK youth motivated to quit smoking. Many of these adolescents were interested in supportive counseling strategies, and NRTs, especially if they were offered for free and in conjunction with behavioural interventions. Similarly, another UK-based study[39] asked current and former youth smokers what could help them stop smoking. Self-help products, particularly NRTs were most commonly mentioned.

Mode of Delivery

One study[36] provided data about youth's preferences regarding intervention mode of delivery that was relevant to the Canadian context. Youth attending the emergency department of a US hospital participated in a survey about their technology use and risky behaviours, and their interest in and preferences for behavioural health interventions.[36] Almost all of the respondents regularly used computers (99%), social networking (85%), and text messaging (95%). Of the youth who reported smoking cigarettes, 82% were interested in a cessation intervention and half of these youth indicated a preference for a technology-based intervention. The most popular format for technology-based cessation interventions was text messaging, followed by email or internet, then videos; social networking was the least chosen option. About one-third of the youth who preferred non-technology interventions reported a preference for in-person cessation counseling from a physician.

Individual or Group-Based

Two studies[37, 39] provided data about youth's preferences regarding whether cessation interventions are delivered to individuals or to groups. Results from interviews with current and former smokers in the UK suggested teens would be interested in professional cessation interventions that targeted peer/friend groups.[39] Reasons for this preference included the potential for removing day-to-day pressures to smoke, participating with peers, and time management (with

friends during counselling). Likewise, although some youth said they would prefer one-on-one counseling, many of the focus group participants in a UK-based study were interested in small peer group sessions or attending counseling with one other friend who also wanted to quit.[37]

Timing

Two studies[37, 39] provided data about youth's preferences regarding the timing of cessation interventions. Despite the potential for negative judgement from teachers or peers, UK teens who were motivated to quit smoking thought it would be ideal to incorporate cessation interventions into regular school classes.[37] This preference was based on the perceived convenience of integrating program activities into adolescents' existing routines and environments. Convenience was also a priority for another group of UK youth who said they preferred flexible, drop-in style cessation services that would be more compatible with their social lives.[39]

Implementation Setting

Four studies[37-39, 43] provided data about youth's and parents' opinions regarding appropriate settings for cessation interventions. Ontario teen smokers responding to a needs assessment identified the importance of accessible settings for smoking cessation interventions.[43] Participants were divided on the issue of whether programs should be provided in schools; those opposed highlighted that many teens smoke, or are influenced to smoke, in the school environment. In a UK-based study, almost all of the youth smokers who were motivated to quit thought cessation interventions should be delivered in schools.[37] Participants who had prior positive experiences with staff at youth clubs and health centres thought community-based treatment services would be another good option. Current and former smokers in another UK-based study suggested schools were not ideal contexts for implementing adolescent smoking cessation interventions.[39] Students did not want to use their break or after-school time to participate in program activities or sessions, they thought teachers were judgmental, and they described schools as "toxic" and unsupportive environments for supporting quit attempts. Finally, US teen smokers, along with their parents, upon presentation at a hospital identified that the emergency department was an acceptable setting to provide information about quitting smoking.[38]

Interventionists

Five studies[34, 35, 37, 39, 41, 43] provided data about youth's opinions regarding who should deliver cessation interventions and the qualities these helpers should bring to this role. Canadian youth were interested in receiving cessation support from someone they knew and who cared about them (as opposed to anonymous hotline counselors).[43] They also thought that it would help if program leaders had personal experience with quitting smoking. Similarly in a US study, youth smokers preferred to receive messages via video from a current teen smoker, followed by a successful former teen smoker or a celebrity.[41] In another US study,[34, 35] the most preferred resources for smoking cessation were friends followed by parents and physicians. Less preferred resources were boy/girlfriends, siblings, school counselors and teen help lines, while teachers, religious leaders, psychologists, school nurses and school doctors were not selected as important sources of help for this problem. Most current and former teen smokers in a UK study thought friends would play an important role in initiating joint quit efforts, promoting smoke free environments

and taking part in activities to distract from smoking cues and urges.[39] Family members were also identified as key sources of emotional support and role models. However, caution was given that family and friends could sometimes be perceived as harassing rather than helping. Apprehension regarding general practitioners as supports was noted as participants felt judged and were concerned about confidentiality. Another group of UK youth smokers thought that cessation counselors must be nonjudgmental, approachable, helpful, and able to maintain confidentiality.[37]

Chapter 4: Discussion, Limitations and Conclusion

Discussion

Summary of Evidence

To our knowledge, this is the most up-to-date systematic review on the effectiveness of prevention and treatment interventions in primary care for tobacco smoking in children and youth, aged 5-18 years, in very high human development countries. Nine RCTs that were conducted in the US and Northern Europe and used multiple behavioural strategies comprised the body of evidence for this review. Pooled analysis showed children and youth who took part in targeted prevention interventions were statistically significantly less likely to report having tried or initiated smoking at follow-up, relative to controls. Likewise meta-analysis of the treatment studies showed adolescents who took part in targeted cessation interventions were statistically significantly more likely to report having quit smoking at the end of the intervention, relative to controls. A subgroup analysis based on data from a single cessation trial also showed that the intervention effect was significantly greater in those who self-described as regular smokers as opposed to experimental or occasional smokers. Longitudinal data were not available to evaluate the effectiveness of either prevention or treatment interventions in terms of their impact on prevalence of adult smoking.

We found no studies that met our review criteria that investigated or reported any adverse effects associated with participation in behavioural or other non-pharmacotherapy interventions for treating tobacco smoking in children and youth. However, finding no evidence about harms is not the same as finding evidence of no harms; until data are available, we cannot infer the harmful impacts of such treatments on this population.

Within the meta-analyses, only two studies that used different intervention approaches demonstrated statistically significant effects related to smoking outcomes compared to control.[26, 27] Thus there was insufficient evidence to provide a clear answer to the question about features of effective primary care interventions.

Comparison with other Reviews

Several other recent systematic reviews have examined topics related to smoking prevention or cession for young people.[9, 44-47] One Cochrane review[44] focused on tobacco prevention for Indigenous youth, but both of the included studies involved school-based (curriculum or classroom) delivery of the interventions which would not provide a comparable context for our interest in primary care relevant strategies. A second Cochrane review[45] looked at a wide range of tobacco cessation interventions for youth, but again, most of the included studies were conducted in educational settings. A third Cochrane review[46] found 135 RCTs that examined smoking prevention programs for children and youth, but all of them were school or curriculum-based interventions. A fourth Cochrane review[47] looked specifically for mentoring interventions to help prevent or reduce adolescent tobacco use, but of the four included studies two were conducted in school settings using known-peer mentors and the other two targeted populations that we excluded from our review (i.e., pregnant teens and teens with substance abuse problems).

The USPSTF[9] started with essentially the same questions we addressed, but their eligibility criteria allowed for inclusion of more studies (e.g., they included studies that compared low intensity with high intensity interventions, interventions that were not tailored to participants' baseline smoking status, and interventions that did not focus primarily on the use of tobacco). Our more conservative approach for selecting studies and differentiating between the prevention and treatment evidence led us to different bodies of evidence that produced both similar and dissimilar results. We found an almost identical effect for the preventive benefit of primary care relevant interventions; our results showed an 18% relative reduction in smoking initiation for the intervention group compared with the control group (RR 0.82; 95% CI 0.72, 0.94), and the USPSTF reported a 19% relative reduction (RR 0.81; 95% CI 0.70, 0.93). However, unlike the USPSTF review that included a broader range of interventions and comparison groups and found no treatment effect (RR 0.96; 95% CI 0.90, 1.02), we found a statistically significant benefit (RR 1.34; 95% CI 1.05, 1.69) when we included only targeted cessation interventions that were compared with no intervention, usual care, wait list, or attention control groups.

There were common limitations in the evidence in recent reviews on smoking prevention and treatment for young people, including the USPSTF review, the Cochrane reviews, and the present review. These limitations include: use of complex intervention strategies that were clinically heterogeneous across trials; inconsistent definition, measurement and reporting of smoking outcomes across studies; unclear or high risk of bias in most studies; and the lack of important trial and intervention details in many published reports.

Limitations

There are limitations associated with our review. First, all of the evidence was taken from studies assessed as having unclear or high risk of bias, primarily due to lack of information about or lack of procedures to ensure random sequence generation, allocation concealment and blinding, as well as other sources of potential bias. All of the studies measured smoking behaviour using self-report strategies; this method is susceptible to socially desirable responding, therefore the findings may reflect some underreporting of tobacco use. Furthermore, the participants who agreed to take part in these studies may have been more health conscious than the general population, and some of the treatment participants may have been more motivated to quit smoking than typical adolescent smokers. For all outcomes there were too few studies to investigate publication bias. These potential methodological biases could have impacted results and effect sizes and therefore raised some concerns about the strength of the evidence included in this review.

Second, limitations in our review approach may affect the generalizability of the findings. In restricting our focus to combustible tobacco products we did not consider interventions specifically directed at preventing or treating the use of smokeless tobacco products or e-cigarettes, nor did we examine the impact of second-hand smoke exposure. We did not include treatment studies that evaluated the effectiveness of drug and NRTs. We only looked at studies that evaluated primary care relevant interventions intended to prevent or treat tobacco smoking in children and youth; we did not include studies of interventions delivered in other settings, that used environmental or policy restrictions, or that focused on parental smoking as a secondary strategy. Finally, studies not conducted in very high human development index countries were excluded from this review, as

were studies published in languages other than English or French (studies published in French prior to 2013 were excluded).

Conclusion

This review synthesized current research on the effectiveness of primary care relevant interventions for preventing and treating tobacco smoking by school-aged children and adolescents. Results of this review, which included mostly moderate GRADE quality evidence, suggest that targeted behavioural interventions can help keep young people from trying or taking up tobacco smoking and can assist adolescents who have already started smoking to quit, without any reported harms. However, the available evidence does not provide clarity regarding ideal intervention strategies nor does it examine the long-term impact of these interventions for preventing smoking during adulthood.

Evidence Set (ES) 1. Prevention - Incidence of Tobacco Smoking

- ES Table 1.1. Overview of Key Results for Prevention of Tobacco Smoking
- ES Table 1.2. GRADE Evidence Profile: Effect of Prevention Interventions on Incidence of Tobacco Smoking
- ES Table 1.3. GRADE Summary of Findings: Effect of Prevention Interventions on Incidence of Tobacco Smoking
- ES Forest Plots 1.1 to 1.5
- ES Table 1.4. Elements of Efficacious Interventions for Preventing Tobacco Smoking

ES Table 1.1. Overview of Key Results for Prevention of Tobacco Smoking

Forest Plot	Outcome and Subgroup	Subgroups	Test for Subgroup Differences	# of Studies (Participants)	GRADE Quality Rating	Risk Ratio (95% CI) I^2	Absolute Risk Reduction	Number Needed to Treat (95% CI)
1.1	Incidence of tobacco smoking overall	-	-	7 (15,545)	Moderate	0.8222 (0.7174, 0.9424) 26%	1.92%	52 (33, 161)
1.2	Incidence of tobacco smoking by age group	5-12 Years	P = 0.22 I^2 = 34.8%	3 (3,648)	Moderate	0.6858 (0.4804, 0.9790) 0%	1.28%	78 (47, 1,172)
		13-18 Years		6 (11,898)	Moderate	0.8673 (0.7796, 0.9647) 6%	1.72%	58 (35, 218)
1.3	Incidence of tobacco smoking by intervention intensity	Low	P = 0.20 I^2 = 37.8%	3 (5,146)	Moderate	0.7527 (0.6132, 0.9240) 7%	2.06%	48 (31, 158)
		High		4 (10,399)	Low	0.8845 (0.7673. 1.0195) 12%	-	-
1.4	Incidence of tobacco smoking by study risk of bias rating	Unclear	P = 0.50 I^2 = 0%	4 (11,383)	Low	0.8458 (0.6956, 1.0284) 33%	-	-
		High		3 (4,162)	Low	0.7695 (0.6361, 0.9310) 0%	2.40%	42 (26, 139)

ES Table 1.2. GRADE Evidence Profile: Effect of Prevention Interventions on Incidence of Tobacco Smoking*

Quality Assessment							# of Participants and Event Rates (%)		Effect				GRADE Quality Rating	Ranking of Outcome Importance
# of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other	Intervention	Control	Relative (95% CI)	Absolute per Million (Range)	ARR**	NNT** (95% CI)		
Incidence of Tobacco Smoking – Overall (immediate post intervention assessment for 6 studies, 3 months post intervention completion assessment for 1 study; self-report)														
7[1]	randomized trials	serious risk[2]	no serious inconsistency[3]	no serious indirectness[4]	no serious imprecision[5]	none[6]	719/7,673 (9.3705%)	850/7,872 (10.7978%)	RR 0.8222 (0.7174, 0.9424)	19,198 fewer (6,220 fewer to 30,514 fewer)	1.92%	52 (33, 161)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Tobacco Smoking – Aged 5-12 Years (immediate post intervention assessment; self-report)														
3[7]	randomized trials	serious risk[8]	no serious inconsistency[9]	no serious indirectness[10]	no serious imprecision[11]	none[6]	47/1,728 (2.7199%)	78/1,920 (4.0625%)	RR 0.6858 (0.4804, 0.9790)	12,764 fewer (853 fewer to 21,109 fewer)	1.28%	78 (47, 1,172)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Tobacco Smoking – Aged 13-18 Years (immediate post intervention assessment for 5 studies, 3 months post intervention completion assessment for 1 study; self-report)														
6[12]	randomized trials	serious risk[13]	no serious inconsistency[14]	no serious indirectness[15]	no serious imprecision[16]	none[6]	673/5,946 (11.3185%)	772/5,952 (12.9704%)	RR 0.8673 (0.7796, 0.9647)	17,212 fewer (4,579 fewer to 28,587 fewer)	1.72%	58 (35, 218)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Tobacco Smoking – Intervention Intensity Low (immediate post intervention assessment; self-report)														
3[17]	randomized trials	serious risk[18]	no serious inconsistency[19]	no serious indirectness[20]	no serious imprecision[21]	none[6]	170/2,580 (6.5891%)	214/2,566 (8.3398%)	RR 0.7527 (0.6132, 0.9240)	20,624 fewer (6,338 fewer to 32,258 fewer)	2.06%	48 (31, 158)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Tobacco Smoking – Intervention Intensity High (immediate post intervention assessment for 3 studies, 3 months post intervention completion assessment for 1 study; self-report)														
4[22]	randomized trials	serious risk[23]	no serious inconsistency[24]	no serious indirectness[25]	serious imprecision[26]	none[6]	549/5,093 (10.7795%)	636/5,306 (11.9864%)	RR 0.8845 (0.7673, 1.0195)	13,844 fewer (27,892 fewer to 2,337 more)	-	-	⊕⊕OO LOW	CRITICAL
Incidence of Tobacco Smoking – Study Risk of Bias Rating Unclear (immediate post intervention assessment; self-report)														
4[27]	randomized trials	serious risk[28]	no serious inconsistency[29]	no serious indirectness[30]	serious imprecision[31]	none[6]	544/5,550 (9.8018%)	638/5,833 (10.9378%)	RR 0.8458 (0.6956, 1.0284)	16,866 fewer (33,295 fewer to 3,106 more)	-	-	⊕⊕OO LOW	CRITICAL
Incidence of Tobacco Smoking – Study Risk of Bias Rating High (immediate post intervention assessment for 3 studies, 3 months post intervention completion assessment for 1 study; self-report)														
3[32]	randomized trials	very serious risk[33]	no serious inconsistency[34]	no serious indirectness[35]	no serious imprecision[36]	none[6]	175/2,123 (8.2431%)	212/2,039 (10.3973%)	RR 0.7695 (0.6361, 0.9310)	23,966 fewer (7,174 fewer to 37,836 fewer)	2.40%	42 (26, 139)	⊕⊕OO LOW	CRITICAL

*Footnotes appear below the Summary of Findings Table.

**Absolute risk reduction (ARR) and number needed to treat (NNT) are only reported for significant effect estimates.

ES Table 1.3. GRADE Summary of Findings: Effect of Prevention Interventions on Incidence of Tobacco Smoking

Outcome: Incidence of Tobacco Smoking	Illustrative Comparative Risks* (95% CI)		Relative Effect (95% CI)	# of Participants (Studies)	Quality of the Evidence (GRADE)
	Assumed Risk Number per Million Control	Corresponding Risk Number per Million Intervention			
Overall (self-report; immediate post intervention assessment for 6 studies, 3 months post intervention completion for 1 study)	**107,978**	**88,779** (77,463 to 101,758)	**RR 0.8222** (0.7174, 0.9424)	15,545 (7 studies[1])	⊕⊕⊕⊖ **moderate**[2,3,4,5,6]
Age Group 5-12 Years (self-report; immediate post intervention assessment)	**40,625**	**27,861** (19,516 to 39,772)	**RR 0.6858** (0.4804, 0.979)	3,648 (3 studies[7])	⊕⊕⊕⊖ **moderate**[6,8,9,10,11]
Age Group 13-18 Years (self-report; immediate post intervention for 5 studies, 3 months post intervention completion assessment for 1 study)	**129,704**	**112,493** (101,117 to 125,126)	**RR 0.8673** (0.7796, 0.9647)	11,898 (6 studies[12])	⊕⊕⊕⊖ **moderate**[6,13,14,15,16]
Intervention Intensity Low (self-report; immediate post intervention assessment)	**83,398**	**62,774** (51,140 to 77,060)	**RR 0.7527** (0.6132, 0.924)	5,146 (3 studies[17])	⊕⊕⊕⊖ **moderate**[6,18,19,20,21]
Intervention Intensity High (self-report; immediate post intervention assessment for 3 studies, 3 months post intervention completion assessment for 1 study)	**119,864**	**106,020** (91,972 to 122,202)	**RR 0.8845** (0.7673, 1.0195)	10,399 (4 studies[22])	⊕⊕⊖⊖ **low**[6,23,24,25,26]
Study Risk of Bias Rating Unclear (self-report; immediate post intervention assessment)	**109,378**	**92,512** (76,083 to 112,484)	**RR 0.8458** (0.6956, 1.0284)	11,383 (4 studies[27])	⊕⊕⊖⊖ **low**[6,28,29,30,31]
Study Risk of Bias Rating High (self-report; immediate post intervention assessment for 3 studies, 3 months post intervention completion assessment for 1 study)	**103,973**	**80,007** (66,137 to 96,798)	**RR 0.7695** (0.6361, 0.931)	4,162 (3 studies[32])	⊕⊕⊖⊖ **low**[6,33,34,35,36]

*The assumed risk is the mean control group risk across studies. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

Footnotes for the GRADE Evidence Profile and Summary of Findings Tables for the Effect of Prevention Interventions on Incidence of Tobacco Smoking

[1] The 7 studies are: Fidler et al. 2001,[26] Hiemstra et al. 2014,[32] Hollis et al. 2005,[27] Hovell et al. 1996,[28] Kentala et al. 1999,[29] Pbert et al. 2008,[30] and Redding et al. 2014.[33]

[2] Using Cochrane's Risk of Bias tool,[17] for this outcome 3 studies (43%) were rated as high risk and 4 studies (57%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (71%), allocation concealment (71%), blinding of participants and/or personnel (86%), blinding of outcome assessors (100% self-report), retention and reporting (43%) and other sources of bias (57%; e.g., baseline characteristics not reported, significant baseline difference for gender with more girls in the intervention than control groups, no mention of power or sample size calculations). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is minimal [Chi^2=8.16, df=6 (P=0.23); I^2=26%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[4] Across the 7 studies, most (n=6) included generally balanced mixed gender samples; 1 included only girls.[33] Only 1 study focused exclusively on younger children (≤12 years),[32] 4 studies targeted older youth (≥13 years),[27, 29, 30, 33] and 2 studies[26, 28] included both younger and older participants. Of the studies that reported race,[27, 28, 30, 32, 33] 4 included primarily white participants (73-92%) and 1[33] mostly included black youth (85%). Only 3 studies provided information related to SES; 1 study[32] reported a majority (75%) of middle to high SES participants, 70% of participants in another study[28] had at least 1 parent who completed post-secondary education, and the third study[33] was conducted in economically disadvantaged communities. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who tried smoking in the past (variably defined e.g., smoke less than once a week or no smoking in past 30 days). Three studies focused on prevention[26, 28, 32] and 4 studies had a combined focus on prevention and treatment.[27, 29, 30, 33] All but 1 intervention was delivered to individual youth; the exception[32] was delivered to individual families. Primary care settings and professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in 3 studies,[26, 27, 30] 2 studies were conducted in dental offices by orthodontists, dentists and other clinic staff,[28, 29] 1 study was conducted in family planning clinics using health counselors as delivery agents,[33] and in 1 study families were recruited mostly through primary schools and researchers facilitated delivery of intervention materials.[32] Five interventions provided education or information,[26-28, 32, 33] 5 offered counseling or advice,[27-30, 33] 2 used motivational interviewing,[27, 30] 2 included booster sessions,[27, 30] and 1 featured changes in the clinic environment (promoting a tobacco-free space).[28] Most of the interventions relied on face-to-face interactions,[27-30, 33] 2 used the telephone,[27, 30], 2 used postal mail,[26, 32] 2 incorporated an interactive computer program[27, 33] and 5 used printed materials or photos.[26-29, 32] Four of the interventions[27, 28, 30, 33] were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants and the other 3 interventions[26, 29, 32] received a low intensity rating due to a lack of or very minimal personal contact. The length of interventions varied; 1 lasted 6 months,[30] 1 went for 9 months,[33] 3 were 12 months long,[26, 27, 32] and 2 lasted for 24 months.[28, 29] Most studies[28-30, 32, 33] used a usual care control group; 1 study[27] used an attention control group (diet intervention) and the remaining study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for all studies except for 1[33] that provided data on smoking outcomes assessed 3 months after program completion. Smoking behaviour was variably defined and measured; 2 studies[29, 32] asked participants if they had ever smoked, 3 studies[26, 30, 33] asked if youth had maintained abstinence since the baseline assessment, and 2 studies[27, 28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. Four studies[27, 28, 30, 33] were conducted in the US and the other 3 studies[26, 29, 32] took place in Europe. Two of the studies[32, 33] were published recently, 1 study[30] appeared in the literature in the last 10 years, and the rest of the studies[26-29] were published more than 10 years ago. This body of evidence was not downgraded for indirectness.

[5] The sample size is adequate (i.e., ≥300; 7,673 Intervention, 7,872 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 0.8222 (95% CI 0.7174, 0.9424)]. This body of evidence was not downgraded for imprecision.

[6] There were too few studies (n<10) to assess publication bias.[48] This body of evidence was not downgraded for reporting bias or any other concerns.

[7] The 3 studies are: Fidler et al. 2001,[26] Hiemstra et al. 2014,[32] and Hovell et al. 1996.[28]

[8] Using Cochrane's Risk of Bias tool,[17] for this outcome 1 study (33%) was rated as high risk and 2 studies (67%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (67%), allocation

concealment (100%), blinding of participants and/or personnel (67%), blinding of outcome assessors (100% self-report), retention and reporting (33%) and other sources of bias (67%; e.g., baseline characteristics not reported, significant baseline difference for gender with more girls in the intervention than control groups). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[9] The statistical heterogeneity is minimal [Chi^2=0.96, df=2 (P=0.62); I^2=0%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[10] All 3 prevention focused studies included balanced mixed gender samples. The 2 studies[28, 32] that reported race included primarily white participants. These 2 studies also provided information related to SES; 1 study[32] reported a majority (75%) of middle to high SES participants and in the other study[28] 70% of participants had at least 1 parent who completed post-secondary education. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., smoke less than once a week or no smoking in past 30 days). Two interventions[26, 28] were delivered to individual youth and 1[32] was delivered to individual families. Primary care providers (e.g., family practitioners) were involved in 1 study,[26] 1 study[28] was conducted in dental offices by orthodontists and other clinic staff, and in 1 study[32] families were recruited mostly through primary schools and researchers facilitated delivery of intervention materials. In terms of general components, all 3 interventions provided education or information and 1 offered counseling and featured changes in the clinic environment (promoting a tobacco-free space).[28] Only 1 of the interventions[28] relied on face-to-face interactions between interventionists and participants, 2 used postal mail,[26, 32] and all 3 used printed materials. One of the interventions[28] was rated as high intensity because it featured multiple personal contacts between interventionists and participants and the other 2 interventions[26, 32] received a low intensity rating due to lack of personal contact. The length of interventions ranged from 1 year[26, 32] to 2 years.[28] Two of the studies[28, 32] used a usual care control group and the third study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for all studies. Smoking behaviour was variably defined and measured; 1 study[32] asked participants if they had ever smoked which was similar to another study[26] that asked if youth had maintained abstinence since the baseline assessment, and the third study[28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour. One study[28] was conducted in the US and the other 2 studies[26, 32] took place in Europe (UK, Netherlands). One study[32] was published recently (2014) and the other 2 studies[26, 28] were published more than 10 years ago (1996, 2001). This body of evidence was not downgraded for indirectness.

[11] The sample size is adequate (i.e., ≥300; 1,728 Intervention, 1,920 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 0.6858 (95% CI 0.4804, 0.9790)]. This body of evidence was not downgraded for imprecision.

[12] The 6 studies are: Fidler et al. 2001,[26] Hollis et al. 2005,[27] Hovell et al. 1996,[28] Kentala et al. 1999,[29] Pbert et al. 2008,[30] and Redding et al. 2014.[33]

[13] Using Cochrane's Risk of Bias tool,[17] for this outcome 3 studies (50%) were rated as high risk and 3 studies (50%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (83%), allocation concealment (67%), blinding of participants and/or personnel (100%), blinding of outcome assessors (100% self-report), retention and incomplete reporting (50%) and other sources of bias (50%; e.g., baseline characteristics not reported, significant baseline difference for gender with more girls in the intervention than control groups, no mention of power or sample size calculations). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[14] The statistical heterogeneity is minimal [Chi^2=5.30, df=5 (P=0.38); I^2=6%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[15] Across the 6 studies, most (n=5) included generally balanced mixed gender samples; 1 included only girls.[33] Of the 4 studies that reported race,[27, 28, 30, 33] 3 included primarily white participants (73-92%) and 1[33] mostly included black youth (85%). Only 2 studies provided information related to SES; 70% of participants in 1 study[28] had at least 1 parent who completed post-secondary education and the other study[33] was conducted in economically disadvantaged communities. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., smoke less than once a week or no smoking in past 30 days). Two studies[26, 28] focused on prevention and 4 studies[27, 29, 30, 33] had a combined focus on prevention and treatment of tobacco smoking. All interventions were delivered to individual youth. Primary care settings and professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in 3 studies,[26, 27, 30] 2 studies were conducted in dental offices by orthodontists, dentists and other clinic staff,[28, 29] and 1 study was conducted in family planning clinics using health counselors as delivery agents.[33] In terms of general components, 4 interventions provided education or information,[26-28, 33] 5 offered counseling or advice,[27-30, 33] 2 used motivational interviewing,[27, 30] 2 included booster sessions,[27, 30] and 1 featured changes in the clinic environment (promoting a tobacco-free space).[28] Most (n=5) of the interventions relied on face-to-face interactions between interventionists and participants,[27-30, 33] 2 used the telephone to communicate,[27, 30] 1 used postal mail,[26] 2 incorporated an interactive computer program in the intervention strategy[27, 33] and 4 used printed materials or photos.[26-29] Four of the interventions[27, 28, 30, 33] were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants and the other 2 interventions[26, 29] received a low intensity rating due to lack of or very minimal (approximately 5 minutes over 2 years) personal contact. The length of interventions varied; 1 lasted 6 months,[30] 1 went for 9 months,[33] 2 were 12 months long,[26, 27] and 2 lasted for 24 months.[28, 29] Most of the studies[28-30, 33] used a usual care control group; 1 study[27] used an attention control group (diet intervention) and the remaining study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for all studies except for 1[33] that provided data on smoking outcomes assessed 3 months after program completion. Smoking behaviour was variably defined and measured; 1 study[29] asked participants if they had ever smoked which was similar to 3 studies[26, 30, 33] that asked if youth had maintained abstinence since the baseline assessment, and 2 studies[27, 28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. Four of the studies[27, 28, 30, 33] were conducted in the US and the other 2 studies[26, 29] took place in Europe (UK, Finland). One study[33] was published recently (2014), 1 study[30] appeared in the literature in the last 10 years (2008), and the rest of the studies[26-29] were published more than 10 years ago (between 1996 and 2005). This body of evidence was not downgraded for indirectness.

[16] The sample size is adequate (i.e., ≥300; 5,946 Intervention, 5,952 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 0.8673 (95% CI 0.7796, 0.9647)]. This body of evidence was not downgraded for imprecision.

[17] The 3 studies are: Fidler et al. 2001,[26] Hiemstra et al. 2014,[32] and Kentala et al. 1999.[29]

[18] Using Cochrane's Risk of Bias tool,[17] for this outcome 2 studies (67%) were rated as high risk and 1 study (33%) was rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (67%), allocation concealment (100%), blinding of participants and/or personnel (67%), blinding of outcome assessors (100% self-report), retention and incomplete reporting (67%) and other sources of bias (100%; e.g., baseline characteristics not reported, significant baseline difference for gender with more

girls in the intervention than control groups, no mention of power or sample size calculations). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[19] The statistical heterogeneity is minimal [Chi^2=2.15, df=2 (P=0.34); I^2=7%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[20] All 3 studies included generally balanced mixed gender samples. Only 1 study focused exclusively on younger children (≤12 years),[32] 1 study targeted older youth (≥13 years),[29] and 1 study[26] included both younger and older participants. One study[32] provided information related to SES; a majority (75%) of participants was considered middle to high SES. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., smoke less than once a week). Two studies[26, 32] were focused on prevention and 1 study[29] had a combined focus on prevention and treatment of tobacco smoking. Two interventions[26, 29] were delivered to individual youth and the third[32] was delivered to individual families. Primary care providers (e.g., family practitioners) were involved in 1 study,[26] 1 study was conducted in dental offices by dentists,[29] and in 1 study families were recruited mostly through primary schools and researchers facilitated delivery of intervention materials.[32] In terms of general components, 2 interventions provided education or information[26, 32] and 1 offered counseling.[29] One of the interventions[29] relied on face-to-face interactions between interventionists and participants,[29] 2 used postal mail,[26, 32] and 3 used printed materials or photos.[26, 29, 32] The length of interventions ranged from 12 months[26, 32] to 24 months.[29] Two studies[29, 32] used a usual care control group and 1 study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for all studies. Smoking behaviour was variably defined and measured; 2 studies[29, 32] asked participants if they had ever smoked which was similar to the other study[26] that asked if youth had maintained abstinence since the baseline assessment. None of the studies used biochemical verification of smoking behaviour. All 3 studies took place in Europe (UK, Netherlands, Finland). One study[32] was published recently (2014) and the other 2 studies[26, 29] were published more than 10 years ago (1999, 2001). This body of evidence was not downgraded for indirectness.

[21] The sample size is adequate (i.e., ≥300; 2,580 Intervention, 2,566 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 0.7527 (95% CI 0.6132, 0.9240)]. This body of evidence was not downgraded for imprecision.

[22] The 4 studies are: Hollis et al. 2005,[27] Hovell et al. 1996,[28] Pbert et al. 2008,[30] and Redding et al. 2014.[33]

[23] Using Cochrane's Risk of Bias tool,[17] for this outcome 1 study (25%) was rated as high risk and 3 studies (75%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (75%), allocation concealment (50%), blinding of participants and/or personnel (100%), blinding of outcome assessors (100% self-report), retention and incomplete reporting (25%) and other sources of bias (25%; e.g., significant baseline difference for gender with more girls in the intervention than control groups). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[24] The statistical heterogeneity is minimal [Chi^2=3.43, df=3 (P=0.33); I^2=12%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[25] Across the 4 studies, most (n=3) included generally balanced mixed gender samples; 1 included only girls.[33] Three studies[27, 30, 33] targeted older youth (≥13 years) and 1 study[28] included both younger and older participants. Four studies[27, 28, 30] included primarily white participants (73-92%) and 1 study[33] mostly included black youth (85%). Only 2 studies provided information related to SES; 1 study[28] reported 70% of participants had at least 1 parent who completed post-secondary education and the other study[33] was conducted in economically disadvantaged communities. In terms

of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., smoke less than once a week or no smoking in past 30 days). One intervention[28] focused on prevention and the other 3 studies had a combined focus on prevention and treatment of tobacco smoking.[27, 30, 33] All interventions were delivered to individual youth. Primary care settings and professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in 2 studies,[27, 30] 1 study was conducted in dental offices by orthodontists and other clinic staff,[28] and 1 study was conducted in family planning clinics using health counselors as delivery agents.[33] In terms of general components, 3 interventions provided education or information,[27, 28, 33] all 4 offered counseling or advice,[27, 28, 30, 33] 2 used motivational interviewing,[27, 30] 2 included booster sessions,[27, 30] and 1 featured changes in the clinic environment (promoting a tobacco-free space).[28] All of the interventions relied on face-to-face interactions between interventionists and participants, 2 used the telephone to communicate,[27, 30] 2 incorporated an interactive computer program in the intervention strategy[27, 33] and 2 used printed materials.[27, 28] The length of interventions varied; 1 lasted 6 months,[30] 1 went for 9 months,[33] 1 was 12 months long,[27] and 1 lasted for 24 months.[28] Most of the studies[28, 30, 33] used a usual care control group and 1 study[27] used an attention control arm (diet intervention). Immediate post intervention assessment data were reported for all studies except for 1[33] that provided data on smoking outcomes assessed 3 months after program completion. Smoking behaviour was variably defined and measured; 2 studies[30, 33] asked if youth had maintained abstinence since the baseline assessment and 2 studies[27, 28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. All 4 studies were conducted in the US. One study[33] was published recently (2014), 1 study[30] appeared in the literature in the last 10 years (2008), and the rest of the studies[27, 28] were published more than 10 years ago (1996, 2005). This body of evidence was not downgraded for indirectness.

[26] The sample size is adequate (i.e., ≥300; 5,093 Intervention, 5,306 Control) but the pooled effect estimate is not precise and the confidence interval includes the null value "1" [RR 0.8845 (95% CI 0.7673, 1.0195)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[27] The 4 studies are: Hiemstra et al. 2014,[32] Hollis et al. 2005,[27] Hovell et al. 1996,[28] and Pbert et al. 2008.[30]

[28] Using Cochrane's Risk of Bias tool,[17] for this outcome all 4 studies (100%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (75%), allocation concealment (75%), blinding of participants and/or personnel (75%), blinding of outcome assessors (100% self-report) and other sources of bias (50%; e.g., significant baseline difference for gender with more girls in the intervention than control groups). Given that all of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[29] The statistical heterogeneity is minimal [Chi^2=4.45, df=3 (P=0.22); I^2=33%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[30] All 4 studies included generally balanced mixed gender samples. Only 1 study focused exclusively on younger children (≤12 years),[32] 2 studies targeted older youth (≥13 years),[27, 30] and 1 study[28] included both younger and older participants. All 4 studies included primarily white participants (73-92%). Only 2 studies provided information related to SES; 1 study[32] reported a majority (75%) of middle to high SES participants and 70% of participants in another study[28] had at least 1 parent who completed post-secondary education. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., no smoking in past 30 days). Two studies focused on prevention[28, 32] and 2 studies had a combined focus on prevention and treatment of tobacco smoking.[27, 30] All but 1 intervention was delivered to individual youth; the exception[32] was delivered to individual families. Primary care settings and

professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in 2 studies,[27, 30] 1 study was conducted in dental offices by orthodontists and other clinic staff,[28] and in 1 study families were recruited mostly through primary schools and researchers facilitated delivery of intervention materials.[32] In terms of general components, 3 interventions provided education or information,[27, 28, 32] 3 offered counseling or advice,[27, 28, 30] 2 used motivational interviewing,[27, 30] 2 included booster sessions,[27, 30] and 1 featured changes in the clinic environment (promoting a tobacco-free space).[28] Most (n=3) of the interventions relied on face-to-face interactions between interventionists and participants,[27, 28, 30] 2 used the telephone to communicate,[27, 30] 1 used postal mail,[32] 1 incorporated an interactive computer program in the intervention strategy[27] and 3 used printed materials or photos.[27, 28, 32] Three of the interventions[27, 28, 30] were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants and the other intervention[32] received a low intensity rating due to lack of personal contact. The length of interventions varied; 1 lasted 6 months,[30] 2 were 12 months long,[27, 32] and 1 lasted for 24 months.[28] Most of the studies[28, 30, 32] used a usual care control group; 1 study[27] had an attention control arm (diet intervention). Immediate post intervention assessment data were reported for all studies. Smoking behaviour was variably defined and measured; 1 study[32] asked participants if they had ever smoked which was similar to another study[30] that asked if youth had maintained abstinence since the baseline assessment, and 2 studies[27, 28] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. Three of the studies[27, 28, 30] were conducted in the US and the other study[32] took place in Europe (Netherlands). One study[32] was published recently (2014), 1 study[30] appeared in the literature in the last 10 years (2008), and the other studies[27, 28] were published more than 10 years ago (1996, 2005). This body of evidence was not downgraded for indirectness.

[31] The sample size is adequate (i.e., ≥300; 5,550 Intervention, 5,833 Control) but the pooled effect estimate is not precise and the confidence interval includes the null value "1" [RR 0.8458 (95% CI 0.6956, 1.0284)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[32] The 3 studies are: Fidler et al. 2001,[26] Kentala et al. 1999,[29] and Redding et al. 2014.[33]

[33] Using Cochrane's Risk of Bias tool,[17] for this outcome all 3 studies (100%) were rated as high risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (67%), allocation concealment (67%), blinding of participants and/or personnel (100%), blinding of outcome assessors (100% self-report), retention and incomplete reporting (100%) and other sources of bias (67%; e.g., baseline characteristics not reported, no mention of power or sample size calculations). Given that all of the information is from studies at high risk of bias, this body of evidence was downgraded for very serious study limitations.

[34] The statistical heterogeneity is minimal [Chi^2=1.66, df=2 (P=0.44); I^2=0%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[35] Across the 3 studies, 2 included generally balanced mixed gender samples and 1[33] included only girls. Two studies targeted older youth (≥13 years)[29, 33] and 1 study[26] included both younger and older participants. Only 1 study[33] reported data for race and SES and it included mostly black (85%) youth from economically disadvantaged communities. In terms of baseline smoking status, the samples were comprised mostly of never smokers but all studies included at least some participants who had tried smoking in the past (variably defined e.g., smoke less than once a week). One intervention focused on prevention[26] and the other 2 had a combined focus on prevention and treatment of tobacco smoking.[29, 33] All interventions were delivered to individual youth. Primary care professionals (e.g., family practitioners) were involved in 1 study,[26] 1 study was conducted in dental offices by dentists,[29] and 1 study was conducted in family planning clinics using health counselors as delivery agents.[33] In terms of general components, 2 interventions[26, 33] provided education or information and 2[29, 33] offered counseling or advice. Two of the interventions relied on face-to-

face interactions between interventionists and participants,[29, 33] 1 used postal mail,[26] 1 incorporated an interactive computer program in the intervention strategy[33] and 2 used printed materials or photos.[26, 29] One intervention[33] was rated as high intensity because it featured multiple personal contacts between interventionists and participants and the other 2 interventions[26, 29] received a low intensity rating due to lack of or very minimal (approximately 5 minutes over 2 years) personal contact. The length of interventions varied; 1 went for 9 months,[33] 1 was 12 months long,[26] and 1 lasted for 24 months.[29] Two of the studies[29, 33] used a usual care control group; 1 study[26] had a no intervention control arm. Immediate post intervention assessment data were reported for two studies[26, 29] and 1 study[33] provided data on smoking outcomes assessed 3 months after program completion. To measure smoking behaviour 1 study[29] asked participants if they had ever smoked which was similar to the other 2 studies[26, 33] that asked if youth had maintained abstinence since the baseline assessment. None of the studies used biochemical verification of smoking behaviour. One study[33] was conducted in the US and the other 2 studies[26, 29] took place in Europe (UK, Finland). One study[33] was published recently (2014) and the other 2 studies[26, 29] were published more than 10 years ago (1999, 2001). This body of evidence was not downgraded for indirectness.

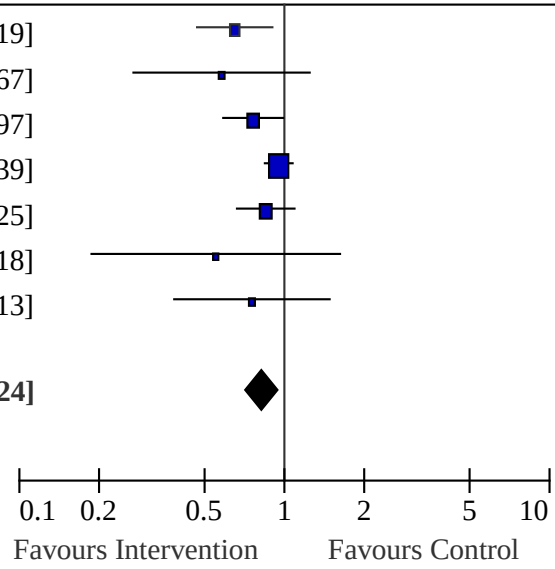
[36] The sample size is adequate (i.e., ≥300; 2,123 Intervention, 2,039 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 0.7695 (95% CI 0.6361, 0.9310)]. This body of evidence was not downgraded for imprecision.

ES Forest Plot 1.1. Effect of Prevention Interventions on Incidence of Tobacco Smoking – Overall

	Intervention		Control			Risk Ratio	Risk Ratio
Study	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**	**M-H, Random, 95% CI**
Fidler et al. 2001	54	1,068	89	1,144	13.3%	0.6499 [0.4683, 0.9019]	
Hiemstra et al. 2014	10	667	18	696	3.0%	0.5797 [0.2696, 1.2467]	
Hollis et al. 2005	89	962	118	973	18.6%	0.7629 [0.5880, 0.9897]	
Hovell et al. 1996	440	3,667	493	3,912	39.9%	0.9521 [0.8441, 1.0739]	
Kentala et al. 1999	106	845	107	726	19.7%	0.8511 [0.6631, 1.0925]	
Pbert et al. 2008	5	254	9	252	1.6%	0.5512 [0.1873, 1.6218]	
Redding et al. 2014	15	210	16	169	3.8%	0.7545 [0.3843, 1.4813]	
Total (95% CI)		**7,673**		**7,872**	**100.0%**	**0.8222 [0.7174, 0.9424]**	
Total events	719		850				

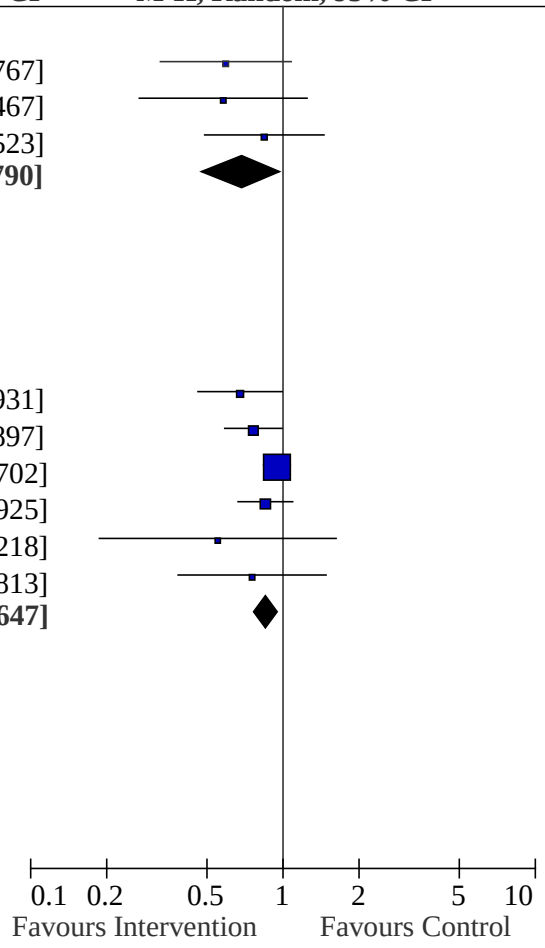
Heterogeneity: Tau² = 0.01; Chi² = 8.16, df = 6 (P = 0.23); I² = 26%

Test for overall effect: Z = 2.81 (P = 0.005)

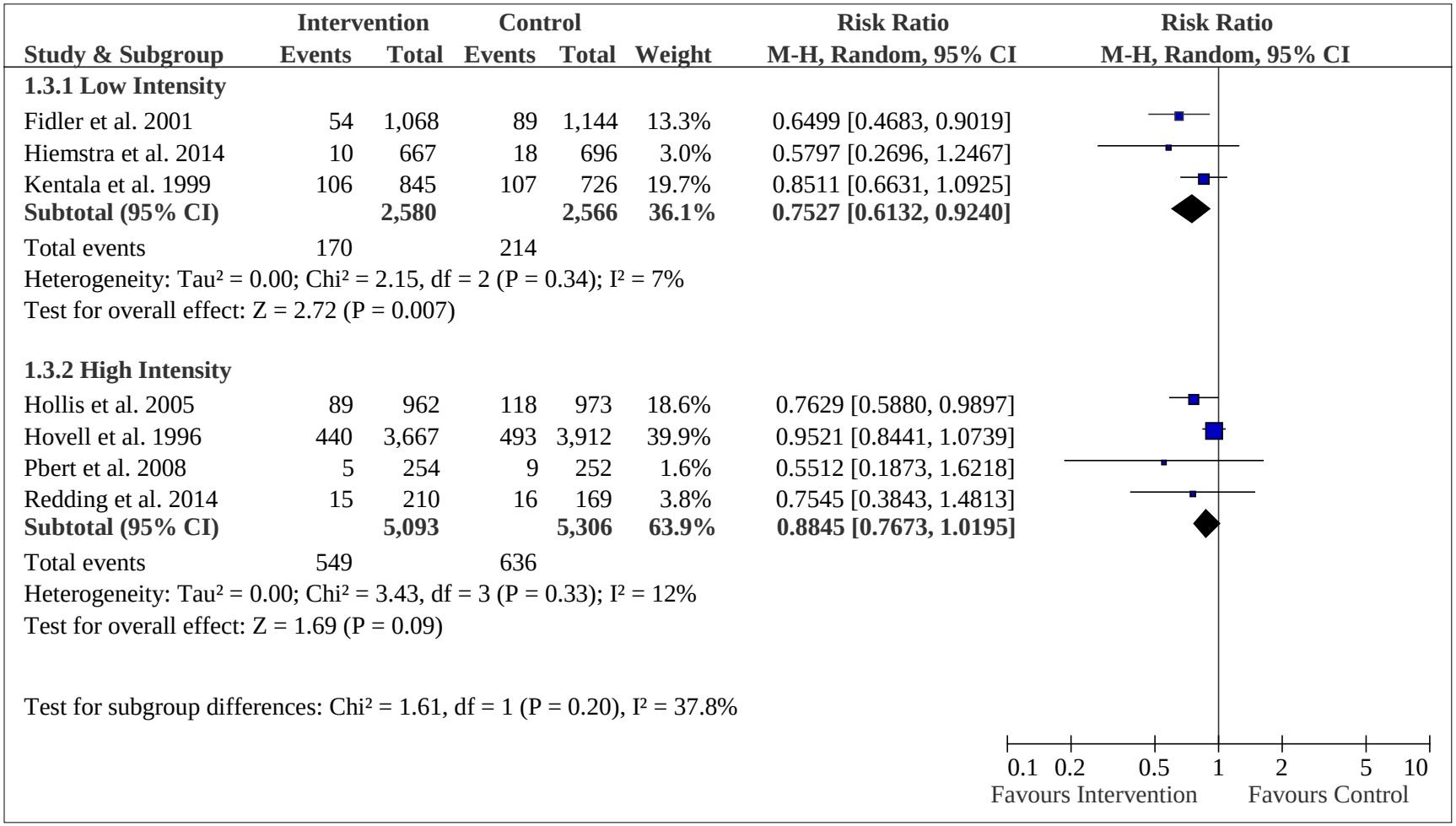


ES Forest Plot 1.2: Effect of Prevention Interventions on Incidence of Tobacco Smoking – by Age Group (5-12 Years, 13-18 Years)

Study & Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
1.2.1 Aged 5-12 Years						
Fidler et al. 2001	16	580	30	645	2.5%	0.5931 [0.3267, 1.0767]
Hiemstra et al. 2014	10	667	18	696	1.5%	0.5797 [0.2696, 1.2467]
Hovell et al. 1996	21	481	30	579	2.9%	0.8426 [0.4889, 1.4523]
Subtotal (95% CI)		**1,728**		**1,920**	**6.9%**	**0.6858 [0.4804, 0.9790]**
Total events	47		78			
Heterogeneity: Tau² = 0.00; Chi² = 0.96, df = 2 (P = 0.62); I² = 0%						
Test for overall effect: Z = 2.08 (P = 0.04)						
1.2.2 Aged 13-18 Years						
Fidler et al. 2001	39	488	59	499	5.9%	0.6759 [0.4600, 0.9931]
Hollis et al. 2005	89	962	118	973	12.9%	0.7629 [0.5880, 0.9897]
Hovell et al. 1996	419	3,187	463	3,333	57.7%	0.9464 [0.8370, 1.0702]
Kentala et al. 1999	106	845	107	726	14.0%	0.8511 [0.6631, 1.0925]
Pbert et al. 2008	5	254	9	252	0.7%	0.5512 [0.1873, 1.6218]
Redding et al. 2014	15	210	16	169	1.9%	0.7545 [0.3843, 1.4813]
Subtotal (95% CI)		**5,946**		**5,952**	**93.1%**	**0.8673 [0.7796, 0.9647]**
Total events	673		772			
Heterogeneity: Tau² = 0.00; Chi² = 5.30, df = 5 (P = 0.38); I² = 6%						
Test for overall effect: Z = 2.62 (P = 0.009)						
Test for subgroup differences: Chi² = 1.53, df = 1 (P = 0.22), I² = 34.8%						

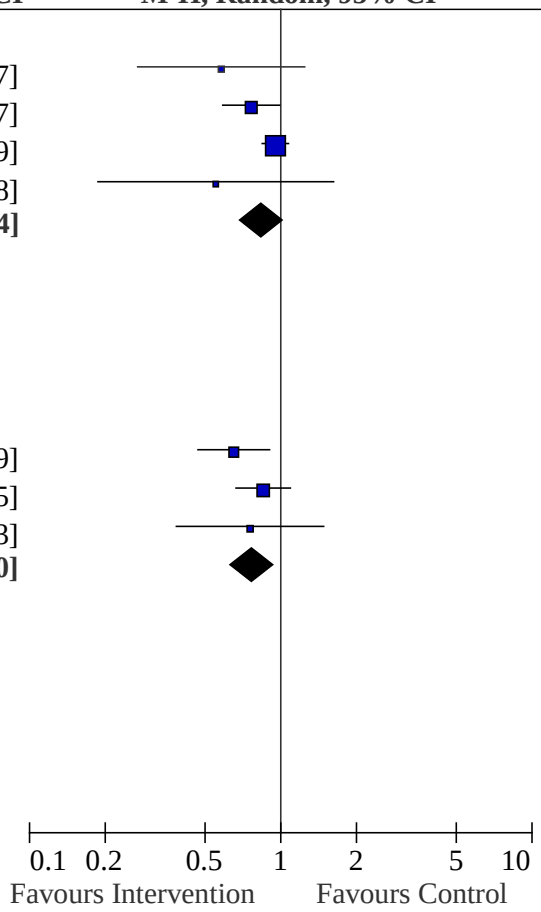


ES Forest Plot 1.3. Effect of Prevention Interventions on Incidence of Tobacco Smoking – by Intervention Intensity (Low, High)



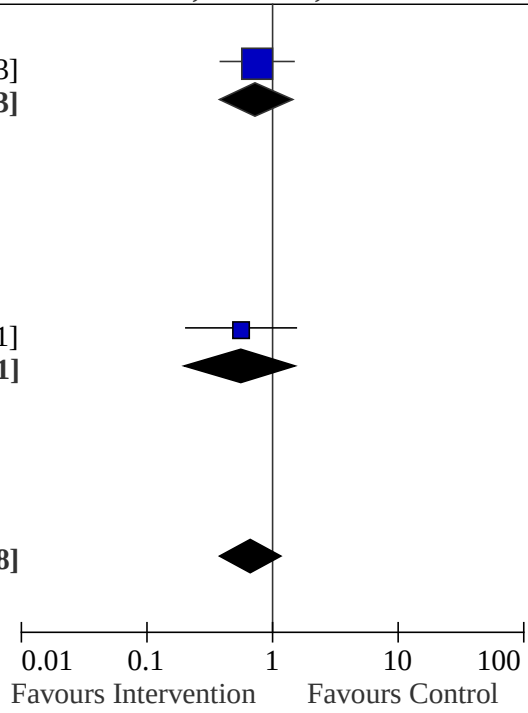
ES Forest Plot 1.4. Effect of Prevention Interventions on Incidence of Tobacco Smoking – by Study Risk of Bias Rating (Unclear, High)

Study & Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
1.4.1 Unclear Risk of Bias						
Hiemstra et al. 2014	10	667	18	696	3.0%	0.5797 [0.2696, 1.2467]
Hollis et al. 2005	89	962	118	973	18.6%	0.7629 [0.5880, 0.9897]
Hovell et al. 1996	440	3,667	493	3,912	39.9%	0.9521 [0.8441, 1.0739]
Pbert et al. 2008	5	254	9	252	1.6%	0.5512 [0.1873, 1.6218]
Subtotal (95% CI)		**5,550**		**5,833**	**63.1%**	**0.8458 [0.6956, 1.0284]**
Total events	544		638			
Heterogeneity: Tau² = 0.01; Chi² = 4.45, df = 3 (P = 0.22); I² = 33%						
Test for overall effect: Z = 1.68 (P = 0.09)						
1.4.2 High Risk of Bias						
Fidler et al. 2001	54	1,068	89	1,144	13.3%	0.6499 [0.4683, 0.9019]
Kentala et al. 1999	106	845	107	726	19.7%	0.8511 [0.6631, 1.0925]
Redding et al. 2014	15	210	16	169	3.8%	0.7545 [0.3843, 1.4813]
Subtotal (95% CI)		**2,123**		**2,039**	**36.9%**	**0.7695 [0.6361, 0.9310]**
Total events	175		212			
Heterogeneity: Tau² = 0.00; Chi² = 1.66, df = 2 (P = 0.44); I² = 0%						
Test for overall effect: Z = 2.70 (P = 0.007)						
Test for subgroup differences: Chi² = 0.46, df = 1 (P = 0.50), I² = 0%						



ES Forest Plot 1.5. Effect of Prevention Interventions on Incidence of Tobacco Smoking – by Baseline Smoking Status (Never, Former)

Study & Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
1.5.1 Never Smokers						
Redding et al. 2014	15	210	16	169	69.2%	0.7545 [0.3843, 1.4813]
Subtotal (95% CI)		**210**		**169**	**69.2%**	**0.7545 [0.3843, 1.4813]**
Total events	15		16			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.82 (P = 0.41)						
1.5.2 Former Smokers						
Redding et al. 2014	4	19	9	24	30.8%	0.5614 [0.2040, 1.5451]
Subtotal (95% CI)		**19**		**24**	**30.8%**	**0.5614 [0.2040, 1.5451]**
Total events	4		9			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.12 (P = 0.26)						
Total (95% CI)		**229**		**193**	**100.0%**	**0.6889 [0.3930, 1.2078]**
Total events	19		25			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.23$, df = 1 (P = 0.63); $I^2 = 0\%$						
Test for overall effect: Z = 1.30 (P = 0.19)						
Test for subgroup differences: $Chi^2 = 0.23$, df = 1 (P = 0.63), $I^2 = 0\%$						



ES Table 1.4. Elements of Efficacious Interventions for Preventing Tobacco Smoking

Study	Fidler et al. 2001[26]	Hollis et al. 2005[27]
Effect	RR 0.65 (95% CI 0.47, 0.90)	RR 0.76 (95% CI 0.59, 0.99)
Population		
Country	UK (Oxfordshire)	US (Oregon and Washington States)
Age Range	10-15 years	14-17 years
Sex	Mixed (53% female)	Mixed (59% female)
Race	Not specified (not reported)	Mixed (78% white)
SES	Not specified (not reported)	Not specified (not reported)
Baseline Smoking Status	Never or not current (smoke less than once a week)	Prevention: never or former (no smoking ≤30 days)
Intervention		
Focus	Prevention	Prevention and treatment
Other Behaviours	No – tobacco smoking only	No – tobacco smoking only
Components	Education/information (information sheets addressing smoking related topics, dangers and health risks of smoking; posters; certificates of non-smoking status)	Education/information, counseling/advice, motivational interviewing, boosters (primary care professionals deliver a 30-60 second message about not starting smoking; multi-media, interactive computer program assesses stage of readiness to begin smoking then delivers tailored advice and encouragement; brief motivational counseling sessions with health counselors)
Mode of Delivery	Printed materials, postal delivery	Face-to-face and phone interactions, multi-media interactive computer program, printed materials
Youth, Parent or Family	Youth only	Youth only
Individual or Group	Individual	Individual
Intensity	Low – no direct or personal contact with providers; 4 packages sent via postal mail, 1 every 3 months	High – about 1 minute of messaging from clinician; 3 sessions of approximately 15 minutes each (10-12 minutes on computer and 3-5 minutes with health counselor)
Estimated Contact Time	None	15 minutes
Primary Care Role(s)	Recruitment, delivery (packages signed and sent directly from each youth's respective primary health care provider)	Recruitment, delivery
Delivery Agent(s)	Primary care providers	Primary care providers, health counselors
Setting(s)	Home	Primary care
Duration	12 months	12 months

Evidence Set (ES) 2. Treatment - Incidence of Stopping Tobacco Smoking

- ES Table 2.1. Overview of Key Results for Treatment of Tobacco Smoking
- ES Table 2.2. GRADE Evidence Profile: Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking
- ES Table 2.3. GRADE Summary of Findings: Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking
- ES Forest Plots 2.1 to 2.3
- ES Table 2.4. Elements of Efficacious Interventions for Treating Tobacco Smoking

ES Table 2.1. Overview of Key Results for Treatment of Tobacco Smoking

Forest Plot	Outcome and Subgroup	Subgroups	Test for Subgroup Differences	# of Studies (Participants)	GRADE Quality Rating	Risk Ratio (95% CI) I^2	Absolute Risk Increase	Number Needed to Treat (95% CI)
2.1	Incidence of stopping tobacco smoking overall	-	-	3 (741)	Moderate	1.3371 (1.0549, 1.6948) 0%	7.98%	13 (6, 77)
2.2	Incidence of stopping tobacco smoking by baseline smoking status	Experimental/ Occasional	P=0.002 I^2=89.5%	1 (140)	Low	0.9129 (0.6477, 1.2866) n/a	-	-
		Regular		1 (448)	Moderate	2.0645 (1.4022, 3.0396) n/a	14.73%	7 (4, 18)
2.3	Incidence of stopping tobacco smoking by study risk of bias rating	Unclear	P=0.18 I^2=44.0%	2 (649)	Moderate	1.4131 (1.0999, 1.8154) 0%	9.64%	10 (5, 43)
		High		1 (92)	Very Low	0.8333 (0.4004, 1.7344) n/a	-	-

ES Table 2.2. GRADE Evidence Profile: Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking*

Quality Assessment							# of Participants and Event Rates (%)		Effect				GRADE Quality Rating	Ranking of Outcome Importance
# of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other	Treatment	Control	Relative (95% CI)	Absolute per Million (Range)	ARI**	NNT** (95% CI)		
Incidence of Stopping Tobacco Smoking - Overall (immediate post intervention assessment for 2 studies, 3 months post intervention completion assessment for 1 study; self-report)														
3[1]	randomized trials	serious risk[2]	no serious inconsistency[3]	no serious indirectness[4]	no serious imprecision[5]	none[6]	115/365 (31.5068%)	89/376 (23.6702%)	RR 1.3371 (1.0549 to 1.6948)	79,792 more (12,995 more to 164,461 more)	7.98%	13 (6, 77)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Stopping Tobacco Smoking – Experimental/Occasional Smokers at Baseline (immediate post intervention assessment; self-report)														
1[7]	randomized trial	serious risk[8]	no serious inconsistency[9]	no serious indirectness[10]	serious imprecision[11]	none[6]	31/67 (46.2687%)	37/73 (50.6849%)	RR 0.9129 (0.6477 to 1.2866)	44,147 fewer (178,563 fewer to 145,263 more)	-	-	⊕⊕OO LOW	CRITICAL
Incidence of Stopping Tobacco Smoking – Regular Smokers at Baseline (immediate post intervention assessment; self-report)														
1[7]	randomized trial	serious risk[8]	no serious inconsistency[9]	no serious indirectness[10]	no serious imprecision[12]	none[6]	64/224 (28.5714%)	31/224 (13.8393%)	RR 2.0645 (1.4022 to 3.0396)	147,319 more (55,662 more to 282,266 more)	14.73%	7 (4, 18)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Stopping Tobacco Smoking – Study Risk of Bias Rating Unclear (immediate post intervention assessment; self-report)														
2[13]	randomized trial	serious risk[14]	no serious inconsistency[15]	no serious indirectness[16]	no serious imprecision[17]	none[6]	105/319 (32.9154%)	77/330 (23.3333%)	RR 1.4131 (1.0999 to 1.8154)	96,390 more (23,310 more to 190,260 more)	9.64%	10 (5, 43)	⊕⊕⊕O MODERATE	CRITICAL
Incidence of Stopping Tobacco Smoking – Study Risk of Bias Rating High (3 months post intervention completion assessment; self-report)														
1[18]	randomized trial	very serious risk[19]	no serious inconsistency[9]	no serious indirectness[20]	serious imprecision[21]	none[6]	10/46 (21.7391%)	12/46 (26.0870%)	RR 0.8333 (0.4004 to 1.7344)	43,487 fewer (156,417 fewer to 191,583 more)	-	-	⊕OOO VERY LOW	CRITICAL

*Footnotes appear below the Summary of Findings Table.
**Absolute risk increase (ARI) and number needed to treat (NNT) are only reported for significant effect estimates.

ES Table 2.3. GRADE Summary of Findings: Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking

Outcome: Incidence of Stopping Tobacco Smoking	Illustrative Comparative Risks* (95% CI)		Relative Effect (95% CI)	# of Participants (Studies)	Quality of the Evidence (GRADE)
	Assumed Risk Number per Million Control	Corresponding Risk Number per Million Intervention			
Overall (self-report; immediate post intervention assessment for 2 studies, 3 months post intervention completion for 1 study)	**236,702**	**316,494** (249,697 to 401,163)	**RR 1.3371** (1.0549 to 1.6948)	741 (3 studies[1])	⊕⊕⊕⊖ **moderate**[2,3,4,5,6]
Baseline Tobacco Smoking Status Experimental/Occasional (self-report; immediate post intervention assessment)	**506,849**	**462,703** (328,286 to 652,112)	**RR 0.9129** (0.6477 to 1.2866)	140 (1 study[7])	⊕⊕⊖⊖ **low**[6,8,9,10,11]
Baseline Tobacco Smoking Status Regular (self-report; immediate post intervention assessment)	**138,393**	**285,712** (194,054 to 420,659)	**RR 2.0645** (1.4022 to 3.0396)	448 (1 study[7])	⊕⊕⊕⊖ **moderate**[6,8,9,10,12]
Study Risk of Bias Rating Unclear (self-report; immediate post intervention assessment)	**233,333**	**329,723** (256,643 to 423,593)	**RR 1.4131** (1.0999 to 1.8154)	649 (2 studies[13])	⊕⊕⊕⊖ **moderate**[6,14,15,16,17]
Study Risk of Bias Rating High (self-report; 3 months post intervention completion assessment)	**260,870**	**217,383** (104,452 to 452,452)	**RR 0.8333** (0.4004 to 1.7344)	92 (1 study[18])	⊕⊖⊖⊖ **very low**[6,9,19,20,21]

*The assumed risk is the mean control group risk across studies. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

Footnotes for the GRADE Evidence Profile and Summary of Findings Tables for the Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking

[1] The 3 studies are: Hollis et al. 2005,[27] Pbert et al. 2008,[30] and Redding et al. 2014.[33]

[2] Using Cochrane's Risk of Bias tool,[17] for this outcome 1 study (33%) was rated as high risk and 2 studies (67%) were rated as unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (67%), allocation concealment (33%), blinding of participants and/or personnel (100%), blinding of outcome assessors (100% self-report), retention and incomplete reporting (33%) and other sources of bias (67%; e.g., significant baseline difference for gender with more girls in the intervention than control groups, insufficient power for smoking cessation outcome). Given that all of the information is from studies at moderate to high risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is minimal [Chi^2=1.83, df=2 (P=0.40); I^2=0%] and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

[4] Across the 3 studies, 2[27, 30] included generally balanced mixed gender samples and 1[33] included only girls. All 3 studies targeted older youth (≥13 years). Two studies[27, 30] included primarily white participants (78-92%) and 1 study[33] included mostly black youth (85%). One study[33] provided information related to SES; the intervention was conducted in economically disadvantaged communities. In terms of baseline smoking status, the samples were variably defined; smoked in last 30 days,[27] smoke more than weekly,[33] or currently a regular or occasional smoker.[30] All interventions were delivered to individual youth. Primary care settings and professionals (e.g., family practitioners, pediatricians, nurses, health counselors) were involved in 2 studies[27, 30] and 1 study[33] was conducted in family planning clinics using health counselors as delivery agents. In terms of general components, 2 interventions provided education or information,[27, 33] all 3 offered counseling or advice, 2 used motivational interviewing,[27, 30] and 2 included booster sessions.[27, 30] All 3 interventions relied on face-to-face interactions between interventionists and participants, 2 used the telephone to communicate,[27, 30] 2 incorporated an interactive computer program in the intervention strategy[27, 33] and 1 used printed materials.[27] All 3 interventions were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants. The length of interventions varied; 1 lasted 6 months,[30] 1 went for 9 months,[33] and 1 was 12 months long.[27] Two studies[30, 33] used a usual care control group and 1 study[27] had an attention control arm (diet intervention). Immediate post intervention assessment data were reported for 2 studies[27, 30] and 1 study[33] provided data on smoking outcomes assessed 3 months after program completion. Smoking behaviour was variably defined and measured; 2 studies[30, 33] asked if youth had smoked since the baseline assessment and 1 study[27] asked if youth had smoked in the past 30 days. None of the studies used biochemical verification of smoking behaviour, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. All 3 studies[27, 30, 33] were conducted in the US. One study[33] was published recently (2014), 1 study[30] appeared in the literature in the last 10 years (2008), and the third study[27] was published more than 10 years ago (2005). This body of evidence was not downgraded for indirectness.

[5] The sample size is adequate (i.e., ≥300; 365 Intervention, 376 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 1.3371 (95% CI 1.0549, 1.6948)]. This body of evidence was not downgraded for imprecision.

[6] There were too few studies (n<10) to assess publication bias.[48] This body of evidence was not downgraded for reporting bias or any other concerns.

[7] The 1 study is: Hollis et al. 2005.[27]

[8] Using Cochrane's Risk of Bias tool,[17] for this outcome the study was rated as having unclear risk. There was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation, blinding of participants and/or personnel, and blinding of outcome assessors (self-report). Given that all of the information is from a study at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[9] Only one study provided data for this outcome; therefore statistical heterogeneity across studies could not be assessed.

[10] This study included a mixed gender (59% female) sample of 14-17 year old, primarily white (78%) youth who had smoked in the last 30 days. The 12 month high intensity intervention was delivered to individual youth in primary care settings by primary care clinicians and health counselors. Education, counseling and motivational interviewing were offered through face-to-face interactions and using printed materials and an interactive computer program. Two booster sessions were conducted via telephone and using printed materials. Immediate post intervention assessment data were reported for the outcome of smoking in the past 30 days. No biochemical verification of smoking behaviour was used. An attention control arm (diet intervention) was used as the comparison. This study was conducted in the US and was published more than 10 years ago (2005). This body of evidence was not downgraded for indirectness.

[11] The sample size is not adequate (i.e., <300; 67 Intervention, 73 Control) and the pooled effect estimate is not precise with a confidence interval that includes the null value "1" [RR 0.9129 (95% CI 0.6477, 1.2866)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[12] The sample size is not adequate (i.e., <300; 224 Intervention, 224 Control) but the pooled effect estimate is precise with a narrow confidence interval [RR 2.0645 (95% CI 1.4022, 3.0396)]. This body of evidence was not downgraded for imprecision.

[13] The 2 studies are: Hollis et al. 2005[27] and Pbert et al. 2008.[30]

[14] Using Cochrane's Risk of Bias tool,[17] for this outcome 2 studies (100%) were rated as having unclear risk. Across studies there was a lack of certainty (unclear ratings) or a high risk of bias associated with: sequence generation (100%), allocation concealment (50%), blinding of participants and/or personnel (100%), blinding of outcome assessors (100% self-report), and other sources of bias (50%; e.g., significant baseline difference for gender with more girls in the intervention than control groups). Given that all of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[15] The statistical heterogeneity is minimal [Chi^2=0.04, df=1 (P=0.84); I^2=0%] and the direction of the effect is consistent across studies with overlapping confidence intervals. This body of evidence was not downgraded for inconsistency.

[16] Both studies included generally balanced mixed gender samples, targeted older youth (≥13 years), and included primarily white participants (78-92%). In terms of baseline smoking status, the samples were variably defined; smoked in last 30 days[27] or currently a regular or occasional smoker.[30] Both interventions were delivered to individual youth in primary care settings by primary care providers (e.g., family practitioners, pediatricians, nurses) and health counselors. In terms of general components, 1 intervention provided education or information,[27] both offered counseling, used motivational interviewing and included booster sessions. Both interventions relied on face-to-face interactions between interventionists and participants as well as telephone communication; 1 intervention[27] also incorporated an interactive computer program in the intervention strategy[27] and used printed materials.[27] Both interventions were rated as high intensity because they featured multiple and/or longer personal contacts between interventionists and participants. One intervention lasted 6 months[30] and the other was 12 months long.[27] One study[30] used a usual care control group and the other study[27] had an attention control arm (diet intervention). Immediate post intervention assessment data were reported for both studies. Smoking behaviour was variably defined and measured; 1 study[30] asked if youth had smoked since the baseline assessment and 1 study[27] asked if youth had smoked in the past 30 days. Neither study used biochemical verification of smoking behaviour, although in 1 study[30] youth were shown a carbon monoxide monitor and were told it might be used to verify self-reports. Both studies[27, 30] were conducted in the US. One study[30] appeared in the literature in the last 10 years (2008), and the other study[27] was published more than 10 years ago (2005). This body of evidence was not downgraded for indirectness.

[17] The sample size is adequate (i.e., ≥300; 319 Intervention, 330 Control) and the pooled effect estimate is precise with a narrow confidence interval [RR 1.4131 (95% CI 1.0999, 1.8154)]. This body of evidence was not downgraded for imprecision.

[18] The 1 study is: Redding et al. 2014.[33]

[19] Using Cochrane's Risk of Bias tool,[17] for this outcome this study was rated as high risk. There was a lack of certainty (unclear ratings) or a high risk of bias associated with: blinding of participants and/or personnel, blinding of outcome assessors (self-report), retention and incomplete

reporting, and other sources of bias (insufficient power to assess smoking cessation). Given that all of the information is from a study at high risk of bias, this body of evidence was downgraded for very serious study limitations.

[20] This study included only girls, aged 14-17 years, who were primarily black (85%), lived in economically disadvantaged communities and smoked more than weekly. The 9 month high intensity intervention was delivered to individual youth attending family planning clinics by health counsellors. Education and counseling was provided through face-to-face interactions and using an interactive computer program. Smoking outcomes were assessed 3 months after the program concluded. Smoking behaviour was defined as smoking since the baseline assessment. No biochemical verification of smoking behaviour was used. A usual care group was assessed for comparison. This study was conducted in the US and was published recently (2014). This body of evidence was not downgraded for indirectness.

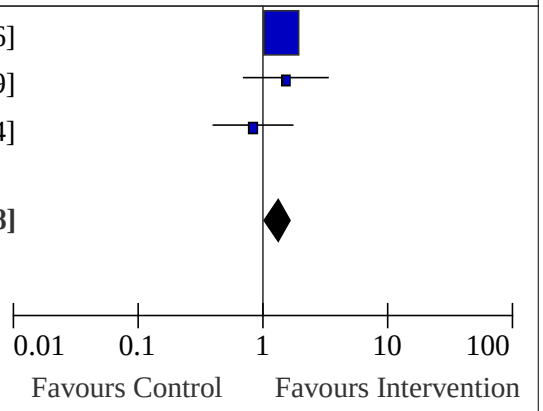
[21] The sample size is not adequate (i.e., <300; 46 Intervention, 46 Control) and the pooled effect estimate is not precise with a confidence interval that includes the null value "1" [RR 0.8333 (95% CI 0.4004, 1.7344)]. This body of evidence was downgraded for serious concerns regarding imprecision.

ES Forest Plot 2.1. Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking – Overall

	Intervention		Control			Risk Ratio	Risk Ratio
Study	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**	**M-H, Random, 95% CI**
Hollis et al. 2005	95	292	69	297	80.3%	1.4004 [1.0748, 1.8246]	
Pbert et al. 2008	10	27	8	33	9.3%	1.5278 [0.7016, 3.3269]	
Redding et al. 2014	10	46	12	46	10.5%	0.8333 [0.4004, 1.7344]	
Total (95% CI)		**365**		**376**	**100.0%**	**1.3371 [1.0549, 1.6948]**	
Total events	115		89				

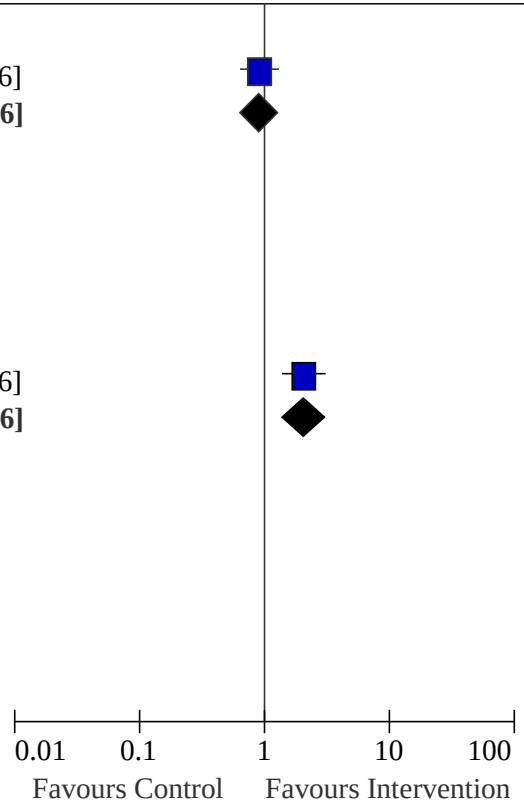
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.83$, df = 2 (P = 0.40); $I^2 = 0\%$

Test for overall effect: Z = 2.40 (P = 0.02)

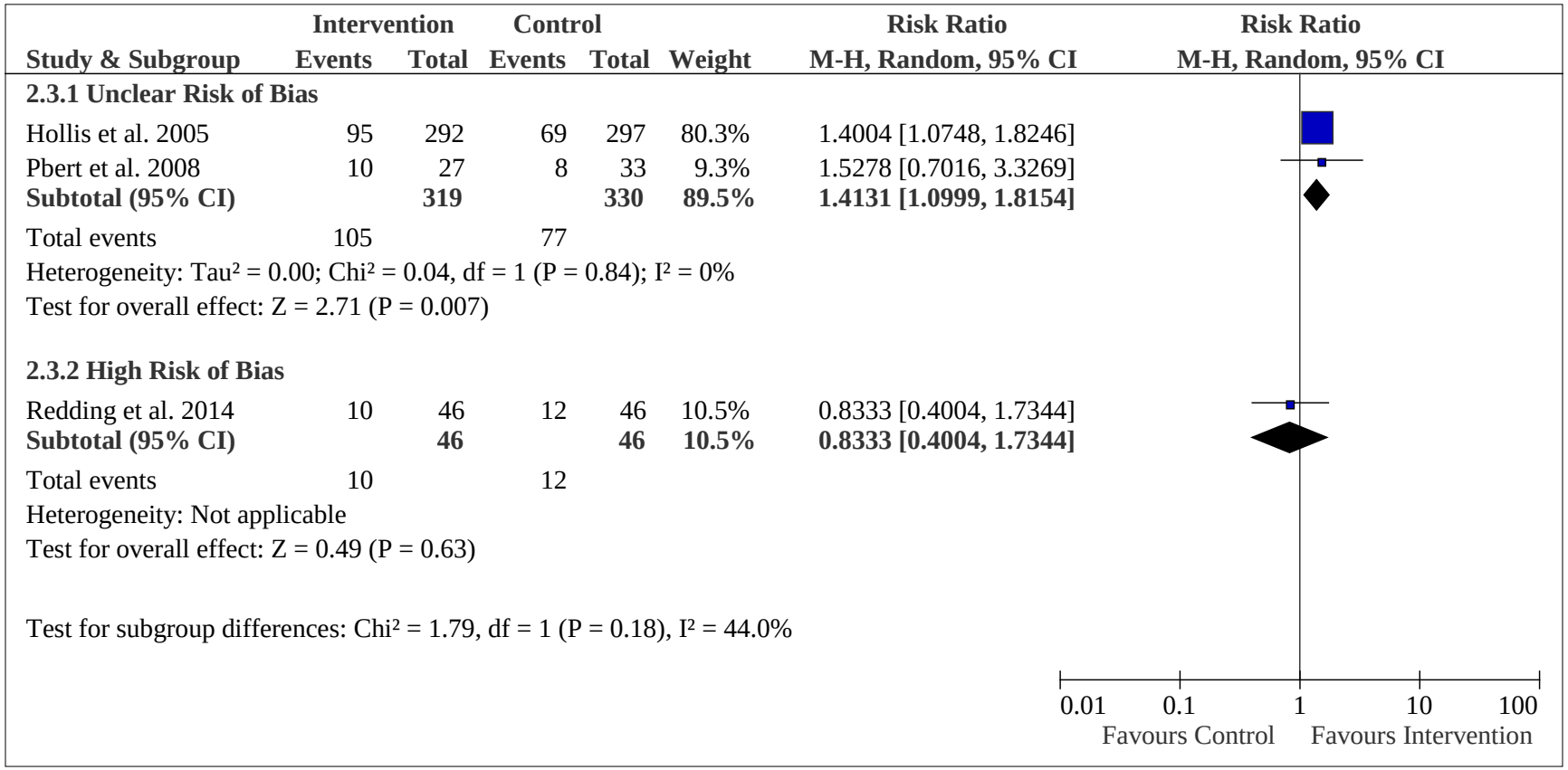


ES Forest Plot 2.2. Effect of Treatment Interventions on Incidence of Tobacco Smoking – by Baseline Smoking Status (Experimental/Occasional, Regular)

	Intervention		Control			Risk Ratio	Risk Ratio
Study & Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**	**M-H, Random, 95% CI**
2.2.1 Experimental/Occasional							
Hollis et al. 2005	31	67	37	73	50.6%	0.9129 [0.6477, 1.2866]	
Subtotal (95% CI)		**67**		**73**	**50.6%**	**0.9129 [0.6477, 1.2866]**	
Total events	31		37				
Heterogeneity: Not applicable							
Test for overall effect: Z = 0.52 (P = 0.60)							
2.2.2 Regular							
Hollis et al. 2005	64	224	31	224	49.4%	2.0645 [1.4022, 3.0396]	
Subtotal (95% CI)		**224**		**224**	**49.4%**	**2.0645 [1.4022, 3.0396]**	
Total events	64		31				
Heterogeneity: Not applicable							
Test for overall effect: Z = 3.67 (P = 0.0002)							
Test for subgroup differences: Chi^2 = 9.57, df = 1 (P = 0.002), I^2 = 89.5%							



ES Forest Plot 2.3. Effect of Treatment Interventions on Incidence of Stopping Tobacco Smoking – by Study Risk of Bias Rating (Unclear, High)

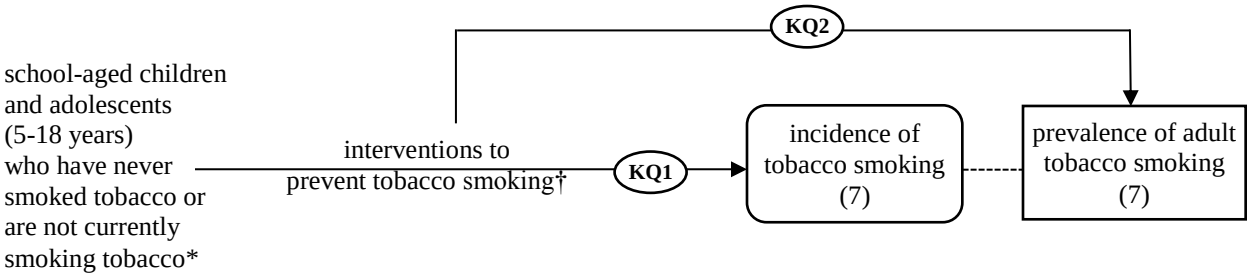


ES Table 2.4. Elements of Efficacious Interventions for Treating Tobacco Smoking

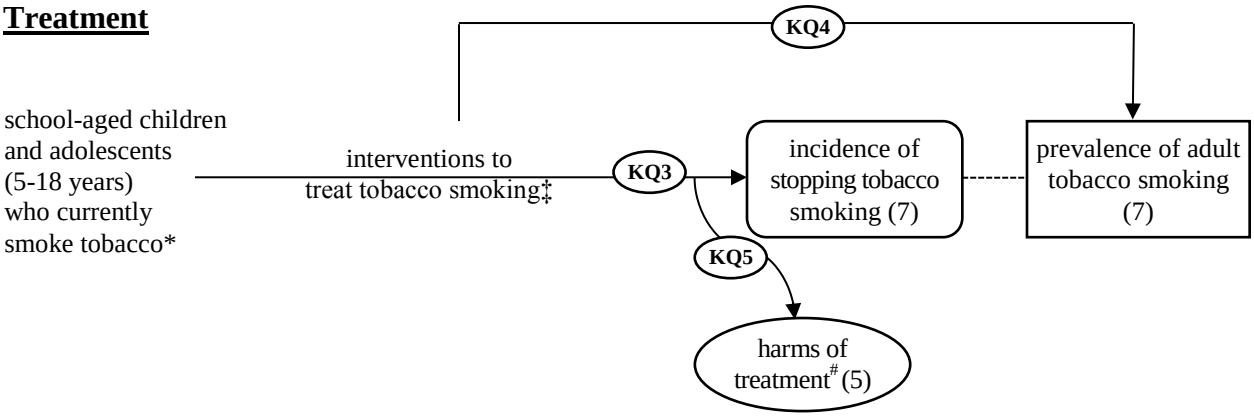
Study	Hollis et al. 2005[27]
Effect	RR 1.40 (95% CI 1.07, 1.82)
Population	
Country	US (Oregon and Washington States)
Age Range	14-17 years
Sex	Mixed (59% female)
Race	Mixed (78% white)
SES	Not specified (not reported)
Baseline Smoking Status	Treatment: smoked in past 30 days
Intervention	
Focus	Prevention and treatment
Other Behaviours	No – tobacco smoking only
Components	Education/information, counseling/advice, motivational interviewing, boosters (primary care professionals deliver a 30-60 second message about quitting smoking; multi-media, interactive computer program assesses stage of readiness to change to quit smoking then delivers tailored advice and encouragement; brief motivational counseling sessions with health counselors; quit kits including cinnamon sticks and candy dispensers)
Mode of Delivery	Face-to-face and phone interactions, multi-media interactive computer program, printed materials
Youth, Parent or Family	Youth only
Individual or Group	Individual
Intensity	High – about 1 minute of messaging from clinician; 3 sessions of approximately 15 minutes each (10-12 minutes on computer and 3-5 minutes with health counselor)
Estimated Contact Time	15 minutes
Primary Care Role(s)	Recruitment, delivery
Delivery Agent(s)	Primary care providers, health counselors
Setting(s)	Primary care
Duration	12 months

Figure 1. Analytic Framework

Prevention



Treatment



(#) Numbers in brackets: indicate the CTFPHC's GRADE[49] rankings for each outcome (7-9=critical; 4-6=important; 1-3 not important and therefore not included here)

***** Current tobacco smoking: generally defined in literature pertaining to smoking by children and youth[1, 9] as any smoking of tobacco products within the last 30 days; some studies may use other timeframes (e.g., within the last 7, 60 or 90 days); includes both regular (e.g., daily or weekly) and occasional smoking

† Interventions to prevent tobacco smoking: behaviourally-based programs (e.g., education, counseling), relevant to Canadian primary care, that are intended to prevent children and youth who have never tried smoking tobacco from initiating this behaviour or to prevent children and youth who have smoked tobacco in the past but who are not currently smoking from re-initiating this behaviour

‡ Interventions to treat tobacco smoking: behaviourally-based programs (e.g., education, counseling) and non-pharmacological alternative or complementary strategies (e.g., acupuncture, acupressure, laser therapy, hypnosis), relevant to Canadian primary care, that are intended to help children and youth who currently smoke tobacco to stop this behaviour

Harms of treatment: any adverse effects or events experienced as a result of participation in behavioural, alternative or complementary interventions designed to help children and youth stop smoking tobacco (e.g., anxiety, pain, discomfort, infection)

Figure 2. Search and Selection Flow Diagram

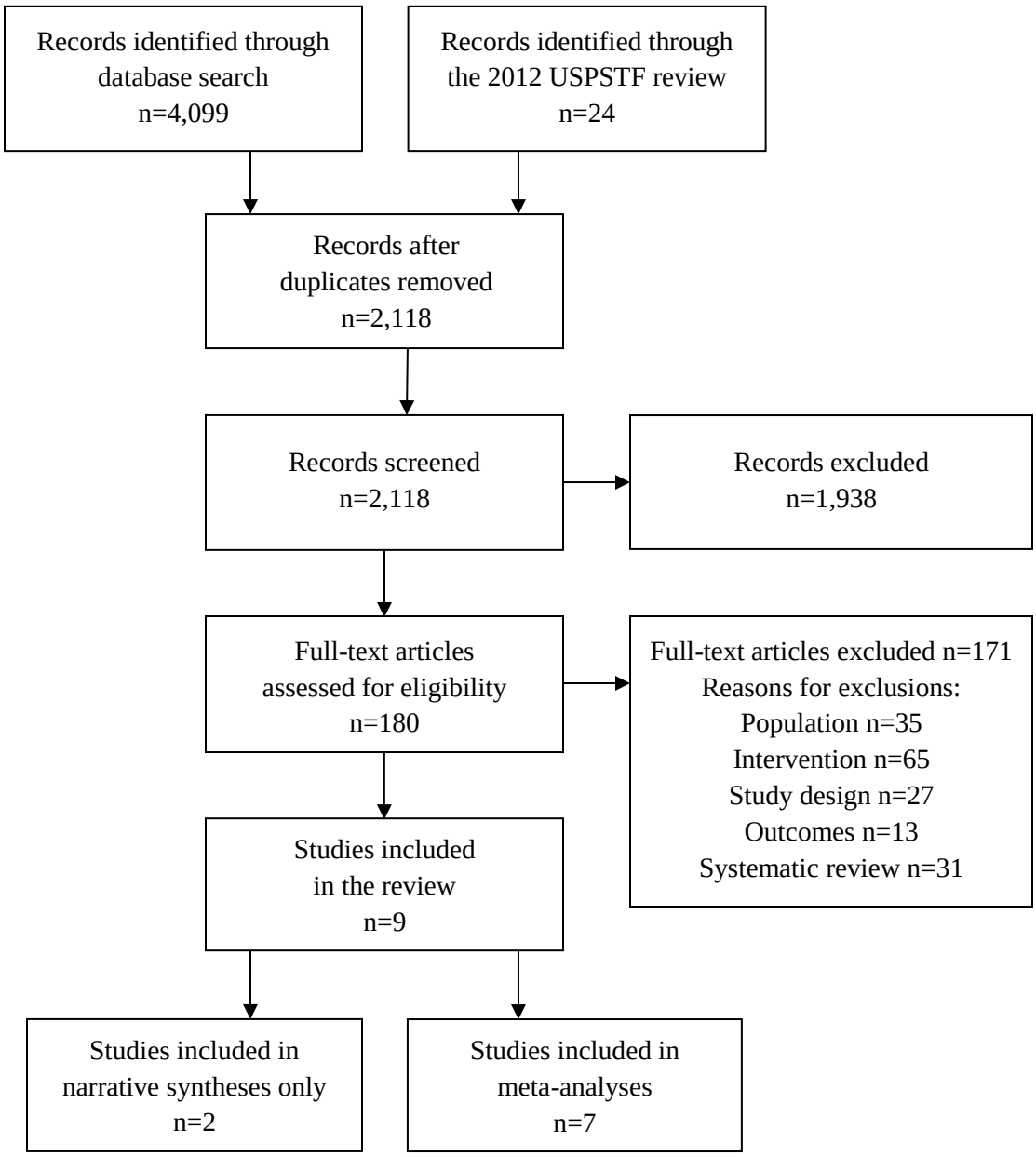


Table 1. Inclusion and Exclusion Criteria for KQ1 and KQ2 - Prevention of Tobacco Smoking

	Inclusion	Exclusion
Product	Tobacco products that are smoked or are combustible (e.g., cigarettes, cigarillos)	Smokeless or non-combustible tobacco products (e.g., chewing tobacco, snuff, e-cigarettes)
Population	School-aged children (5-12 years) and adolescents (13-18 years) ≥80% of sample must be ≤18 years at baseline or study must report separate results for analyses on a subsample of participants ≤18 years; if % is not reported then mean age of sample plus 1.5 SD must be ≤18 years at baseline Have never smoked tobacco or are not currently smoking tobacco (e.g., no smoking within last 30 days); if study authors do not explicitly specify participants' smoking status as never or former but they do explicitly identify the intervention as a preventive strategy we will accept this as an appropriate population Interventions may be delivered to parents and/or children but the target population for tobacco smoking prevention must be school-aged children and adolescents	Sample comprised only of adults aged ≥19 years at baseline or sample includes any adults ≥25 years >20% of sample is aged ≥19 years at baseline or there is no subgroup analysis for participants ≤18 years Participants are all current tobacco smokers (e.g., have smoked in last 30 days) or current smokers are included in the sample and the intervention is not tailored to smoking status Sample is limited to pregnant adolescents Sample is limited to children or adolescents with cognitive deficits, mental or physical health issues and/or substance abuse

	Inclusion	Exclusion
Interventions	Primary care relevant [i.e., offered through or could be reasonably/feasibly conducted within primary care and (could be) delivered by health care professionals such as primary care physicians, other physicians, nurse practitioners, nurses, physician assistants, pharmacists, health educators, health counselors, dentists, dental assistants or hygienists] behaviourally-based interventions (e.g., education, counseling) for preventing tobacco smoking Interventions that combine non-smokers with current smokers and cover prevention and treatment will be included only if the delivery of messages/contents/components is tailored to each individual's baseline smoking status and if outcomes are reported separately for non-smokers and current smokers Multi-component interventions that cover a range of substances (alcohol, tobacco, drugs) will be included if the majority of the intervention content focuses on preventing tobacco smoking Intervention may be delivered to individuals or to groups; groups must be formed for the purpose of intervention delivery only. Delivery of intervention content may be via real-time personal contact (e.g., in-person, phone), technology-based messaging (e.g., website, email, text), or print media (e.g., pamphlets, newsletters, workbooks) Interventions of any duration or intensity	Treatment oriented interventions for helping children and youth stop ongoing tobacco smoking Interventions that include non-smokers and current smokers and provide the same messages/contents/components to all participants regardless of smoking status/history Multi-component interventions that include a major emphasis on topics or behaviours besides substance use (e.g., a healthy lifestyle choices intervention that considers alcohol and tobacco use as well as sex, nutrition, exercise); tobacco smoking is covered among many other topics and is not a central focus of the intervention Interventions that involve peer counseling by a known peer Interventions delivered to pre-existing groups (e.g., team, class, club, peer group) or where there is increased likelihood that some or all participants already know each other and interaction is likely as part of the intervention Broad public health or policy interventions or media campaigns or community-based interventions that increase awareness or restrict product access/consumption or decrease environmental tobacco exposure (e.g., product pricing and placement; legal age to purchase cigarettes; laws regarding smoke-free vehicles, recreation, restaurants and other settings; restrictions on product advertising; health consequences advertising)
Comparators	No intervention, usual care that does not involve a specifically designed smoking prevention component, attention control (with no tobacco related content) or wait list	Any type or intensity of intervention specifically designed or intended to prevent tobacco smoking in school-aged children and youth
Outcomes	Benefits • incidence of tobacco smoking • prevalence of adult tobacco smoking	Outcomes not specified for inclusion (e.g., change in attitudes or knowledge regarding cigarette smoking or general tobacco use)
Outcome Assessment (Type and Timing)	Self-report If biochemically verified data are reported for incidence of smoking these biomarker data will be extracted for possible sensitivity analysis compared to self-report Outcomes must be reported at ≥6 months (≥24 weeks) post baseline follow-up	Population-based data (i.e., not based on study sample) <6 months (<24 weeks) follow-up post baseline assessment
Study Design	Randomized controlled trials (RCTs) that have a minimum of 30 participants per arm/group of interest for baseline measures	Study designs other than RCT or RCTs that include an arm of interest that has <30 participants with baseline measures
Study Quality	All studies that meet inclusion criteria regardless of methodological quality	No exclusions based on study quality

	Inclusion	Exclusion
Time Period	Published between 1980 and 2012 AND included in the 2012 USPSTF review or excluded from that review for study quality Published from February 2012 to April 15, 2015	Published prior to 1980
Settings	Primary care and other health-care related settings such as dental offices, research clinics, school-based health clinics Location may vary as long as the intervention is linked to primary care or is primary care referable (e.g., health care office appointment, on-line/virtual exchange, hosted in a community setting such as a church, library, youth centre or school)	Schools (interventions may be hosted/located in a school setting or be provided by a school nurse as part of primary care services to individual students but they may not be curriculum-based, class-based, teacher delivered, etc.) Hospital (e.g., inpatient programs) Institutional or residential (e.g., correctional centres, group homes)
Country	The USPSTF included studies (pre-2012) had to be conducted in countries, rated "very high" using Human Development Index 2010 (http://hdr.undp.org/en/statistics/) Update search (2012 to April 15, 2015) used the very high index list for 2014 http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components	Studies conducted in all other countries
Language	Published results available in English or French (French studies considered in update only; 2012 to April 15, 2015)	Published results available only in languages other than English or French (French language studies were excluded by USPSTF)

Table 2. Inclusion and Exclusion Criteria for KQ3, KQ4 and KQ5 – Treatment of Tobacco Smoking

	Inclusion	Exclusion
Product	Tobacco products that are smoked (e.g., cigarettes, cigarillos)	Smokeless tobacco products (e.g., chewing tobacco, snuff)
Population	School-aged children (5-12 years) and adolescents (13-18 years) ≥80% of sample must be ≤18 years at baseline or study must report separate results for analyses on a subsample of participants ≤18 years; if % is not reported then mean age of sample plus 1.5 SD must be ≤18 years at baseline Current tobacco smokers (e.g., smoked in last 30 days); if study authors explicitly identify the intervention as a treatment, cessation or "stop smoking" strategy we will accept this as an appropriate population Interventions may be delivered to parents and/or children but the target population for tobacco smoking cessation must be school-aged children and adolescents	Sample comprised only of adults aged ≥19 years at baseline or sample includes any adults ≥25 years >20% of sample is aged ≥19 years at baseline or there is no subgroup analysis for participants ≤18 years Never smoked tobacco or are not currently smoking tobacco (e.g., no smoking within last 30 days) Sample is limited to pregnant adolescents Sample is limited to children or adolescents with cognitive deficits, mental or physical health issues and/or substance abuse

	Inclusion	Exclusion
Interventions	Primary care relevant [i.e., offered through or could be reasonably/feasibly conducted within primary care and (could be) delivered by health care professionals such as primary care physicians, other physicians, nurse practitioners, nurses, physician assistants, pharmacists, health educators, health counselors, dentists, dental assistants or hygienists] behavioural, alternative or complimentary interventions (e.g., counseling, education, acupuncture, acupressure, hypnosis, laser therapy) for treating/stopping tobacco smoking Interventions that combine non-smokers with current smokers and cover prevention and treatment will be included only if the delivery of messages/contents/components is tailored to each individual's baseline smoking history/status and if outcomes are reported separately for non-smokers and current smokers Multi-component interventions that cover a range of substances (alcohol, tobacco, drugs) will be included if the majority of the intervention content focuses on helping children/youth stop ongoing tobacco smoking; at least 80% of the participants must be identified as current tobacco users at baseline Intervention may be delivered to individuals or to groups; groups must be formed for the purpose of intervention delivery only Delivery of intervention content may be via real-time personal contact (e.g., in-person, phone), technology-based messaging (e.g., website, email, text), or print media (e.g., pamphlets, newsletters, workbooks) Interventions of any duration or intensity	Interventions for preventing children and youth from smoking tobacco Interventions that include non-smokers and current smokers and provide the same messages/contents/components to all participants regardless of smoking status/history Trials that use drugs such as buproprion (Zyban) or varenicline tartrate (Chanix/Champix) or any other pharmaceutical treatments for smoking cessation Trials that incorporate NRTs (e.g., patches, sprays, gums) solely or adjunctively as part of the intervention Multi-component interventions that include a major emphasis on topics or behaviours besides substance use (e.g., a healthy lifestyle choices intervention that considers alcohol and tobacco use as well as sex, nutrition, exercise); tobacco smoking is covered among many other topics and is not a central focus of the intervention. Interventions that involve peer counseling by a known peer Interventions delivered to pre-existing groups (e.g., team, class, club, peer group) or where there is increased likelihood that some or all participants already know each other and interaction is likely as part of the intervention Broad public health or policy interventions or media campaigns or community-based interventions that increase awareness or restrict product access or consumption or decrease environmental tobacco exposure (e.g., product pricing and placement; legal age to purchase cigarettes; laws regarding smoke-free vehicles, recreation, restaurants and other settings; restrictions on product advertising; health consequences advertising)
Comparators	No intervention, usual care without a specifically designed smoking cessation component, attention control (with no tobacco related content) or wait list	Any type or intensity of intervention specifically designed or intended to stop ongoing tobacco smoking in school-aged children and youth
Outcomes	Benefits • incidence of stopping tobacco smoking • prevalence of adult tobacco smoking Harms • adverse effects of interventions (e.g., anxiety, pain, discomfort, infection)	Outcomes not specified for inclusion (e.g., change in quantity of cigarettes smoked, intention to quit, stage of change)

	Inclusion	Exclusion
Outcome Assessment (Type and Timing)	Self-report If biochemically verified data are reported for incidence of stopping smoking these biomarker data will be extracted for possible sensitivity analysis compared to self-report Benefit outcomes must be reported at ≥6 months (≥24 weeks) post baseline follow-up No minimum follow-up required for harms	Population-based data (i.e., not based on study sample) <6 months (<24 weeks) follow-up post baseline assessment (for benefit outcomes)
Study Design	For benefits include RCTs that have a minimum of 30 participants per arm/group of interest for baseline measures Studies reporting harms may use RCT or comparative observational designs and there are no conditions regarding sample size	For benefits, study designs other than RCT or RCTs that include an arm of interest that has <30 participants with baseline measures If study only reports harms exclude if the design is uncontrolled observational
Study Quality	All studies that meet inclusion criteria regardless of methodological quality	No exclusions based on study quality
Time Period	Published between 1980 and 2012 AND included in the 2012 USPSTF review or excluded from that review for study quality Published from February 2012 to April 15, 2015	Published prior to 1980
Settings	Primary care and other health-care related settings such as dental offices, research clinics, school-based health clinics Location may vary as long as the intervention is linked to primary care or is primary care referable (e.g., health care office appointment, on-line/virtual exchange, meeting hosted in a community setting such as a church, library, youth centre or school)	Schools (interventions may be hosted/located in a school setting or be provided by a school nurse as part of primary care services to individual students but they may not be curriculum-based, class-based, teacher delivered, etc.) Hospital (e.g., inpatient programs) Institutional or residential (e.g., correctional centres, group homes)
Country	USPSTF studies had to be conducted in very high index countries (Human Development Index 2010 http://hdr.undp.org/en/statistics/) The update search used the very high index list for 2014 http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components	Studies conducted in all other countries
Language	English or French (French studies considered in update only; 2012 to April 15, 2015)	Languages other than English or French (French language studies were excluded by USPSTF)

Table 3. Summary of Study Risk of Bias Assessments*

Study	Sequence Generation	Allocation Concealment	Blinding Participants and Personnel	Blinding Outcome Assessment	Incomplete Reporting	Selective Reporting	Other** Risk of Bias	Overall Risk of Bias
Curry et al. 2003[25]	U	U	H	H	H	L	H	H
Fidler et al. 2001[26]	H	U	H	H	H	L	U	H
Hiemstra et al. 2013[32]	L	U	L	H	L	L	U	U
Hollis et al. 2005[27]	U	L	H	H	L	L	L	U
Hovell et al. 1996[28]	U	U	H	H	L	L	L	U
Kentala et al. 1999[29]	H	U	H	H	H	L	H	H
Pbert et al. 2008[30]	U	U	H	H	L	L	L	U
Redding et al. 2014[33]	L	L	H	H	H	L	U	H
Stevens et al. 2002[31]	H	U	H	H	L	L	H	H

*Assessments performed using the Cochrane's Risk of Bias Tool[17]; L (green) = Low Risk; U (yellow) = Unclear Risk; H (red) = High Risk

**Other potential sources of bias: sample size <30 participants per arm of interest at baseline; no power calculation or study powered to <70%; significant baseline differences in study groups on important characteristics such as smoking status, age, gender, SES; low compliance rate; contamination (e.g., participants using NRT on their own while taking part in intervention); industry funding with no statement about other involvement in study aspects; conflicts of interest not appropriately addressed

Table 4. Summary of Study Features - Populations

Study	Country	Baseline Age (Years)	Sex (% Female)	Race	SES	Baseline Smoking
Curry et al. 2003[25]	US	Range 10-12 Assessment cohort mean 11	Assessment cohort 52%	84% White	68% with annual family income ≥$45K; 76% parents post-secondary education	Most never smoked 6.7% had experimented 1.2% had smoked ≤30 days
Fidler et al. 2001[26]	UK	Range 10-15 38% 10-11 34% 12-13 27% 14-15	Overall 53%	Not reported	Not reported	Never or not current (<1/week)
Hiemstra et al. 2014[32]	Netherlands	Range 9-11 Overall mean 10	Intervention 57% Control 49%	98% Dutch	25% families low SES, 27% middle, 48% high	No criteria for participation but only never smokers included in analysis
Hollis et al. 2005[27]	US	Range 14-17 27% 14 26% 15 25% 16 22% 17	Overall 59%	78% White	Not reported	Prevention: never or former (no smoking ≤30 days) Treatment: smoked ≤30 days
Hovell et al. 1996[28]	US	Range 11-19 Overall mean 14	Overall 54%	73% White	70% reported a parent graduated college	Never or not current; those who smoked ≤30 days were excluded from analysis
Kentala et al. 1999[29]	Finland	Overall mean 13	Overall 49%	Not reported	Not reported	Prevention: those who do not smoke Treatment: those who smoke
Pbert et al. 2008[30]	US	Range 13-17 Overall mean 17	Intervention 55% Control 53%	91-92% White	Not reported	Prevention: never smokers, non-smokers (1-2 puffs >1 year ago) or former smokers (smoked ≤ year but not ≤30 days) Treatment: current regular or occasional smokers
Redding et al. 2014[33]	US	Range 14-17 Overall mean 16	Overall 100%	83-85% Black	Economically disadvantaged areas	Prevention: never smoked ≥weekly Treatment: smoke >weekly
Stevens et al. 2002[31]	US	Range 9-12 Overall mean 11	Intervention 50% Control 46%	Not reported	>56% reported annual family incomes ≥$50K	95% never smoked

Table 5. Summary of Study Features - Interventions

Study	Focus	Other Behaviours	Components	Mode	Youth or Family	Intensity	Contact Time	Primary Care Role	Agent(s)	Setting(s)	Length (Months)
Curry et al. 2003[25]	Prevention	No	Education/information Counseling/advice Booster sessions	Face-to-face Phone Computer Print Videos	Family	High	Not reported	Recruitment Delivery	Physician or pediatrician Health counselors	Primary care Home	14
Fidler et al. 2001[26]	Prevention	No	Education/information	Print Postal	Youth	Low	None	Recruitment Messenger	Primary care providers	Home	12
Hiemstra et al. 2014[32]	Prevention	No	Education/information	Print Postal	Family	Low	None	No role	Researchers sent materials	Home	12
Hollis et al. 2005[27]	Prevention & Treatment	No	Education/information Counseling/advice Motivational interviewing Boosters	Face-to-face Phone Computer Print	Youth	High	~15 minutes	Recruitment Delivery	Primary care providers Health counselors	Primary care	12
Hovell et al. 1996[28]	Prevention	No	Education/information Counseling/advice Environment change	Face-to-face Print	Youth	High	Not reported	Recruitment Delivery	Dentists	Dental clinic	24
Kentala et al. 1999[29]	Prevention & Treatment	No	Counseling/advice	Face-to-face Photos	Youth	Low	~5 minutes	Delivery	Dentists	Dental clinic	24
Pbert et al. 2008[30]	Prevention & Treatment	No	Counseling/advice Motivational interviewing Boosters	Face-to-face Phone	Youth	High	~70 minutes	Recruitment Delivery	Primary care providers Health counselors	Primary care	6
Redding et al. 2014[33]	Prevention & Treatment	Condom use	Education/information Counseling/advice	Face-to-face Computer	Youth	High	Not reported	Recruitment Delivery	Health counselors	Family planning clinic	9
Stevens et al. 2002[31]	Prevention	Alcohol use	Education/information Counseling/advice	Face-to-face Phone Print Postal	Family	High	Not reported	Recruitment Delivery	Primary care providers	Primary care Home	36

Table 6. Summary of Study Features - Methods

Study	Design	Comparator	Smoking Outcome	Biochemical Verification	Assessment Point
Curry et al. 2003[25]	RCT	Usual care	Smoked even a puff ≤30 days	None	6 months post intervention completion
Fidler et al. 2001[26]	RCT	No intervention	Smoked since baseline	None	Immediate post intervention
Hiemstra et al. 2014[32]	RCT	Usual care	Ever smoked	None	Immediate post intervention
Hollis et al. 2005[27]	RCT	Attention control: diet intervention	Smoked ≤30 days	None	Immediate post intervention
Hovell et al. 1996[28]	RCT	Usual care	Used tobacco ≤30 days	None	Immediate post intervention
Kentala et al. 1999[29]	RCT	Usual care	Ever smoked	None	Immediate post intervention
Pbert et al. 2008[30]	RCT	Usual care	Prevention: maintained abstinence Treatment: report quitting since baseline	None – but shown CO_2 monitor and told it might be used	Immediate post intervention
Redding et al. 2014[33]	RCT	Usual care	Prevention: smoked since baseline Treatment: no smoking since baseline	None	3 months post intervention completion
Stevens et al. 2002[31]	RCT	Attention control: safety behaviours	Ever smoked	None	Immediate post intervention

Table 7. Characteristics of Included Studies

STUDY/LOCATION	Curry 2003,[25] US
OBJECTIVE	To evaluate a family-based multi-component smoking prevention intervention for children aged 10-12 years
METHODS	**Design**: RCT **Recruitment**: automated files used to identify a random sample of >8,000 families with ≥1-year membership in 2 large nonprofit health maintenance organizations (HMO); parents sent a letter describing the smoking prevention study and notifying them of a pending phone call from investigators to invite them to participate in the study **Inclusion Criteria**: families with at least 1 dependent child aged 10-12 years; the identified child resided with the consenting parent at least 50% of the time; no smoking related eligibility criterion **Exclusion Criteria**: families intending to leave the HMO in the next 6 months **Smoking Outcome**: incidence of tobacco smoking (% who smoked, even a puff, in past 30 days) **Biochemical Verification**: none **Assessment Points:** 6 months and 12 months post baseline (interim assessments); 6 months post intervention completion (20 months post baseline assessment) **Funding:** National Cancer Institute grant
PARTICIPANTS	**Sample**: Overall n=4,026 families, Intervention n=2,020 families (randomized), Control n=2,006 families (randomized) **Assessment Cohort** (baseline data only available for this group, 12.5% of overall sample): Overall n=504, Intervention n=245, Control n=259 **Loss to Follow-up** (child respondents at 20 month assessment point): Overall n=436 (10.5%), Intervention n=271 (13.4%), Control n=192 (9.6%) **Age** Range: 10-12 years; Mean Age: Overall (assessment cohort) 11 years **Sex** (Female): Overall (assessment cohort) 52% **Race** (White): Overall (parent respondents) 84% **SES**: 68% of Intervention and Control families had household incomes ≥$45,000/yr; 78% of Intervention parents and 76% of Control parents had post-high school education **Baseline Tobacco Smoking**: most of the assessment cohort reported never having smoked tobacco, 6.7% had experimented (even a puff), 1.2% reported smoking in past 30 days
INTERVENTION	**Focus**: prevention of tobacco smoking **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: family **Parental Involvement**: yes **Role of Primary Care**: recruitment, optional primary care component **Delivery Agents**: primary care physicians or pediatricians, health counselors **Setting(s)**: primary care, home **Components**: education/information, counselling/advice, booster sessions **Mode(s)**: face-to-face, phone (speaking), computer (website), print (handbook, comic, newsletters), videos **Group Sessions**: no **Intensity**: high - ≥2 personal (telephone) contacts, 2 mailings of materials, possible in-person physician contact **Duration**: approximately 6 weeks of expected higher intensity activity; booster approximately 1 year later; overall duration about 14 months

	Estimated Contact Time with Delivery Agent(s): not reported **Description**: Intervention families were mailed a smoking prevention kit (12 chapter handbook with information and activities, video and viewing guide, comic book, pen and stickers). Several weeks later parents received an education/counseling telephone call from a health educator. About a year later parents received a 6-page newsletter and a booster counseling call as well as access to a program website. During the intervention period families attending for routine primary care visits might have received motivational messages and/or smoking prevention pamphlets from their providers; medical record reminders were used to prompt physicians to deliver this information. **Control Group:** usual care (no other details)
STUDY/LOCATION	**Fidler 2001,[26] UK**
OBJECTIVE	To evaluate the effectiveness of a primary health care intervention for helping youth stay non-smokers
METHODS	**Design**: RCT **Recruitment**: random selection of 6,000 youth from patient lists of 14 health clinics in Oxfordshire; no details on how youth invited to participate except that parents who did not want their children to take part had to opt them out of rather than into the study **Inclusion Criteria**: non-smoker, aged 10-15 years **Exclusion Criteria**: current smoker (smokes ≥1 cigarettes per week) **Smoking Outcome**: smoked tobacco since baseline assessment **Biochemical Verification**: none **Assessment Points**: immediate post (12 months post baseline assessment) **Funding:** British Heart Foundation
PARTICIPANTS	**Sample**: Overall n=2,942 (randomized; 47 of these returned undeliverable), Intervention n=1,437, Control n=1,458 **Loss to Follow-up** (at 12 month assessment point): Intervention n=314 (21.5%), Control n=365 (25.4%) **Age** Range: 10-15 years; Overall (only those with follow-up data) 38.2% aged 10-11, 34.4% aged 12-13, 27.4% aged 14-15; Intervention (only those with follow-up data) 36.5% aged 10-11, 35.6% aged 12-13, 27.9% aged 14-15; Control (only those with follow-up data) 39.7% aged 10-11, 33.4% aged 12-13, 26.9% aged 14-15 **Gender** (Female): Overall (only those with follow-up data) n=1,167 (52.8%), Intervention (only those with follow-up data) n=558 (52.2%), Control (only those with follow-up data) n=609 (53.2%) **Race**: not reported **SES**: not reported **Baseline Tobacco Smoking**: either never smoked or not current smoker (current smoker defined as someone who smokes ≥1 cigarettes per week; did not include a specific timeframe, e.g., use in past 30 days)
INTERVENTION	**Focus**: prevention of tobacco smoking **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: child/youth **Parental Involvement**: no **Role of Primary Care**: recruitment, packages were signed as being sent by health care provider **Delivery Agents**: primary health care providers (materials signed by/sent on behalf of), research team (managed mailings) **Setting(s)**: home **Components**: education/information

	Mode(s): print, postal mail **Group Sessions**: no **Intensity**: low - no direct or personal contact with providers; 4 packages sent via postal mail, 1 every 3 months **Duration**: 12 months **Estimated Contact Time with Delivery Agent(s)**: 0 (no personal contact) **Description**: Every 3 months youth received a confidential postal delivery containing anti-smoking materials (information sheets addressing smoking related topics, dangers and health risks of smoking; posters; certificates of non-smoking status). Packages were signed by and sent directly from each youth's respective primary health care provider. **Control Group:** no intervention
STUDY/LOCATION	**Hiemstra 2014,[32] Netherlands**
OBJECTIVE	To evaluate the long-term effects of a home-based prevention program during preadolescence on smoking initiation during adolescence
METHODS	**Design**: RCT **Recruitment**: school boards asked to mail study information letters to families of primary school children; interested parents provided contact information; to meet goal of 200 children with asthmatic symptoms a range of recruitment strategies was used such as contacting the media and general practitioners **Inclusion Criteria**: child aged 9-11 years (one per family); mother or female guardian; mother and child can read and speak Dutch; no smoking related eligibility criterion to take part in the intervention but children who reported ever having puffed a cigarette at baseline were excluded from the analysis **Exclusion Criteria**: none reported **Smoking Outcome**: ever smoked tobacco **Biochemical Verification**: none **Assessment Points**: immediate post (12 months post baseline assessment) **Funding:** The Netherlands Organization for Health Research and Development and the Dutch Asthma Foundation. Explicit statement that "the sponsors had no role in the study design, data collection, data analysis, data interpretation, decision to publish, or preparation of the manuscript."
PARTICIPANTS	**Sample**: Overall n=1,478 mothers and children (randomized), Intervention n=728 (randomized), Control n=750 (randomized); after excluding children who ever smoked Overall n=1,398, Intervention n=684, Control n=714 **Loss to Follow-up** (at 12 month assessment point): Intervention n=24 (3%), Control n=22 (3%) **Age** Range: 9-11 years; Mean (SD): Overall 10.10 (0.78) years, Intervention 10.13 (0.78) years, Control 10.08 (0.77) years **Sex** (Female): Overall 52.6%, Intervention 56.6%, Control 48.7% **Race** (Dutch - child): Overall 98.2%, Intervention 98.7%, Control 97.8% **SES**: Low – Overall 25.2%, Intervention 24.9%, Control 25.5%; Middle – Overall 26.6%, Intervention 26.5%, Control 26.7%; High – Overall 48.2%, Intervention 48.6%, Control 47.8% **Baseline Tobacco Smoking**: no eligibility restrictions for participation in the intervention but any children who had ever even puffed one cigarette were excluded from analysis
INTERVENTION	**Focus**: prevention of tobacco smoking **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: family **Parental Involvement**: yes

	Role of Primary Care: none **Delivery Agents**: researchers sent materials to families **Setting(s)**: home **Components**: education/information **Mode(s)**: print (activity modules), postal mail **Group Sessions**: no **Intensity**: low - no direct personal contact with researchers or clinicians; 5 modules delivered at 4 week intervals over 6 months; booster module mailed at 12 months post baseline **Duration**: 12 months **Estimated Contact Time with Delivery Agent(s)**: none **Description**: Families were mailed 5 printed activity modules, 1 every 4 weeks (topics: general communication about smoking, influence of smoking messages, rule setting and a non-smoking agreement, creating a smoke-free house and environment related to second hand smoking, and the influence of peers). Modules contained various assignments (e.g., games, scripted role-plays) and a sheet that offered additional background information and communication tips. A booster module was mailed at 12 months post baseline. **Control Group:** usual care (parents provided with publicly available fact sheets containing general information about youth smoking)
STUDY/LOCATION	**Hollis 2005,[27] US**
OBJECTIVE	To evaluate a brief counseling and interactive computer-based tobacco prevention and cessation program targeting youth attending routine primary health care visits
METHODS	**Design**: RCT **Recruitment**: electronic records of 7 Health Maintenance Organizations were screened to identify youth aged 14-17 with pending appointments; study staff approached eligible youth in the waiting areas of pediatric and family practice clinics and invited them to take part in a study about "healthy lifestyles and changes in health habits" **Inclusion Criteria**: aged 14-17 years; willing to remain at the clinic about 15 minutes after appointment; no plans to move in next year; no smoking related eligibility criterion (allocation to prevention or cessation stream depending on baseline smoking status) **Exclusion Criteria**: none reported **Smoking Outcome**: smoked tobacco in past 30 days **Biochemical Verification**: none **Assessment Points**: immediate post (12 months post baseline assessment) **Funding:** National Cancer Institute grant
PARTICIPANTS	**Sample**: Overall n=2,526 (randomized), Intervention n=1,254 (randomized), Control n=1,272 (randomized) **Loss to Follow-up** (at 12 month assessment point): Overall n=159 (6.3%), Intervention n=101 (8.1%) Control n=58 (4.6%) **Age** Range: 14-17 years; Overall 26.7% aged 14; 25.7% aged 15, 25.2% aged 16, 22.4% aged 17; Intervention 27.5% aged 14, 25.2% aged 15, 25.6% aged 16, 21.7% aged 17; Control 25.9% aged 14, 26.3% aged 15, 24.8% aged 16, 23.0% aged 17 **Sex** (Female): Overall n=1,496 (59.2%), Intervention n=738 (58.9%), Control n=758 (59.6%) **Race** (White): Overall n=1,962 (78.2%), Intervention n=989 (79.6%), Control n=973 (76.9%) **SES**: not reported **Baseline Tobacco Smoking**: no eligibility restrictions; prevention program included never or former smokers (no smoking in past 30 days); treatment program included

	those who smoked ≥1 cigarettes in past 30 days
INTERVENTION	**Focus**: prevention of tobacco smoking and treatment of tobacco smoking (combined intervention – targeted according to baseline smoking status) **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: child/youth **Parental Involvement**: no **Role of Primary Care**: recruitment, conducted in primary care setting, provider delivered some **Delivery Agents**: primary care clinicians, trained health counselors, interactive computer program **Setting(s)**: primary care **Components**: education/information, counselling/advice, motivational interviewing, booster sessions, tangible quit aids (e.g., candy, cinnamon sticks) **Mode(s)**: face-to-face, phone (speaking), computer (multi-media interactive program), print (handouts) **Group Sessions**: no **Intensity**: high - about 1 minute of messaging from clinician; 3 sessions of approximately 15 minutes each (10-12 minutes on computer and 3-5 minutes with health counselor) **Duration**: 12 months **Estimated Contact Time with Delivery Agent(s)**: 15 minutes **Description**: Primary care professionals received a written prompt to deliver a suggested 30-60 second message about quitting or not starting smoking and to encourage patients to meet with a health counselor after the visit. Youth then participated in 3 sessions (initial and 2 boosters) over the next year that involved 10-12 minutes using the "Pathways to Change" computer program (a multi-media, interactive program that assesses stage of readiness to begin smoking or stage of change to quit smoking then delivers tailored advice and encouragement; also includes 5-10 second videos and generates handouts) followed by 3-5 minutes of motivational counseling with a trained health counselor. Youth also received quit kits (e.g., cinnamon sticks, candy dispensers). The first session took place in-person at the health clinic. The 2 booster sessions were conducted via telephone with mailed materials. **Control Group:** attention control (diet intervention: health counselors provided 3-5 minutes motivational counseling to individual youth to encourage fruit and vegetable consumption; 2 pamphlets with nutrition information; fruit leather snack)
STUDY/LOCATION	**Hovell 1996,[28] US**
OBJECTIVE	To evaluate the effect of an orthodontic-based tobacco use prevention intervention on the incidence of adolescents starting to use tobacco
METHODS	**Design**: RCT **Recruitment**: California-based orthodontic clinics identified through professional associations and the yellow pages were invited to attend an information session; interested and eligible orthodontists (i.e., independent practitioners, not controlled by a private practice organization, working in the office 2+ days per week, not intending to retire or sell their practice during the study, and having 75+ active patients aged 11-18 years) were recruited from 154 offices across 5 counties; study information letters were sent to 58% of the youth patients and their parents in each clinic; all youth who did not signal refusal were contacted by telephone to conduct baseline interviews (surveys were mailed to those who could not be reached by phone) **Inclusion Criteria**: aged 11-18 years; currently wearing bands or braces on teeth; not planning to change orthodontists during the study; no smoking related eligibility criterion (but youth who reported using tobacco in past 30 days were excluded from

	the analysis) **Exclusion Criteria**: another member of the household is already participating in the study; parent is an orthodontist and is participating in the study **Smoking Outcome**: used tobacco in any form in past 30 days (sometimes article refers to tobacco use and sometimes refers to smoking initiation) **Biochemical Verification**: none **Assessment Points**: immediate post (24 months post baseline) **Funding:** Cigarette and Tobacco Surtax Fund of the State of California through the Tobacco Related Disease Research Program of the University of California; some intervention materials provided in kind by the American Cancer Society, the American Lung Association and the American Heart Association
PARTICIPANTS	**Sample**: Overall n=16,915 (completed baseline interview/survey), after excluding baseline smokers (n=869) Intervention n=7,149, Control n=7,626 **Loss to Follow-up** (at 24 month assessment point): Overall n=1,271 (7.5%), Intervention 7.2%, Control 7.7% **Age** Range: 11-19 years; Mean (SD): Overall 14.4 (1.8) years **Sex** (Female): Overall 54% **Race** (White): Overall 73% **SES**: Overall 70% of youth reported at least one parent had graduated college **Baseline Tobacco Smoking**: either never smoked or not current smoker (youth who reported using tobacco within past 30 days at baseline were excluded from analysis)
INTERVENTION	**Focus**: prevention of tobacco use **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: child/youth **Parental Involvement**: no **Role of Primary Care**: recruitment, conducted in dental setting, provider delivered most **Delivery Agents**: orthodontists, clinic staff **Setting(s)**: orthodontic clinic **Components**: education/information, counselling/advice, prescriptions (printed anti-tobacco messages), environmental change (tobacco-free space) **Mode(s)**: face-to-face, print (prescription packages) **Group Sessions**: no **Intensity**: high - not clear how many times patients seen over the 2 year period or how long each intervention-related interaction lasted; youth received anti-tobacco counseling and were given 1 of 8 anti-tobacco prescriptions whenever they visited the clinic (could be multiple times per year to monitor braces/bands) **Duration**: 24 months **Estimated Contact Time with Delivery Agent(s)**: not reported **Description**: Each clinic was asked to promote a tobacco-free environment by instituting a non-smoking office policy, removing tobacco ads, cancelling subscriptions to magazines containing tobacco ads, and posting tobacco prevention information (posters, handouts, signs, stickers). At each visit, the orthodontist or clinic staff gave youth a printed prescription that featured 1 of 8 anti-tobacco topics (announcement of a tobacco-free office, tobacco advertising, tobacco and sports, smokeless tobacco, nicotine and tobacco addiction, passive smoking, tobacco and teeth, negative consequences of tobacco use) and included the youth's name and the practitioner's signature. At each visit the clinician had a brief conversation with the patient regarding the message and then asked the youth not to start smoking. Orthodontic offices received $0.50 for each prescription delivered to an eligible adolescent. **Control Group:** usual care (no anti-tobacco counseling, no alteration of clinic

	environment)
STUDY/LOCATION	**Kentala 1999,[29] Finland**
OBJECTIVE	To evaluate the effects of an annual brief dental care counseling intervention on youth smoking behaviour
METHODS	**Design**: RCT **Recruitment**: all patients of the target age who attended for routine check-ups with one of 64 participating dentists in community dental health clinics in 4 Finish cities were asked to complete a smoking questionnaire prior to their dental exams **Inclusion Criteria**: born in 1979 (age 13 at baseline); no smoking related eligibility criterion **Exclusion Criteria**: none reported **Smoking Outcome**: ever smoked tobacco (assumed, no timeframe specified) **Biochemical Verification**: none **Assessment Points**: immediate post (24 months post baseline); intervention included a third annual visit and a 36 months post baseline assessment but these data were not reported due to low response rate **Funding:** government (Ministry of Social Affairs and Health) and a charitable foundation supporting economic and medical research (Yrjo Jahnsson Foundation)
PARTICIPANTS	**Sample**: Overall: n=2,586 (randomized), Intervention n=1,348 (randomized); Control n=1,238 (randomized) **Loss to Follow-up** (at 24 month assessment point): Overall n=1,015 (39.2%), Intervention n=503 (37.3%), Control n=512 (41.4%) **Age** (Baseline Mean): 13.1 years **Sex** (Female): Overall n=1,264 (48.9%) **Race**: not reported **SES**: not reported **Baseline Tobacco Smoking**: no eligibility restrictions; dentist "inquires about smoking" and delivers one of two brief interventions depending on answer; answers given in article ("adolescent does not smoke" or "adolescent smokes") suggest a focus on current smoking behaviour but no timeframe is given to know if dentists asked about current or ever smoking; non-smokers (unclear if this includes only never smokers or never and former smokers) n=2,438 (95.3%); smokers (unclear if this includes current smokers or current and former smokers) n=148 (5.7%)
INTERVENTION	**Focus**: prevention of tobacco smoking and treatment of tobacco smoking (combined intervention – targeted according to baseline smoking status) **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: child/youth **Parental Involvement**: no **Role of Primary Care**: conducted in primary health care related setting, provider delivered all **Delivery Agents**: dentists **Setting(s)**: dental clinic **Components**: counselling/advice **Mode(s)**: face-to-face, print (photos) **Group Sessions**: no **Intensity**: low – 1 visit per year, brief intervention (couple minutes per exam) **Duration**: approximately 30 months (initial exam followed by recalls at 12, 24 and 30 months – estimated using mean age at each time point; only report data up to 24 months recall visit) **Estimated Contact Time with Delivery Agent(s)**: 5 minutes

	Description: At outset of routine annual exam dentist asks youth about smoking behaviour. Youth who report not smoking undergo usual check-up and receive positive feedback for not smoking; they are then shown photos of teeth discoloured from smoking and are given a mirror to check whether their teeth are stained. Youth who report smoking undergo usual check-up then are shown the same photos of discoloured teeth and are given a mirror to examine their teeth for stains. **Control Group:** normal care (no other details)
STUDY/LOCATION	**Pbert 2008,[30] US**
OBJECTIVE	To examine the effect of a pediatric practice-based smoking prevention and cessation intervention on abstinence rates among adolescents
METHODS	**Design**: RCT **Recruitment**: all pediatric clinics in central Massachusetts with at least 3 pediatricians were invited (8 of 11 practices agreed); adolescent patients were invited to participate through letters from their physicians, telephone calls, and advertisements posted in the clinics; a research assistant was available on-site to meet with interested patients **Inclusion Criteria**: patient of 1 of the 8 clinics; aged 13-17 years; scheduled for routine or acute care office visits; no smoking related eligibility criterion **Exclusion Criteria**: none reported **Smoking Outcomes**: incidence of tobacco smoking (% of baseline never, non and former smokers remaining abstinent); incidence of stopping tobacco smoking (% baseline current smokers reporting having quit, specific measure not reported) **Biochemical Verification**: none, but prior to initial assessment youth were shown a carbon monoxide monitor and told it might be used to verify smoking status and were reminded of this possibility at other assessment points **Assessment Points:** immediate post (6 months post baseline); 6 months post intervention completion (12 months post baseline) **Funding:** National Institutes of Health, National Cancer Institute grant
PARTICIPANTS	**Sample**: Overall n=2,711 recruited (57%), n=2,709 with baseline data; Intervention n=1,346 (randomized); Control n=1,365 (randomized) **Loss to Follow-up**: Overall n=21 (<1%), Intervention= 9 (<1%), Control= 12 (<1%); totals at baseline were used in analysis **Age** Range: 13-17 years; Mean (SD): Intervention 16.84 (1.44) years, Control 16.85 (1.41) years **Sex** (Female): Intervention n=743 (55.4%), Control n=721 (52.9%) **Race** (White): Intervention n=1,224 (91.6%), Control n=1,240 (91.2%) **SES**: not reported **Baseline Tobacco Smoking**: no eligibility restrictions; prevention program included never or non-smokers (no prior use or 1-2 puffs but not in past year) and former smokers (smoked in past year but not in past 30 days); treatment program included current smokers (smoke tobacco regularly or occasionally)
INTERVENTION	**Focus**: prevention of tobacco smoking and treatment of tobacco smoking (combined intervention – targeted according to baseline smoking status) **Addressed Other Behaviours**: no **Targeted Child/Youth, Parent or Family**: child/youth **Parental Involvement**: no **Role of Primary Care**: recruitment, conducted in primary care setting, provider delivered some **Delivery Agents**: primary care professionals (pediatricians, nurse practitioners, pediatric residents, physician's assistant), trained peer health counselors (female college students aged 21-25 years who smoked during adolescence and successfully

	quit – "peer" referred to closeness in age and shared smoking experience rather than a person known to program participants) **Setting(s)**: primary/pediatric care **Components**: brief counseling, personalized counseling/advice (5-A model), motivational interviewing, booster sessions **Mode(s)**: face-to-face, phone (speaking) **Group Sessions**: no **Intensity**: high – 6 separate interactions: 1 brief interaction with primary care professional, 1 15-30-minute face-to-face session and 4 10-minute phone calls with peer counselor **Duration**: 6 months **Estimated Contact Time with Delivery Agent(s)**: 70 minutes **Description**: Using a patient-centered approach, clinicians asked participants about their smoking status, advised them to quit or continue abstinence and referred youth to peer counseling to develop a tailored plan for cessation or maintaining abstinence. Immediately after the visit youth attended an initial (15-30 minute, face-to-face) session with one of the peer counselors who used the 5-A model, motivational interviewing and behaviour change counseling. Peer counselors followed up with 10-minute phone calls to youth after 2, 6, 12 and 21 weeks. The focus of the peer counseling sessions was tailored to the individual youth's smoking status (e.g., triggers for smoking, strategies for quitting or maintaining abstinence, barriers to quitting). Youth offered financial incentives to complete each assessment (up to $60 in gift certificates). **Control Group:** usual care (providers had no training and no materials to distribute)
STUDY/LOCATION	**Redding 2014,[33] US**
OBJECTIVE	To evaluate a transtheoretical model tailored intervention to increase condom use and decrease tobacco smoking among female adolescents
METHODS	**Design**: RCT **Recruitment**: 2 family planning clinics and 2 community-based health centres in Philadelphia that served economically disadvantaged youth; participants were informed of the study at the reception desk by a receptionist or health educator; due to concerns around confidentiality of clinic services participants were not required to have parental consent for study participation **Inclusion Criteria**: female; aged 14-17 years; not pregnant; no smoking related eligibility criterion **Exclusion Criteria**: none reported **Smoking Outcome**: smoked tobacco since baseline assessment (prevention); stopped smoking tobacco since baseline assessment (treatment) **Biochemical Verification**: none **Assessment Points**: 3 months post intervention completion (12 months post baseline assessment); 9 months post intervention completion (18 months post baseline assessment) **Funding:** grants from the National Cancer Institute at the National Institutes of Health
PARTICIPANTS	**Sample**: Overall n=828 (randomized), Intervention n=424 (randomized), Control n=404 (randomized) **Loss to Follow-up** (at 12 month assessment point): Overall 36.4% **Age** Range: 14-17 years; Mean (SD) Intervention 16.4 (1.07) years, Control 16.4 (0.99) years **Sex** (Female): 100% **Race** (Black): Intervention 82.5%, Control 85.4% **SES**: recruitment in settings serving economically disadvantaged urban youth

	Baseline Tobacco Smoking: no eligibility restrictions; participants who had "never smoked weekly or more" were considered non-smokers and allocated to the prevention stream; participants who had "ever smoked more than weekly" were considered smokers and allocated to the treatment stream
INTERVENTION	**Focus**: prevention of tobacco smoking and treatment of tobacco smoking (combined intervention – targeted according to baseline smoking status) **Addressed Other Behaviours**: yes (condom use) **Targeted Child/Youth, Parent or Family**: youth **Parental Involvement**: no **Role of Primary Care**: recruitment, conducted in clinic settings, provider delivered some **Delivery Agents**: health counselors, computer program **Setting(s)**: family planning clinics **Components**: education/information, counselling/advice **Mode(s)**: face-to-face, computer program **Group Sessions**: no **Intensity**: high – up to 4 sessions over 9 months including both in-person counseling (length of each session not reported) and computer module (20-30 minutes each time) **Duration**: 9 months **Estimated Contact Time with Delivery Agents**: not reported **Description**: Transtheoretical model (TTM) tailored intervention strategy. Participants completed online surveys that allowed staff to tailor the computer-delivered modules on condom use and smoking cessation or prevention. A report was generated for the participant and counselor based on the individual's answers. The tailored report was delivered in 5 sections: stage of change, pros and cons, situational self-efficacy or temptations, over-use and under-use of the key processes of change, and supportive tips and strategies to facilitate progress. Health counselors delivered stage-targeted counseling using a client-centred and personalized approach and motivational interviewing techniques. **Control Group:** usual care (completed same survey as those in the intervention but instead of the system generating a personalized and stage-targeted report they were given generic information and advice on condom use and avoiding smoking; health counselors provided only standard contraceptive counseling/education)
STUDY/LOCATION	**Stevens 2002,[31] US**
OBJECTIVE	To compare the effects of two interventions delivered through pediatric primary care practices focused on preventing early adolescent health risk behaviours and to maintain and improve safety behaviours
METHODS	**Design**: RCT **Recruitment**: pediatric clinicians working at 12 pediatric primary care practices in 3 Eastern States invited all families with age eligible children who attended for well-child visits during a 21 month period to take part in the study **Inclusion Criteria**: child in 5th or 6th grade; parent or legal guardian present at well-child appointment; 1 child and parent/guardian pair per family; no smoking related eligibility criterion **Exclusion Criteria**: none reported **Smoking Outcome**: ever smoked tobacco **Biochemical Verification**: none **Assessment Points**: immediate post (36 months post baseline assessment) **Funding:** National Institute of Alcohol and Alcohol Abuse grant; support from the Biostatistical Shared Service at the Norris Cotton Cancer Center

PARTICIPANTS	**Sample**: Overall n=3,496 (eligible families) n=3,145 (families enrolled), Intervention n=1,780 (with baseline data); Control n=1,331 (with baseline data) **Loss to Follow-up** (at 36 month assessment point): Overall 4% **Age** Range: 9-12 years; Mean (SD): Intervention 11.0 (0.9) years; Control 11.0 (0.8) years **Sex** (Female): Intervention 50%; Control 46% **Race**: not reported **SES**: annual family income <$18,000: Intervention 6.3%, Control 7.2%; $18,000-29,999 Intervention 9.2%, Control 9.9%; $30,000-39,999 Intervention 11.4%, Control 12.0%; $40,000-49,999 Intervention 14.7%, Control 14.4%; ≥$50,000 Intervention 58.5%, Control 56.6% **Baseline Tobacco Smoking**: no eligibility restrictions; most children reported never smoking (Overall 95%, Intervention 95.4%, Control 94.6%)
INTERVENTION	**Focus**: prevention of tobacco smoking **Addressed Other Behaviours**: yes (alcohol use) **Targeted Child/Youth, Parent or Family**: family **Parental Involvement**: yes **Role of Primary Care**: recruitment, conducted in pediatric primary care practices, provider delivered some **Delivery Agents**: pediatricians, nurse practitioners, research team sent newsletters (and may have made the bi-annual telephone calls) **Setting(s)**: pediatric primary care clinics, home **Components**: education/information, counselling/advice, incentives/reinforcements (card games, magnets, pens) **Mode(s)**: face-to-face, phone (speaking), print (behaviour contract, brochure, newsletters), postal mail **Group Sessions**: no **Intensity**: high – discussion and reminders of risk factors were provided by the clinician and office staff at initial and follow-up appointments, not clear how much time spent but potential for multiple interactions; 12 newsletters for children and 12 for parents over the course of 36 months (sent quarterly) **Duration**: 36 months **Estimated Contact Time with Delivery Agent(s)**: not reported **Description**: Intervention families received facts about alcohol and tobacco use from primary care clinicians and office staff during well-child visits. The child and parent signed a contract indicating a commitment to talk about risks at home and develop a family policy about alcohol and tobacco. A follow-up letter was sent from the clinician reminding the family of the agreement. The clinician revisited topics of alcohol and tobacco at all visits over next 3 years. Newsletters providing communication tips and information on intervention-specific risk factors were mailed quarterly to families over 36 months (12 for children, 12 for parents). Biannual calls to parents and children to offer supplemental information (no details about who made these calls or what kind of supplemental information was offered). Annual incentives (e.g., card game, magnet, pens) were mailed to families to reinforce key messages. **Control Group:** attention control (participants received the same amount of contact from pediatric clinicians and study staff but the focus of their intervention was about safety issues related to bicycle helmet and seatbelt use and gun storage)

Appendix A. AMSTAR Assessment of the USPSTF Review

1. Was an 'a priori' design provided? The research question and inclusion criteria should be established before the conduct of the review.	✓ Yes □ No □ Can't answer □ Not applicable
2. Was there duplicate study selection and data extraction? There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.	✓ Yes □ No □ Can't answer □ Not applicable
3. Was a comprehensive literature search performed? At least two electronic sources should be searched. The report must include years and databases used (e.g. Central, EMBASE, and MEDLINE). Key words and/or MESH terms must be stated and where feasible the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialized registers, or experts in the particular field of study, and by reviewing the references in the studies found.	✓Yes □ No □ Can't answer □ Not applicable
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion? The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language etc.	□ Yes ✓ No □ Can't answer □ Not applicable
5. Was a list of studies (included and excluded) provided? A list of included and excluded studies should be provided.	✓ Yes □ No □ Can't answer □ Not applicable
6. Were the characteristics of the included studies provided? In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the studies analyzed e.g. age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.	✓ Yes □ No □ Can't answer □ Not applicable
7. Was the scientific quality of the included studies assessed and documented? 'A priori' methods of assessment should be provided (e.g., for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.	✓ Yes □ No □ Can't answer □ Not applicable

8. Was the scientific quality of the included studies used appropriately in formulating conclusions? The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.	✓ Yes □ No □ Can't answer □ Not applicable
9. Were the methods used to combine the findings of studies appropriate? For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e. Chi-squared test for homogeneity, I^2). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e. is it sensible to combine?).	✓ Yes □ No □ Can't answer □ Not applicable
10. Was the likelihood of publication bias assessed? An assessment of publication bias should include a combination of graphical aids (e.g., funnel plot, other available tests) and/or statistical tests (e.g., Egger regression test).	✓ Yes □ No □ Can't answer □ Not applicable
11. Was the conflict of interest stated? Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.	□ Yes ✓ No □ Can't answer □ Not applicable

Appendix B. PRESS Checklist

PRESS EBC Search Submission	
Searcher's Name: USPSTF-Prevention	**E-mail:**
Date submitted:	**Date needed by:**
Note to peer reviewers – please enter your information in the Peer Review Assessment area	

Remember: this peer review only pertains to your MEDLINE search strategy.

Search question (Describe the purpose of the search)

KQ 1. Are behaviourally-based interventions relevant to the Canadian primary care setting that are designed to prevent tobacco smoking effective in preventing school-aged children and youth from trying or taking up tobacco smoking?

a. Are there differences in the incidence of tobacco smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking status [never, former (e.g., have tried smoking tobacco in past but not in last 30 days), (iii) intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a ½ day or entire day workshop), low (≤1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?

b. What are the elements of efficacious interventions designed for preventing tobacco smoking in school-aged children and youth?

KQ 2. Are behaviourally-based interventions relevant to Canadian primary care that are designed to prevent tobacco smoking in school-aged children and youth effective in reducing future tobacco smoking during adulthood

PICO format (Outline the PICO for your question, i.e., the Patient, Intervention, Comparison and Outcome)
P: School-aged children and youth (5-18)
I: behaviourally-based interventions
C: No intervention, usual care that does not involve a specifically designed smoking prevention component, attention control (with no tobacco related content) or wait list
O: incidence of tobacco smoking, prevalence of adult tobacco smoking

Inclusion criteria (List criteria such as age groups, study designs, to be included)
-5-18 years of age
- Randomized controlled trials

Exclusion criteria (List criteria such as study designs, to be excluded)
-all other populations
-non-RCTs

Was a search filter applied? (Remember this pertains only to the MEDLINE strategy)
Yes ☐ *No* ☐

If yes, which one?
Cochrane hedge: PUBMED clinical query:
Haynes/McKibbon et al: SIGN (Scottish):
CRD (UK): Robinson and Dickerson:
Other:

MEDLINE search interface used
EBSCO ☐ *OVID* x *PubMED* ☐ *Other* _____

Has the search strategy been adapted (i.e., subject heading and terms reviewed) for other databases? Please check all that apply.

Ageline	☐
AMED	☐
C2-SPCTRE	☐
CINAHL	
Cochrane Database of Systematic Reviews (CDSR; Cochrane Reviews)	X
Cochrane Central Register of Controlled Trials (CENTRAL; Clinical Trials)	X
Cochrane Methodology Register (CMR; Methods Studies)	☐
Cochrane Library (all databases)	☐
Database of Abstracts of Reviews of Effects (DARE; Other Reviews)	X
Embase	
ERIC	☐
ICTRP (International Clinical Trials Registry Platform)	☐
LILACS (Latin American and Caribbean Health Sciences Literature)	☐
MEDLINE	☐
PreMEDLINE	☐
PsycINFO	X
Other PubMed	X
Other	☐

Other notes or comments that you feel would be useful for the peer reviewer?

Please paste your MEDLINE strategy here:

1. Smoking Cessation/
2. "Tobacco Use Disorder"/
3. tobacco.ti,ab.
4. smoking.ti,ab.
5. cigarette*.ti,ab.
6. 1 or 2 or 3 or 4 or 5
7. prevention & control.fs.
8. prevent*.ti,ab.
9. initiat*.ti,ab.
10. (start* adj3 smok*).ti,ab.
11. behavio?r* change*.ti,ab.
12. behavio?r* intervention*.ti,ab.
13. 7 or 8 or 9 or 10 or 11 or 12
14. 6 and 13
15. adolescent/ or child/
16. children.ti,ab.
17. adolescen*.ti,ab.
18. child.ti,ab.
19. childhood.ti,ab.
20. teen*.ti,ab.
21. youth*.ti,ab.
22. 15 or 16 or 17 or 18 or 19 or 20 or 21
23. (clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.
24. clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/
25. clinical trial*.ti,ab.
26. (control* adj3 trial*).ti,ab.
27. random*.ti,ab.
28. 23 or 24 or 25 or 26 or 27
29. 14 and 22
30. 28 and 29
31. limit 30 to english language
32. limit 31 to yr=2002-Current

Peer Review Assessment [for peer reviewers only]			
Peer Reviewer's Name: Maureen Rice (McMaster Evidence Review and Synthesis Centre librarian) **Date Completed:** March 10, 2015 *Please select the one most appropriate answer for each element*			
	Adequate	**Adequate with revisions***	**Needs revision***
1. Translation of the research question	x		
2. Boolean and proximity operators	x		
3. Subject headings	x		
4. Natural language / free-text	x		
5. Spelling, syntax and line numbers	x		
6. Limits and filters		x	
7. Search strategy adaptations	x		
* Provide an explanation or example for "Adequate with revisions" and "needs revision": *We will be expanding the language restriction to include French for our search* Other Comments (please limit to 3-5 sentences): *As per our methods manual, we will also be searching EMBASE from the end of the USPSTF search forward.*			

PRESS EBC Search Submission	
Searcher's Name: USPSTF-Treatment/Harms	**E-mail:**
Date submitted:	**Date needed by:**
Note to peer reviewers – please enter your information in the Peer Review Assessment area	

Remember: this peer review only pertains to your MEDLINE search strategy.

Search question (Describe the purpose of the search)

KQ 3. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in achieving smoking cessation?

a. Are there differences in the incidence of stopping smoking across subgroups, as defined by: (i) baseline age (5-12 years, 13-18 years), (ii) baseline tobacco smoking pattern [current regular (daily or weekly), current occasional], (iii) intervention intensity [high (e.g., ≥2 meetings/interactions with a health professional of any length or one long session, such as a ½ day or entire day workshop), low (≤1 brief meeting or encounter with a health professional or provision of written materials such as a pamphlet)], and (iv) study risk of bias rating (low, unclear, high)?

b. What are the elements of efficacious interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

KQ 4. Are behaviourally-based and non-pharmacological alternative and complementary interventions relevant to the Canadian primary care setting that are designed to help school-aged children and youth stop ongoing tobacco smoking effective in reducing future tobacco smoking in adulthood?

KQ 5. What if any, adverse effects are associated with behaviourally-based and non-pharmacological alternative and complementary interventions designed to help school-aged children and youth stop ongoing tobacco smoking?

PICO format (Outline the PICO for your question, i.e., the Patient, Intervention, Comparison and Outcome)
P: School-aged children and youth (5-18)
I: behaviourally-based interventions
C: No intervention, usual care without a specifically designed smoking cessation component, attention control (with no tobacco related content) or wait list
O: Benefits

- incidence of stopping tobacco smoking
- prevalence of adult tobacco smoking

Harms

- adverse effects of interventions (e.g., anxiety, pain, discomfort, infection

Inclusion criteria (List criteria such as age groups, study designs, to be included)
- 5-18 years of age
- Randomized controlled trials for benefits
- RCT or comparative observational designs

Exclusion criteria (List criteria such as study designs, to be excluded)
-all other populations
-non-RCTs for treatment benefits
-pharmacological treatments

Was a search filter applied? (Remember this pertains only to the MEDLINE strategy)
Yes ☐ *No* ☐

If yes, which one?

Cochrane hedge:	PUBMED clinical query:
Haynes/McKibbon et al:	SIGN (Scottish):
CRD (UK):	Robinson and Dickerson:
Other:	

MEDLINE search interface used
EBSCO ☐ *OVID* x *PubMED* ☐ *Other* _____

Has the search strategy been adapted (i.e., subject heading and terms reviewed) for other databases? Please check all that apply.

Ageline	☐
AMED	☐
C2-SPCTRE	☐
CINAHL	
Cochrane Database of Systematic Reviews (CDSR; Cochrane Reviews)	X
Cochrane Central Register of Controlled Trials (CENTRAL; Clinical Trials)	X
Cochrane Methodology Register (CMR; Methods Studies)	☐
Cochrane Library (all databases)	☐
Database of Abstracts of Reviews of Effects (DARE; Other Reviews)	X
Embase	
ERIC	☐
ICTRP (International Clinical Trials Registry Platform)	☐
LILACS (Latin American and Caribbean Health Sciences Literature)	☐
MEDLINE	☐
PreMEDLINE	☐
PsycINFO	X
Other PubMed	X
Other	☐

Other notes or comments that you feel would be useful for the peer reviewer?

Please paste your MEDLINE strategy here:

1 smoking cessation/
2 "Tobacco Use Disorder"/
3 tobacco.ti,ab.
4 smoking.ti,ab.
5 cigarette*.ti,ab.
6 3 or 4 or 5
7 cessation.ti,ab.
8 quit*.ti,ab.
9 "stop*".ti,ab.
10 7 or 8 or 9
11 6 and 10
12 1 or 2 or 11
13 adolescent/ or child/
14 children.ti,ab.
15 adolescen*.ti,ab.
16 child.ti,ab.
17 childhood.ti,ab.
18 teen*.ti,ab.
19 youth*.ti,ab.
20 13 or 14 or 15 or 16 or 17 or 18 or 19
21 12 and 20
22 (clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.
23 clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/
24 clinical trial*.ti,ab.
25 (control* adj3 trial*).ti,ab.
26 random*.ti,ab.
27 placebo*.ti,ab.
28 22 or 23 or 24 or 25 or 26 or 27
29 21 and 28
30 limit 29 to english language
31 limit 30 to yr=2009-Current

Peer Review Assessment [for peer reviewers only]			
Peer Reviewer's Name: Maureen Rice (McMaster Evidence Review and Synthesis Centre librarian) **Date Completed:** March 10, 2015 *Please select the one most appropriate answer for each element*			
	Adequate	**Adequate with revisions***	**Needs revision***
1. Translation of the research question		x	
2. Boolean and proximity operators	x		
3. Subject headings	x		
4. Natural language / free-text	x		
5. Spelling, syntax and line numbers	x		
6. Limits and filters		x	
7. Search strategy adaptations		x	

* Provide an explanation or example for "Adequate with revisions" and "needs revision":

- *Limitations on study type are not compatible with our inclusion criteria for harms of treatment*

Other Comments (please limit to 3-5 sentences):

- *We will be doing a separate search for harms that isn't limited to RCTs (see Appendix A for search details)*
- *As per our methods manual, we will also be searching EMBASE from the end of the USPSTF search forward*
- *We will be expanding the language restriction to include French for our search*

Appendix C. Search Strategies

Key Questions Search Strategy

Prevention

Medline-OVID
1. Smoking Cessation/
2. "Tobacco Use Disorder"/
3. tobacco.ti,ab.
4. smoking.ti,ab.
5. cigarette*.ti,ab.
6. 3 or 4 or 5
7. prevention & control.fs.
8. prevent*.ti,ab.
9. initiat*.ti,ab.
10. (start* adj3 smok*).ti,ab.
11. behavio?r* change*.ti,ab.
12. behavio?r* intervention*.ti,ab.
13. 7 or 8 or 9 or 10 or 11 or 12
14. 6 and 13
15. adolescent/ or child/
16. children.ti,ab.
17. adolescen*.ti,ab.
18. child.ti,ab.
19. childhood.ti,ab.
20. teen*.ti,ab.
21. youth*.ti,ab.
22. 15 or 16 or 17 or 18 or 19 or 20 or 21
23. (clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.
24. clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/
25. clinical trial*.ti,ab.
26. (control* adj3 trial*).ti,ab.
27. random*.ti,ab.
28. 23 or 24 or 25 or 26 or 27
29. 14 and 22
30. 28 and 29
31. limit 30 to (english or french)
32. limit 31 to ed=20120130-20150415

Smoking Cessation in General

Medline-OVID
1. Smoking Cessation/
2. "Tobacco Use Disorder"/
3. tobacco.ti,ab.
4. smoking.ti,ab.

5. cigarette*.ti,ab.
6. 3 or 4 or 5
7. cessation.ti,ab.
8. quit*.ti,ab.
9. "stop*".ti,ab.
10. 7 or 8 or 9
11. 6 and 10
12. 1 or 2 or 11
13. adolescent/ or child/
14. children.ti,ab.
15. adolescen*.ti,ab.
16. child.ti,ab.
17. childhood.ti,ab.
18. teen*.ti,ab.
19. youth*.ti,ab.
20. 13 or 14 or 15 or 16 or 17 or 18 or 19
21. 12 and 20
22. (clinical trial or controlled clinical trial or meta analysis or randomized controlled trial).pt.
23. clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/
24. clinical trial*.ti,ab.
25. (control* adj3 trial*).ti,ab.
26. random*.ti,ab.
27. placebo*.ti,ab.
28. 22 or 23 or 24 or 25 or 26 or 27
29. 21 and 28
30. limit 29 to (english or french)
31. limit 30 to ed=20120130-20150415

Tobacco Cessation Harms

Medline-OVID
1. Smoking Cessation/
2. "Tobacco Use Disorder"/
3. tobacco.ti,ab.
4. smoking.ti,ab.
5. cigarette*.ti,ab.
6. 3 or 4 or 5
7. cessation.ti,ab.
8. quit*.ti,ab.
9. "stop*".ti,ab.
10. 7 or 8 or 9
11. 6 and 10
12. 1 or 2 or 11
13. adolescent/ or child/
14. children.ti,ab.
15. adolescen*.ti,ab.
16. child.ti,ab.

17. childhood.ti,ab.
18. teen*.ti,ab.
19. youth*.ti,ab.
20. 13 or 14 or 15 or 16 or 17 or 18 or 19
21. 12 and 20
22. (ae or co or de or mo).fs.
23. (adverse and (effect* or event*)).mp.
24. (safe* or harm* or side effect*).mp.
25. Anxiety/
26. Depression/
27. Pain/
28. Infection/
29. or/22-28
30. 21 and 29
31. limit 30 to (english or french)
32. limit 31 to ed=20120130-20150415
33. limit 32 to (case reports or comment or editorial or letter or news)
34. 32 not 33

Contextual Questions Search Strategy

Medline-OVID (last run March 11, 2015)
1. "patient acceptance of health care"/
2. patient compliance/
3. exp patient participation/
4. patient satisfaction/
5. patient preference/
6. "treatment refusal"/
7. consumer satisfaction/
8. ((parent? or guardian*) adj3 (acceptance or preference? or satisfaction or experience?)).tw.
9. (consumer? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
10. (patient? adj3 (acceptance or perference? or satisfaction or experience?)).tw.
11. willingness to pay.tw.
12. ((conjoint or contingent) adj3 (valuation or analysis)).tw.
13. Choice Behavior/
14. standard gamble.ti.
15. standard gamble.tw.
16. time trade off.tw.
17. choice model?ing.mp.
18. survey preferences.mp.
19. preference?.tw.
20. or/1-19
21. Smoking Cessation/
22. "Tobacco Use Disorder"/
23. tobacco.ti,ab.
24. smoking.ti,ab.

25. cigarette*.ti,ab.
26. 23 or 24 or 25
27. cessation.ti,ab.
28. quit*.ti,ab.
29. "stop*".ti,ab.
30. 27 or 28 or 29
31. prevention & control.fs.
32. prevent*.ti,ab.
33. initiat*.ti,ab.
34. (start* adj3 smok*).ti,ab.
35. behavio?r* change*.ti,ab.
36. behavio?r* intervention*.ti,ab.
37. 31 or 32 or 33 or 34 or 35 or 36
38. adolescent/ or child/
39. children.ti,ab.
40. adolescen*.ti,ab.
41. child.ti,ab.
42. childhood.ti,ab.
43. teen*.ti,ab.
44. youth*.ti,ab.
45. 38 or 39 or 40 or 41 or 42 or 43 or 44
46. 30 or 37
47. 26 and 46
48. 45 and 47
49. 20 and 48
50. limit 49 to (english or french)
51. limit 50 to yr="2005 - 2015"

Appendix D. Acknowledgements

Funding to conduct this review was provided by the Public Health Agency of Canada.

Dr. Jennifer O'Loughlin (University of Montréal) and Dr. Michèle Tremblay (Institut national de santé publique du Québec) provided clinical expertise for this review.

The Public Health Agency of Canada Scientific Research Managers, Dr. Sarah Connor Gorber and Dr. Kate Morissette, contributed to the original protocol development and/or review of drafts of the technical report.

The Tobacco Working Group of the Canadian Task Force for Preventive Health Care members, Dr. Brett Thombs (Chair), Dr. Patricia Parkin, Dr. Kevin Pottie, and Dr. Marcello Tonelli, provided comments on the protocol, initial analyses and technical report.

Finally, we are grateful to the external reviewers who provided feedback on the full draft of this technical report: Dr. Carrie Patnode, Dr. Jonathan Klein, and a third expert who preferred to remain anonymous.

Reference List

1. Health Canada. Summary of results of the Youth Smoking Survey 2012-2013. Ottawa ON: Author. 2014. Available from: http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_survey-sondage_2012-2013/result-eng.php.

2. Janz T. Health at a glance. Current smoking trends. Ottawa, ON: Statistics Canada. 2012. Catalogue no. 82-624-X. Available from: http://www.statcan.gc.ca/pub/82-624-x/2012001/article/11676-eng.htm.

3. US Preventive Services Task Force. Counseling to prevent tobacco use and tobacco-caused disease: recommendation statement. Rockville, MD: Agency for Healthcare Research and Quality (AHRQ). 2003. AHRQ Pub. No. 04-0526. Available from: http://webapp1.dlib.indiana.edu/virtual_disk_library/index.cgi/6468753/FID1921/PDFs/Vol2/Vol2_p273-277.pdf.

4. US Preventive Services Task Force [Internet]. Tobacco use in children and adolescents: primary care interventions. US: Author. Date accessed 11-11-2014. Available at: http://www.uspreventiveservicestaskforce.org/Page/Topic/recommendation-summary/tobacco-use-in-children-and-adolescents-primary-care-interventions.

5. Ministry of Health. New Zealand smoking cessation guidelines. Wellington, NZ: Author. 2007. Available from: http://www.treatobacco.net/de/uploads/documents/Treatment%20Guidelines/New%20Zealand%20treatment%20guidelines%20in%20English%202007.pdf.

6. US Department of Health and Human Services. Clinical practice guideline: treating tobacco use and dependence: 2008 update. Rockville, MD: Agency for Healthcare Research and Quality (AHRQ). 2008. Available from: http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/tobacco/clinicians/update/treating_tobacco_use08.pdf.

7. Institute for Clinical Systems Improvement (ICSI). Tobacco use prevention and cessation for infants, children and adolescents. Bloomington, MN: Author. 2004. Available from: http://www.guideline.gov/algorithm/3732/NGC-3732.pdf.

8. CAN-ADAPTT's Clinical Practice Guideline Development Group, O'Loughlin J. Can-ADAPTT Canadian smoking cessation guideline. Specific populations: youth (children and adolescents). Toronto, ON: Author. 2011. Available from: https://www.nicotinedependenceclinic.com/English/CANADAPTT/Documents/Guideline/Youth%20%28Children%20and%20Adolescents%29.pdf.

9. Patnode CD, O'Connor E, Whitlock EP, Perdue LA, Soh C. Primary care relevant interventions for tobacco use prevention and cessation in children and adolescents. A systematic evidence review for the US Preventive Services Task Force. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ). 2012. Evidence Syntheses, No. 97. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23270006.

10. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol. 2007;7(1):10-6. Available from: http://www.biomedcentral.com/1471-2288/7/10.

11. Thomas RE, Baker P, Lorenzetti D. Family-based programmes for preventing smoking by children and adolescents. Cochrane Database Syst Rev. 2007(1):CD004493. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17253511.

12. Christakis DA, Garrison MM, Ebel BE, Wiehe SE, Rivara FP. Pediatric smoking prevention interventions delivered by care providers: a systematic review. Am J Prev Med. 2003;25(4):358-62. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14580640.

13. Grimshaw GM, Stanton A. Tobacco cessation interventions for young people. Cochrane Database Syst Rev. 2006(4):CD003289. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23975659.

14. Sampson M, McGowan J, Lefebvre C. An evidence based checklist for the peer review of electronic search strategies (PRESS EBC). 2010;5(1):149-54. Available from: http://ejournals.library.ualberta.ca/index.php/EBLIP/article/view/7402/6436.

15. CADTH Information Services. Grey Matters: a practical search tool for evidence-based medicine. Ottawa, ON: CADTH Evidence Driven. 2014. Available from: http://www.cadth.ca/en/resources/finding-evidence-is/grey-matters.

16. Distiller (DistillerSR systematic review software) [computer program]. Ottawa, ON: Evidence Partners. Available from: http://systematic-review.net/.

17. The Cochrane Statistical Methods Group, The Cochrane Bias Methods Group. Assessing risk of bias in included studies. In: Higgins JPT, Altman DG, Sterne JAC, the Cochrane Statistical Methods Group, the Cochrane Bias Methods Group, editors. *Cochrane handbook for systematic reviews of interventions*, Version 5.1.0 [updated March 2011]: The Cochrane Collaboration; 2011. Available from: http://handbook.cochrane.org/.

18. GRADE working group. 2005. Available at: http://www.gradeworkinggroup.org/.

19. GRADEpro. [Computer program on www.gradepro.org]. Version 2015. McMaster University.

20. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials. 1986;7(3):177-88. Available from: http://www.ncbi.nlm.nih.gov/pubmed/3802833.

21. The Cochrane Statistical Methods Group. Special topics in statistics. Approximate analyses of cluster-randomized trials for a meta-analysis: effective sample sizes. In: Higgins JPT, Deeks JJ, Altman DG, the Cochrane Statistical Methods Group, editors. *Cochrane handbook for systematic reviews of interventions*, Version 5.1.0. The Cochrane Collaboration; 2011. Available from: http://handbook.cochrane.org/.

22. Schünemann HJ, Oxman AD, Vist GE, Higgins JPT, Deeks JJ, Glasziou P, et al. Interpreting results and drawing conclusions. Expressing absolute risk reductions. In:

Higgins JPT, Green S, editors. *Cochrane handbook for systematic reviews of interventions*, Version 5.1.0 [updated March 2011]: The Cochrane Collaboration; 2011. Available from: http://handbook.cochrane.org/.

23. Review Manager (RevMan) [Computer Program]. Version 5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration. Available from: http://tech.cochrane.org/revman/download.

24. The Cochrane Statistical Methods Group. Analysing data and undertaking meta-analyses. In: Deeks JJ, Higgins JP, Altman DG, the Cochrane Statistical Methods Group, editors. *Cochrane handbook for systematic reviews of interventions*, Version 5.1.0 [updated March 2011]: The Cochrane Collaboration; 2011. Available from: http://handbook.cochrane.org/.

25. Curry SJ, Hollis J, Bush T, Polen M, Ludman EJ, Grothaus L, et al. A randomized trial of a family-based smoking prevention intervention in managed care. Prev Med. 2003;37(6 Pt 1):617-26. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14636795.

26. 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. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11226356.

27. Hollis JF, Polen MR, Whitlock EP, Lichtenstein E, Mullooly JP, Velicer WF, 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. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15805374.

28. Hovell MF, Slymen DJ, Jones JA, Hofstetter CR, Burkham-Kreitner S, Conway TL, et al. An adolescent tobacco-use prevention trial in orthodontic offices. Am J Public Health. 1996;86(12):1760-6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9003134.

29. Kentala J, Utriainen P, Pahkala K, Mattila K. Can brief intervention through community dental care have an effect on adolescent smoking? Prev Med. 1999;29(2):107-11. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10446036.

30. Pbert L, Flint AJ, Fletcher KE, Young MH, Druker S, DiFranza JR. Effect of a pediatric practice-based smoking prevention and cessation intervention for adolescents: a randomized, controlled trial. Pediatrics. 2008;121(4):e738-e47. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18381502.

31. Stevens MM, Olson AL, Gaffney CA, Tosteson TD, Mott LA, Starr P. 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. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11875146.

32. Hiemstra M, Ringlever L, Otten R, van Schayck OCP, Jackson C, Engels RCME. Long-term effects of a home-based smoking prevention program on smoking initiation: a cluster randomized controlled trial. Prev Med. 2014;60:65-70. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24355576.

33. Redding CA, Prochaska JO, Armstrong K, Rossi JS, Hoeppner BB, Sun X, et al. Randomized trial outcomes of a TTM-tailored condom use and smoking intervention in urban adolescent females. Health Educ Res. 2014;30(1):162-78. Available from: http://her.oxfordjournals.org/content/early/2014/05/02/her.cyu015.full.pdf.

34. Marcell AV, Halpern-Felsher BL. Adolescents' beliefs about preferred resources for help vary depending on the health issue. J Adolesc Health. 2007;41(1):61-8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17577535.

35. Marcell AV, Halpern-Felsher BL. Adolescents' health beliefs are critical in their intentions to seek physician care. Prev Med. 2005;41(1):118-25. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15917002.

36. Ranney ML, Choo EK, Spirito A, Mello MJ. Adolescents' preference for technology-based emergency department behavioral interventions: does it depend on risky behaviors? Pediatr Emerg Care. 2013;29(4):475-81. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23528509.

37. Molyneux A, Lewis S, Coleman T, McNeill A, Godfrey C, Madeley R, et al. Designing smoking cessation services for school-age smokers: a survey and qualitative study. Nicotine Tob Res. 2006;8(4):539-46. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16920651.

38. Horn K, Dino G, Hamilton C, Noerachmanto N, Zhang J. Feasibility of a smoking cessation intervention for teens in the emergency department: reach, implementation fidelity, and acceptability. Am J Crit Care. 2008;17(3):205-16. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18476313.

39. MacDonald S, Rothwell H, Moore L. Getting it right: designing adolescent-centred smoking cessation services. Addiction. 2007;102(7):1147-50. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17567403.

40. Beatty SE, Cross DS. Investigating parental preferences regarding the development and implementation of a parent-directed drug-related educational intervention: an exploratory study. Drug Alcohol Rev. 2006;25(4):333-42. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16854659.

41. Latimer AE, Krishnan-Sarin S, Cavallo DA, Duhig A, Salovey P, O'Malley SA. Targeted smoking cessation messages for adolescents. J Adolesc Health. 2012;50(1):47-53. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22188833.

42. Davidson BM, Vergotine RJ, Punwani IC, Koerber A, Crawford J. Parental attitudes regarding pediatric dentists' counseling on tobacco use: a survey of five private practices. Pediatr Dent. 2013;35(7):515-8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24553274.

43. Kernoghan A, MacRae Stevens D, Estill A, Eaglesham D. Youth smoking cessation needs: assessment findings and program recommendations. Guelph, ON: Wellington-Dufferin-Guelph Public Health. 2014. Available from:

https://www.wdgpublichealth.ca/sites/default/files/wdgphfiles/youth-smoking-cessation-report.pdf.

44. Carson KV, Brinn MP, Labiszewski NA, Peters M, Chang AB, Veale A, et al. Interventions for tobacco use prevention in Indigenous youth. Cochrane Database Syst Rev. 2012;8:CD009325. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22895988.

45. Stanton A, Grimshaw G. Tobacco cessation interventions for young people. Cochrane Database Sys Rev. 2013;8:CD003289. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23975659.

46. Thomas RE, McLellan J, Perera R. School-based programmes for preventing smoking. Cochrane Database Syst Rev. 2013;4:CD001293. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23633306.

47. Thomas RE, Lorenzetti DL, Spragins W. Systematic review of mentoring to prevent or reduce tobacco use by adolescents. Acad Pediatr. 2013;13(4):300-7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23830017.

48. Sterne JAC, Egger M, Moher D, the Cochrane Bias Methods Group. Addressing reporting biases. In: *Cochrane handbook for systematic reviews of interventions* Version 5.1.0 [updated March 2011] [Internet]. The Cochrane Collaboration; 2011. Available from: http://handbook.cochrane.org/.

49. Selecting and rating the importance of outcomes. In: Schünemann HJ, Brożek J, Guyatt GH, Oxman A, editors. *GRADE handbook: introduction to GRADE handbook* [Updated October 2013]; 2013. Available from: http://www.guidelinedevelopment.org/handbook/#h.svwngs6pm0f2.