

RESEARCH COMMUNICATION

Longitudinal Study of Smoking Progression in Chinese and Vietnamese American Adolescents

Celia P Kaplan^{1,2}, Tung T Nguyen^{1,2,3}, Vivian Weinberg³

Abstract

The use of tobacco remains a significant public health concern among Asian American (AA) adolescents. Understanding the factors that affect smoking progression among Chinese and Vietnamese adolescents in particular, may help in illuminating potential interventions that can be implemented to maximize scarce programming and resources. This study is a longitudinal cohort study with data collected in California via telephone over a two-year period. 1,270 Chinese and Vietnamese American adolescents were recruited via telephone listings from one southern and four northern California counties. Main outcomes were smoking susceptibility and change in smoking status. Examination of these adolescents indicated that in both groups: boys were more likely than girls to become susceptible to smoking, risk behaviors were associated with becoming smokers, having been susceptible at baseline was associated with susceptibility and smoking at follow-up, and the influence of friends was a predictor of susceptibility and smoking.

Key Words: Smoking progression - Vietnamese adolescents - Chinese adolescents

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Introduction

Cigarette smoking represents a significant public health problem and has been identified as the single most preventable cause of disease and premature death in the United States (CDC, 2000). Initiation primarily begins in adolescence when the consequences of morbidity or mortality seem irrelevant or distant. Experimentation follows, culminating in a choice about whether or not to smoke regularly. This choice can be conceptualized as the end point in a series of decisions that reflect an individual's family and peer environment, cultural background, and personal characteristics.

Asian Americans (AAs) are one of the fastest growing ethnic minority groups in the United States. Among AAs, Chinese and Vietnamese groups are of particular importance, since they comprise more than one-third of the AA population in the US. Although AA adolescents smoke less than non-Asians (Chen et al., 1999a; Wallace et al., 2002), it appears that this group may initiate smoking at a later age than whites (Chen et al., 1999a; Chen et al., 1999b).

While several studies have included AA adolescents in their samples (Chen and Unger, 1999; Chen et al., 1999a; Chen et al., 1999b; Harachi et al., 2001), most of these studies have been based on cross-sectional data (Chen and Unger, 1999; Shakib et al., 2003; Weiss et al., 2006), have not examined smoking behavior separately for AAs (O'Loughlin et al., 1998; Ellickson et al., 2003;

Trinidad et al., 2004), or have not differentiated between the different ethnic Asian groups. Examination of AA adolescents as a group suggests that parental smoking behavior (Chen and Unger, 1999), participation in high-risk behaviors, poor grades (Landrine et al., 1994), and peer smoking are related to smoking prevalence (Unger et al., 2000b; Unger et al., 2001). Acculturation indicators have been examined in cross-sectional studies and have been consistently identified as risk factors for smoking among AA adolescents, particularly girls (Weiss et al., 2006). While these factors have been found to increase risk of AA adolescent smoking, potential protective elements prevalent in the AA culture, such as strong academic and personal aspirations (Fulgini, 2001) and strong family relationships (Schneider and Lee, 1990; Kao, 1995), have not been fully explored.

Research on smoking initiation and progression among adolescents in general has increased our overall understanding of the smoking initiation process (Landrine et al., 1994). Several frameworks exist to describe the progression of behavior along the smoking continuum (Flay et al., 1992; Pierce et al., 1998a), and an important stage along this continuum—susceptibility to smoking—has been identified previously in the literature (Pierce et al., 1993). Pierce et al. (Pierce et al., 1993) describe this stage as a susceptibility to smoking measured by the absence of having made a decision not to smoke in the future. Using this framework as a theoretical guide, our longitudinal study examined smoking progression among

¹Division of General Internal Medicine, Department of Medicine, ²Medical Effectiveness Research Center for Diverse Populations,

³Comprehensive Cancer Center Biostatistics Core, University of California, San Francisco, San Francisco, CA, USA

*For Correspondence: E-mail: celia.kaplan@ucsf.edu

1,270 Chinese and Vietnamese adolescents in California. The effects of acculturation, risk behavior, personal aspirations, and parental and peer influences on the transition to smoking are identified separately for Chinese and Vietnamese adolescents. Understanding these factors will facilitate the development of an intervention focused on preventing cigarette smoking in these two groups of understudied adolescents.

Materials and Methods

Data Collection

Our cohort was obtained using phone listings for households with common Vietnamese and Chinese surnames, a method successfully utilized in prior research (Jenkins et al., 1990). Phone listings came from one southern California county and four northern California counties. Our final sample contained approximately equal percentages of participants from each ethnic group. Baseline data were collected between November 1998 and March 1999. Follow-up 1 was conducted between January and May 2000, and follow-up 2 was conducted between February and March 2001.

Households with an adolescent resident, 12 to 17 years old, of Vietnamese, Chinese, or mixed Vietnamese/Chinese descent were eligible. Parents/guardians gave verbal informed consent for their children's participation, and adolescents subsequently gave their verbal assent. In the follow-ups, we did not require parental consent for adolescents 18 years and older. Adolescents received \$5 for their participation. The Committee on Human Research at the University of California, San Francisco, approved all study protocols.

Among the 4145 potentially eligible households, we obtained permission from 34% (n=1391) of the parents to interview their children, and 91% (n=1270) of the adolescents agreed to be interviewed. A total of 1035 respondents completed follow-up 1 (51 refusals and 184 participants lost to follow-up). For follow-up 2 2975 (77% of baseline) respondents completed interviews, (28 refusals, and 32 cases lost to follow-up). Comparison of participants who completed all interviews and those who dropped out of the study revealed lower completion for Vietnamese, males, older adolescents, and those who were foreign born, less acculturated, and not living with both parents (data not shown).

The survey instrument consisted of items developed specifically for this study and questions from the California Tobacco Survey (Pierce et al., 1998b), the Youth Risk Behavior Surveillance System developed by the Center for Disease Control (MMWR, 1995), and the Health Behavior Questionnaire (Jessor, 1991). The survey was designed in English, translated into Vietnamese and Cantonese, and back-translated into English to ensure accuracy (Brislin, 1986). The abbreviated follow-up questionnaires included a subset of baseline questions.

Outcome Measures

Adolescent smoking behavior was classified into three categories at baseline and at each follow-up as described below:

- (1) Nonsmokers/non-susceptibles: never tried smoking and would "definitely not" smoke in the following 12 months.
- (2) Nonsmokers/susceptibles: never tried cigarettes, but would "definitely yes", "probably yes", or "probably not" smoke in a year.
- (3) Experimenters/smokers: tried cigarettes, smoked within the past 30 days, or smoked more than 100 cigarettes in their lifetime.

Predictors

Background

These variables included ethnicity (Vietnamese versus Chinese), gender, age at baseline (12-17 years), and parents' education level (high school or less versus any college).

Acculturation

Adolescents reported their country of birth (foreign versus US) and language preferences. Using a language acculturation scale, four items identified the language/s the adolescent used as a child, read in, usually spoken at home, and usually spoken with friends. Responses ranged from only Vietnamese/Chinese to only English. Factor analysis confirmed the unidimensionality of this scale (alpha reliability of 0.72). Calculating the mean of these items yielded an overall language acculturation score with higher scores corresponding to higher levels of acculturation.

Risk behavior

Any adolescent reporting ever having had a drink of beer, wine, or liquor; or ever having had sex was classified as exhibiting a risk behavior. Smoking susceptibility at baseline was incorporated as a risk factor for future smoking.

Family and peer influences

(1) Parental and peer smoking: Maternal and parental smoking was combined into one variable, reflecting whether either parent ever smoked. Participants also reported whether any siblings ever smoked and any friends currently smoke.

(2) Parental support: Adolescents recounted how frequently (never, rarely, sometimes, often) their parents praised them for doing a good job, listened to what they had to say, and attended events or activities that were important to them. Factor analysis confirmed the unidimensionality (alpha=0.60) of these three items allowing for a combined predictor. A high value denotes strong parental support.

Academic and personal aspirations

(1) School performance: Participants' reported average grades were dichotomized into "mostly As and Bs" versus everything else.

(2) Life goals: Adolescents estimated their chances of achieving six potential life goals using a five-point scale (1=very low chance, 5=very high chance). Two scales emerged through factor analysis: perception of scholastic achievement that included chances of graduating from

high school and going to college (alpha reliability 0.71) and perception of personal success that assessed their chances of having a job that pays well, a happy family life, good friends that they can count on, and owning a own home (alpha reliability 0.71).

Statistical Analysis

Data was analyzed using SAS version 8.0 (SAS Institute, 1999). We began with factor analyses using the promax method of rotation to determine the independent scales combining survey questions to be included in the analyses. Once these subscales were established, we confirmed the reliability of the scales by computing Cronbach's coefficient alpha for each set of variables within a scale.

Descriptive statistics including means, standard deviations, and frequencies were calculated for each ethnicity. We also compared the baseline demographics of subjects who completed the study with those who did not using chi-square tests for categorical variables and Student's t-tests for continuous variables. The primary outcomes studied were the measures of smoking behavior at each time period (nonsmoker/non-susceptible, nonsmoker/susceptible, and experimenter/smoker). Assuming a Markov model, all respondents were categorized into the three possible smoking states. The transition probabilities of the models refer to the probabilities of a change in smoking status based on the current smoking state.

Finally, we examined the relationship of a three-level response of the smoking behavior (nonsmoker/non-susceptible, nonsmoker/susceptible, and experimenter/smoker) at the second follow-up and potential covariates using a generalized logistic regression model for a

polytomous outcome for Vietnamese and Chinese participants (McCullagh and Nelder, 1989). We used the nonsmoker/non-susceptible category as the reference outcome, and we reported the binary logic comparisons of nonsmoker/susceptible versus nonsmoker/non-susceptible and experimenter/smoker versus nonsmoker/non-susceptible. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were computed with the multivariate models.

Results

Respondent Characteristics (Table 1)

A total of 1270 participants were recruited at baseline, with equal proportions of males and females. Age of participants ranged from 12 to 17, with a mean age of 14.7. A higher proportion of Chinese participants reported higher scores on the language acculturation scale, were born in the U.S, and had parents who attended college compared to Vietnamese participants. A greater proportion of Chinese adolescents reported risk behaviors, average grades of mostly As and Bs, and higher scores in both the personal and academic aspiration scales than their Vietnamese counterparts. A lower proportion of Chinese were nonsmokers/non-susceptible at baseline. A greater proportion of Vietnamese adolescents reported that they had a parent who smoked and had a higher mean score on the parental support scale compared to Chinese adolescents.

Smoking Behavior (Table 2)

At baseline, 79.2% of adolescents were classified as nonsmokers/non-susceptibles, 14.3% as nonsmokers/susceptible, and 6.5% of adolescents as experimenters/

Table 1. Baseline Characteristics of Chinese and Vietnamese adolescent participants, California, 1999-2001

	Total (n = 1270)	Vietnamese (n = 638)	Chinese (n = 632)	P value
BACKGROUND				
Gender, % male (n)	49.0 (622)*	47.5 (299)	50.4 (323)	0.31
Age, Mean (SD)	14.7 (1.6)	14.6 (1.6)	14.8 (1.6)	0.05
Current grade, Mean (SD)	9.0 (1.6)	9.0 (1.6)	10.0 (1.6)	0.17
Parent's higher education, % college	71.6 (837)	59.8 (332)	82.2 (505)	<0.001
Living with both parents % (n)	85.6 (1087)	85.5 (538)	85.6 (549)	1.00
ACCULTURATION				
Country of birth % U.S. born (n)	51.7 (657)	41.2 (259)	62.1 (398)	<0.001
Language acculturation scale, range 1-5 Mean (SD)	3.4 (0.9)	3.2 (0.8)	3.6 (0.9)	<0.001
RISK BEHAVIORS				
Had sex or drank alcohol % (n)	28.0 (354)	23.2 (145)	32.7 (209)	<0.001
Susceptible or smoker at baseline % (n)	20.8 (264)	17.3 (109)	24.2 (155)	<0.01
FAMILY AND PEER INFLUENCES				
Parent ever smoked % (n)	51.1 (649)	61.4 (386)	41.0 (263)	<0.001
Parents desire not to smoke % (n)	79.6 (1011)	79.8 (502)	79.4 (509)	0.89
Parental support (Mean, SD)	3.4 (0.6)	3.4 (0.7)	3.3 (0.6)	0.01
Friends ever smoked % (n)	52.8 (610)	51.3 (314)	54.2 (296)	0.33
Sibling ever smoked % (n)	16.5 (209)	17.8 (112)	15.1 (97)	0.23
Siblings desire not to smoke % (n)	52.7 (669)	64.4 (405)	41.2 (264)	<0.001
ACADEMIC AND PERSONAL ASPIRATIONS				
School performance Grades, % As and Bs (n)	77.9 (989)	74.9 (471)	80.8 (518)	0.01
Perception of scholastic achievement, range 1-5 Mean (SD)	4.6 (0.6)	4.4 (0.7)	4.7 (0.5)	<0.001
Perception of personal success, range 1-5 Mean (SD)	4.3 (0.6)	4.2 (0.6)	4.3 (0.5)	<0.01

Table 2. Smoking Behavior and Markov Probabilities, Chinese and Vietnamese Adolescents, California, 1999-2001

SMOKING BEHAVIOR (%)			
	Nonsmokers ¹	Susceptible ²	Smokers ³
Baseline (n=1270)	79.2	14.3	6.5
Follow-up 1 (n=1035)	67.5	20.9	11.5
Follow-up 2 (n=975)	65.2	20.1	14.7
Baseline			
Chinese	75.8	16.4	7.8
Vietnamese	82.7	12.2	5.1
Follow-up 1			
Chinese	66.7	20.5	12.8
Vietnamese	68.8	21.3	9.9
Follow-up 2			
Chinese	67.0	17.5	15.5
Vietnamese	63.1	23.2	13.7

MARKOV MODEL—TRANSITION PROBABILITIES			
Baseline to Follow-up 1 (n=1,024)			
Nonsmoker/Non-susceptible	80%	17%	3%
Nonsmoker/Susceptible	25%	52%	23%
Experimenter/Smoker ^a	0%	0%	100%
Follow-up 1 to 2 (n=932)			
Nonsmoker/Non-susceptible	83%	13%	2%
Nonsmoker/Susceptible	30%	54%	16%
Experimenter/Smoker ^a	0%	0%	100%
Baseline to Follow-up 2 (n=932)			
Nonsmoker/Non-susceptible	68%	23%	9%
Nonsmoker/Susceptible	33%	31%	36%
Experimenter/Smoker ^a	0%	0%	100%

¹Nonsmoker/Non-susceptible, ²Nonsmoker/Susceptible, ³Experimenter/Smoker ^aBy definition, it is not possible for a smoker to become a nonsmoker, either non-susceptible or susceptible. Smoking is an absorbing state in the Markov model

smokers. The proportion of experimenters/current smokers increased at each follow-up, to 11.5% at follow-up 1 and to 14.7% at follow-up 2. The proportion of nonsmokers/non-susceptibles decreased at each follow-up, dropping to 67.5% at follow-up 1 and 65.2% by follow-up 2.

Based on a Markov model analysis, the probability of remaining a nonsmoker/non-susceptible was 80% from baseline to follow-up 1, 83% from follow-up 1 to 2, and 68% between baseline and the second follow-up.

At the first follow-up, among the nonsmokers/non-susceptibles, 17% made a transition to susceptibles and only 3% became smokers. Among the susceptibles, one-quarter made a reverse transition to nonsmoker/non-susceptible, 52% remained in the same status, and 23% made a transition to smoker.

By the second follow-up, only 2% of those who were nonsmokers/non-susceptibles at first follow-up became smokers, while 16 % of nonsmokers/susceptibles at follow-up 1 were smokers by follow-up 2.

From baseline to the second follow-up, among nonsmoker/susceptibles, 31% remained in the same status, 33% reversed transition to non-susceptibles, and 36% became smokers. Transition probabilities were identical for both Vietnamese and Chinese subsets.

Multivariate Analyses (Table 3)

In both groups, males were more likely than females to become both susceptible and smokers. US-born Chinese adolescents were more likely to report smoking

Table 3. Polytomous Generalized Logistic Regression of Smoking Progress at Second Follow-up Interview, Chinese and Vietnamese Adolescents, California, 1999-2001

	VIETNAMESE		CHINESE	
	Susceptible OR (95 CI)	Smokers OR (95 CI)	Susceptible OR (95 CI)	Smokers OR (95 CI)
BACKGROUND				
Gender (male vs. female)	2.15 (1.25, 3.70)**	3.59 (1.62, 7.92)**	2.50 (1.45, 4.33)***	2.27 (1.11, 4.65)*
Age	0.99 (0.82, 1.21)	1.02 (0.77, 1.35)	0.86 (0.70, 1.04)	1.06 (0.80, 1.41)
Parents' education				
Parents' college education	1.05 (0.60, 1.84)	1.63 (0.72, 3.69)	0.93 (0.45, 1.92)	0.86 (0.37, 2.05)
Education missing	1.59 (0.50, 5.05)	2.12 (0.45, 10.07)	1.00 (0.24, 4.27)	0.38 (0.02, 6.31)
ACCULTURATION				
Country of birth (U.S. vs. foreign)	0.92 (0.50, 1.71)	1.35 (0.57, 3.20)	1.45 (0.75, 2.78)	3.90 (1.63, 9.35)**
Language acculturation scale	1.13 (0.77, 1.66)	1.14 (0.67, 1.96)	0.97 (0.68, 1.38)	0.66 (0.42, 1.03)
RISK BEHAVIORS				
Risk behaviors (sex and alcohol)	0.98 (0.47, 2.05)	3.44 (1.53, 7.75)**	1.36 (0.76, 2.46)	2.64 (1.29, 5.39)**
Smoking at baseline (susceptibles/smokers vs. non-susceptible/nonsmoker)	9.80 (4.03, 23.9)****	12.3 (4.56, 33.2)****	9.23 (4.57, 18.6)****	23.7 (10.7, 52.5)****
FAMILY AND PEER INFLUENCES				
Parent ever smoke (yes vs. no)	0.78 (0.45, 1.34)	1.73 (0.74, 4.02)	1.36 (0.80, 2.33)	1.37 (0.69, 2.75)
Parents desire not smoke	1.05 (0.59, 1.87)	1.36 (0.61, 3.05)	0.73 (0.40, 1.35)	1.19 (0.54, 2.64)
Lack of parental support	1.57 (0.99, 2.47)*	1.43 (0.74, 2.74)	1.40 (0.84, 2.31)	1.44 (0.78, 2.66)
Friends smoke (yes vs. no)	1.82 (1.02, 3.25)*	10.9 (3.70, 32.2)****	1.72 (0.94, 3.23)	5.47 (1.95, 15.4)**
Sibling ever smoke (yes vs. no)	1.26 (0.61, 2.58)	0.70 (0.24, 2.02)	1.40 (0.64, 3.03)	2.61 (1.13, 6.01)*
Sibling desires not to smoke	1.48 (0.83, 2.64)	1.34 (0.59, 3.05)	1.07 (0.62, 1.84)	1.02 (0.51, 2.05)
ACADEMIC AND PERSONAL ASPIRATIONS				
School performance	1.16 (0.56, 2.36)	0.86 (0.35, 2.12)	0.91 (0.43, 1.91)	0.76 (0.33, 1.78)
Perception of scholastic achievement	1.82 (1.06, 3.12)*	1.41 (0.73, 2.74)	0.90 (0.47, 1.69)	0.57 (0.26, 1.25)
Perception of personal success	0.73 (0.43, 1.26)	0.54 (0.25, 1.14)	0.80 (0.46, 1.40)	0.52 (0.27, 1.03)

^aEstimated odds ratios for age was computed based on a 5-year increment. *****,***,**,*, denotes ≤ 0.05, ≤ 0.01, 0.001, 0.0001

at the second follow-up than foreign-born Chinese [OR = 3.90 (1.63, 9.35)]. Engagement in risk behaviors was associated in both ethnic groups with becoming smokers [OR = 3.44 (1.53, 7.75) for Vietnamese and OR = 2.64 (1.29, 5.39) for Chinese]. Having been susceptible or a smoker at baseline was associated in each group both with susceptibility and with smoking. Similarly, having friends who smoke was a predictor of susceptibility and smoking in both groups, while having a sibling who smoked was positively associated with smoking for Chinese adolescents only [OR=2.61 (1.13, 6.01)]. For Vietnamese adolescents, lack of parental support was associated with susceptibility to smoking [OR = 1.57 (0.99, 2.47)], as was having a positive view of scholastic achievement [OR = 1.82 (1.06, 3.12)].

Discussion

Research on adolescent smoking uptake reveals that it is a multi-stage process that occurs over time. In this study, the overall smoking pattern for Chinese and Vietnamese adolescents was found to be very similar. However, there are some differences between the two groups, as well as differences between our findings and those of previous research.

As established in prior research, our analysis confirmed a low level of smoking experimentation and use among AA adolescents. However, in our sample, we found greater susceptibility compared to other studies (Unger et al., 2000b) and greater smoking compared to another larger California study (Gilpin et al., 2001). Age differences between the samples and differing definitions of smoking among the studies may explain the divergent smoking rates. Also, differences may be the result of changes in adolescent smoking behavior over time.

Among Chinese and Vietnamese adolescents in our study, the greatest progression to smoking occurred among those who were identified as susceptible in the prior year. As indicated in other research, intentions are highly predictive of future smoking behavior (O'Callaghan et al., 1999). Our study also confirms that once adolescents become smokers, they are very unlikely to revert to being nonsmokers.

Country of birth, a measure of acculturation, was related to progression to smoking in the Chinese sample and only as a predictor of smoking. This finding is consistent with other studies that have measured the relationship between acculturation indicators and smoking (Chen et al., 1999a; Unger et al., 2000a). In prior research, AAs who came to the United States after their sixth birthday were found to have a lower risk of initiating smoking than those who arrived at a younger age or were born in the US (Chen et al., 1999b). This finding suggests that although AA youth generally have lower smoking levels than other ethnic groups (Chen et al., 1999a), the levels may approach those of native residents as increasing numbers of US-born AA children reach adolescence. Cultural norms may deter children and youth from smoking, although such restrictions are not present for adults (Ellickson et al., 2003), as evidenced by the high rates of smoking among adults males in Asian countries

and among Vietnamese men living in the US (Wiecha et al., 1998).

For both groups, males were more likely by the second follow-up (Fulkerson and French, 2003) to become susceptible and/or smokers than females. This supports previous findings of higher levels of smoking by AA males compared to AA females (Maxwell et al., 2005). Although recent studies have identified an interaction effect between gender and acculturation indicators among adults (Maxwell et al., 2005; Tang et al., 2005) and among adolescent girls (Weiss and Garbanati, 2006), our analysis failed to identify a different pattern among adolescents of different gender and acculturation levels.

The association between risk behaviors and smoking is well noted in the literature (Scal et al., 2003; Paavola et al., 2004). Surprisingly, in our study, risk behaviors were linked only with smoking status and not with susceptibility. It is possible that adolescents who were already engaged in risk behaviors at baseline had moved into the susceptibility stage earlier in their development.

The effect of friends' smoking is also well documented (Unger et al., 2001; Hoffman et al., 2006) and was again found in our sample. However, it is unclear whether adolescents' selection of friends who smoke is a reflection of their susceptibility to smoking or a leading influence towards that behavior. The longitudinal nature of our study suggests that the influence of peer smoking may precede the effects of susceptibility and smoking status.

Given the strong AA family ties, we hypothesized that parents would exert a strong influence on their children's smoking behavior. Our results did not support this notion and contradict results of prior longitudinal research (Hill et al., 2005). The literature supports the idea that parents who ever smoked place their children at higher risk compared to parents who never smoked (Bricker et al., 2003). However, parents' smoking was not a predictor of smoking among the Vietnamese or Chinese adolescents in our study.

With respect to the aspiration indicators, Vietnamese adolescents who indicated high expectations of scholastic achievement were associated with greater susceptibility to smoking. While the literature reports a strong negative association between education and smoking, recent reports suggest that academic competitiveness may increase smoking initiation (Johnson and Hoffmann, 2000).

Although this study provides information that may be incorporated into smoking prevention programs, there are several limitations. First, adolescents may have under- or over-reported their smoking behavior. Our study is also limited by the somewhat low response rate, partly due to the two-year cohort study design. Our findings may have limited generalizability to AAs living elsewhere in the US, because of differences in state-level tobacco control policies. In addition, since surnames were used to obtain the sample, adolescents with non-Chinese or non-Vietnamese last names may have been missed. However, the strength of our study lies in its inclusion of large numbers of bilingual Vietnamese and Chinese youth and in its longitudinal nature.

In sum, this study highlights common factors that affect Vietnamese and Chinese adolescent progression

along the smoking continuum. The use of tobacco remains a significant public health concern among AA adolescents, as well as a complex issue involving cultural values that may differ from those of US society. Understanding which factors influence smoking progression among AA adolescents may help illuminate on potential common and individual interventions that can be implemented to maximize scarce resources.

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