

Adolescent Depression and Future Smoking Behavior: A Prospective Study

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Abstract The aim of the study was to examine the associations between depressive symptoms and smoking, concurrently and prospectively, in adolescents in America, the evaluation of depressive symptoms according to different group's smoking status, and the assessed associations between concurrent depressive level and success in smoking cessation. The participants were 2,735 boys and 2,890 girls from the Add Health data set. The prospective analysis indicated that participants with higher depressive symptoms in Wave I were more likely to start smoking and become regular smokers in Wave II. Moreover, regression analysis found that depressive symptoms in both Waves I and II predicted current smoking status. Findings are discussed within the context of the empirical and theoretical review and implications for social work practice are considered.

Keywords Smoking · Adolescent · Add Health · Depression · Prospective analysis

Adolescence signifies a dynamic period of growth that can be perceived as enjoyable and enriching, tumultuous and challenging, or a combination of both for many adolescents. During this phase of development, adolescents' emotions and behaviors are more susceptible to influence by internal (physical) and external (social and environmental) factors than adults. Therefore, it may be important to examine factors that affect their well-being. Two such factors are smoking and depression.

Over the past three decades, considerable numbers of studies have been done on the area of smoking and depression, and some of these studies have examined the

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adolescent population. In general, research has suggested a strong association between smoking and depression (Crum et al. 2008; Fergusson et al. 2003; Goodman and Capitman 2000; Kendler et al. 1993; Lam et al. 2005; Lewinsohn et al. 1998; McCaffery et al. 2008; Nezami et al. 2005; Steuber and Danner 2006; Upadhyaya et al. 2002; Wu and Anthony 1999). However, the direction of the association remains debatable. Some of these studies have found that an increase in smoking behavior also increases depressive symptoms (Goodman and Capitman 2000; Wu and Anthony 1999) while others have found that increased depressive symptoms led to increases in smoking (Covey and Tam 1990; Kandel and Davies 1986; Lam et al. 2005; McCaffery et al. 2008; Nezami et al. 2005; Patton et al. 1996, 1998).

Two of these studies conducted secondary data analysis on two separate sets of data (Martini et al. 2002; Wu and Anthony 1999). Martini et al. (2002) examined cross-sectional data of 13,826 adolescents from the National Household Survey on Drug Abuse. The study categorized participants into one of three smoker categories: never, former, and current smoker, and assessed for depression by utilizing eight self-reported questions from the Youth Self Report. The findings showed that current smoker had higher levels of depression when compared to former smokers and those that had never smoked, and depression level decreased as time elapsed from last smoking. Two other studies examined the National Longitudinal Study of Adolescent Health (Add Health) data and found that smoking can lead to depression (Goodman and Capitman 2000; Steuber and Danner 2006) Goodman and Capitman (2000) first examined 8,704 non-depressed adolescents at baseline for tobacco use development of at least one pack of cigarettes per week at a 1 year follow-up. Secondly, 6,947 non-smokers for the past 30 days at baseline were assessed for developing high depressive symptomatology. Results from multivariate modeling found current smoking predicted high depressive symptoms, but high depressive symptoms did not predict heavy smoking. However, bivariate analyses showed that high depressive symptoms did increase the risk of heavy smoking by three times. This study did not take into account that varying levels of smoking can also affect levels of depressive symptoms.

Steuber and Danner (2006) also used Add Health to examine the association of depression and smoking. Participants were categorized into four smoking status groups: never, starter, quitter, and maintainer. A modified version of the Center for Epidemiological Studies Depression scale (CES-D) was used to measure depression, and the score of 24 and 22 were used as depression cut-offs for females and males, respectively. Results indicated that the starters, quitters, and maintainers were 1.5, 1.4, and 2.0 times likelier to be depressed than the group who never smoked at time 2, and regular smokers were more likely to show higher levels of depression. Although these results indicated that smoking predicts depression, it could not prove that smoking leads to depression. In addition, the cut-offs scores from CES-D only predicted depression, but could not diagnose causal factors.

Although some of these studies found that smoking promotes depressive symptoms, other studies have found the depressive symptoms promotes smoking (Covey and Tam 1990; Escobedo et al. 1998; Kandel and Davies 1986; Kubik et al. 2003; Lam et al. 2005; Martini et al. 2002; Nezami et al. 2005; Patton et al. 1996,

1998). Escobedo et al. (1998) and Lam et al. (2005) in particular, have noted the latter finding through a secondary data analysis on two separate longitudinal studies.

Similarly, Escobedo et al. (1998) analyzed data from the Teenage Attitudes and Practices Survey collected from 7,885 adolescents between the ages of 12–18. The depressive symptoms scale included in the study created was used to assess depressive symptoms and 21.8 was the cut-off value for depression. However, the included scale has shown to detect greater incidences of depressive symptoms than clinical diagnoses, so it was questionable whether the scale over-reported depressive symptoms.

A stronger, though limited research effort, was conducted by Lam et al. (2005) through a prospective longitudinal study with 1,894 7th grade students in Hong Kong within two waves. Anonymous self-reported surveys were utilized, and those students were reassessed 12 months later (Time 2). The students were categorized by smoking status ('never smokers,' 'ex-smokers,' and 'current smokers') and depressive symptoms ('low depressive symptoms' were students with scores lower than the 75th percentile and 'high depressive symptoms' were students with a score higher than the 75th percentile). Lam et al. (2005) found that students in the 'never smokers' category with high depressive symptoms, predicted a 50% likelihood of being a smoker at Time 2, while 'ex'-and 'current smokers' in Time 1 had higher depressive symptoms than those in the "never smokers" category at Time 2. Among the groups, persistent smokers had the highest depressive symptoms followed by new smokers. However, after 12 months, unsuccessful and non-dissonant smokers had higher depressive symptoms than successful quitters. Although Lam et al. (2005) suggested that depressive symptoms affect smoking; this study was done in only one grade level and in Hong Kong. Therefore, the generalizability of the study, particularly to adolescents in United States, is questionable.

Other studies on smoking and psychiatric comorbidity also affirm this association of depression promoting smoking (Kubik et al. 2003; Upadhyaya et al. 2002). For example, Kubik et al. (2003) conducted a cross-sectional survey with 3,621 seventh grade students from 16 middle schools. The study used the Center for Epidemiological Studies Depression scale (CES-D) to assess for depressive symptoms. Two measures for assessment of smoking (one for monthly smoking and one for weekly smoking) were used. Results found that monthly smoking was independently associated with elevated depressive symptoms especially among adolescent females.

In conclusion then, the overall scientific literature provides a wealth of information on depression and smoking, but provides limited insight on how depression and smoking associate with each other practically. Furthermore, research in this well-studied area has been conducted utilizing a myriad of research methods, such that there is no consensus on how this area is best studied. This serves as a factor in the discrepancies of the findings in this area of research.

Discrepancies in this area indicate a clear need to continue to further explore the association between depression and smoking. With this issue in mind, this study examines the associations between depressive symptoms and smoking, concurrently and prospectively, in adolescents in America, the evaluation of depressive symptoms according to different group's smoking status, and the assessed associations between concurrent depressive level and success in smoking cessation.

This current study utilized a prospective longitudinal study from Lam et al. (2005) as its framework to assess adolescents of different ages in various areas of the United States. The current study analyzed data from the first and second waves of the National Longitudinal Study of Adolescent Health (Add Health) from 1994 to 1996. This research design clearly separated the experimental, current, and past smokers. This was crucial because failure to separate participants by smoking status could result in confounding factors interfering with the group results. Examining each group of smokers separately ensured that each course of smoking could be studied independently. Furthermore, resurveying after approximately a year, will allow researchers to identify new smokers, without risk of inclusion of current smokers, who may be affected by possible extraneous depressive symptoms of continuous tobacco use. More importantly, this study used a nationwide longitudinal sample that comprised of a large sample size that was representative of the adolescent population across age and race. This large population sample increased the generalizability and decreased biases toward one group of adolescents over another. Although two other studies have been done using this data set which have found smoking increases the likelihood of depression, this study's design differed from the other studies by separating smoking status and treating depressive symptoms as a continuous variable. Participants who scored in the 75th percentile or above were placed in the high depressive symptoms group. In this way, the participants' symptoms were relative to the other subjects in the study group. The hypotheses of the study were as follows:

- (1) High levels of depressive symptoms will increase current and prospective smoking predisposition levels regardless of smoking status.
- (2) Depressive symptoms, gender, and age predict current status as a smoker.
- (3) Current depressive symptoms predict difficulty in smoking cessation.

Methods

The National Longitudinal Study of Adolescent Health (Add Health) studied the health status of teenagers, investigated causes of health-related behaviors, and examined environment effects on adolescents (Kelley and Peterson 1997). The Add Health study collected self-reported data related to adolescent behaviors and outcomes (Udry 1998). The data set from baseline to follow-up used various questions and instruments to gather information through the in-school and in-home interviews on the adolescent's physical, emotional, and mental health as well as social behaviors and environment. The current study utilized the public data from Add Health for analysis (Udry 1998).

Participants

The Adolescent Health Study's sample came from students from 80 high schools and the additional 54 middle schools that feed students into those high schools. The schools were randomly chosen and stratified across the United States by geography,

community type (urban/suburban/rural), type of school (private/public/parochial), ethnic composition, and size. Any student on the rosters of the 134 schools was eligible to participate in the Adolescent Health Wave I in-home survey and in-school questionnaire. Students who responded to age, gender, race, depressive symptoms, and smoking habits in both Waves I and II were included in the current study. The final sample for this current study included 2,735 boys (48.6%) and 2,890 girls (51.4%), with a mean age of 16.04 ($SD = 1.62$).

Measures

The data in this current study were obtained from the initial and follow-up (Waves I and II) from the In-Home Interview portion of Add Health from 1994 to 1996.

Cigarette Use

In order to assess for cigarette use, two questions were taken from the Add Health in Wave I:

- (1) "Have you ever tried cigarette smoking, even just 1 or 2 puffs?"
- (2) "Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?"

Three questions were taken from Wave II:

- (1) "Since (Month of Last Interview), have you ever tried cigarette smoking, even just 1 or 2 puffs?"
- (2) "Since (Month of Last Interview), have you ever tried cigarette smoking, even just 1 or 2 puffs?"
- (3) "During the past 6 months, have you tried to quit smoking cigarettes?"

Participants answered yes or no to these questions. From these questions, participants were divided into three smoking status: 'non-smoker', 'experimenter', and 'smoker'. 'Non-smoker' participants answered "No" in "Have you ever tried cigarette smoking, even just 1 or 2 puffs?" in Wave I and "No" in "Since (Month of Last Interview), have you ever tried cigarette smoking, even just 1 or 2 puffs?" in Wave II.

'Experimenters' are participants that answered "Yes" on "Ever smoked a cigarette (Have you ever tried cigarette smoking, even just 1 or 2 puffs?)" in Wave I and/or "Smoked a cigarette (Since [MOLI], have you ever tried cigarette smoking, even just 1 or 2 puffs)" in Wave II, but "No" on "Smoked cigarettes regularly (Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave I and/or "Smoked cigarettes regularly (Since [MOLI], have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave II. 'Smoker' participants answer "Yes" to both "Smoked cigarettes regularly (Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave I and "Smoked cigarettes regularly (Since [MOLI], have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave II.

In order to assess for smoking cessation, participants in the smoker category were further divided into three groups according to their smoking cessation status: 'successful quitter,' 'unsuccessful quitter,' and 'non-dissonant smoker.' 'Successful quitter' was a smoker that answered "Yes" to "Smoked cigarettes regularly (Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave I and "No" to "Smoked cigarettes regularly (Since [MOLI], have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave II.

Smokers that answered "Yes" to "Smoked cigarettes regularly (Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave I, "yes" to "Smoked cigarettes regularly (Since [MOLI], have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave II, and "Yes" to "Past 6 months, tried quit smoking (During the past 6 months, have you tried to quit smoking cigarettes?)" in Wave II were labeled as 'unsuccessful quitter'.

'Non-dissonant smoker' was a participant that answered "Yes" to "Smoked cigarettes regularly (Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?)" in Wave I, and "No" to "Past 6 months, tried quit smoking (During the past 6 months, have you tried to quit smoking cigarettes?)" in Wave II.

Depressive Symptoms

To measure depressive symptoms, this study used a modified version of the Center for Epidemiologic Studies Depression (CES-D) scale that had 19 items instead of the original 20. Radloff (1977) designed this scale to assess current depressive symptomatology and to study relationships between depression and other variables. This short self-report can be administered by lay interviewers, which makes it ideal for surveying large populations. The CES-D is highly reliable and internally consistent with sufficient test-retest repeatability, and the scale is also reliable when used with the adolescent population (Radloff 1977, 1991). The scale originally had 20 items, but two items, "My sleep was restless" and "I had crying spells" were omitted and one item, "I felt that life was not worth living" was inserted. Items were scored on a frequency range of 0–3 (0 = rarely or none of the time; 1 = some or a little of the time; 2 = occasionally or moderate amount of time; 3 = most or all the time). The scale took a sum of the responses, with a maximum score of 57. The higher the score, the higher the depressive symptoms. The CES-D has been shown to be highly reliable and internally consistent (Cronbach's α) with .85 for Wave I and .86 for Wave II (Hann et al. 1999). The CES-D was created with an arbitrary cutoff of 16 as an indication of current depressive symptoms. However, this study did not use that cutoff score as the indicator for depressive symptomatology because the cutoff was derived from the adult population. It was questionable whether the cutoff at 16 would be indicative of adolescent depressive symptoms. Because depressive symptom was a continuous variable in this study, this study used a cutoff from the 75th percentile as differentiation between high and low depressive symptoms. Adolescents in the 75th percentile and above are considered to have 'High'

depressive symptoms, and those below the 75th percentile are considered to have 'Low' depressive symptoms. This percentage related to the depressive-symptoms population from the epidemiological study by Rushton et al. (2002), whose results derived from the same data as the current study in Add Health. Rushton et al. (2002) examined prevalence of depressive symptoms based on two different cut off scores: 24 and 16. Prevalence of depressive symptoms based on a score of 24 was 9.2% at time 1 and 9.4% at time 2, and a score of 16 resulted in 28.7% at time 1 and 28.6% at time 2. Based on these results, the cutoff score of 16 was comparable to the 75th percentile cutoff in this study. However, cutting off highly depressive symptoms at the 75th percentile allowed this study to assess symptomatology in relationship to the participants and not to an arbitrary external parameter.

Demographics

The current study also examined depression and smoking in association with three demographic variables: gender, age, and race. Gender was assessed by the interviewer at the time of interview. The age of the participant was determined by birth date in month and year from the Add Health study. Six questions were used to assess ethnicity and race. Participants were asked the following:

- (1) "Are you of Hispanic or Latino origin?"
- (2) "What is your race? White"
- (3) "What is your race? Black or African American"
- (4) "What is your race? American Indian or Native American"
- (5) "What is your race? Asian or Pacific Islander"
- (6) "What is your race? Other"

From there, the current study categorized participants into the following groups by race: White, Black, Hispanic, Asian American and Pacific Islander, American Indian, and Other. Although Hispanic is considered an ethnicity and not a race in accordance to the Office of Management and Budget, when a respondent answered "yes" to "Are you of Hispanic or Latino origin?", that respondent was given a race of 'Hispanic' and eliminated from all other race categories in the Add Health data. In other words, participants assigned to White, Black, Asian American and Pacific Islander, American Indian, and Other are all non-Hispanic participants (Add Health 2004). The 'Other' category was for participants who were unable to identify with other categories.

Results

Of the 6,504 adolescents who responded in the public-use data set, only data from 5,625 participants were utilized because 879 participants entered multiple answers for the race and/or Hispanic ethnicity question. Overall, about half (50.9%) of the sample were non-smokers ($n = 2,863$; 1,372 males and 1,491 females), followed by 26.3% experimenters ($n = 1,477$; 729 males and 748 females) and 22.8% regular smokers ($n = 1,285$; 634 males and 651 females).

Table 1 Sample demographics by smoking status

	Total sample (<i>n</i>)	Smoking status		
		Non-smoker	Experimenter	Smoker
Gender				
Male	2,735 (48.6%)	1,372 (50.1%)	729 (26.7%)	634 (23.2%)
Female	2,890 (51.4%)	1,491 (51.6%)	748 (25.9%)	651 (22.5%)
Race				
White	2,900 (51.6%)	1,296 (44.7%)	783 (27%)	821 (28.3%)
Black	1,315 (23.4%)	884 (67.2%)	306 (23.3%)	125 (9.5%)
Hispanic	624 (11.1%)	328 (52.6%)	179 (28.7%)	117 (18.8%)
Asian	232 (4.1%)	144 (62.1%)	53 (22.9%)	35 (15.1%)
American Indian	203 (3.6%)	94 (46.3%)	58 (28.6%)	51 (25.1%)
Other	351 (6.2%)	182 (51.9%)	102 (29.1%)	67 (19.1%)
Age				
Mean (SD)	16.04 (1.62)	15.73 (1.65)	16.20 (1.47)	16.59 (1.47)

The racially diverse sample was comprised of 51.6% Whites (2,900), 23.4% Blacks (1,315), 11.1% Hispanics (624), 4.1% Asians and Pacific Islanders (232), 3.6% American Indians (203), and 6.2% Other (351). The Black (67.2%) and Asian and Pacific Islander (62.1%) group had the highest percentages of non-smokers. Aside from the other groups (29.1%), Hispanic (28.7%) and American Indian (28.6%) had the highest percentages of experimenters. The White (28.3%) and American Indian (25.1%) had the most smokers according to race. The mean age of the participants was 16.04 years \pm 1.62. There were age differences in all three smoking status groups; non-smoker group (15.73 \pm 1.65) was the lowest followed by experimenter (16.20 \pm 1.47) and smoker (16.59 \pm 1.47).

Sample demographics by smoking status are shown in Table 1. Gender ($\chi^2 = 11.72$, $p = .003$) was significantly related to smoking status but race ($\chi^2 = 12.21$, $p = .142$) was not significantly related to smoking status. The results of a one-way ANOVA showed that age was also significantly related to smoking status with regular smokers being significantly older than either experimenters ($p < .001$) or non-smokers ($p < .001$).

Concurrent Associations Between Smoking and Depression

Table 2 presents the concurrent distribution of depressive symptoms for non-smokers, experimenters, and regular smokers at the two waves of the study. At T1, 77.1% ($n = 4,320$) of the participants were in the low depressive symptoms group, and 22.9% ($n = 1,280$) were in the high depressive symptoms group. Similar percentages appeared in T2: 77.7% ($n = 3,223$) of the participants were in the low depressive symptoms while 22.3% ($n = 927$) were in the high depressive symptoms group. Although there were no significant changes in the percentage of participants with depressive symptoms in Waves I and II, there were significant differences

Table 2 Concurrent associations among smoking status and depression

Depression	Concurrent smoking status			Comparisons between groups (mean differences and standard errors)		
	Non-Smoker (1)	Experimenter (2)	Smoker (3)	1 vs. 2	1 vs. 3	2 vs. 3
Time 1						
Low ^a	2,375 (83.4%)	1,106 (75.1%)	839 (65.5%)	-2.16 (.24)***	-4.13 (.25)***	-1.96 (.28)
High	473 (16.6%)	366 (24.9%)	441 (34.5%)			
Group total	2,848	1,472	1,280			
Mean (SD) ^b	9.46 (6.73)	11.62 (7.63)	13.59 (8.37)			
Time 2						
Low	1,823 (83.5%)	811 (83.5%)	589 (67.3%)	-2.39 (.27)***	-3.74 (.29)***	-1.35 (.33)***
High	359 (16.5%)	282 (16.5%)	286 (32.7%)			
Group total	2,182	1,093	875			
Mean (SD) ^b	9.39 (6.70)	11.78 (7.56)	13.13 (8.37)			

^a Depression dichotomized into below ('low symptoms') and above ('high symptoms') 75th percentile for the group; ^b Depression treated as a continuous variable; *** $p < .001$

between the depressive symptoms and smoking status groups. Among the non-smokers group, 16.6 % of the participants had high depressive symptoms and that proportion doubled for regular smokers at Wave I (34.5%) and Wave II (32.7%). The proportion of participants with high depressive symptoms increased from non-smokers to experimenters in Wave I, but not in Wave II.

Table 2 also presents means and standard deviations for the (continuous) depressive symptoms measure for the three smoking groups. Wave I depressive symptoms were lower for the non-smokers compared to experimenters and regular smokers. However, there were no significant differences between the experimenters and smokers at Wave I. At Wave II, the differences in depressive symptoms among the three groups were more evident in all paired comparisons. From this, smoking and depressive symptoms showed concurrent associations, regardless of whether depressive symptoms were treated as a continuous variable.

Prediction Offered to Smoking at Wave II by Depressive Symptoms at Wave I

Table 3 shows the prospective analyses. Only non-smokers at Wave I were included in the first set. High versus low depressive symptoms at Wave I predicted future smoking status and experiment status of non-smokers. In parallel analyses for depressive symptoms as a continuous variable, non-smokers at Wave II had lower levels of depressive symptoms at Wave I than regular smokers and experimenters. Multivariate associations were also tested. Non-smokers with high depressive symptoms at Wave I had a 50% higher likelihood of becoming a smoker a year later [OR, 95% CI = 1.40 (1.04–1.89), $p < .05$] than those who reported low levels of depressive symptoms.

Prediction Offered to Depressive Symptoms at Wave II by Smoking at Wave I

Only those who reported 'low' depressive symptoms at Wave I was included in these analyses. Many more experimenters and regular smokers than non-smokers (categorized at Wave I) had developed high levels of depressive symptoms a year later (Wave II). When depressive symptoms were treated as a continuous variable, experimenters and regular smokers at Wave I had higher depressive scores than non-smokers a year later (Table 3). Also, regular smokers at Wave I had higher depressive scores than experimenters a year later. After controlling for age and gender, smoking status (ever versus never) at Wave I predicted high versus low depressive symptoms at Wave II [OR, 95% CI = .55 (.44–.68), $p < .001$]. Prediction by Wave I smoking status ($\beta = .14$, $p < .001$) was sustained when depressive symptoms were examined as a continuous variable in linear regression.

Predictors of Current Smoking Status

The current study examined whether depressive symptoms, gender, and age predicted smoking status. Table 4 shows the multiple logistic regression analysis of predicting current smoking status. Depressive symptoms at Waves I and II, as well as age, predicted current smoking status, but gender did not.

Table 3 Prospective associations among smoking status and depression

Depression	Concurrent smoking status			Comparisons between groups (mean differences and standard errors)		
	Non-smoker (1)	Experimenter (2)	Smoker (3)	1 vs. 2	1 vs. 3	2 vs. 3
Time 1 depression to Time 2 smoking^a						
Low (<i>n</i> = 2,898) ^b	1,644 (92.2%)	687 (84.4%)	567 (82%)	-1.65 (.26)***	-2.37 (.29)***	-.72 (.33)
High (<i>n</i> = 577)	178 (9.8%)	127 (15.6%)	272 (18%)			
Group total (<i>n</i> = 3,475)	1,822	814	839			
Mean (SD) ^c	8.01 (5.69)	9.66 (6.26)	10.38 (6.86)			
Time 1 smoking to Time 2 depression^d						
Low (<i>n</i> = 2,160) ^b	1,861 (82.3%)	239 (76.4%)	60 (67.3%)	-1.14 (.41)*	-3.33 (.79)***	-2.19 (.87)*
High (<i>n</i> = 494)	400 (17.7%)	74 (23.6%)	20 (32.7%)			
Group total (<i>n</i> = 2,654)	2,261	313	80			
Mean (SD) ^c	9.64 (6.84)	10.78 (6.88)	12.98 (8.74)			

^a Analyses only 3,475 participants with low depression at Time 1; ^b depression dichotomized into below ('low symptoms') and above ('high symptoms') 75th percentile for the group; ^c depression treated as a continuous variable; ^d analyses includes only 2,654 'never smokers' at Time 1; * *p* < .05; *** *p* < .001

Table 4 Multiple logistic regression analysis predicting current status as a smoker ($n = 5,625$)

Variable	Odds ratio	95% Confidence interval
Depression ^a at Time 1 (0: Low; 1: high)	1.41**	1.11–1.78
Depression ^a at Time 2 (0: Low; 1: high)	1.36**	1.08–1.71
Gender (1: male; 2: female)	1.04	.86–1.26
Age	1.26**	1.19–1.34

^a Depression dichotomized into below ('low symptoms') and above ('high symptoms') 75th percentile for the group; ** $p < .01$

Table 5 Concurrent depression and smoking cessation status

Depression	Concurrent smoking cessation status			Comparisons between groups (mean differences and standard errors)		
	Successful (1)	Unsuccessful (2)	Non-dissonant (3)	1 vs. 2	1 vs. 3	2 vs. 3
Time 1						
Low ^a	37 (68.5%)	202 (65.8%)	163 (62.5%)	-1.13 (1.22)	-1.20 (1.24)	-.06 (.70)
High	17 (31.5%)	105 (34.2%)	98 (37.5%)			
Group total	54	307	261			
Mean (SD) ^b	12.89 (7.17)	14.02 (8.25)	14.08 (8.49)			
Time 2						
Low ^a	40 (74.1%)	204 (66%)	173 (65.8%)	-1.51 (1.28)	-1.28 (1.30)	.23 (.73)
High	14 (25.9%)	105 (34%)	90 (34.2%)			
Group total	54	309	263			
Mean (SD) ^b	12.20 (8.14)	13.71 (8.51)	13.49 (8.99)			

^a Depression dichotomized into below ('low symptoms') and above ('high symptoms') 75th percentile for the group; ^b Depression treated as a continuous variable

Depressive Symptoms and Smoking Cessation

At Waves I and II, successful quitters had fewer high depressive symptoms compared to unsuccessful quitters and non-dissonant smokers (Table 5). However, the differences between the three groups on a continuum of depressive symptoms were not significant.

Discussion

This prospective adolescent study examined data on smoking and depressive symptoms collected from the National Longitudinal Adolescent Health Study between 1994 and 1996. This study aimed to examine the associations between depressive symptoms and smoking, concurrently and prospectively, in American

adolescents, the predictors of smoking, and the associations between concurrent depressive symptoms and success in smoking cessation.

Results of the study presented that higher levels of depressive symptoms at baseline (Wave I) were indicative of participants who smoked in the past and persisted to smoke regularly with low depressive symptoms. Also, higher levels of depressive symptoms at Wave II were characteristic of participants who smoked regularly. These results suggest that depressive symptoms promote concurrent smoking behavior, and further support the directional association in previous findings (Covey and Tam 1990; Escobedo et al. 1998; Kandel and Davies 1986; Kubik et al. 2003; Lam et al. 2005; Martini et al. 2002; Nezami et al. 2005; Patton et al. 1996, 1998).

Although, the current study examined participants by various smoking status to avoid confounding interference, it is possible that the study did not adequately filter out all confounding factors. The literature review on smoking and depression reveals that both are predictors of adolescents' risky behaviors such as alcohol and substance use, poor academics, early parenthood, poor sleep, and other health problems (Breslau 1995; Kubik et al. 2003; Mathers et al. 2006). It is probable that some confounding factors cut across smoking status. Aside for the causal explanation to the comorbidity of smoking and depression, an alternative is confounding and selection. These confounding factors can include genetic and environmental that increases the risk of depression and smoking.

In addition to the associations of smoking and depressive symptoms, this study also examined depressive symptoms and smoking cessation. Results indicate differences in the depressive symptoms of successful quitters compared to unsuccessful quitters and non-dissonant smokers, but the differences are not enough to be significant. This indicates that smoking cessation is affected by multiple factors. Because of the addictive effects of nicotine, smokers have difficulty quitting. Predictors of smoking cessation include influences from other adolescent non-smokers, readiness to change, confidence to quit smoking, and negative beliefs about smoking predicted readiness for smoking cessation (Apodaca et al. 2007; Stanton et al. 2006). Zhu et al. (1999) conducted a study on data from the National Teenage Attitudes and Practices Survey I and II. The study found frequency of smoking, length of past smoking cessation attempts, self-estimate of continual smoking, maternal smoking status, and depressive symptoms as significant baseline factors of smoking cessation. While the current study did not find significant differences between depression symptoms among the different smoking quit statuses, it recorded depressive symptom differences. Further study needs to be done to validate this predictor.

The associations between depression and smoking in relationship to gender and age revealed age is a predictor of current smoking status. In other words, the older the participant, the likelihood of current smoking increases. This can be attributed to the peer pressure face by older adolescents. Older adolescents tend to be more self-conscious and aware of peer's perception of their behavior, and studies support that peer effects on adolescent smoking status (Epstein et al. 2007; Miller et al. 2006; Scal et al. 2003). In addition, older adolescents can potentially smoke to reduce stress. Older adolescents experience more stress from school, social system, and

family in their stage of development compared to younger adolescents, and that can predispose them to smoke to alleviate stress. Although age is a predictor, gender differences do not predict current smoking status. This can be due to the similar environmental factors that adolescents experience despite gender differences. Although, adolescent boys and girls develop differently and at different rates, they encounter similar general developmental milestones. Also, there can be gender differences in the stressors and risk factors that cause smoking, but they have common coping mechanisms, both healthy and harmful. This explanation is supported by the similar percentages of non-smokers, experimenters, and smokers in this study in both males and females.

Although race was not examined in relation to depressive symptoms and smoking, this study examined racial differences and smoking status. African American adolescents had the highest rates of non-smokers and lowest rates of smokers. This finding is consistent with other studies on African Americans and smoking (Brook et al. 2004, 2006; Burke et al. 2007; D'Amico and McCarthy 2006; White et al. 2004, 2007; Wills et al. 2007). In contrast, White adolescents had the lowest rate of non-smokers and highest rates of regular smokers. This too is consistent with other studies (D'Amico and McCarthy 2006; White et al. 2004). These findings might seem surprising and inconsistent because African American adults have higher prevalence of current smoking even though White adults report higher prevalence of lifetime smoking. This can be explained by the late on-set of African American smoking and lower rates of cessation (White et al. 2004, 2007). White et al. (2007) found that Whites initiated smoking earlier and smoked more cigarettes than African Americans.

An explanation for low rates of African American adolescent smoking may be due to the tight knit family structure in African American families. African American families tend to be more hierarchical and strict, use demanding behavioral standards, and apply physical discipline. However, such strict discipline is balanced by strong love and support. In addition, the family structure is not limited to immediate family. Extended family as well as close friends are considered part of kin, and therefore adolescents can receive support from multiple relatives. In turn, the family is able to monitor adolescents more closely to reduce the risk of smoking and other delinquent behaviors.

The Add Health data allowed the current study to examine longitudinal data between two common problems, depressive symptoms and smoking, in a large sample across United States. However, limitations in the current study require caution in interpretation of the findings. First, the self-report nature of the Add Health can lead to unreliable and invalid data. Participants can choose to under-report, over-report, or provide factitious information which the study cannot safeguard against. Interviewer information, diagnostic interviews, and biochemical markers for tobacco use could be used to determine actual use of tobacco and concrete cases of depressive symptoms. Second, the small smoker sample size for a longitudinal study can affect the association between depressive symptoms and smoking. In turn, random errors can influence results. Third, although the current study did not use the arbitrary cut-off point in the CES-D, the study set its own arbitrary cut-off at the 75th percentile to examine depressive symptoms relative to

the participants. This arbitrary point could have potentially under and/or over-screened depressive symptoms. Fourth, CES-D does not clinically diagnose Major Depression, so the depressive symptoms can be indicative of other psychiatric disorders such as anxiety. In addition, CES-D might not be culturally sensitive to accurately identify depressive symptoms in different cultures. Hispanic cultures tend to be expressive while Asian cultures tend to be reserved, so depressive symptoms can manifest differently, which in turn may affect CES-D. Fifth, the smoking questions on Add Health used in this study have not been standardized or validated, and therefore the reliability and validity of the smoking measures may be questionable.

Overall, these findings provide insight for the growing body of information on smoking and depressive symptoms. Even though the results of this study supported other studies that found depressive symptoms promote smoking, other studies have found the opposite or the confounding factor explanation to be true. Therefore, additional studies need to be done to continue to investigate the mechanism behind this comorbidity. Meanwhile, the association between depressive symptoms and smoking endorses calls for effective evidence-based intervention that targets depressive symptoms and healthy coping methods with adolescents. This is important for adolescents of all racial backgrounds but particularly the White and African American population. In addition, older adolescents are susceptible to smoking, so smoking prevention can provide alternatives to smoking and the reasons or precursors to smoking. Schools can implement smoking education for young adolescents to reinforce the alternatives for the future.

Practice Implications

In our attempt to determine how the selected influences of depression and smoking affect adolescents, we have determined that reduced rates of adolescent depression are associated with lower adolescent smoking rates. Improvements in emotional health therefore, may result in reducing risks to physical health relative to smoking for the sample studied. Furthermore, rates of smoking cessation are positively associated with lower average rates of depression, whereas concurrent and prospective smoking is associated more with higher rates of adolescent depression.

Social workers, and other allied health professionals, who provide health or behavioral health services for adolescents may be in a unique position to positively affect a major public health concern. Adolescents who smoke are likely to become lifelong or habitual smokers. Interceding in the internal (physical) issues experienced by adolescents, such as depression, can potentially reduce incidence rates of long term smoking, among those who began smoking as adolescents. Furthermore, determining the external issues (social and environmental) that contribute to adolescent depression may serve to reduce more generalized rates of habitual smoking within the United States population of adolescents relative to age and race. Both internal and external influences may be experienced differentially based upon relative age (within adolescence) and other demographic characteristics such as, self identified ethnic group. Gender, however, is not an influential factor, based on data from this study. Additionally, the Add Health Form 1994 to 1996 and CES-D Form

used in this study have utility in screening for smoking behavior and adolescent depression respectfully for purposes of establishing criteria for service utilization suitability of affected adolescents. For those adolescents who are already smoking and experiencing some dissonance about smoking behaviors, and adolescents who are in the experimentation stage of smoking behavior, early detection of adolescent depression and effective anti-depressive intervention may be associated long term reductions in negative health outcomes for adolescents who smoke.

Practitioners who work in school and adolescent health or behavioral health services are uniquely well positioned to affect adolescent smoking behaviors through training in the screening of adolescents for depression, and in addressing social and environmental influences that contribute to adolescent depression. Though a behavioral change in adolescent smoking behavior is desired, reduction of depressive symptoms and contributing external influences may be essential to achieving behavioral change. Furthermore, length of time either of depressed adolescent mood, or of adolescent smoking behavior, may be considerations relative to achieving positive behavioral change outcomes. This study provides critically needed and relevant decision-support for those seeking to develop public health and behavioral health programming, and group, or cohort membership evaluative technologies, to reduce adolescent smoking within the United States.

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