NON-DAILY SMOKING PREDICTS HAZARDOUS DRINKING AND ALCOHOL USE DISORDERS IN YOUNG ADULTS IN A LONGITUDINAL U.S. SAMPLE

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Abstract

BACKGROUND—It is known that daily smoking is associated with the development of alcohol use disorders. However, non-daily smoking is prevalent in young adults and is associated with increased rates of problematic alcohol use in cross-sectional data. It is unknown whether non-daily smoking is predictive of hazardous drinking and alcohol use disorders using longitudinal data. The primary aim of the present investigation was to explore the temporal relationship between non-daily smoking and drinking in young adults, and secondarily, whether college status modified this relationship.

METHODS—Using Waves 1 (2001–2002) and 2 (2004–2005) of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC), we examined the predictive relationship of smoking status at Wave 1 and change in college status between Waves on alcohol drinking, hazardous drinking, and alcohol abuse and dependence disorders at Wave 2. The sample was restricted to individuals aged 18–25 years at Wave 1.

FINDINGS—Daily and non-daily smokers at Wave 1, compared to nonsmokers, were at a greater risk for hazardous drinking and alcohol use disorders at Wave 2, after controlling for Wave 1 drinking. College status did not modify smoking and drinking interactions.

CONCLUSIONS—The findings indicate non-daily smoking is predictive of increased, problematic alcohol use among young adults longitudinally and they support increasing evidence that non-daily smokers represent an important population. Future research should be conducted to continue developing targeted interventions. Early treatments for smoking behavior might have a beneficial effect on reducing the development of problematic patterns of alcohol use and alcohol use disorders.

Keywords

young adults; smoking; alcohol; NESARC; hazardous drinking

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1. Introduction

Alcohol and smoking are often paired activities in young adults (McKee et al., 2004), and rates of co-morbid tobacco and alcohol use are the highest in this age group (Falk et al., 2006). An estimated 23.6% of young adults aged 18–24 years are smoking daily (Centers for Disease Control and Prevention, 2005), however non-daily smoking is also prevalent in this age group (Hassmiller et al., 2003; Hennrikus et al., 1996). Population studies have documented that 19% to 24% of current smokers use cigarettes on a non-daily basis, with 29% of young adults reporting this pattern of use (Harrison et al., 2008). Although the relationship between drinking and daily smoking is well characterized in young adults (Bobo and Husten, 2000; Schorling et al., 1994; Weitzman and Chen, 2005), few epidemiological investigations have examined associations between non-daily smoking and alcohol use. We recently explored these associations in young adults aged 18–25 (Harrison et al., 2008) using Wave 1 of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC; Wave 1, 2001–2002; Grant et al., 2003a). Non-daily smokers were more likely to be current drinkers, to drink more alcohol, and to drink more frequently than nonsmokers. Non-daily smokers were 15.8 times more likely to be hazardous drinkers, while daily smokers were 7.2 times more likely, compared to nonsmokers. Non-daily smokers were 5.0 times more likely to meet criteria for an alcohol use disorder, while daily smokers were 3.8 times more likely. College status did not influence the relationship between smoking and alcohol outcomes.

The current investigation extends our cross-sectional study (Harrison et al., 2008) to explore the temporal relationship between non-daily smoking and drinking use in young adults. We examined the relationship between smoking status at Wave 1 (2001–2002) and alcohol use, binge drinking, hazardous drinking, and alcohol diagnoses at Wave 2 (2004–2005; Grant and Kaplan, 2005). Longitudinal research with young adults has indicated that light smoking can be predictive of alcohol use at later assessments (Jackson et al., 2002). To the degree that non-daily smoking confers risk for binge drinking, alcohol use disorders, and hazardous drinking, we predicted that Wave 1 non-daily smoking would be predictive of Wave 2 alcohol use, even after controlling for Wave 1 alcohol use.

Secondarily, we examined whether college status modified relationships between smoking and drinking. Research examining joint trajectories of smoking and drinking in young adults has either focused on college samples, or has not examined college status (Jackson et al., 2008). In our recent work (Harrison et al., 2008), college status did not influence the relationship between smoking and drinking at Wave 1 of the NESARC. Given that we did not observe significant interactions between college status and smoking in our analyses of Wave 1 (Harrison et al., 2008), no significant interactions were predicted in the current study.

2. Materials and Methods

2.1 Data Source

The NESARC study was conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Wave 1 (2001–2002) data were collected by personal interviews with 43,093 civilian, noninstitutionalized adults (age, ≥ 18 years) residing in the United States. African-Americans, Hispanics, and adults aged 18–24 were oversampled. Wave 2 (2004–2005) was conducted with 34,653 participants. Data were weighted to account for oversampling and to adjust for nonresponse, and were further adjusted to be representative of the US civilian population using the 2000 decennial census. Further details of the sampling, purpose, and weighting have been published elsewhere (Grant et al., 2005). Age was restricted to 18–25 years at Wave 1 for our analyses (n=4,468).

2.2 Definitions of Smoking Status, Drinking Behavior, Alcohol Diagnoses, and College Status

Current (anytime within the past 12 months) smoking and drinking behavior and alcohol diagnostic criteria were assessed at each Wave with the Alcohol Use Disorders and Associated Disabilities Interview Schedule-DSM-IV [Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition] Version (AUDADIS-IV; Grant et al., 2001). The AUDADIS-IV has demonstrated reliability and validity for the assessment of smoking and drinking behavior and alcohol use disorders (Grant et al., 2003b; Nelson et al., 1999).

2.2.1 Cigarette Use—We coded the NESARC data for Wave 1 into the following categories for past 12-month cigarette use. *Daily:* Responded 'yes' when asked, "did you smoke in the past year?" and when asked "how often did you smoke in the past year" indicated 'everyday'. *Non-daily:* Responded 'yes' when asked "did you smoke in the past year" and when asked "how often did you smoke in the past year" indicated between 'once a month or less' up to '5–6 days a week'. *Non-smoker:* Responded 'no' when asked about use of cigarettes, cigars, pipe tobacco, snuff, and chewing tobacco in the past 12 months. This group was comprised of never and former smokers. Only 3.7% of the Wave 1 sample were former smokers, and study-related outcomes did not substantively differ when former smokers were combined with never smokers.

2.2.2 Alcohol Use Measures—Current drinking was assessed with the item 'how often drank any alcohol in last 12 months'. Increasing cut-points of alcohol drinking frequency were calculated, from drinking at least once in the past 12 months, to drinking at least once a month, to drinking at least once a week, to drinking daily or nearly everyday. Frequencies of binge drinking were assessed with the variable of 'how often an individual consumed 5 or more (for men) or 4 or more drinks (for women) of any alcohol in the last 12 months'. Increasing cut-points of binge drinking were calculated, from binge drinking at least once in the past 12 months (yes/no), to binge drinking at least once a month (yes/no), to binge drinking at least once a week (yes/no), to binge drinking daily or nearly everyday (yes/no) (Harrison et al., 2008).

2.2.3 Hazardous Drinking—NIAAA guidelines, (USDHHS, 2005) which define hazardous drinkers as those exceeding sex-specific weekly limits (men, > 14 drinks per week; women, > 7 drinks per week) or exceeding daily drinking limits (men, ≥5 drinks per day; women, ≥4 drinks per day at least once in the past year), were used at each Wave.

2.2.4 Alcohol Diagnoses—Individuals who met criteria for alcohol abuse or dependence using the AUDADIS-IV were categorized as such. Those who met criteria for both diagnoses were categorized as alcohol dependent.

2.2.5 College Status—Full-time and part-time college students were considered students in this analysis. Participants who indicated they were students at Waves 1 and 2 were considered *continuing students*. Students at Wave 1 only were considered *former students*. Students at Wave 2 only were considered *new students*. Non-students at both Waves 1 and 2 were considered *continuing non-students*.

2.3 Data Analysis

Data analysis proceeded in several steps. Analyses were conducted with Stata version 11 using survey (svy) commands to account for the complex sampling design of the NESARC. First, demographic variables (gender, race, education, marital status) were compared across smoking status (daily, non-daily, nonsmokers) for descriptive purposes. Second, associations were calculated between smoking status, college status and measures of frequency of

alcohol drinking, frequency of binge drinking, hazardous drinking, and alcohol diagnoses. Logistic regression procedures were used to assess bivariate relationships between drinking variables, and smoking and college status. Multinomial logistic models were used to estimate relative risk ratios for hazardous drinking status and alcohol diagnosis by smoking and college status. Analyses were adjusted for sex, race, and the analogous Wave 1 alcohol variable. For example, analysis of Wave 2 current drinker status included Wave 1 current drinker status as a covariate. We chose not to report main effects of college status on drinking outcomes, as these associations have been published elsewhere (Dawson et al., 2004). We were only interested in whether college status modified relationships between smoking and drinking behavior. Significant p-values were reduced to $p < .001$ in all analyses to account for the number of dependent variables.

3. Results

Table 1 presents demographic variables. At Wave 1, prevalence rates of smoking behavior were 23.5% daily smokers, 7.1% non-daily smokers, and 69.4% non-smokers. At Wave II, prevalence rates of smoking were 25.3% daily smokers, 6.1% non-daily smokers, and 68.5% non-smokers. The sample was 49.9% female. Continuing students comprised 23.3% of the sample, with 31.5% former students, 5.6% new students, and 39.6% continuing non-students. Age did not differ across smoking status for either wave of the data. The mean age at Wave 1 was 21.4 years (SE = 0.04) and at Wave 2 was 24.6 years (SE = 0.05).

Differences were noted in the demographic variables. Whites were most likely to be daily smokers, followed by non-daily smokers and then non-smokers. Blacks were most likely to be non-smokers, versus daily smokers and non-daily smokers. Hispanics were most likely to be non-daily smokers and non-smokers versus daily smokers. Daily smokers were less likely to have attended some college (40%), compared to non-daily smokers (54.8%) and nonsmokers (56.8%).

No significant interactions between smoking status and college status in predicting alcohol drinking were observed. Significant effects of smoking status on drinking behavior were demonstrated and are discussed below.

Table 2 presents results examining Wave 2 drinking status by Wave 1 smoking status. Daily smokers were more likely to report drinking daily or nearly every day, compared to nonsmokers. Non-daily smokers, compared to non-smokers, were more likely to report drinking at least once a month and once a week. Daily and non-daily smokers compared to non-smokers were more likely to report binge drinking at each cut-point, except daily or nearly every day for non-smokers. Daily and non-daily smokers compared to nonsmokers were more likely to be hazardous drinkers and to meet criteria for alcohol abuse and dependence diagnosis.

4. Discussion

The purpose of the present study was to explore the longitudinal relationship of non-daily smoking and drinking behavior in young adults aged 18–25 years using Waves 1 and 2 of the NESARC database (Grant, 2003; Kaplan et al., 2003; Grant and Kaplan, 2005). We examined the relationship between Wave 1 smoking status and Wave 2 alcohol drinking. Non-daily smokers drank greater quantities of alcohol at greater frequencies and were more likely to report meeting current alcohol abuse and dependence criteria, compared to nonsmokers. Few differences between daily and non-daily smokers were observed; daily smokers were more likely to endorse the highest frequencies of drinking and binge drinking. Similar to prior research (Gilpin et al., 1997; Hassmiller et al., 2003), Hispanics were more

likely to be non-daily than daily smokers, and non-daily smokers were more likely to be college educated than daily smokers.

We also evaluated whether college status modified the role of smoking status on alcohol drinking. As predicted, no interactions of smoking status and college status were observed. However, it is known that living arrangements of college students (e.g., residence in fraternities or sororities) are strong predictors of drinking behavior (Wechsler et al., 1995) and should be assessed in future work.

Findings from this study indicate that non-daily smoking can be predictive of future alcohol drinking behavior, including binge drinking, hazardous drinking, and alcohol abuse and dependence across a 3 year time span. These findings cannot be explained by differences in Wave 1 alcohol drinking or in demographic variables. All analyses included Wave 1 drinking behavior as a covariate and were further adjusted for important demographic variables. Understanding potential mechanisms underlying the relationship between non-daily smoking and problematic alcohol use is important, particularly as rates of non-daily smoking are increasing (Schane et al., 2009). Non-daily smoking could be leading to higher rates of alcohol consumption by elevating positive subjective alcohol effects (Harrison et al., 2009). Subjective reports from young adults indicate that smoking increases the "buzz" from alcohol (e.g., Nichter et al., 2006). Increased positive reinforcement from alcohol, following smoking, could increase alcohol consumption and therefore promote binge drinking (Harrison and McKee, 2008). Future research should examine the role of intermittent nicotine exposure on alcohol reinforcement.

In conclusion, the present findings add to a growing body of literature highlighting the relationship between non-daily smoking and problematic alcohol use in young adults. The development of interventions that provide some protection against the pairing of alcohol and tobacco use, such as smoking bans in bars, could results in decreased rates of hazardous drinking and development of alcohol use disorders (McKee et al., 2009). Greater consideration of how non-daily smoking, an increasingly common pattern of tobacco use, potentiates alcohol reinforcement should lead to a better understanding of how current rates of problematic alcohol use could be decreased.

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Table 1

Distribution of Demographic Characteristics and Wave 1 and 2 Alcohol Drinking

All	n = 4468	All %	Daily Smokers (n=1007, 23.5%)		Non-daily Smokers (n=299, 7.1%)		Non-Smokers[a] (n=3125, 69.4%)	
			n	%	n	%	n	%
Gender								
Male	1957	50.1	470	53.2	161	57.9	1312	48.2
Female	2511	49.9	537	46.8	138	42.1	1813	51.8
Race/Ethnicity[*]								
White, non-Hispanic	2251	62.4	675	77.8	171	66.0	1387	56.9
Black, non-Hispanic	837	13.4	123	7.5	26	7.0	685	16.2
Other, non-Hispanic	230	6.9	46	5.3	20	9.2	162	7.1
Hispanic	1150	17.3	163	9.5	82	17.8	891	19.8
Marital Status at Wave 1								
Married	874	19.7	164	17.8	48	15.7	657	20.6
Not Currently Married	3594	80.3	843	82.2	251	84.3	2468	79.4
Education at Wave 1[*]								
< HS graduate	777	15.5	231	21.3	42	13	498	13.7
HS graduate	1465	32.0	374	38.7	91	32.2	986	29.5
Some college	2226	52.5	402	40.0	166	54.8	1641	56.8
Student Status[b][*]								
Continuing Student	979	23.3	125	12.3	77	27.8	769	26.6
Former Student	1355	31.5	270	26.1	93	34.8	978	32.7
New Student	279	5.6	79	7.3	18	4.6	182	5.3
Continuing Non-Student	1855	39.6	533	54.3	111	32.8	1196	35.4
Wave 1 Alcohol Drinking								
Frequency								
Drink +1 in past year	3127	71.9	897	89.2	281	94.3	1926	64.0
Drink +1 times/month	2087	49.0	681	67.6	219	72.8	1171	40.6
Drink +1 times/week	1229	29.1	455	46.2	142	47.4	620	21.5

All	n = 4468	All %	Daily Smokers (n=1007, 23.5%)		Non-daily Smokers (n=299, 7.1%)		Non-Smokers[a] (n=3125, 69.4%)	
			n	%	n	%	n	%
Drink daily or nearly daily	185	4.3	89	9.0	22	4.5	72	2.7
Binge[c]								
Binge +1 in past year	1686	40.8	617	62.2	202	69.2	69.2	30.8
Binge +1 times/month	1107	27.2	450	46.9	145	51.5	51.5	18.2
Binge +1 times/week	656	16.8	281	30.9	84	29.8	29.8	10.8
Binge daily or nearly daily	93	2.2	55	5.7	10	2.0	2.0	1.0
Alcohol Classifications								
Hazardous drinking[d]	1695	41.0		62.5	202	69.2	856	30.9
Alcohol Abuse[e]	295	6.8		9.8	41	14.0	154	5.0
Alcohol Dependence[f]	436	10.7		21.0	66	23.2	170	6.0
Wave 2 Alcohol Drinking								
Frequency								
Drink +1 in past year	3393	78.3	873	88.2	271	92.3	2219	73.6
Drink +1 times/month	2484	58.4	669	67.2	225	79.5	1565	53.2
Drink +1 times/week	1537	37.0	456	46.9	163	59.8	903	31.3
Drink daily or nearly daily	192	4.6	89	9.4	21	6.1	79	2.8
Binge[b]								
Binge +1 in past year	2104	50.6	664	67.6	226	78.6	1193	42.0
Binge +1 times/month	1228	30.0	428	44.7	146	54.1	644	22.5
Binge +1 times/week	734	18.1	278	30.5	90	33.5	359	12.4
Binge daily or nearly daily	87	2.3	51	5.5	8	3.1	26	1.1
Alcohol Classifications								
Hazardous drinking[d]	2107	50.6	664	67.5	226	78.6	1196	42.1
Alcohol Abuse[e]	374	9.0	135	13.5	49	17.8	190	6.5
Alcohol Dependence[f]	432	10.8	159	17.7	54	19.4	219	7.6

n (unweighted) % (weighted);

*
  p<.001 by smoking status

[a] Non-smokers reported not consuming any tobacco product in the past 12 months. The group was comprised of both never and ex smokers.

[b] Continuing students were in college at Waves 1 & 2. Former students were in college at Wave 1. New students were in college at Wave 2. Continuing nonstudents were not in college at either Wave.

[c] Binge drinking is defined as consuming 5 or more (for men) or 4 or more (for women) alcoholic drinks in a single episode.

[d] NIAAA hazardous drinking definition: 5+ drinks per day for men and 4+ drinks per day for women at least once in the past year or consumes more than 14 drinks per week for men and more than 7 drinks per week for women

[e] Alcohol Abuse is defined as any past 12 month DSM-IV Alcohol Abuse Diagnosis

[f] Alcohol Dependence is defined as any past 12 month DSM-IV Alcohol Dependence Diagnosis

Table 2

Odds and Relative Risk Ratios (99.9% Confidence Intervals) from Regressions Analyses Examining Associations of Smoking Status with Alcohol Use Patterns and Classifications

	Smoking Status		
	Daily Smoker	Non-daily Smoker	Non-Smoker[a]
	Odds Ratios (99.9% Confidence Interval)		
Frequency of Drinking			
Current Drinker [b] (yes/no)	1.60 (0.99–2.57)	1.38 (0.86–2.20)	ref
Drinks 1+/month (yes/no)	1.17 (0.79–1.73)	1.43 (1.07–1.93)[*]	ref
Drinks 1+/week (yes/no)	1.41 (0.98–2.02)	1.53 (1.16–2.02)[*]	ref
Drinks daily or nearly every day (yes/no)	3.07 (1.37–6.85)[*]	1.40 (0.82–2.39)	ref
Binge Drinking [c]			
Binge drinking in past 12 months (yes/no)	1.79 (1.24–2.59)[*]	1.71 (1.20–2.42)[*]	ref
Binge 1+/month (yes/no)	1.78 (1.22–2.60)[*]	1.56 (1.19–2.05)[*]	ref
Binge 1+/week (yes/no)	2.39 (1.52–3.77)[*]	1.60 (1.14–2.25)[*]	ref
Binge daily or nearly every day (yes/no)	4.65 (1.39–15.51)[*]	1.54 (0.65–3.67)	ref
Alcohol Classifications	Relative Risk Ratios (99.9% Confidence Interval)		
Non-hazardous drinker vs. Non-drinker in past 12 months	1.09 (0.64–1.82)	0.95 (0.55–1.64)	ref
Hazardous drinker [e] vs. Non-drinker in past 12 months	1.72 (1.01–2.93)	1.51 (0.90–2.55)	ref
Hazardous drinker vs. Non-hazardous drinker	1.58 (1.07–2.35)[*]	1.59 (1.11–2.27)[*]	ref
Alcohol Abuse[f] vs. No Alcohol Diagnosis in past 12 months	1.93 (1.27–2.93)[*]	2.40 (1.29–4.42)[*]	ref
Alcohol Dependence[g] vs. No Alcohol Diagnosis in past 12 months	1.98 (1.33–2.96)[*]	2.15 (1.18–3.91)[*]	ref
Alcohol Abuse vs. Alcohol Dependence	0.97 (0.57–1.64)	1.12 (0.53–2.35)	ref

n=4468,

[*] p<.001; compared to non-smokers. These analyses were adjusted for race, sex, and analogous Wave 1 drinking outcome variable (e.g. current drinker status at wave 1 was used as a covariate in analysis of wave 2 current drinker status).

[a] Non-smokers reported not consuming any tobacco product in the past 12 months. The group was comprised of both never and ex smokers.

[b] Any consumption of alcohol in past 12 months;

[c] defined as consuming 5 or more (for men) or 4 or more (for women) alcoholic drinks in a single episode;

[d] Past 12 month DSM-IV Alcohol Abuse or Dependence diagnoses;

[e] NIAAA hazardous drinking definition: 5+ drinks per day for men and 4+ drinks per day for women at least once in the past year or consumes more than 14 drinks per week for men and more than 7 drinks per week for women;

[f] Alcohol Abuse is defined as any past 12 month DSM-IV Alcohol Abuse Diagnosis;

[g] Alcohol Dependence is defined as any past 12 month DSM-IV Alcohol Dependence Diagnosis.