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# Effectiveness of School-Based Smoking Cessation Programs

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*Abstract: This study aims to examine the evidence of whether or not school-based smoking cessation programs help students in public schools to stop smoking and to determine the effectiveness of school-based smoking cessation programs. The systematic review of studies published in peer-review journals over the last 10 years (2008-2019) by using key terms related to adolescent smoking cessation. The literature search was conducted from December 2019 to January 2020. The two researchers read 14 full-text articles and assessed them by using Joanna Briggs Institute (JBI) appraisal tools. There were seven different interventions reported, including a cognitive-behavioral approach, motivation interviews, a parental intervention program, physical activities and motivation interviewing, a peer-led program, a mother–adolescent dyad with health education, proactive telephone counseling interventions and the Project Ex curriculum. The papers were reviewed, and 11 were randomized controlled trials and three were quasi-experimental studies. The sample size of the studies ranged from 94 to 2,801 subjects. All of the articles included studies with both male and female subjects. The age of students being studied ranged from 11 to 19 years old. This study review provided a summary of knowledge about various methods of programs to stop smoking. This review highlights smoking cessation* programs in public schools. Based on the evidence from this review, we recommend that the Project Ex curriculum and physical activites, along with motivational interviews to be included in smoking cessation programs in schools.

Keywords: Smoking cessation, School-based, Adolescents

## Introduction

Nowadays, the majority of tobacco users, some of which die of the tobacco related diseases, live in low and middle-income countries. The WHO reported that each year there are 8 million tobacco related deaths, which includes 7 million deaths that are the consequence of direct tobacco use and about 1.2 million deaths from secondhand smoking. More than 1.2 million premature deaths per year and 65, 000 deaths among children are due to illnesses attributable to second-hand smoke (WH0, 2017). Moreover, it is estimated that around 25 million children aged 13–15 years smoke cigarettes and almost 13 million use smokeless tobacco products (WHO, 2017). Social environmental factors that increase the likelihood of students smoking include having a parent smoking in house and being surrounded by friends who smoke. Moreover, societal conditions also influence whether young adolescents take up and continue smoking (NICE, 2010). These factors include tobacco price and availability, restrictions on smoking in public places, tobacco industry advertising, point-of-sale promotions, and other promotional strategies such as tobacco product placement (Thomas, McLellan and Perera, 2013). The social competence skills taught in school programs for smoking cessation can help student improve their personal social competence and social skills.This study used an integrated curriculum for smoking cessation that taught students to stop smoking by using social refusal and problem decision making skills to overcome combined parent and peer pressure (Thomas, McLellan and Perera R, 2013).

Adolescents spend many years of study in school, and often form many health-risk behaviors. A school's environment can influence student attitude, beliefs, and behaviors including smoking. School is the place where students can receive integrated health education,

health messages, or other classroom interventions for smoking cessasion (Nihaya et al., 2016; Thammaraksa et al., 2019). Smoking cessation interventions have been implemented in school for many years. There are interventions were conducted in several studies for smoking cessation in school such as a school-based educational program (Thammaraksa et al., 2019), parent participation components (Guilamo-Ramos et al., 2010), peer-led program (Stigler et al., 2007). Most of studies reported the evidence of smoking reduction and limited evidence that support smoking cessation, desmoking behavior and little studies to no evidence of long-term effectiveness. Thus, there continues to be a need for well- designed, adequately powered, randomized controlled trials of interventions for teen smokers in order to applied for helping students stop smoking. The objectives of this research were 1) to evaluate the evidence for whether school-based smoking cessation programs help students stop smoking among students in public schools, and 2) to determine the effectiveness of school- based smoking cessation programs.

## Research methodology

We conducted a systematic review of published articles in peer-review journals in the past 11 years by hand searching for electronic articles. We included articles on smoking cessation interventions among adolescents in public schools. We conducted our review using the PRISMA (Preferred reporting items for systematic reviews and meta- analyses) guidelines that were current as of September 2019 (Liberati et al., 2009).We searched following electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and EBSCO from December 2019 to January 2020. We used search terms for tobacco use cessation in school including: smoking cessation, cigarette cessation, adolescents, teen, young adolescence, young adult, teenage, intervention, school. We required that all articles were written in English and published in the last 10 years (2008-2019).

*Inclusion criteria*

Peer- reviewed journal articles were included following criteria: 1) The study evaluated any smoking cessation intervention among students in public schools, 2) The study design was an experimental, quasi- experimental, or a randomized control trial assessing the effect of smoking cessation intervention in a public school on a measured of reduction of smoking during the follow- up after finishing the intervention program, 3) The students were ages 13- 18 years old, 4) Students reported previous experience with cigarette smoking. We excluded articles that did not report of any outcomes of smoking cessation. The minimum outcome measure was the prevalence of smoking at 3 months after the completion of the smoking cessation program.

*Data extraction*

We conducted the search with inclusion criteria noted previously using the online databases CINAHL, PubMed, and EBSCO**.** Two authors (KH, AB) retrieved and extracted articles independently. They assessed the risk of bias using the standardized critical appraisal tools developed by JBI (Tufanaru, Munn, Aromataris, Campbell, Hopp, 2017). They also

independently extracted data on participant characteristics, intervention characteristics, smoking cessation outcome, and other quantitative information on the implementation of the intervention. We excluded interventions specifically targeting students in vocational schools and adults. We also excluded any programs aimed primarily at hospitals or healthcare centers, those having no school-based interventions, as well as those had incomplete follow-up data.

## Research results

After removing duplicate studies, the search yielded 1,469 articles for review. Seventy-two full-text articles were available. Two authors read the full-text articles in order to determine if the studies were suitable for our review based on inclusion criteria. Thus, using our inclusion criteria, only thirteen articles were included. Four additional articles were included due to the prior article citations referring to their study methodology. Because the retrieved studies were heterogeneous in terms of study design and outcome measure, we qualitatively synthesized the results from the fourteen included studies. The PRISMA flow diagram and the number of studies excluded at each stage of the process are shown in Figure 1.

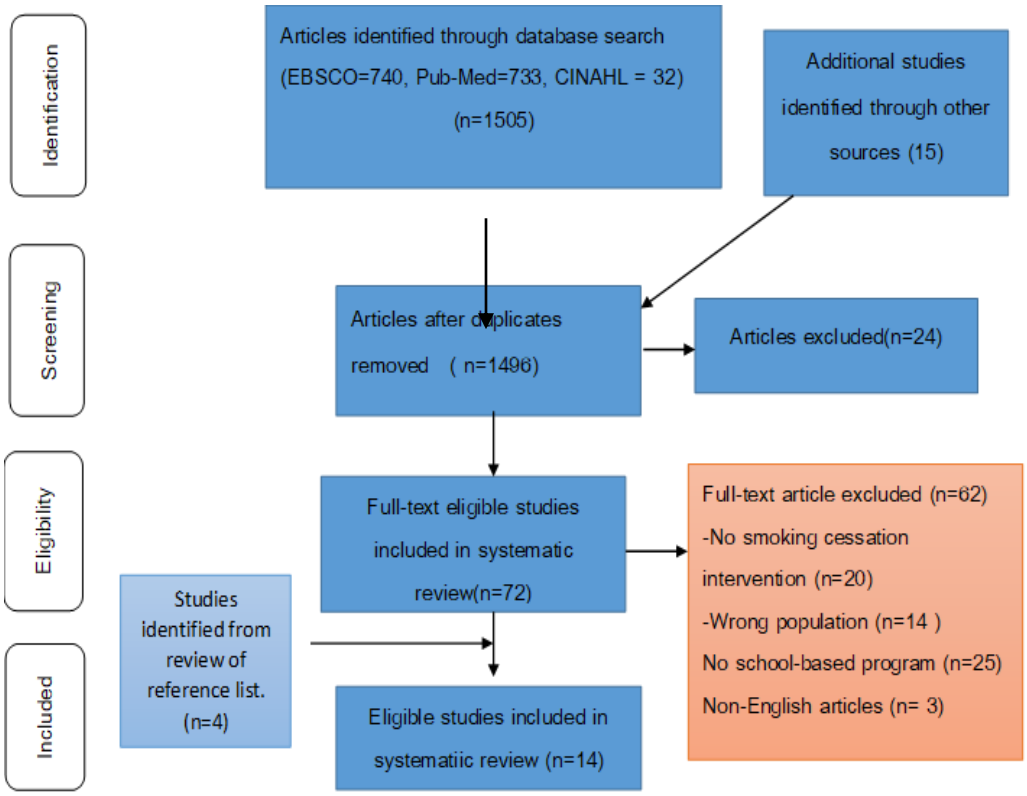


Figure 1 Literature review flowchart based on PRISMA guidelines (Liberati et al., 2009)

*Evaluation the evidence for school-based smoking cessation programs help students stop smoking among students in public schools*

This systematic review of effectiveness of school-based smoking cessation programs evaluated the evidence of fourteen studies in topic as following:

Regarding the systematic review process, all studies to be included were first assessed for methodological rigor. The risk of bias of randomized and non- randomized controlled trials was assessed by one reviewer using the JBI Critical Appraisal Tools. This review retrieved 15 articles from three database sources. Three studies of fifteen articles were non- randomized controlled trials that included control groups which did not receive any tobacco- related programming (Fritz et al., 2008 ; Chansatitporn et al., 2016 ; Yu et al., 2019). Two studies adapted interventions from an original evidence-based program, Program Ex, both of which required participants to complete a three- month follow- up ( Chansatitporn et al., 2016;Yu et al., 2019). However, one study did not have follow-up measurement at three months (Fritz et al., 2008). There was risk of bias in a quasi- experimental study due to a small sample size, and selection bias using convenience sampling. Two studies from Korea and Thailand composed mainly of boys. Thus, these studies are highly selective, may have involved youth with a unique level of motivation, and results may not be generalizable to girls.

For the randomized controlled trials that we reviewed, we summarized our judgment on the risk of study bias in Figure 2. Of the 11 randomized controlled trials, we found just one study to be at high risk of selection bias because of the way in which students and mothers were recruited (Guilamo-Ramos et al., 2010).Four studies did not provide sufficient information about allocation concealment; thus, we judged them to be unclear risk of selection bias (Perry et al., 2009; Espada et al., 2014; Espada et al., 2015; Gonzálvez et al., 2017). For the performance bias, we found that one article had an unclear description of masking participants (Krist et al.,2016). We labeled two studies as high risk of performance bias (Krist et al.,2016; Guilamo-Ramos et al., 2010) due to the fact that participants were not blinded and participants in control group knew what group they were assigned to.

Two studies from India provided insufficient information about blinding of outcome assessment so we considered them to have unclear risk of detection bias (Perry et al., 2009; Stigler et al., 2007). Two studies were judged to have high risk of detection bias due to the lack of consistency while measuring physical activity and having a relatively homogeneous sample. (Horn et al., 2013; Blank et al., 2017) One study reported intervention contamination due to the control and intervention group being administered in the same school. Thus, we judged this study to be at high risk of detection bias (Guilamo-Ramos, 2010). The authors also judged six studies to be at high risk of attrition bias due to a high rate of drop out during the follow- up process, which was being greater than 30% (Stigler et al., 2007; Guilamo-Ramos, 2010; Horn et al., 2013; Blank et al., 2017).

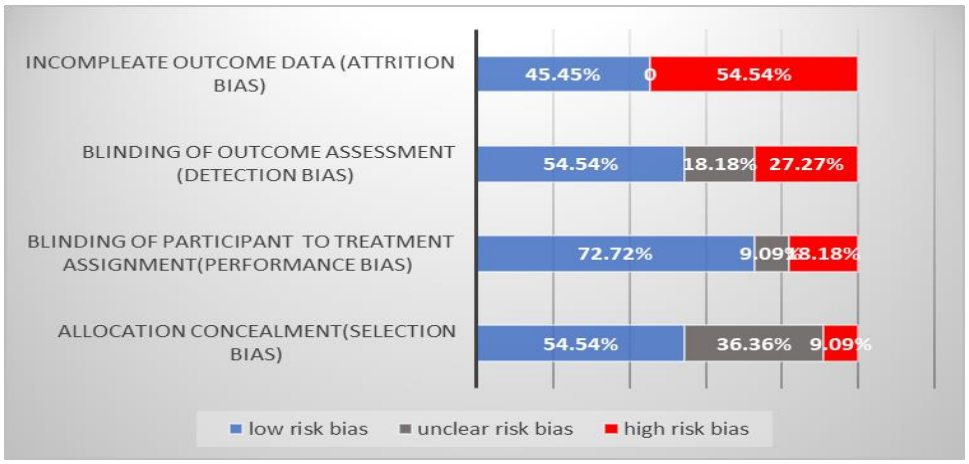


Figure 2 Bar graph showing percentage of studies at low, unclear, and high risk of different types of study bias for school-based tobacco cessation programs from 2007-2019

The reviewed studies were conducted in six different countries including the U.S.A (n=6), Spain (n=3), India (n=2), Germany (n=1), Thailand (n=1) and South Korea (n=1). We compared different articles with similar interventions and different outcome periods in our synthesis. Thus, we identified seven interventions in this systematic review. All articles published between 2007-2019. The study designs comprised of 11 randomized controlled trials and 3 non-randomized controlled trials. The studies' sample sizes ranged from 94 to 2801. Fourteen articles included male and female equally, while two studies included mostly males (Chansatitporn et al., 2016; Yu et al., 2019). The students participating in the included study ranged from age 11 to 19 years old at baseline (see table 2).

Table 1 Overview characteristics of smoking cessation programs among adolescent students studies from 2008-2019

| No | Type of Intervention | Design | Participants |
|---|---|---|---|
| 1 | Computerized Adolescent Smoking Cessation Program (CASCP) ( Fritz, et al. 2008) Country: USA | Quasi- experimental | -121 students, -Age: 14-19 years |
| 2 | Parental intervention Program (Krist, et al. 2016) Country: Germany | Three-armed cluster- rrandomized controlled trial | -2,801 students<br>- Age: 11-16 years |
| 3,4 | Physical activity and motivation interviewing ZHom et al. 2013), Blank et al. (2017) Country:USA | Randomized controlled trial | 232 students -Age : 14-19 years |
| 5,6 | Peer-led program (Perry et al. 2009) Country: India | A group-randomized trial | -14,063 students |
| 7 | Mother–adolescent dyads with health education Guilamo-Ramos, et al (2010). Country: USA | A randomized controlled trial. | -A total of 1,386 dyads (80% of those contacted). |
| 8,9 | Proactive, telephone counseling intervention (Peterson et al.,2009) Country: USA | A group randomized controlled trial. | - 2,151 smokers,<br>- Age: 16–21 years |
| 10, 11 | Project Ex curriculum, educational program (Espada et al.,2014; Espada et al. 2015) | Cluster-randomized-controlled-trial | -1,546 students<br>-Age : 13-19 years |
| 12 | Project Ex curriculum, educational program (Gonzalvez et al.,2017) Country: Spain | Group randomized controlled trial | -211 smokers<br>- Age: 13-19 years |
| 13 | Project Ex curriculum, educational program Chansatitporn, et al. (2016) Thailand | Quasi-experimental trial | -210 students<br>-Age:15.20 years<br>- Males 98% |
| 14 | Project Ex curriculum, educational program Yu, et al.,2019) South Korea | Quasi-experimental trial | -160 students<br>-Age: 14-20 years |

Included articles consist of seven different interventions including: 1) cognitive-behavioral approach and motivation interviewing (Fritz et al., 2008) 2) parental intervention Program (Krist et al., 2016) 3) physical activity and motivation interviewing (Horn et al., 2013; Blank et al., 2017) 4) peer-led program (Stigler et al., 2007; Perry et al., 2009) 5) mother–adolescent dyads with proactive health education (Guilamo-Ramos et al., 2010) 6) telephone counseling intervention (Peterson et al., 2009; Peterson et al., 2016) and 7) Project Ex curriculum, educational program (Espada et al., 2014; Espada et al., 2015; Gonzalvez et al.,2017; Chansatitporn et al., 2016; Yu et al., 2019) (see table 2).

The intervention components for students who smoked tobacco in thirteen studies were different and comprehensive. Three articles provided information about nicotine addiction, the harmful effects of smoking, and had a designated person teach students how to overcome the urge to smoke and to cope with withdrawal symptoms (Fritz et al., 2008; Horn et al., 2013; Krist et al., 2016; Blank et al., 2017).A brief intervention and exercise program were applied in two studies from America (Horn et al., 2013; Blank et al., 2017). Those in the N-O-T and N-O-T+FIT conditions also received 10 weekly educational sessions. The study participants self-reported their smoking cessation status at 3-months follow-up, which was coded as "quit" or "not quit" smoking. Two studies utilized a cognitive-behavioral and motivation interviewing (MI) approach delivered by trained counselors to change student smoking behavior (Peterson et al., 2009; Peterson et al., 2016). Trained counselors used cognitive behavioral therapy, with an MI communication style, through phone conversations to help the students prepare to stop smoking and to take action to do. In particular, the counselors helped the students (1) develop a plan for stopping, (2) identify potentially difficult situations or smoking triggers and suitable coping skills, and (3) set a stop date. In addition, another study used a cognitive-behavior approach delivered by computer sessions to help students control their smoking. The experimental group completed four 30-minute computer sessions over a period of 4 to 6 weeks (Fritz et al., 2008).

The peer-led program intervention consisted of behavioral classroom curricula which provided a comprehensive social influences program, with a focus on normative education and skill building. The intervention's knowledge components classroom curricula included creating school posters, parental postcard, peer-led health activism (Stigler et al., 2007; Perry et al., 2009). Towards No Tobacco Use (TNT) intervention involves a 10-day classroom-based curriculum, with each lesson lasting 45 minutes and a 2-lesson booster session (1 month and 6 months after completing the intervention.The intervention provided the information to mothers about effective communication and parental monitoring strategies for preventing adolescent tobacco use, and included homework for mothers about the consequences of smoking.

The well-known school-based intervention, Project EX, included eight sessions, in which each session was 40 to 45 minutes long. During the first four sessions, students are prepared to strengthen their resolve to quit smoking. The second four sessions are focused on attempts to quit smoking. The curriculum used of four talk show enactments of different smoking cessation issues, alternative medicine techniques, a homework assignment in which smokers identified what effects smoking had on them, a game about passive smoking and the consequences of tobacco, an exercise in which smokers notice the effects of not smoking cigarettes on them, a competitive game about how to quit smoking and strategies on how to maintain abstinence from smoking (Espada et al., 2014; Espada et al., 2015; Gonzalvez et al., 2017).

Though all retrieved studies evaluated the smoking cessation by using self- report, interventions ranged one day to six years. The effectiveness of study in this review was shown in short term and long term period follow-up. Computerized Adolescent Smoking Cessation Program (CASCP) has shown at 1 month after the intervention, 23% of the experimental group quit smoking (Fritz, et al. 2008). Parental intervention program with three-armed cluster-randomized controlled trial article from Geramany revealed that a intervention did not result in a statistically significant reduction in regular smoking compared with a control group or a student-only intervention at 12 and 24 months(Krist, et al. 2016). The effective studies of smoking reduction in student with physical activity and motivation interviewing intervention founded that teens with exercise 20 minutes were significantly more likely stop smoking and there is reduction in teen smoking for those who got the interventions at three month follow-up and (Blank et al., 2017; Hom et al., 2013). Two studies from India with peer-led and normative education program indicated that students in the intervention group were significantly less likely than students in the control group to exhibit increases in cigarette smoking over the 2-year study period (Stigler et al. 2007; Perry et al., 2009).

In addition, intervention of mother–adolescent dyads with health education have shown that the odds of smoking cigarettes were reduced by 42% for adolescents in the parent add-on condition versus the only classroom-based at fifteen months post-intervention (Guilamo-Ramos et al., 2010). The study of proactive, telephone counseling intervention had a long-term follow-up period from one year to seven years, the intervention increased the percentage who achieved 6-month prolonged smoking abstinence among all smokers however no evidence of intervention impact at seven years post high school graduation (Peterson et al. 2016). Project EX, was applied with school-based-smoking cessaion program located in Spain, Thailand and Korea. The clinic program of Project EX seem to be effective both short and long term period of school-based-smoking cessaion program as shown in Espada and colleagues (2015) which indicated that Project Ex significantly influenced on future smoking expectation. Moreover, the effective of Project Ex have been examine at the six-month follow-up, the percentage of quitters in the program group was 14.28%, whereas no smokers quit smoking in the control group (Espada et al., 2015) and finding from Projeect Ex inpremented in Thailand revealed that the quit rate at three months follow-up was 23% (Chansatitporn, et al., 2016) and 30.2% of quit rate in the program group in Korea's study.

Espada and colleagues used Project EX and claimed that Two articles have shown that the influence of long term intervention is that participants in the treatment group tend to smoke less in the future (Peterson et al., 2016; Blank et al., 2017). Studies utilizing Project Ex, Project MYTRI, and Not- on- Tobacco which included exercise interventions show that larger proportions of intervention participants quit smoking more than control participants for both short and long period follow-up time points (Fritz et al., 2008; Krist et al., 2016; Peterson et al., 2009; Peterson et al., 2016).

## Discussion

There was a variety of studies with evidence on interventions to helping young people to stop smoking. However, many trials did not have strong evidence and were not confident about wider application of the results. Various trials also differed in how they measured whether a person had quit smoking. We retrieved full-text articles in this review that reported smoking reduction using self-reported intention to quit smoking in short- and long-term time periods.

Researchers have reported strong evidence that Project Ex, originally developed as a clinic-based smoking cessation program in America, is effective (Fanshawe et al., 2017). Project Ex has been reported to result in high percentages of participants quitting smoking after a short follow-up time period in various countries (Reported as: duration of follow-up period; % of intervention participants that quit smoking at follow-up): China (4 months follow-up period; 11% of intervention group quit smoking) (Zheng et al., 2004), Russia (6 months; 7.5%) (Idrisov et al., 2013), Spain (6 months; 14.3%), and Thailand (3 months; 23%). However, the study in Spain which applied the Project EX school-based program found attrition bias. Thus, a limitation of this study was the high drop out rate of in follow-up process (62.4% retention rate after one year and 46.7% retention rate after two-year follow-up (Gonzálvez et al., 2017).

Two articles from U.S.A claimed that physical activity outcomes are strong evidence for teen participation stop smoking over three months. The authors explain that the physical activity may be easy to apply for students to practice in their daily life for stop smoking (Blank et al., 2017; Hom et al., 2013). The proactive personalized telephone intervention included applied cognitive behavioral therapy, with motivation interviewing to help the student prepare for stopping and to take action to do. This study showed strong evidence that the intervention impacted both long and short-duration smoking abstinence endpoints and for progress toward smoking cessation (Stigler et al., 2007; Guilamo-Ramos et al., 2010; Espada et al., 2015).

In the study which included parent involvement, Krist (2016) reported that adding parent involvement to the intervention did not result in a statistically significant reduction in regular smoking compared with a control group or a student-only intervention at 12 and 24 months (Fritz et al., 2008). The researcher commented that a limitation of this study is that parental intervention was not consistently implemented in all schools, but instead varied across schools and classes. There was also a universal policy change to restrict in teen smoking, which affected all students regardless of whether they were in the intervention or control group. In contrast, project Towards No Tobacco Use (TNT) was effective at one-year follow-up. The odds of smoking cigarettes were reduced by 42% for adolescents in the parent add-on condition versus the TNT-only condition (Perry et al., 2009).

The strengths of this study are most of the studies (11 out of 14) were randomized controlled trials with measurement of self-reported smoking at baseline and at the endpoint of intervention. However, comparison of outcomes among various studies is difficult because most of included study were indicated short-term period outcome of intervention and high of dropout rate intervention at follow-up period. A limitation of our review is that we used three databases focusing on the peer-reviewed literature, so we may have excluded program reports and grey literature with useful and effective smoking cessation programs.

## Conclusions

This review included fourteen studies from different countries and found that three programs: 1) Project Ex 2) the proactive personalized telephone intervention applied cognitive behavioral therapy plus motivation interviewing and 3) N-O-T plus exercise showed the strong evidence of reducing teen smoking. One important finding is that we identified good outcomes from specific intervention components in various study. These components can incorporate into school policy to stop smoking among students in public school. These results addressed Project Ex may be useful for makers of education policy in Thailand to develop effective behavioral modification programs in the curriculum to reduce teen smoking. Further research should involve in meta-analysis which include standardizing of the trial design, definitions of smoking status, and the content of interventions.

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