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Amanita K. Hana

School of Public Health, Seoul National University, South Korea, hanach1310@snu.ac.kr

Sung-il Cho

Graduate School of Public Health, Seoul National University, Korea 08826, South Korea

Eunsil Cheon

Graduate School of Public Health, Seoul National University, Korea 08826, South Korea

Suhyun Kwon

Graduate School of Public Health, Seoul National University, Korea 08826, South Korea

Rajapakshe Thishani

Department of Biochemistry and Molecular Biology, Irving K. Barber School of Arts and Sciences, University of British Columbia, Vancouver, BC V6T 1Z1, Canada

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A Systematic Review of the Association Between Intrapersonal Factors and Smoking Cessation in Adolescents in the United States

Amanita K Hana^{1*}, Sung-il Cho¹, Eunsil Cheon¹, Suhyun Kwon¹, Rajapakshe Thishani²

1. Graduate School of Public Health, Seoul National University, Korea 08826, Republic of Korea
2. Department of Biochemistry and Molecular Biology, Irving K. Barber School of Arts and Sciences, University of British Columbia, Vancouver, BC V6T 1Z1, Canada

*E-mail: hanach1310@snu.ac.kr

Abstract

Background: Premature death in developed countries, and smoking by adolescents is a serious health issue in the US. There are several aspects that influence smoking cessation in adolescents, one of which comprises intrapersonal factors. The aim of this systematic review was therefore to identify and categorize specific intrapersonal factors that affect the smoking cessation of adolescents in the United States. **Methods:** Through a search on PubMed, identified quantitative research studies on the intrapersonal factors affecting the smoking cessation of adolescents in the US. The search results imported into Endnote X9. The intrapersonal factors examined into 4 classifications: nicotine dependence, stress, related beliefs, and other emotional factors. Each study's bias was assessed using RoBAN and RevMan 5. **Results:** The sample sizes ranged from 66 to 975 participants, with an age range of 12–21 years. 7 studies were classified as covering nicotine dependence, 2 studies as covering other emotional factors, 1 study was classified as covering related beliefs, and 1 study was classified as covering stress. **Conclusions:** Nicotine dependency was found to have the highest incidence among all the contributing factors. Stress and other emotional factors were found to stem from depression and low emotional control.

Keywords: adolescents, nicotine, smoking cessation, stress

Introduction

Smoking is the main cause of premature death in developed countries due to its causal link to chronic diseases such as cardiovascular disease and various types of cancer. Tobacco use was responsible for more than 1 million deaths among smokers aged 35 to 69 years, with a mean of 22 years of life lost for those individuals.¹ Second-hand smoke is also directly linked to non-communicable diseases such as cardiovascular disease and cancer and affects the health of infants and children.² Smoking among adolescents is considered a serious health problem because adults who smoke begin using tobacco during their adolescence. The adolescent brain is still developing and is therefore more susceptible to nicotine's effects on the brain's reward system and aspects involved in emotional and cognitive functions. Numerous studies have concluded that smoking in early youth is a major predictor of smoking habits in adulthood.³ A study in 1995 reported that 63.5% of a group of high school seniors had smoked, while 34% of the seniors reported having smoked cigarettes within the last 30 days.⁴ Even though since 2000, there has been a steep decline in the rate of young people smoking in the US from 25% in 1998 to 6% in 2015, smoking is still a

serious problem as 3.6 million middle and high school students were current cigarette smokers in 2017.⁶ Eighty-four percent of adolescents 12–18 years of age who smoked numerous packs of cigarettes a day admitted being dependent on cigarettes.¹ Logically, smoking cessation is a behaviorally different process for adolescents than for adults due to the unique characteristics of adolescents, such as high sensitivity to intrapersonal and interpersonal factors. Cigarette smoking among adolescents is therefore a substantial public health problem. Figure 1 displays a map of the smoking prevalence of adolescents worldwide (2016), created using World Health Organization's Global Health Observatory dataset "Prevalence-most recent youth survey data by country." from the map we can see that adolescence smoking prevalence relatively high in USA, This systematic review therefore focused on adolescents in the United States.⁷

Intrapersonal factors are a set of influences within the individual's mind or self. Considerable research has been conducted on the association between intrapersonal factors and smoking cessation. However, the criteria for intrapersonal factors differ among the studies, and no global standard has been ratified. For example, the study by Yu *et al.* included the following interpersonal factors:

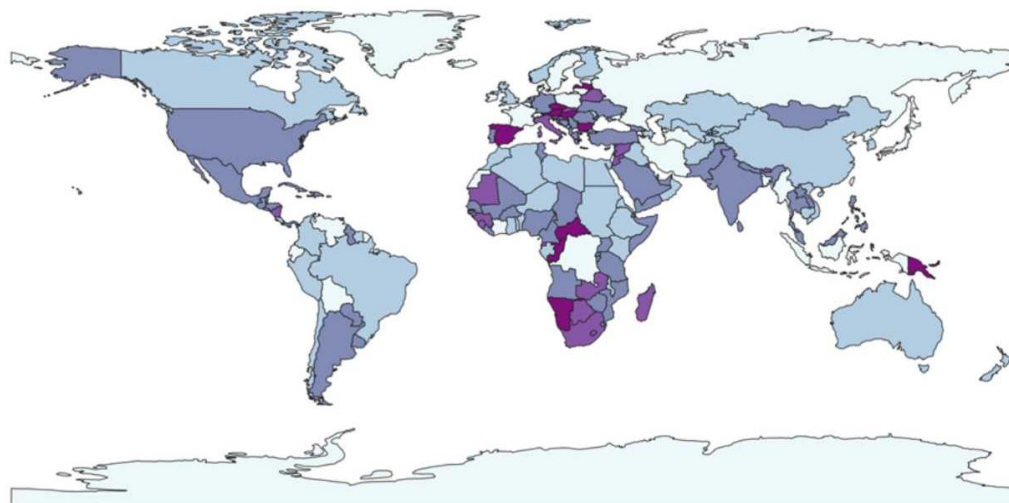
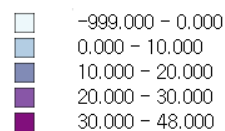


Figure 1. Map of smoking prevalence among adolescents worldwide (2016)⁷



age, sex, weekly income, safety perception of 1 year of smoking, awareness of the harmful effects of second-hand smoke, and positive images of smoking.⁸ The study by Loon *et al.*⁹ included self-efficacy, depression, mastery, extraversion, neuroticism, and hostility. There is an obvious need for establishing our own set of criteria for intrapersonal factors. We therefore divided intrapersonal factors into 3 categories: nicotine dependence, stress, and other factors (internalizing behavior, belief etc.) Nicotine dependence and withdrawal are often associated with constant smoking and the difficulty in quitting smoking. Nicotine dependence could play an essential role in retaining a smoking status among adolescents as they progress from an experimental experience to regular smoking. There is research supporting this claim; a study in the United Kingdom stated that 63% of 116 young female smokers reported a greater severity of withdrawal symptoms during previous attempts to quit and that the symptoms were directly related to the level of cigarette use.¹⁰ In a study of 77 adolescent smokers in a youth detention center, 42% reported having relatively high levels of nicotine dependence, and approximately 80% reported previous attempts at smoking cessation failed due to nicotine cravings.¹¹ However, only a few studies have employed formally structured interviews to diagnose nicotine dependence, while most studies have relied on self-reporting measures such as the Fagerstrom Tolerance Questionnaire (FTQ, 1978) or the modified FTQ (mFTQ, 1998). The FTQ was developed to help clinicians and researchers classify individuals who smoke based on their level of nicotine dependence. The differences in measurements, however, make it difficult to directly compare the results across studies.¹²

Psychological stress can influence smoking-related behaviors such as initiation, maintenance, and relapse. Exposure to stress can lessen self-regulation in controlling the urge to smoke. Previous observational studies have shown that severe and persistent stressors are related to a higher prevalence of smoking compared with individuals who did not experience the stressors.¹³ A number of studies have suggested that stress can trigger smoking behaviors and is related to an increased urge to smoke. Individuals who smoke often report that they smoke to relax or reduce stress-induced pressure.¹⁴

We included other factors that could be considered internalized behaviors such as depression, anxiety, beliefs about smoking, neuroticism, impulsivity, and self-efficacy. We selected these intrapersonal factors at the start of the study and reorganized them after the review was complete. The aim of this systematic review was to assess and interpret the association between intrapersonal factors and smoking cessation among adolescents in the US, where the prevalence of adolescent smokers is high. We established guidelines roughly in accordance with the PICO (Population, Intervention, Comparison, Outcome) model. The population consisted of US adolescents of both sexes who smoke. The analysis focused on intrapersonal factors such as stress, nicotine dependence, and other emotions. Our study did not use a comparison group, and the outcome was smoking cessation success or failure. The goal of this systematic review was to identify the specific intrapersonal factors that affect the smoking cessation status of adolescents in the US.

Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist. We conducted a systematic search using PubMed and the Google Scholar databases using the search query “(tobacco OR cigarette OR smoking OR cigar) AND (teen OR adolescent OR youth) AND (cessation OR quit),” which resulted in 8015 initial search hits. The limitations were “humans,” “English,” and publication date from January 1, 1999, to May 7, 2018, which resulted in 4989 articles.

We imported the database results into Endnote X9 and removed the duplicates. We extracted data based on the following categories: sample size, participant characteristics, study design, country, criteria of interpersonal factors, and results. Among the 4989 articles, we conducted a title scan and manually excluded articles using the following categories: interpersonal studies, college-conducted studies, therapies, interventions, and duplicates. We included journals related to failure, reasons, intrapersonal aspects, stress, depression, and mental factors. Of the 19 selected articles, we ultimately chose 11 after another review of the abstracts. Figure 2 displays the process in detail. Each of the authors of this

study reviewed 2–3 journals, and discrepancies between the authors were discussed among all authors of this review.

To assess the bias, we employed the Risk of Bias Assessment Tool for Non-randomized Studies (RoBANS) (Figure 3), which covers 6 domains; “confounding variables” (selection bias caused by inadequate selection of participants), “blinding of outcome assessment” (detection bias caused by inadequate blinding of outcome assessment), “selection of participants,” “incomplete outcome data” (attrition bias caused by improper handling of incomplete outcome data), “intervention (exposure) measurement” (selection bias caused by inadequate confirmation and consideration of confounding variable), and “selective outcome reporting” (reporting bias caused by selective outcome reporting), with scores of “low,” “high” or “unclear.” We employed Review Manager5 (RevMan5) software to prepare and maintain the Cochrane reviews. RoBANS can be incorporated into the RevMan5 program. Each author assessed the bias of 2–3 journals and subsequently assessed the total bias of the journals (Figure 4 and Figure 5).

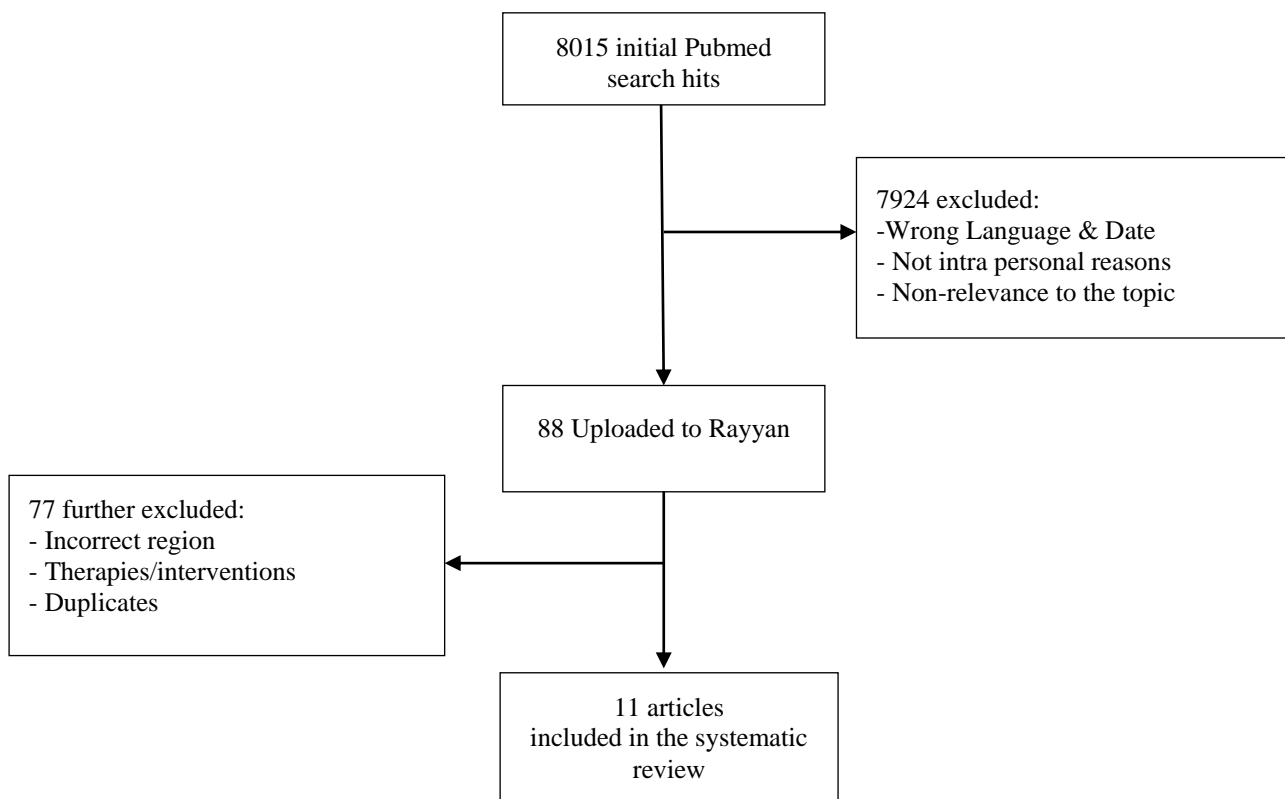


Figure 2. Results of a systematic search in the pubmed and google databases related to the smoking cessation

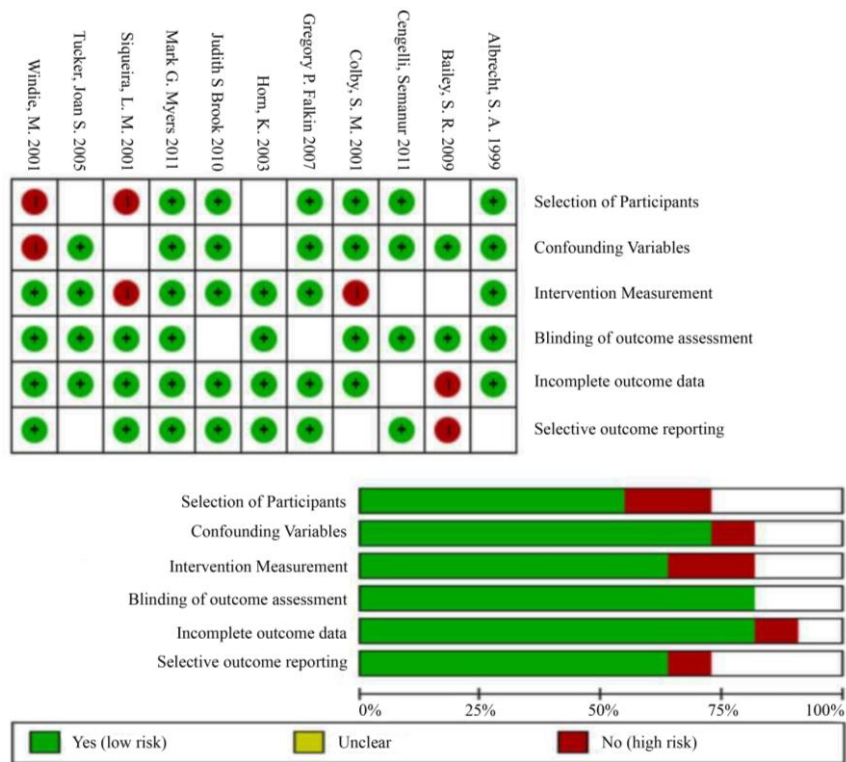


Figure 3. The developed and validated version of RoBANS

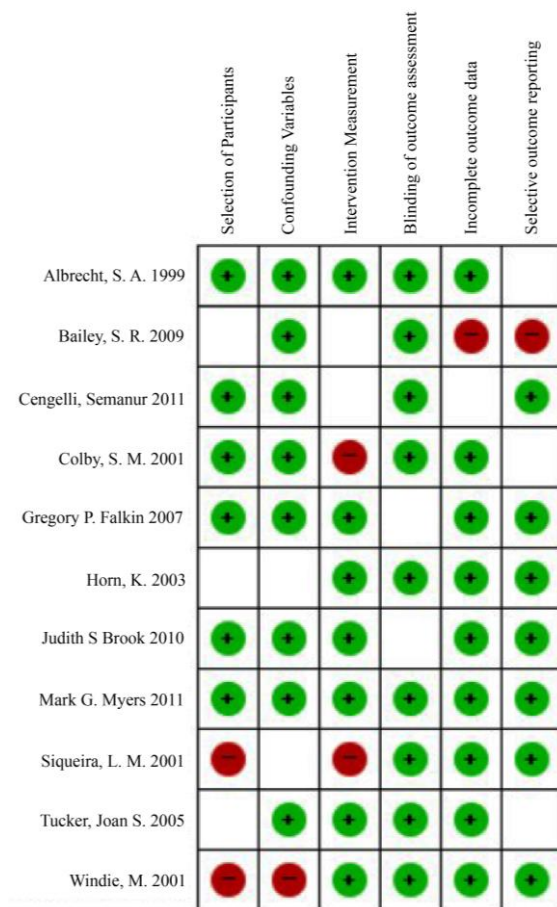


Figure 4. Risk of bias summary: judgement about risk of bias for each included study

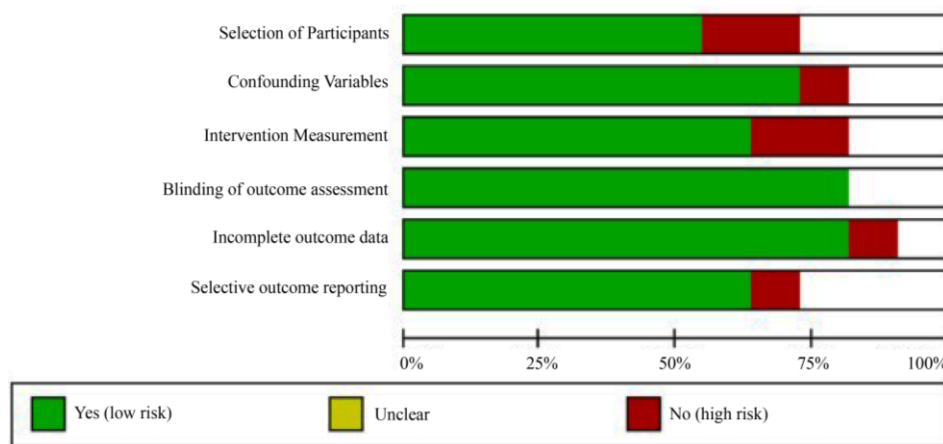


Figure 5. Risk of bias graph: Judgement about risk of bias presented as percentages across all included studies

Results

Study Selection. From the 1028 articles identified by the employed keywords, 88 remained after removing articles with non-English text, those containing non-intrapersonal factors, articles older than 1999, and those containing irrelevant topics. Further screening excluded 77 articles whose study region was not the US, as well as a number of articles with therapies and intervention, resulting in a total of 11 articles for the systematic review.

General Study Characteristics. All 11 studies examined the association between intrapersonal factors influencing smoking cessation success and failure for adolescents in the US.

As seen on Table 1, the intrapersonal factors in each study were categorized into 3 classifications: nicotine dependence, stress, and other emotional factors. More than half of the studies (7 studies) were classified into nicotine dependence, 3 were classified into other emotional factors, and 1 was classified into stress. Sample sizes ranged from 66 to 975 participants, with an age range of 12–21 years.

Half of the studies (54%) were published between 2005 and 2011, and the remaining articles were published from 1999 to 2003. All studies were conducted in the US, 3 of which were longitudinal, 2 were cross-sectional, and the rest were case-control and prospective studies.

Measurement and Analysis of Intrapersonal Factors Affecting Smoking Cessation. We assessed 4 studies classified into nicotine dependence factors using a modified FTQ for adolescents, while the other 3 studies that fall into this classification were examined using a smoking patterns questionnaire that included frequency of smoking, duration of smoking, and age at the start of smoking.

We assessed studies of other emotional factors by employing the Center for Epidemiological Studies Depression Scale and a linear structural relations (LISREL) analysis of internalizing behaviors and emotional control. Another study classified into the stress factor was analyzed using grounded theory and consisted of several processes to identify the most important topics from the data. Individual interviews in the study were interpreted qualitatively, and the text files were imported into Atlas/ti, a program for coding and managing qualitative data.

Association between Nicotine Dependence Factors and Smoking Cessation Failure. Nicotine dependence factors were classified into 5 categories: withdrawal symptoms, blood nicotine level, and age at the start of smoking, frequency of smoking, and duration of smoking. Those individuals with a higher dependency on nicotine tended to have more severe withdrawal symptoms, making cessation harder. The higher the blood nicotine level, the harder it was to quit. The younger the individual at the start of smoking, the greater the difficulty in quitting. The frequency and duration of smoking also affected smoking cessation attempts; the more frequent and longer a person had smoked, the harder it was for them to quit.

Association between Other Emotional Factors and Smoking Cessation Failure. The emotional factors category included depression and low emotional control. Severe and constant depressive symptoms were potential predictors of increased smoking behavior. When these individuals encountered such situations, the urge increased to smoke again to overcome their depression. Low educational expectations were also related to being “unconventional,” which was associated with low emotional control and having internalizing behaviors directly related to a lower tendency to attempt smoking cessation.

Table 1. Study characteristics: design, demographics, and measures of intrapersonal factors of smoking cessation attempts

Type of Study Assessment	Demographics Age, Sample Size	Assessment	Results
Albrecht, S. A. (1999) ¹⁵ Cross-sectional study Voluntary Fagerstrom Tolerance Questionnaire	94 pregnant adolescents African American, 59.6%; Asian/Pacific Islander, 1.1%; Hispanic, 1.1%; and European American, 38.3%. Average age: 17 years	Average daily number of cigarettes per day Age at start of smoking, duration of smoking	Those who smoked more than 10 cigarettes per day reported experiencing more withdrawal symptoms. Lighter smokers had a greater tendency to quit smoking after a previous attempt.
Myers, M. G. (2011) ¹⁶ 4 independent smoking cessation trials	2011 Age: 13-18 Participants from 4 studies of adolescent smoking cessation treatment who reported having attempted smoking cessation for at least 24 hours but eventually resumed smoking. P Size: 204	Characteristics of adolescents who relapsed to smoking after attempting to quit. Recent cigarette use (Time-Line Follow-Back procedure; TLFB). Cigarette use history (Customary Drinking and Drug Use Record) Cigarette use history (Adolescent Smoking History and Patterns Questionnaire) Nicotine dependence (mFTQ) Lapse characteristics Precipitants (the Adolescent Smoking Relapse Review)	The relapse occurred while socializing with friends at home. Social pressure and cravings were the common triggers for smoking relapses. The most commonly reported influence was negative emotions, cigarette cravings and the idea that it is okay to smoke occasionally or just wanted to see what it would be like.
Horn, K. (2003) ¹⁷ Case-control study Self-administered questionnaire	365 adolescents 153 males/212 females White: 81% Hispanic:11% Average age range:14–19 years	Smoking patterns (age at start of smoking, number of cigarettes smoked per weekday and on weekends) Current smoking status Nicotine dependence (Fagerstrom Tolerance questionnaire)	The more cigarettes smoked and the longer an individual smoked daily, the greater the dependence. Adolescent who smoked heavily would have lower cessation rates than those smoked lightly
Siqueira, L. M. (2001) ¹⁸ Cross-sectional study Self-administered questionnaire	354 patients between the age of 12 and 21 years who reported past or present smoking	Smoking status Perceived reasons for continued smoking Attempts to quit, withdrawal symptoms Standardized scales assessing nicotine dependence, stress, and coping methods	Those who experience more withdrawal symptoms and higher stress and who had fewer cognitive coping skills had a lower tendency to quit of their own volition.
Bailey, S. R. (2009) ¹⁹ Collected questionnaires before each smoking cessation treatment (once a week–10 times: 10 weeks) Self-administered questionnaire	66 adolescent smokers from a high school in the San Francisco Bay Area during the 2007-2008 academic school year (14–18 years of age; smoking at least 5 cigarettes per day; an interest in quitting smoking; no current use of antidepressants, antipsychotics, benzodiazepines; not currently seeing a psychologist or physician for major depression, panic disorder, social anxiety, or agoraphobia; no current heavy alcohol or substance use)	Nicotine withdrawal symptoms (measured with DSM-IV-TR)–anxiety, sleepiness, depression, difficulty focusing, frustration, restlessness, anger Modified Fagerstrom Tolerance Questionnaire (mFTQ)–helping researchers classify smokers based on their level of nicotine dependence (scoring: below 13, low nicotine dependence; 13–15, medium nicotine dependence; above 16, high nicotine dependence)	Baseline mFTQ score [6-23]: 14.3 (3.6) 47 of 66 reduced smoking by at least 50%, and 19 of 66 ceased smoking for at least 1 week. Baseline mFTQ scores were correlated with craving (p<0.001), anxiety (p<0.001) and frustration (p<0.0001). Nicotine withdrawal symptoms varied by degrees of nicotine dependence.
Killen J. D. (2001) ²⁰ Controlled prospective study (Session 1 (baseline) + Session 2), was conducted over a 2- year period.	92 adolescent smokers (41 girls and 51 boys) from a shelter for homeless youth and 2 alternative high schools (13–18 years of age; smoked a minimum of 10 cigarettes per day; expired air carbon monoxide (CO) level of at least 5 ppm)	Nicotine withdrawal symptoms (DSM-IV)–a scale from 1 (no symptoms) to 10 (severe symptoms) (anxiety, sleepiness, depression, difficult focusing, frustration, restlessness, anger) Expired air CO levels–useful index to verify smoking status	The first hypothesis (heart rate would decrease from S1 to S2 only in the placebo condition) was confirmed. The second hypothesis (subjective withdrawal symptoms would increase significantly from S1 to S2 only in the placebo condition) was not confirmed.
The assessment for S1 and S2 were identical (randomly wear placebo patch or nicotine patch), but at S2, participants were not permitted to use any tobacco.	The researcher visited each site by LPCH health van between December 1997 and July 1999.	Modified Fagerstrom Tolerance Questionnaire (mFTQ)–5 questions modified from FTQ	

Table 1. Continued

Type of Study Assessment	Demographics Age, Sample Size	Assessment	Results
Tucker, Joan S. (2005)²¹ Longitudinal study Self-administered postal questionnaires	527 males and females in the RAND Adolescent/Young Adult Panel Study (California/Oregon)	Smoking, cessation attempts, and cessation status Multivariate analyses conducted with and without 2 smoking-related predictor variables, age at initial cigarette use, quantity-frequency measure of smoking representing the average quantity of cigarettes smoked per day during the past 30 days	Among smokers aged between 23-29 years, 76% attempted to quit, and 26% quit for 6 months or longer.
Other Emotional Factors			
Cengelli, Semanur (2010)²² Longitudinal Population-based Systematic Review	Various studies found from 1984-2011. Varying demographics, varying size	Tobacco, stop, quit, and cessation as keywords for search 502 titles and 871 abstracts searched 9 articles were kept for data abstraction	5 factors affecting success smoking cessation: ♦ not having any peers who smoke ♦ having no thoughts of smoking in the future ♦ resisting peer pressure to smoke ♦ being older when first starting to smoke ♦ having negative beliefs about smoking
Brook, J. S. (2010)²³ Structured interviews	2010 Random sample of adolescents residing in upstate New York Population size: 400	LISREL analysis generally supported the hypothesized model. Partial covariance matrices employed as the input matrices to account for the influence of the participants' age and sex and their parents' educational level.	Having parents who smoked and having low educational expectations related to being unconventional, which was associated with having low emotional control and having more internalizing behaviors that were directly related to a lower tendency to quit smoking.
Windle, M. (2001)²⁴ Longitudinal study Self-administered questionnaire	975 high school sophomores (53%) and juniors (47%) recruited from 2 homogeneous suburban high school districts in western New York Average age: 15.54 years	Depressive symptoms—data collection using the Center for Epidemiologic Studies Depression Scale (20 self-reported items) Smoking status	Severe and constant depressive symptoms were potential predictors of increased cigarette use.
Stress Factors			
Falkin, G. P. (2007)²⁵ Individual interviews Focus group interview	2007 Teenagers in New York City Age: 16-18 P Size: 54	Quitting experience: perception, reasons, strategies, method Data analysis was developed using grounded theory and comprised several processes to identify the most important topics from the data. First, each individual audiotaped interview was appropriately analyzed, and the text files were imported into Atlas/ti, a program for coding and managing qualitative data	54 adolescents resumed smoking and then tried to quit several times. The main barrier to smoking cessation was the unanimous belief that quitting smoking meant that they would stop smoking forever. The daily stresses also made it difficult for the adolescents to abstain from smoking.

Association between Stress Factors and Smoking Cessation Failure. Daily stress made it difficult for the adolescents to abstain from smoking. The stress was mostly due to family and friends. Arguments with parents or friends that the adolescents could no longer cope with resulted in the adolescents resorting to cigarette use. The pressure to do well in school was often a source of stress, as was the pressure due to job conditions and stressors, making it hard for the adolescents to resist resuming smoking.

Other Findings: Related Beliefs. In addition to the 3 previously mentioned factors, we discovered another factor: related beliefs, which included negative

preconceived notions and fear of permanence. Negative beliefs regarding cigarette and smoking tend to result in longer periods of smoking cessation than when the negative beliefs are not present. The success of smoking cessation can be boosted by other aspects such as not having thoughts of smoking in the future and the ability to resist peer pressure regarding smoking. Fear of permanence was another factor affecting smoking cessation, a belief that quitting smoking meant quitting forever, an ideal that put significant pressure on some adolescents, given that the lifestyle associated with constant smoking is hard to leave, a goal that was difficult for them to imagine achieving.

Discussion

Interpersonal contributors to smoking cessation failure are multifactorial, and it is critical to address these issues when considering the high proportion of adolescent smokers who want to quit. We hypothesized that 3 main interpersonal factors would directly affect smoking cessation: nicotine dependency, stress, and a generalized “other” category for symptoms and emotions such as depression, anxiety, impulsivity, and self-efficacy. In this review of 10 longitudinal studies and 1 previous systematic review, we identified 4 factors could have significant intrapersonal effects: nicotine dependence, stress, related beliefs, and other emotional factors.

Most prominently, nicotine dependency was found to have the highest incidence among all the contributing factors. This factor included any biological repercussions due to the intensity and frequency of tobacco usage. We could speculate that nicotine dependency would be the most critical factor to target when designing a prospective smoking cessation intervention. More than half of the analyzed papers studied aspects of nicotine dependency and its repercussions, in particular, the intensity of withdrawal symptoms, measured blood nicotine levels, the age of onset of smoking, the frequency of smoking, and the duration of time spent as a smoker. These aspects are unsurprising, given the well-known impact of nicotine addiction on withdrawal symptoms and relapse in adult smokers.

Stress was proposed to have a significant impact on the ability to quit, and we expected a high proportion of papers to analyze this aspect. However, only one paper made a notable connection between stress as predictor of failure to quit. Perhaps this failure is due to the fact that stress is considered an outcome alongside tobacco use as a response to other factors, such as intrapersonal relationships. Adolescent perspectives and general beliefs regarding tobacco use were an unexpected finding of the review. Preconceived notions about the effects of tobacco, perceived health status, and negative beliefs and fear of quitting permanently were noted in multiple studies. Associations with lifestyle and anxiety about giving up smoking forever were also found. These are valuable findings by which modifications in treatment plans and cessation interventions might yield better results.

Finally, emotional factors such as internalizing behaviors, anxiety, and frustration had a negative impact on the ability to quit successfully. Only certain aspects of the emotional factors initially proposed were observed in the participants of the systematic review. It is also possible that there is a strong relationship between intrapersonal and interpersonal factors. The desire to

quit is multifactorial, and interpersonal aspects are often confounded by environmental and socioeconomic aspects. While the interconnectedness of these factors is likely, it remains important to target treatments to specific interpersonal issues as well. The systematic review we conducted had limitations that reduce the generalizability of the results. Each paper had a different nicotine dependency index, thus, it was impossible to streamline the data and statistics. Instead, a descriptive analysis was performed. This review allowed for no consideration of characteristics such as race, ethnicity, or gender. The lack of diverse research in this field, and well as unstratified data on these variables in the articles analyzed, made it difficult to draw generalizable conclusions. It was particularly difficult to synthesize the studies from 1999 to 2011. Youth access and attitudes toward tobacco might have changed during this time period. In addition, the effects of the recent development of e-cigarettes on smoking cessation is not well known. There is also the possibility of other interpersonal factors impacting cessation failure that were identified in the currently available literature. We were unable to confirm the impact of proposed factors like neuroticism, impulsivity, and self-efficacy. Limiting the participants of the systematic review to the United States adds a further limitation to the applicability of the results to other countries.

Conclusions

The current database on research pertaining to the intrapersonal factors involved in smoking cessation among adolescents is limited. The intrapersonal factors most often studied in the literature are similar in scope (nicotine dependence, stress). The intrapersonal and environmental influences on smoking cessation for adolescents have been studied in greater depth yet still fall short when compared with the quantity of studies on adult populations. This lack of focus on the intrapersonal aspects of adolescents raises the possibility for further research on the subject. Given that most cases of long-term smoking and lung cancer begin with tobacco use at a young age, it is critical that we address this susceptible population. Future research into the particular issues of intrapersonal aspects among adolescents who smoke could provide new insight and value when designing intervention treatments and policy targets. However, health professionals should view these studies with caution until the findings can be replicated with large and diverse populations. Employing multidimensional approaches (with a greater consideration for intrapersonal factors) to intensive interventions could yield greater success for tobacco cessation among adolescents.

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Conflict of Interest Statement

There were no conflicts of interest.

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