Associations between Smoking and Depression in Adolescence: An Integrative Review

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Background. Although research has established the existence of an association between smoking and depression among adolescents, researchers have not reached consensus on the nature of the association.

Objectives. The purpose of this paper is to review the literature, to examine the nature of the relationship between smoking and depression in adolescence, and to suggest future research directions.

Method. A literature search was conducted from the following six databases: (a) Ovid MEDLINE, (b) CINAHL, (c) PubMed Unrestricted, (d) PsycINFO, (e) ERIC, and (f) Sociological Abstracts. The combinations of the words, "depression," "smoking," "tobacco," "adolescent," and "teen" were used for keyword searches to find relevant articles.

Results. In 47 of 57 studies, significant associations between smoking and depression were found. However, these significant relationships may either be spurious or unrelated to depression because a substantial number of studies did not adjust for confounders or did not use validated instruments to measure depression. Additionally, if the relationship is causal, its direction remains controversial. Five relationships have been suggested: (a) Depression causes smoking, (b) smoking causes depression, (c) there is a bidirectional relationship between smoking and depression, (d) smoking and depression occur due to confounders, and (e) subgroups with different relationships between the two conditions exist.

Conclusions. It is necessary to further explore the relationship between smoking and depression. Future research should consider the need for: (a) longitudinal research designs, (b) more accurate measurement of depression, and (c) the control of confounders between smoking and depression.

Key Words : Smoking; Depression; Adolescents; Teens; Review

INTRODUCTION

In the United States, smoking is the leading cause of preventable death (Center for Disease Control and Prevention [CDC], 2002), and it is widely known that smoking has detrimental effects, both acute and chronic, on health such as bronchitis, asthma, and cancer (Arday et al., 1995). Although the percentages of experimental and regular smoking among adolescents have decreased since 2001, smoking among adolescents is still prevalent (CDC, 2004). Thus, adolescent smoking is a great concern. Depression is another major concern during adolescence for the following reasons: (a) the high prevalence of major depressive disorder (MDD) in adolescence (i.e., 15 to 20 %), (b) high recurrence of MDD (i.e., approximately 25% by 1 year, 40% by 2 years, and 70% by 5 years), and (c) high rate of suicide attempts

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among depressed adolescents (approximately 30% among clinically depressed youngsters by age 17) (Cicchetti & Toth, 1998; Mash & Wolfe, 2002).

Researchers have suggested that smoking and depression are associated. However, in the literature, researchers have not reached a consensus on the nature of the relationship between smoking and depression. The current literature suggests five possible relationships between the two conditions. The first suggested relationship is that depression causes smoking. This idea is based on the "self-medication" hypothesis. This hypothesis posits that when people are depressed or cannot control negative feelings, they begin smoking to alleviate their depressive symptoms (Lerman et al., 1996). Studies have shown that nicotine can function as an anti-depressant (Hall, Muñoz, Reus, & Sees, 1993). Administration of nicotine increases the release of such neurotransmitters as dopamine, norepinephrine, and acetylcholine, which may help people change their negative affects into positive ones (Hall et al., 1993).

The second suggested relationship is that smoking causes depression. Smoking may increase stress levels, and in turn heightened stress levels may trigger the development of depression (Brook, Schuster, & Zhang, 2004). Parrott (1999) also proposes that smoking directly increases stress and that the potential soothing effects of smoking merely represent a temporary decrease in stress triggered by lack of nicotine. Levels of daily stress among smokers are higher than among non-smokers because stress repeatedly increases due to nicotine abstinence (Parrott, 1999). The third hypothesis proposes that the relationship is not unidirectional but bidirectional. This hypothesis suggests that either stress or negative mood can encourage smoking that may then influence the development of depression through a change in a neurochemical system (Wang, Fitzhugh, Westerfield, & Eddy, 1994). The fourth assertion about relationships between smoking and depression is the "comorbidity" hypothesis. This hypothesis suggests that the relationship between smoking and depression is non-causal (Kendler et al., 1993). This hypothesis postulates that there are common factors (e.g., genetics) that influence both smoking and depression, and due to these common factors, smoking and depression occur together. Lastly, Rodriguez, Moss, and Audrain-McGovern (2005) suggest that the relationship between smoking and depression is not homogeneous in a population and that subpopulations may have different relationships between the two conditions.

Understanding the nature of the relationship between smoking and depression will be important for developing strategies to diminish the prevalence of both conditions. Glassman et al. (1988) suggest that depressed smokers are less likely to quit smoking. They found that a history of depression was prevalent among smokers who wanted to stop smoking but that these smokers' attempts to quit smoking were less likely to be successful than smokers with no history of depression. This may be the case because depressed people need the neurochemical release that is stimulated by nicotine in order to change their negative mood. Researchers have attempted to use antidepressants to help people stop smoking based on the "self-medication" hypothesis. Hall et al. (2002), found that the use of anti-depressants (e. g., nortriptyline) facilitated smoking cessation. However, as we show below, the "self-medication" hypothesis is itself still subject to dispute in the literature. Hence, strategies to reduce the prevalence of smoking and depression will differ based on the nature of the relationship between the two conditions. Thus, identifying the nature of the relationship remains a critical matter.

The purpose of this paper is to review studies that examine relationships between engagement in smoking (i.e., the onset of smoking or progression to higher levels of smoking) and clinical symptoms of depression. This paper also examines the measurement of depression and the potential role of confounders. Finally, based on this review, gaps in current knowledge and suggestions for future research directions are identified.

METHODS

A literature search was conducted from the following six databases: (a) Ovid MEDLINE from 1966 to January 2005, (b) CINAHL (Cumulative Index to Nursing and Allied Health Literature) from 1982 to January 2005, (c) PubMed Unrestricted, (d) PsycINFO from 1887 to January 2005, (e) ERIC from 1966 to January 2005, and (f) Sociological Abstracts from 1963 to January 2005. The combinations of the words, "depression," "smoking," "tobacco," "adolescent," and "teen" were used for keyword searches to find relevant articles.

Inclusion and exclusion criteria for this paper are as follows. First, articles examining an adolescent population were selected. It is difficult to define an adolescent period based on chronological age, but it is generally

considered that adolescence begins with puberty and ends with role changes such as marriage, financial independence, and the ending of formal education (Dusek, 1996; McCandless & Coop, 1979). Thus, this paper reviewed studies examining respondents attending middle and high schools, but excluded studies examining college students. Second, only community-based studies were selected. Hospital-based studies were excluded due to the possibility of Berkson's bias, which states that it is more likely to find significant associations among hospital-based samples than community-based samples (Berkson, 1946). Martini, Wagner, and Anthony (2002) raise the possibility of Berkson's bias regarding associations between smoking and depression among clinic-based samples: Smokers who seek treatments at clinics may suffer more from unpleasant mood states or other smoking-related diseases than smokers who do not seek treatment. Consequently, it is more likely to find significant associations between smoking and depression in hospital-based studies. Therefore, Martini et al. (2002) stress the importance of using community-based samples in investigating associations between smoking and depression. Third, only articles written in English were included for review. Articles written in Korean were excluded because all the studies conducted in South Korea are cross-sectional, and as a result provide limited information on the nature of the relationship between smoking and depression. In other words, cross-sectional studies cannot provide information on causalities between two conditions and an impact of a third factor on them, and thus does not add much knowledge to the paper. Finally, articles investigating smoking initiation or progression to higher levels of smoking associated with depression were selected. Studies linked with smoking cessation were excluded from the sample, because the focus of this paper is to reveal how engagement in smoking behavior is associated with depression in the literature.

Association between Smoking and Depression

Of 57 articles that were reviewed, 36 were cross-sectional studies, 20 were longitudinal studies, and 1 was a trajectory study. Regardless of study designs, in 47 out of 57 studies, statistically significant associations between smoking and depression were found. Among the 10 studies that did not find significant associations, five

studies were conducted with a cross-sectional design, and the other studies were conducted with a longitudinal design (See Table 1).

Significant Associations in Cross-sectional Studies

More than half of the studies reviewed used a cross-sectional study design. Although a cross-sectional design provides information on whether or not there are important associations between smoking and depression, this study design lacks the ability to answer questions about temporal order between the two conditions. Moreover, nine cross-sectional studies compared a relationship between smoking and depression without considering other potential factors that may affect this relationship (See Table 1). Unlike the cross-sectional studies in the literature that compared levels of depression between smokers and non-smokers, Yunis, Mattar, and Wilson (2003) examined the severity of depression across three smoking groups: current smokers, ex-smokers, and non-smokers. Yunis et al. (2003) revealed that current smokers at the time of the study had the highest depressive symptoms, followed by former smokers and non-smokers. Even though the majority of these nine studies suggested statistically significant associations between smoking and depression, caution in the interpretation of the findings is necessary because other potential influencing factors were not controlled.

Most cross-sectional studies controlling for the effects of other factors revealed significant associations between smoking and depression. These studies showed that depression was associated with (a) current smoking at the time of the study[3], (b) the frequency of cigarette use[4], (c) the progression to higher stages of smoking (Lloyd-Richardson, Papandonatos, Kazura, Stanton, & Niaura, 2002), and (d) regular smoking (Acierno et al., 2000; Boys et al., 2003; Patton et al., 1996; Simantov, Schoen, & Klein, 2000; Wang et al., 1994).

In particular, Kelder et al. (2001) proposed a dose-response relationship between smoking and depression. An increase in the severity of depression was linked with an increase in frequency of cigarette use. Kaplan, Landa, Weinhold, and Shenker (1984) also found a dose-response relationship between smoking and depression. They examined the severity of depression across four groups: (a) non-smokers, (b) ex-smokers, (c) those who smoked ½ pack or less per day, and (d) those who

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3,4. References will be provided by request

Table 1. Table of Evidence

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance be-tween depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Cross-sectional studies						
Kaplan et al., 1984	11-18 years old USA N = 398	Analysis of covariance (ANOVA)	Beck Depression Inventory for major depressive disorder (MDD)	Significant		Demographics
Stefanis et al., 1986	14-18 years old Greece N = 11,058	Multiple range test (Student-Newman-Keuls)	Depressive mood scale with 19 items	Significant		No adjustment
Covey et al., 1990	11th graders USA N = 205	Logistic regression	15 of the 20-item Center for Epidemiological Studies Depression Scale (CES-D)	Significant		Demographics
Hawkins et al., 1992	High school students USA N = 1,056	Correlation	CES-D scale	Significant		Demographics
Pesa et al., 1993	12-18 years old USA N = 440	Chi-square test Odds ratio (OR) in a 2*2 cross tabulation	6 items related to depressive feelings	Significant		No adjustment
Landrine et al., 1994	9th graders USA N = 4375	Multiple regression analyses	7 items from the Child Depression Inventory	Significant		Social- and school-related variables
Wang et al., 1994	14-18 years old USA N = 6,900	Logistic regression	6 items related to depressive feelings	Significant		Demographics
Patton et al., 1996	7th to 9th graders Australia N = 2,525	Logistic regression	Clinical Interview Schedule (CIS)-R	Significant		Demographics, parental smoking, and alcohol consumption
Millgan et al., 1997	18 years old Australia N = 583	Correlation and regression	Zung Depression Scale with a 20-item scale	Significant		No adjustment
Pederson et al, 1997	6th graders Canada N = 1,552	t-test	CES-D scale	Significant		No adjustment
Coogan et al., 1998	7-12 graders USA N = 25,761	Chi-square test of independence	No explanation	Significant		No adjustment
Crisp et al., 1998	10-19 years old England and Canada N = 2,768	Multiple logistic regression	Negative mood inventory	Not significant		Weight-related variables
Miller-Johnson et al., 1998	6th graders USA N = 340 African Americans	Repeated measures ANOVA	Child Assessment Schedule	Not significant		No adjustment
Acierno et al., 2000	12-17 years old USA N = 4,023	Logistic regression	National Survey of Adolescents Depression Module	Significant		Demographics, Assault, posttraumatic stress disorder, and family substance use

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance between depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Koval et al., 2000	8th graders Canada N = 1,543	Logistic regression	CES-D scale	Not significant		Stress, rebelliousness, mastery, social conformity, and friends' smoking
Simantov et al., 2000	5th to 12th graders USA N = 5,513	Multinomial logistic regression	The modified version of the Children's Depression Inventory consisting of 14 out of the 27-item scale	Significant		Demographics, sexual abuse, family violence, negative life events, parental support, and extracurricular activities
Hanna et al., 2001	15-16 years old USA N = 719	Logistic regression	DSM III diagnostic criteria for depression or dythymia at any time in their life	Not significant		Demographics, School problem, and alcohol use
Kelder et al., 2001	6th-8th graders USA N = 5,721	Multivariate logistic regression	26-item DSM scale for depression (DSD)	Significant		Sex, school grade, and race/ethnicity
Tomori et al., 2001	17 to 18.11 years old Solvenia N = 1,028	Stepwise logistic regression	Zung's Self-rating Depression scale	Not significant		Factors related to family, school, and individual
Unger et al., 2001	7th graders China N = 205	Multiple regression	CES-D scale	Significant		Events related to school, family, and peer
Whalen et al., 2001	13-16 years old USA N = 170	Multivariate logistic regression	Youth version of the CES-D	Significant		No adjustment
Brooks et al., 2002	9-12 graders USA N = 2,224	Logistic regression	1 item (In the last 30 days, how many days did you feel depressed/stressed?)	Significant		Demographics, grades, drug use, exercise, physical fight, sexual risk, and pregnancy
Coelho et al., 2002	Mean age = 16.9 Portugal N = 775	t-test or Chi-square test	21-item Portuguese version of the BDI-II	Significant		No adjustment
Glied et al., 2002	10-18 years old USA N = 4,648	Multiple logistic regression	Children's depression Inventory	Significant		Demographics, family type, sexual abuse, violence, and life events
Lloyd-Richardson et al., 2002	7th to 12th graders USA N = 20,747	Cumulative odds ordinal regression model	17 items from the CES-D scale	Significant		Demographics, delinquency, significant others' smoking, alcohol use, school-connectedness, and family connectedness
Martini et al., 2002	12-17 years old USA N = 13,827	Ordinal logistic regression	8-item Youth Self Report	Significant		Demographics and substance use

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance between depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Tercyak, Goldman, et al., 2002	9th graders USA N = 1,123	Logistic regression	CES-D scale	Significant		Demographics, exposure to environmental smoking, receptivity of tobacco advertising, and smoking exposure
Tercyak et al., 2002	9th graders USA N = 1,123	Logistic regression	CES-D scale	Significant		Demographics, current cigarette smoking, and tobacco exposure
Boys et al., 2003	13-15 years old England Scotland Wales N = 2,624	Logistic regression	The open-ended structured questions	Significant		Demographics, ACORN categories, and substance use
Diego et al., 2003	High school senors USA N = 98	Multiple regression	20-item CES-D scale	Significant		GPA and Popularity among friends
Kubik et al., 2003	12 and 13 years old USA N = 3,261	Logistic regression	20-item CES-D scale	Significant		Demographics and substance use
Otsuki, 2003	9th and 12th graders USA N = 4,300	Logistic regression	7 items related to depression	Significant		Demographics and self-esteem
Vogel et al., 2003	16-19 years old USA N = 98	Stepwise regression	Multi-score Depression Inventory (MDI)	Significant		Demographics and parental smoking
Yunis et al., 2003	Mean age = 16.67 UAE N = 473	One-way ANOVA	Self-reporting questionnaire (SRQ) with 20 items	Significant		No adjustment
Haarasilta et al., 2004	15-19 years old Finland N = 509	Logistic regression	University of Michigan Composite-International Diagnostic Interview Short Form (UM-CIDI SF)	Significant		Demographics, frequency of drunkenness, chronic illness, and frequency of exercise
Ja'velaid et al., 2004	14-18 years old Estonia N = 977	Logistic regression	The 21-item Beck depression inventory	Significant		Gender
Longitudinal studies examining the effects of depression on smoking						
Rohde et al., 1994	High school students USA N = 1,507	Logistic regression	-CES-D scale -The Beck Depression Inventory	Significant	Depression causes smoking.	Current depression construct at T2
Killen et al., 1997	9th graders USA N = 1,901	Stepwise Cox proportional hazard analyses	20-item CED-S scale	Significant	Depression causes smoking	Age, friends who smoke, drive for thinness, temperament, body mass index, and alcohol consumption
Costello et al., 1999	9, 11, and 13 years old USA N = 1,420	Logistic regression with Generalized Estimating Equations	Child and Adolescent Psychiatric Assessment (CAPA)	Significant	Depression causes smoking	Comorbidity with other disorders (anxiety and behavior disorders)

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance between depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Skara et al., 2001	14 to 18 years old USA N = 252	Logistic regression	20-item index (No explanation)	Not significant		24 predictors (social, behavioral, intrapersonal, and demographic items)
Fleming et al., 2002	1st and 2nd graders USA N = 810	Logistic regression	1 item (Do you feel upset about things a lot?)	Significant	Depression causes smoking	Demographics, parent smoking, peer characteristics, antisocial behavior, academic skills, commitment to school, and peer antisocial behavior
Audrain et al., 2003	9th graders USA N = 978	Latent growth modeling	20-item CES-D	Not significant		Demographics and physical activity
Simon-Morton et al., 2003	6th graders USA N = 973	Ordinal regression analyses	6 items	Not significant		Demographics and factors related to school and parents
Dierker et al., 2004	7th to 12th graders USA N = 9,449	Chi-square test	17 items from the CES-D scale	Significant	Depression causes smoking initiation and the progression to regular smoking	No adjustment
Audrain-McGovern et al., 2004	9th graders USA N = 615	Ordinal logistic model	CES-D scale	Significant	Depression and genetic predisposition may increase smoking progression	Genotype (SLC6A3 and DRD2), school performance, gender, and baseline smoking status
Gilpin et al., 2004	12 to 15 years old USA N = 2,119	Multiple logistic regression	No explanation	Significant .	Depression causes smoking	Perceived ease of access to smoking, GPA, rebelliousness, friends who smoke, any benefit to smoking, favorite cigarette advertisement, willingness to use a tobacco promotion item, and factors related to family and parents
Kandel, et al., 2004	6th to 12th graders USA N = 5,374 for smoking initiation N = 4,474 for daily smoking	Multiple logistic regression	18 items from the CES-D scale	Not significant		Demographics, friends, school, and parents

Longitudinal studies examining the effects of smoking on depression

Albers et al., 2002	12-15 years old USA N = 522	Logistic regression	6 items related to depressive symptoms	Not significant, once rebelliousness was controlled		Demographics, household smoking, rebelliousness with 6 items, and baseline depression level

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance between depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Longitudinal studies examining the bidirectional relationship between smoking and depression						
Brown et al, 1996	14-18 years old USA N=1,709	Logistic regression	-At T1, a version of the Schedule for affective Disorders and Schizophrenia for School-Age Children (K-SADS) -At T2, the Longitudinal Interval Follow-up Evaluation	Significant	Bidirectional relationship	Demographics and commorbidity of psychiatric disorder
Patton et al., 1998	14-15 years old Australia N=2,032	Cox proportional hazard model	The revised Clinical Interview Schedule	Significant	Depression causes smoking	Demographics, peer's and parents' smoking, dieting status, alcohol consumption, and daily sports
Wang et al., 1996	12-18 years old USA N=3,811	Cross-lagged correlation: Kendall tau b	6 items measuring depression	Significant	Bidirectional relationship	No adjustment
Wu et al., 1999	8/9- 13/14 years old USA N=1,731	Survival analyses	Depression-screening questions	Significant	Smoking causes depression	Gender, ethnicity, and prior alcohol use
Goodman et al., 2000	6-12 graders USA N= 8,704 with no history of depression N=6,974 with no history of smoking	Logistic regression	18 items from the 20-item CES-D scale	Significant	Smoking causes depression	Demographics, GPA, self-esteem, anxiety, delinquency, alcohol and other drug use, and friends' smoking
Windle et al., 2001	10th and 11th graders USA N=1,218	Longitudinal, autoregressive multiple regression model	CES-D scale	Significant	Bidirectional relationship	Demographics, parental smoking, family social support, substance use, alcohol use, task orientation, positive mood, flexibility, history of smoking and depression at T1
Longitudinal studies examining common factors that influence both smoking and depression						
Fergusson et al., 1996	A birth cohort, followed until age 16 New Zealand N=947	Chi-square test: Logistic regression: Log linear modeling:	-Interview Schedule for Children -The parent version of the Interview Schedule for Children	Significant	Co-occurrence of smoking and depression	Family social position, family history of criminality, parental smoking, life events, parental attachment, conduct problems, self-esteem, affiliation with delinquent peers, and sex

Author and year of publication	Age/grade at baseline, Place, and sample size	Analytic strategy	Measurement of depression	Statistical Significance between depression and smoking	Directions of causality between smoking and depression	Adjusted variables
Silberg et al., 2003	12 years old USA N = 1071	Cross-lagged Multivariate genetic structural model	Child and Adolescent Psychiatric Assessment (CAPA)	Significant	- Genetic influences among females - Environmental influences (family and peer) among boys	Conduct disturbance, deviant peers, and characteristics of family environments
Subgroups Whose Relationships Between Smoking and Depression Differ						
Rodriguez et al., 2005	9th graders USA N = 925	General growth mixture modeling	CES-D scale	Significant	Relationships between depression and smoking differ across three subgroups with different depression trajectories.	Demographics, alcohol and marijuana use, academic performance, non-sport extracurricular activity, peer smoking and house-hold smoking, physical activity, and team sport participation

smoked 1-2 packs or more per day, and revealed that respondents who smoked more frequently had higher depressive symptoms. Among the cross-sectional studies reviewed, Tercyak and Audrain-McGovern (2002) examined the relationship between the use of alternative tobacco products (e.g., chew/snuff, cigar, and pipe) and depression, and concluded that adolescents who were more depressed had a higher risk of using alternate tobacco products more frequently after adjusting for the effect of cigarette use.

Martini et al. (2002) attempted to examine a causal relationship between smoking and depression with a cross-sectional design. They asserted that smoking may cause depression, but admitted limitations of directly exploring causal associations with this study design. This study reached the above conclusion based on the finding that current smokers had the highest risk of developing depression, followed by former smokers and non-smokers. They also found that former smokers who quit smoking more than 1 year ago had the lowest risk of experiencing depression, followed by former smokers who quit smoking recently, compared to current smokers.

Directions of Associations Between Smoking and Depression

In addition to the significant association between

smoking and depression, directions of causality have been an interest among researchers. In this section, longitudinal studies examining causal associations between smoking and depression are reviewed. More specifically, four assertions regarding associations between the two conditions in current knowledge are discussed: (a) Depression causes smoking, (b) smoking causes depression, (c) smoking and depression influence each other, and (d) smoking and depression co-exist due to the influences of other factors on both smoking and depression.

Depression as a predictor of smoking. Eleven studies investigated the effects of depression on smoking, and seven of these studies revealed significant effects of depression on smoking behavior (See Table 1). Among the seven studies, smoking-related outcomes can be grouped into three categories. First, four studies (e.g., Costello, Erkanli, Federman, & Angold, 1999; Fleming, Kim, Harachi, & Catalano, 2002; Gilpin, Lee, & Pierce, 2004; Killen et al., 1997) concluded that depression caused smoking initiation. Second, current smoking at the time of the survey was also predicted by a history of depression (Rohde, Lewinsohn, & Seeley, 1994). Finally, depression was an important predictor of the progression to higher levels of smoking (Audrain-McGovern, Lerman, Wileyto, Rodriguez, & Shields, 2004; Dierker, Avenevoli, Goldberg, & Glantz, 2004). Furthermore,

Dierker et al. (2004) found more depressive symptoms among experimenters than non-smokers. The same trend was found in a comparison of depression between experimenters and regular smokers: more depressive symptoms among regular smokers than experimental smokers. Audrain-McGovern et al. (2004) investigated the influences of genetic and depressive factors on the progression from experimental smoking to higher levels of smoking. They found a significant interaction between genetic factors and depression in predicting the progression to higher levels of smoking. Audrain-McGovern et al. (2004) suggested that the adolescents who had both a certain gene and depressive symptoms had a higher likelihood of progressing to higher stages of smoking.

Smoking as a predictor of depression. Only one study in the current literature hypothesized smoking as an antecedent to the development of depression. Albers and Biener (2002) suggested that rebelliousness might be associated with both smoking and depression, and thus rebelliousness might be an underlying factor in explaining the mechanism of smoking as a cause of depression. In their study, a rebelliousness variable was constructed based on a tendency to take risks, poor relationships with family, and solidarity with deviant friends. In the model without rebelliousness, smoking was an important predictor of the development of depression, but after the inclusion of rebelliousness in the model, smoking no longer predicted the development of depression. Accordingly, they proposed that rebelliousness may serve as a modifiable factor to break the linkage between smoking and depression among adolescents.

Bidirectional relationship between smoking and depression. Six longitudinal studies investigating a bidirectional relationship between smoking and depression reached inconsistent results. Some studies found a bidirectional relationship (Brown, Lewinsohn, Seeley, & Wagner, 1996; Wang, Fitzhugh, Turner, Fu, & Westerfield, 1996; Windle & Windle, 2001), but the others found unidirectional relationships, either depression as a predictor of smoking or smoking as a predictor of depression (Goodman & Captman, 2000; Patton, Carlin, Coffey, & Wolfe, 1998; Wu & Anthony, 1999). Brown et al. (1996) investigated the effects of smoking at Time 1 (i.e., those who smoked three or more times per week vs. those who smoked two or less times per week) on the incidence of depression between Time 1 and Time 2 among those who did not experience depression at Time 1. These researchers also examined the effects of depres-

sion at Time 1 on the onset of smoking at Time 2. In their findings, smoking significantly predicted an episode of major depressive disorder and vice versa, indicating a bidirectional relationship.

Unlike the above three studies suggesting a bidirectional relationship between smoking and depression, Patton et al. (1998) suggested that there was a unidirectional relationship between the two conditions suggesting that depression/anxiety leads to smoking. In the analysis of smoking initiation and daily smoking as an antecedent to depression, smoking did not predict the onset of depression/anxiety. However, on the other hand, in the analysis of depression/anxiety as an antecedent to the two smoking-related outcomes, there was an interaction between depression and peer smoking. In cases where most of the adolescents' friends were smokers, depression/anxiety was an important predictor of smoking initiation and daily smoking.

There are other studies finding a unidirectional relationship between smoking and depression (Goodman & Captman, 2000; Wu & Anthony, 1999). This causal direction, smoking as a predictor of depression, is the opposite of that of Patton et al. (1998). While excluding adolescents who had experienced either smoking or depression at Time 1 from the samples, smoking initiation (e.g., Wu & Anthony, 1999) and current smoking (e.g., Goodman & Captman, 2000) at Time 1 were a significant predictor of depression rather than vice versa.

Comorbidity of smoking and depression. Two studies of adults suggest that common factors may affect smoking and depression. One study by Kendler et al. (1993) suggested that the association between smoking and depression was not causal, and familial factors such as genetics had an impact on both smoking and depression. The other study by Breslau, Kilbey, and Andreski (1993) raised the possibility that personality traits such as neuroticism may influence both smoking and depression, and that consequently, the association between smoking and depression may not be causal.

In adolescent samples, two studies investigated the existence of factors affecting both smoking and depression (Fergusson, Lynskey, & Horwood, 1996; Silberg, Rutter, D'Onofrio, & Eaves, 2003). Fergusson et al. (1996) examined common predisposing factors in a birth cohort followed until the age of 16. They concluded that social and childhood factors substantially accounted for the significant associations between depression and the frequency of smoking. After controlling for the effects of

the common factors, smoking was still significantly associated with depression, but the significant association between the two conditions reduced considerably. These findings were similar to those in the study of adults by Kendler et al. (1993). However, the two studies asserted different common factors: Kendler et al. (1993) suggested genetic factors as common predisposing factors, while Fergusson et al. (1996) proposed social and childhood factors (e.g., self-esteem and affiliation with delinquent peers). Silberg et al. (2003) proposed that factors affecting both smoking and depression were not the same between female and male adolescents. They suggested that genetic factors were predominantly associated with both smoking and depression among female adolescents, while environmental factors (e.g., familial and peer influences) were related to smoking and depression among male adolescents.

Subgroups with Different Relationships Between Smoking and Depression

Rodriquez et al. (2005) sought to explain the nature of the relationship between smoking and depression using subgroups with different trajectories of depression over time. While this study found a significant relationship between smoking and depression, it also showed that there were several subgroups with different depression trajectories over time, and that the relationship between smoking and depression among these subgroups differed.

Three depression-trajectory groups (i.e., high, medium, and low depression levels) were identified in their study. Overall, in the group with high depression level, baseline smoking (i.e., smoking at the entry of the study) was related to a decrease in depression level over time, while in the group with medium depression level, baseline smoking was related to an increase in depression level. In the group with low depression level, baseline smoking was not related to a change in depression over time. Rodriquez et al. (2005) suggested the relationship between smoking and depression among adolescents with high depression level might be evidence of an antidepressant-like effect of nicotine. However, it should be noted that their study did not have information on smoking behavior and depression before their study began, and thus the temporal order of smoking and depression (i.e., which one of the two conditions occurred first) could not be determined. Also, it should be noted that there were not objective guidelines in determining

the number of depression trajectories across time in this research design (Rodriquez et al., 2005).

Measurement of Depression

The validity of the measurement of variables is critical in investigating associations among those variables (Kane, 1997). The precise measurement of depression is essential when exploring the relationship between smoking and depression for the following two reasons. First, the expression of depression is not the same across different developmental stages (Mash & Wolfe, 2002; Parry-Jones, 1991). For example, the recognition of depression in adolescence is not easy because depressive symptoms in adolescence are often masked and expressed as different symptoms (e.g., somatic complaints and delinquent behavior) (Parry-Jones, 1991). Second, depression in adolescence can be assessed in terms of increasing severity ranging from the appearance of depressive symptoms, to a syndrome, and finally to a full-blown episode of major depression. A depressive symptom can occur without serious problems and may be temporary. A depressive syndrome implies a group of depressive symptoms and is more serious than a single symptom. A depressive episode of the full disorder is the worst case among the three categories, and adolescents who have a depressive disorder have severe impairments in function (Mash & Wolfe, 2002). Thus, it may be important to differentiate these stages of depression.

Considering that the expression of depression varies according to different developmental stages and that its expression can overlap with other disorders, precisely measuring depression during adolescence is an important issue. Approximately two-thirds of the studies reviewed used instruments that were validated for child and adolescent populations. However, 18 studies reviewed used either only a portion of questions from the depression instruments for adolescents or questions representing depressive feelings without validation (See Table 1). For example, Fleming et al. (2002) used only a single item to measure depression when examining associations between smoking and depression. The question for measurement of depression in the study is "if the respondent feels upset about things a lot." This item may be sensitive to a wide range of conditions and seems unlikely to assess depression precisely among adolescents.

Among the 18 studies that did not use validated de-

pression instruments, 10 were cross-sectional studies, and all of these studies found the statistically significant relationship between smoking and depression (Boys et al., 2003; Brooks et al., 2002; Coogan et al., 1998; Covey & Tam, 1990; Landrine et al., 1994; Lloyd-Richardson et al., 2002; Martini et al., 2002; Otsuki, 2003; Pesa, Cowdery, Wang, & Fu, 1993; Wang et al., 1994). Five of eight longitudinal studies found the statistically significant relationships between smoking and depression: Three studies found depression as an antecedent to smoking, and two studies found the bidirectional relationship between smoking and depression (Dierker et al., 2004; Fleming et al., 2002; Gilpin et al., 2004; Goodman & Captman, 2000; Wang et al., 1996). Despite the fact that the majority of the 18 studies found a statistically significant relationship between smoking and a putative measure of depression, these significant relationships may not reflect the same processes that are assessed with more valid measures of depression.

Controlling for Confounders

Confounding means that a predictor of interest is correlated with the effect of a third factor that is related to both the predictor and an outcome. If the effects of confounders are not controlled, an association between a predictor and an outcome is likely to be spurious. Therefore, in exploring how smoking and depression are associated, the adjustment for the effect of confounders is a critical issue in obtaining an accurate result. In studies exploring the association between smoking and depression, managing confounders at the analysis stage is common because these studies are observational, and thus it is not easy to control for confounding at the stage of research design.

Despite the importance of the adjustment for confounders, the current literature did not take into account confounding as a serious issue. Eleven (approximately 20%) out of the 57 articles reviewed examined bivariate associations between smoking and depression without controlling for any other factors. Among the studies adjusting for other factors, five studies only controlled for the effects of demographics such as gender, age, and race. The rest of the studies adjusted for other factors (e.g., anti-social behaviors and weight-related variables) in addition to demographics. However, most of them did not provide justification for including the factors as confounders in the model (See Table 1).

The following factors have been proposed as confounders in the examination of the relationship between smoking and depression among adolescents. First, environmental influences may affect smoking and depression. Vogel et al. (2003) showed that parental smoking was linked with both smoking and depression among adolescents. Family dysfunction and deviant peers were also related to smoking and depression (Fergusson et al., 1996; Silberg et al., 2003). Second, Fergusson et al. (1996) proposed low self-esteem as a confounder, showing that low self-esteem was significantly associated with both depressive disorders and nicotine dependence. Third, Unger et al. (2001) hypothesized that stressful life events had a relationship with the development of depression and smoking among adolescents. In their study, a negative school-related event was related to both smoking and depression. Finally, a genetic factor has been an interest among researchers. Audrain-McGovern et al. (2004) found that carrying the dopamine receptor D2 A1 gene and experiencing substantial depression was synergistically related to adolescents' transition to higher levels of smoking. Silberg et al. (2003) also pointed out the influence of a genetic factor on depression and smoking, but they found the significant role of a genetic factor only among female adolescents. Although the current literature shows that environmental, individual, and genetic factors may act as confounders in the association between the two conditions, confounders affecting both smoking and depression have not been identified clearly.

Gaps in Current Knowledge and Future Research Directions

The majority of the studies in the literature showed significant associations between smoking and depression among adolescents; however, the current literature has significant gaps. First, despite statistically significant associations between smoking and depression in the majority of the studies reviewed, the current literature has not yet eliminated the possibility that the relationship is spurious. In addition, it is possible that if the two conditions are causally related, the relationship may reflect several potential causal mechanisms in which: (a) depression is an antecedent to smoking, (b) smoking is an antecedent to depression, (c) there is a bidirectional relationship between smoking and depression, or (d) there are subgroups whose relationship between smoking and

depression differs. Therefore, the nature of the relationship between the two conditions needs to be investigated further. Among the above hypotheses, smoking as an antecedent to depression should be given more attention since researchers have not adequately tested the role of stress in this association.

In exploring this relationship, a study with a longitudinal design is necessary, because a cross-sectional study seeks significant relationships among factors at one point in time, and lacks the ability to provide information about temporal order. However, a longitudinal design collects information over time, which makes it possible to determine temporal order among factors (Hennekens & Buring, 1987). Considering that researchers agree on the existence of a significant relationship between smoking and depression, but currently disagree about the nature of this relationship, longitudinal studies will be more informative than cross-sectional studies. In addition, the existence of groups with heterogeneous relationships between smoking and depression needs further investigation. If a possibility of different depression trajectories in a population is overlooked, findings about the relationship between smoking and depression may be invalid (Rodriguez et al., 2005). Sample selection in a longitudinal design is another important issue to consider. Since those who experience depression are at greater risk of future episodes of depression, the adjustment for a history of depression is essential (Cicchetti & Toth, 1998). It is desirable to select adolescents who have experienced neither smoking nor depression at the entry of a study because in this sample, researchers do not have to be concerned about controlling for the possible effects of a history of either depression or smoking in order to explore the association between the conditions.

Second, despite the importance of accurate measurement of depression, 18 studies (approximately one-third of the studies) reviewed did not use a validated instrument for the measurement of depression, instead using one or more items measuring negative affect or other indicators of depressive feelings. The use of one or more items representing sad feelings is clearly not a valid measure of depressive symptoms, and the operationalization of the construct of depression in these studies is questionable. The majority of these 18 studies found a statistically significant relationship between smoking and depression; only 3 of them failed to observe a statistically significant relationship between the two conditions. In understanding the relationship between smoking and de-

pression based on these findings, caution must be exercised since these significant relationships might reflect other processes not related to depression. For future research, the use of validated instruments to measure depressive symptoms during adolescence is essential in understanding the relationship between smoking and depression.

Third, confounders between smoking and depression need to be explored thoroughly, and if possible, controlled for their effects in analysis. In the literature reviewed, parental smoking, family dysfunction, deviant peers, low self-esteem, stressful life events, and genetic differences (e.g., dopamine receptor D2) were considered confounders (Audrain-McGovern et al., 2004; Fergusson et al., 1996; Silberg et al., 2003; Unger et al., 2001; Vogel et al., 2003). The evidence that genetic and family background variables may predispose individuals to express both conditions seems particularly persuasive. Hence, to draw the strongest conclusions, future research should attempt to control these factors. At the same time, it is important to recognize that the question of which factors may act as confounders in the association between smoking and depression during adolescence has not been completely answered. Thus, an important area for future research is to identify factors that can act as confounders in examining the association between smoking and depression. Indeed, one fifth of the studies reviewed examined a relationship between smoking and depression without adjusting for any other factors. Furthermore, most researchers who controlled for other factors in the studies reviewed did not provide a rationale for their decision to include those factors in their model. In future research, greater attention should be given to the potential role of theoretically relevant confounders that can produce both smoking and depression.

CONCLUSION

Of the 57 studies reviewed, 47 revealed significant associations between smoking and depression. It is well established that smoking is significantly related to depression, but it should be noted that the significant relationship between smoking and depression in the literature may not reflect a causal relation between the two conditions, because many studies did not use validated instruments of depression and did not take into account plausible confounding variables. Hence, the relationship may

be spurious. Additionally, if the relationship is causal, researchers have still not identified its direction. Therefore, in studies regarding smoking and depression in adolescence, directions of associations between the two conditions and the existences of subpopulations with different relationships between the two conditions must be explored further preferably with longitudinal designs.

References

Acierno, R., Kilatrick, D.G., Resnick, H., Saunders, B., De Arellano, M., & Best, C. (2000). Assault, PTSD, family substance use, and depression as risk factors for cigarette use in youth: Findings from the National Survey of Adolescents. *J Trauma Stress, 13*(3), 381-396.

Albers, A.B., & Biener, L. (2002). The role of smoking and rebelliousness in the development of depressive symptoms among a cohort of Massachusetts adolescents. *Prev Med, 34*, 625-631.

Arday, D.R., Giovino, G.A., Schulman, J., Nelson, D.E., Mowery, P., & Samet, J.M. (1995). Cigarette smoking and self-reported health problems among U.S. high school seniors, 1982-1989. *Am J Health Promot, 10*(2), 111-116.

Audrain-McGovern, J., Lerman, C., Wileyto, E.P., Rodriguez, D., & Shields, P.G. (2004). Interacting effects of genetic predisposition and depression on adolescent smoking progression. *Am J Psychol, 161*, 1224-1230.

Berkson, J. (1946). Limitations to the application of fourfold table analysis to hospital data. *Biometrics Bulletin, 2*(3), 47-53.

Boys, A., Taylor, F.C., Marsden, J., Brugha, T., Bebbington, P., Jenkins, R., et al. (2003). Psychiatric morbidity and substance use in young people aged 13-15 years: Results from the Child and Adolescent Survey of Mental Health. *Br J Psychiatry, 182*, 509-517.

Breslau, N., Kilbey, M., & Andreski, P. (1993). Nicotine dependence and major depression. *Arch Gen Psychiatry, 30*, 31-35.

Brook, J.S., Schuster, E., & Zhang, C. (2004). Cigarette smoking and depressive symptoms: A longitudinal study of adolescents and young adults. *Psychol Rep, 95*, 159-166.

Brooks, T.L., Harris, S.K., Thrall, J.S., & Woods, E.R. (2002). Association of adolescent risk behaviors with mental health systems in high school students. *J Adolesc Health, 31*, 240-246.

Brown, R.A., Lewinsohn, P.M., Seeley, J.R., & Wagner, E.F. (1996). Cigarette smoking, major depression, and other psychiatric disorders among adolescents. *J Am Acad Child Adolesc Psychiatry, 35*(12), 1602-1610.

Center for Disease Control and Prevention (2002). Annual smoking-attributable mortality, years of potential life lost, and economic costs-United States, 1995-1999, *MMWR Morb Mortal Wkly Rep, 51*(14), 300-303.

Center for Disease Control and Prevention (2004). Cigarette use among high school students: United States, 1991-2003. *MMWR Morb Mortal Wkly Rep, 53*(23), 499-502.

Cicchetti, D., & Toth, L. (1998). The development of depression in children and adolescents. *Am Psychol, 53*(2), 221-241.

Coelho, R., Martins, A., & Barros, H. (2002). Clinical profiles relating gender and depressive symptoms among adolescents ascertained by the Beck Depression Inventory II. Eur Psychiatry, 17, 222-226.

Coogan, P.F., Adams, M., Geller, A.C., Brooks, D., Miller, D.R., Lew, R.A., et al. (1998). Factors associated with smoking among children and adolescents in Conneticut. *Am J Prev Med, 15*(1), 17-24.

Costello, E.J., Erkanli, A., Federman, E., & Angold, A. (1999). Development of psychiatric comorbidity with substance abuse in adolescents: effects of timing and sex. *J Clin Child Psychol. 28*(3):298-311.

Covey, L.S., & Tam, D. (1990). Depressive mood, the single-parent home, and adolescent cigarette smoking. *Am J Public Health, 80*(11), 1330-1333.

Dierker, L.C., Avenevoli, S., Goldberg, A., & Glantz, M. (2004). Defining subgroups of adolescents at risk for experimental and regular smoking. *Prev Sci, 5*(3), 169-183.

Dusek, J.B. (1996). Adolescent development and behavior (3 rd Eds.). Upper Saddle River, N.J: Prentice Hall.

Fergusson, D.M., Lynskey, M.T., & Horwood, L.J. (1996). Comorbidity between depressive disorders and nicotine dependence in a cohort of 16-year-olds. *Arch Gen Psychiatry, 53*(11), 1043-1047.

Fleming, C.B., Kim, H., Harachi, T.W., & Catalano, R.F. (2002). Family processes for children in early elementary school as predictors of smoking initiation. *J Adolesc Health, 30*, 184-189.

Gilpin, E.A., Lee, L., & Pierce, J.P. (2004). Does adolescent perception of difficulty in getting cigarettes deter experimentation? *Prev Med, 38*, 485-491.

Glassman , A.H., Stetner, F., Walsh, T., Raizman, P.S., Fleiss, J.L., Cooper, T.B., et al. (1988). Heavy smokers, smoking cessation, and clonidine. *JAMA, 259*(19), 2863-2866.

Goodman, E., & Captman, J. (2000). Depressive symptoms and cigarette smoking among teens. *Pediatrics, 106*, 748-755.

Hall, S.M., Humfleet, G.L., Reus, V.I., Muñoz, R.F., Hartz, D.T., & Maude-Griffin, M. (2002). Psychological intervention and antidepressant treatment in smoking cessation. *Arch Gen Psychiatry, 59*, 930-936.

Hall, S.M., Muñoz, R.F., Reus, V.I., & Sees, K.L (1993). Nicotine, negative affect, and depression. *J Consult Clin Psychol, 61*(5), 761-767.

Hawkins, W.E., Hawkins, M.J., & Seeley, J. (1992). Stress, health-related behavior and quality of life on depressive symptomatology in a sample of adolescents. *Psychol Rep. 71*(1):183-186.

Hennekens, C.H., & Buring, J.E. (1987). Epidemiology in medicine. Philadelphia, PA: Lippincott Williams & Wilkins.

Kane, R.L. (1997). Understanding health care outcomes research. Gaithersburg, MD: Aspen Publishers.

Kaplan, S.L., Landa, B., Weinhold, C., & Shenker, I.R. (1984). Adverse health behaviors and depressive symptomatology in adolescents. *J Am Acad Child Psychiatry, 23*(5), 595-601.

Kelder, S.H., Murray, N.G., Oprinas, P., Prokhorov., A., McReynolds, L., & Roberts, R. (2001). Depression and substance use in minority middle-school students. *Am J Public Health, 91*, 761-766.

Kendler, K.S., Neale, M.C., MacLean, C.J., Heath, A.C., Eaves, L.J., & Kessler, R.C. (1993). Smoking and major depression: A causal analysis. *Arch Gen Psychiatry, 50*, 36-43.

Killen, J.D., Robinson, T.N., Haydel, F., Hayward, C., Wilson, D.M., Hammer, L.D., et al. (1997). Prospective study of risk factors for the initiation of cigarette smoking. *J Consult Clin Psychol, 65*(6), 1011-1016.

Landrine, H., Richardson, J.L., Klonoff, E.A., & Flay, B.R. (1994).

Cultural diversity in the predictors of adolescent cigarette smoking: The relative influence of peers. *J Behav Med, 17*(3), 331-346.

Lerman, C., Audrain-McGovern, J., Orleans, C.T., Boyd, R., Gold, K., Main, D., et al. (1996). Investigation of mechanisms linking depressed mood to nicotine dependence. *Addict Behav, 24*(1), 9-19.

Lloyd-Richardson, E.E., Papandonatos, G., Kazura, A., Stanton, C., & Niaura, R. (2002). Differentiating stages of smoking intensity among adolescents: Stage-specific psychological and social influences. *J Consult Clin Psychol, 70*(4), 998-1009.

Martini, S., Wagner, F.A., & Anthony, J.C. (2002). The association of tobacco smoking and depression in adolescence: Evidence from the United States. *Subst Use Misuse, 37*(14), 1853-1867.

Mash, E.J., & Wolfe, D.A. (2002). Abnormal child psychology. Belmont, CA: Wadsworth.

McCandless, B.R., & Coop, R.H. (1979). Adolescents: Behavior and development (2nd Eds.). New York: Holt, Rinehart, and Winston.

Millgan, R.A.K., Burke, V., Beiling, L.J., Dunbar, R.D., Spencer, M., Balde, E., et al. (1997). Health-related behaviors and psychosocial characteristics of 18 year-old Australians. *Soc Sci Med, 45*(10), 1549-1562.

Parrott, A.C. (1999). Does cigarette smoking cause stress? *Am Psychol, 54*(10), 817-20.

Parry-Jones, W.L. (1991). Historical aspects of mood and its disorders in young people. In I.M. Goodyer. (2nd Eds.), The depressed child and adolescent (pp.1-23). New York, NY: Cambridge University Press.

Patton, G.C., Carlin, J.B., Coffey, C., & Wolfe, R. (1998). Depression, anxiety, and smoking initiation: A prospective study over 3 years. *Am J Public Health, 88*(10), 1518-1522.

Patton, G.C., Marienne, H., Macolm, J.R., Carlin, J.B, Caust, J., & Bowes, G. (1996). Is smoking associated with depression and anxiety in teenagers? *Am J Public Health, 86*(2), 225-230.

Pederson, L.L.., Koval, J.J., & O'connor, K. (1997). Are psychosocial factors related to smoking in grade-6 students? *Addict Behav, 22*(2), 169-181.

Pesa, J.A., Cowdery, J.E., Wang, M.Q., & Fu, Q. (1993). Self-reported depressive feelings and cigarette smoking among Mexican-American Adolescents. *Health Educ Res, 7*, 69-80.

Rodriguez, D., Moss, H.B., & Audrain-McGovern, J. (2005). Developmental heterogeneity in adolescent depressive symptoms: Associations with smoking behavior. *Psychosom Med, 67*, 200-210.

Rohde, P., Lewinsohn, P.M., & Seeley, J.R. (1994). Are adolescents

changed by an episode of major depression? *J Am Acad Child Adolesc Psychiatry, 33*(9), 1289-1298.

Otsuki, T.A. (2003). Substance use, self-esteem, and depression among Asian American adolescents. *J Drug Educ, 33*(4), 369-390.

Silberg, J., Rutter, M., D'Onofrio, B., & Eaves, L. (2003). Genetic and environmental risk factors in adolescent substance use. *J Child Psychol Psychiatry, 44*(5):664-676.

Simantov, E., Schoen, C., & Klein, J.D. (2000). Health-compromising behaviors: Why do adolescents smoke or drink? *Arch Pediatr Adolesc Med, 154*, 1025-1033.

Stefanis, C.N., & Kokkevi, A. (1986). Depression and drug use. *Psychopathology, 19*(2), 124-131.

Tercyak, K.P., & Audrain-McGovern, J. (2002). Psychosocial correlates of alternates tobacco product use during early adolescence. *Prev Med, 35*, 193-198.

Unger, J.B., Yan, L., Johnson, A., Gong, J., Chen, X., Li, C.Y., et al. (2001). Stressful life events among adolescents in Wuhan, China: Associations with smoking, alcohol use, and depressive symptoms. *Int J Behav Med, 8*(1), 1-18.

Vogel, J.S., Hurford, D.P., Smith, J.V., & Cole, A. (2003). The relationship between depression and smoking in adolescents. *Adolescence, 38*(149), 57-74.

Wang, M.Q., Fitzhugh, E.C., Turner, L., Fu, Q., & Westerfield, R.C. (1996). Association of depressive symptoms and school adolescents' smoking: a cross-lagged analysis. *Psychol Rep, 79*(1), 127-130.

Wang, M.Q., Fitzhugh, E.C., Westerfield, R.C., & Eddy, J.M. (1994). Predicting smoking status by symptoms of depression for U.S. adolescents. *Psychol Rep. 75*(2):911-914.

Whalen, C.K., Jamner, L.D., Henker, B., & Delfino, R.J. (2001). Smoking and moods in adolescents with depressive and aggressive dispositions: Evidence from surveys and electronic diaries. *Health Psychol, 20*(2), 99-111.

Windle, M., & Windle, R.C. (2001). Depressive symptoms and cigarette smoking among middle adolescents: Prospective associations and intrapersonal and interpersonal influences. *J Consult Clin Psychol, 69*(2), 215-226.

Wu, L.T., & Anthony, J.C. (1999). Tobacco smoking and depressed mood in late childhood and early adolescence. *Am J Public Health, 89*(12), 1837-1840.

Yunis, F.A., Mattar, T., & Wilson, A.K. (2003). The association between tobacco smoking and reported psychiatric symptoms in an adolescent population in the United Arab Emirates. *Soc Behav Pers, 31*(5), 461-466.