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SMOKING STATUS IS A CLINICAL INDICATOR FOR ALCOHOL MISUSE IN US ADULTS

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Abstract

Context—Screening for alcohol use in primary care settings is recommended by clinical care guidelines, but is not adhered to as strongly as screening for smoking. It has been proposed that smoking status could be used to enhance the identification of alcohol misuse in primary and other medical settings but national data are lacking.

Objective—To investigate smoking status as a clinical indicator for alcohol misuse in a national sample of US adults, following clinical care guidelines for the assessment of these behaviors.

Design, Setting, and Participants—Analyses are based on a sample of 42,565 US adults from the National Epidemiological Survey on Alcohol and Related Conditions (Wave I, 2001–2002).

Main Outcome Measures—Odds ratios (O.R.) and test characteristics (sensitivity, specificity, positive and negative predictive value [PPV, NPV], and likelihood ratio [LR] of smoking behavior (daily, occasional, former) were determined for the detection of hazardous drinking behavior and alcohol-related diagnoses, assessed by the Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV.

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Results—Daily, occasional, and ex-smokers were more likely than never smokers to be hazardous drinkers (O.R.3.23 [95% CI 3.02–3.46]; O.R.5.33 [95% CI 4.70–6.04]; O.R.1.19 [95% CI 1.10–1.28], respectively). Daily and occasional smokers were more likely to meet criteria for alcohol diagnoses (O.R.3.52 [95% CI 3.19–3.90], O.R.5.39 [95% CI 4.60–6.31]; respectively). For the detection of hazardous drinking by current smoking (occasional + daily), sensitivity was 42.5%; specificity 81.9%, PPV 45.3% (vs. population rate of 26.1%), and LR+ 2.34. For the detection of alcohol diagnoses by current smoking; sensitivity was 51.4%; specificity 78.0%, PPV 17.8% (vs. population rate of 8.5%), and LR+ 2.33.

Conclusions—Occasional and daily smokers were at heightened risk for hazardous drinking and alcohol use diagnoses. Smoking status can be used as a clinical indicator for alcohol misuse, and as a reminder for alcohol screening in general.

Keywords

smoking; alcohol misuse; screening; clinical care guidelines

The current National Institute on Alcoholism and Alcohol Abuse (NIAAA) Clinician's Guide, Helping Patients Who Drink Too Much,[1] not only recommends screening for alcohol use disorders, but advocates screening for less severe 'at-risk' or hazardous drinking. The US Preventive Services Task Force (USPSTF)[2] recommends screening for alcohol misuse (which includes hazardous drinking, alcohol abuse, and alcohol dependence) and have assigned a Grade B recommendation for screening and brief inventions for hazardous alcohol consumption in primary care settings. Even though screening [3–6] and brief intervention [7,8] provided in primary care settings are effective, clinicians have low rates of adherence to the guidelines for screening for alcohol misuse[9–10]. Using a national sample, Edlund[11] estimates that only 30% of individuals who had a primary care visit reported being screened for an alcohol or drug use problem. In contrast, physicians are much more likely to screen and apply brief interventions to address smoking behavior.[12,13] Studies of physician and patient reports, and medical record review find that the majority of primary care patients are screened for smoking status (81%)[14]. Smoking status is more likely to be recorded in the medical chart than is drinking behavior.[15,16] Studies of medical patients suggest that smoking status and alcohol misuse are highly associated, such that current smoking status may be used to help identify problem drinkers.[17,21] In a sample of German medical patients, the rate of daily smoking was 47.1% in those with alcohol misuse, compared to 18.4% in the general population.[20] In a sample of medical and dental patients, the rate of hazardous drinking was 20.3% in current smokers, and 11.7% in current non-smokers [21].

The National Epidemiological Survey on Alcohol and Related Conditions (NESARC; Wave I, 2001–2002)[22] provides a unique opportunity to investigate the sensitivity and specificity of smoking status as an indicator of alcohol misuse among US adults following clinical care guidelines for the assessment of these behaviors. Current and prior smoking behavior (daily, occasional, former-smoker) was assessed, rather than nicotine dependence to be consistent with clinical care guidelines for screening of smoking status in primary care settings.[23,24] Drinking behavior was assessed according to NIAAA screening guidelines, which recommends first assessing current drinking status, then hazardous drinking status, followed by alcohol use diagnoses. Thus, the goals of this study were to use the NESARC database to answer the following questions: 1) Can smoking status (daily, occasional, former) be used to detect alcohol misuse (hazardous drinking, alcohol-related diagnoses)?; and 2) Is smoking status differentially related to alcohol misuse?

METHODS

Data Sources

The NESARC study (Wave I, 2001–2002) was conducted by the National Institute on Alcohol Abuse and Alcoholism. The data were collected by personal interviews with 43, 093 civilian, noninstitutionalized, adults (≥18 years), residing in the United States. The response rate was reported to be 81%, and was calculated by multiplying the household response rate (89%), person response rate (93%), and sample frame response rate (99%).[22] African Americans, Hispanics, and adults aged 18 to 24 years of age were oversampled. In our analyses, the data were weighted to account for oversampling and to adjust for nonresponse. The weighted data 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.[22]

Definitions of Smoking Status and Alcohol Misuse

Current (anytime within the past 12 months) smoking and drinking behavior, and alcohol diagnostic criteria were assessed with the Alcohol Use Disorders and Associated Disabilities Interview Schedule-DSM IV (AUDADIS-IV)[25]. The AUDADIS-IV has demonstrated both reliability and validity for the assessment of smoking and drinking behavior, and alcohol use disorders.[26–28]

Cigarette Use—In this study, the NESARC data were coded into the following categories for past 12-month cigarette use.[29] *Daily:* Someone who at the time of the survey is smoking cigarettes at least once per day. *Occasional:* Someone who currently smokes cigarettes but not every day. *Ex-Smoker:* A non-user who has previously been a daily or occasional smoker. *Never-Smoker:* Non-user who has never used any tobacco product. Smoking status was assessed with the following variables; 'tobacco use status' (current user, ex-user, lifetime nonuser), 'cigarette smoking status' (smoked in the past 12 months, smoked prior to the last 12 months), and 'usual frequency when smoked'. As defined, these variables were designed to replicate the smoking status information that is typically collected by providers in primary care and other medical settings, and is recommended by clinical care guidelines.[23,24]

Hazardous Drinking—The NIAAA guidelines[1], which define hazardous drinkers as those exceeding gender-specific weekly limits (males – more than 14 drinks per week; females- more than 7 drinks per week) or exceeding daily drinking limits (males – more than 5 drinks per day; females – more than 4 drinks per day at least once in the past year) were used to define hazardous drinking. Current drinking in the NESARC was defined as 'drank at least one alcoholic drink in the last 12 months'. To determine whether weekly quantity limits were exceeded, we converted the variable 'average daily volume of ethanol intake' (see NESARC data notes for calculation)[30] to weekly number of drinks consumed (using a standard of 0.6 oz ethanol per drink).[31] To determine whether daily criteria were exceeded, frequency of binge drinking was 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'. Frequencies of binge drinking were converted to days per week using the midpoints of the categorical responses. These criteria for hazardous drinking are easily assessed in primary care settings.

Alcohol Diagnoses—The AUDADIS uses DSM-IV[32] criteria to determine alcohol diagnoses. DSM-IV is the standard by which alcohol abuse and dependence are diagnosed in health care settings. A diagnosis of alcohol dependence requires three or more of the following events in the past year: tolerance; withdrawal; drinking more or longer than intended; persistent desire or unsuccessful efforts to cut down or control alcohol use; a great deal of time spent obtaining alcohol, using it, or recovering from its effect; important social, occupational, or

recreational activities given up or reduced because of alcohol; and continued use despite knowledge of having a persistent or recurrent physical or psychological problem caused or exacerbated by alcohol. A diagnosis of alcohol abuse requires one or more of the following events in the past year: recurrent use resulting in failure to fulfill major role obligations at work, school, or home; recurrent use in physically hazardous situations; recurrent alcohol-related legal problems; continued use despite having persistent or recurrent social, interpersonal problems caused or exacerbated by alcohol. Individuals who met criteria for either alcohol abuse or dependence were categorized as having an alcohol diagnoses.

Statistical Methods

Absolute and relative frequencies of alcohol misuse by smoking status were calculated both with and without sample weights for each of the three outcomes (hazardous drinkers versus all others, hazardous drinkers versus non-hazardous drinkers, and those with an alcohol diagnosis versus all others). Logistic regressions were used to analyze the statistical significance of differences in alcohol misuse rates by daily, occasional, and former smokers relative to never smokers. Using these regression results, we determined an ordering of smoking status risk for the following evaluation of smoking status as a clinical indicator for each of the alcohol misuse outcomes. Occasional smokers represented the highest risk level, followed by current smokers (occasional + daily), current or prior smokers (occasional + daily + former), and lastly, all subjects (occasional + daily + former + never). Specificity, sensitivity, positive and negative predictive value (PPV, NPV) and positive likelihood ratio (LR+) statistics were calculated for successively lower levels of smoking risk. Sensitivity was calculated as the proportion of individuals with alcohol misuse who were at a particular smoking risk level (i.e., rate of true positives). Specificity was calculated as the proportion of individuals without alcohol misuse, who were not at that particular smoking risk level (i.e., rate of true negatives). PPV was calculated as the probability that the individual did misuse alcohol given that a particular level of smoking risk was met. Conversely, NPV was calculated as the probability that a person did not misuse alcohol given that the individual was not at that level of smoking risk. The LR+ was calculated as the ratio of the chance of alcohol misuse in individuals who were at a particular smoking risk level relative to those who did not meet criteria for alcohol misuse. LR + is a method of converting the pretest probability (i.e., population prevalence for alcohol misuse) into post-test probabilities.[33] All estimates, standard errors, and 95% confidence intervals were generated by STATA version 9.1 using survey (svy) commands to account for the complex sampling design of the NESARC data.

RESULTS

The population prevalence of hazardous drinking and alcohol diagnoses were 26.1% and 8.5%, respectively. Current drinkers comprised 65.5% of the population and their rate of hazardous drinking was 39.9%. Prevalence rates for the smoking status categories were 20.6% for daily smokers, 3.9% for occasional smokers, 19.5% for former smokers, and 56.0% for never-smokers.

Table 1 presents smoking status by NIAAA criteria for hazardous drinking for the full sample. Daily (O.R. 3.23; 95% CI 3.02–3.46), occasional (O.R. 5.33; 95% CI 4.70–6.04), and ex-smokers (O.R. 1.19; 95% 1.10–1.28) compared to never smokers were more likely to exceed the daily (*5+ drinks per day for men and 4+ drinks per day for women at least once in the past year*) or weekly drinking limits (*more than 14 dinks per week for men and more than 7 drinks per week for women)*. Further, occasional smokers (with daily smokers as the reference group) had the greatest odds of being a hazardous drinker (O.R. 1.65; 95% CI 1.45 – 1.88). A similar pattern was found for the presence of alcohol diagnoses and for hazardous drinking among the subset of drinkers. There was one exception. Former smokers were not more likely than never

smokers to have an alcohol diagnoses or to meet criteria for hazardous drinking (vs. non-hazardous drinkers).

Table 2 presents tests characteristics for smoking status as a clinical indicator for presence of hazardous drinking and alcohol diagnoses. Across the levels of smoking risk (excluding never smokers), sensitivity was generally low (8.3 – 59.0%), whereas specificity was moderate to high (61.3 – 97.7%) for the prediction of hazardous drinking in the full sample. The PPV and LR+ indicated that smoking status provided added information for the presence of hazardous drinking in the full sample. PPV (35.0 – 55.8%) and LR+ (1.52 – 3.57) were found to increase as smoking status risk increased. This pattern of results was also demonstrated for hazardous drinking in the drinkers subset (PPV 58.0 – 63.7; LR+ 1.37 – 2.65), and for the presence of alcohol diagnoses (PPV 12.4 – 23.5%; LR+ 1.53 – 3.31).

COMMENT

Following clinical care guidelines for the assessment of smoking and drinking behaviors, we identified that current smokers were significantly more likely to be hazardous drinkers and to meet criteria for alcohol diagnoses, compared to never smokers among US adults. Overall, test characteristic data highlight that smoking status signifies heightened risk for alcohol misuse. While specificity was moderate to high (range 56.8 – 97.7%), smoking status was generally not a sensitive indicator for alcohol misuse (range 8.3 – 64.5%). However, other indicators (i.e., PPV and LR+) demonstrated that smoking status provided added benefit for the prediction of hazardous drinking and alcohol diagnoses. Among individuals with unknown drinking status (i.e., full sample), 26.1% met criteria for hazardous drinking and 8.5% met criteria for an alcohol diagnosis. Among current smokers, these rates were 45.3% for hazardous drinking and 17.8% for an alcohol diagnosis. Among known drinkers, smoking status still provided added predictive power. The rate of hazardous drinking among drinkers was 39.9%, and in drinkers who were also current smokers, the rate was 58%.

This study is the first to document that occasional, non-daily smoking confers the greatest risk associated with hazardous drinking (OR 5.33; 95% CI 4.70 – 6.04) and alcohol-related diagnoses (OR 5.39; 95% CI 4.60 – 6.31). Occasional smokers had a 55.8% probability of meeting criteria for hazardous drinking in the full sample, and 63.7% probability in the subset of drinkers. Additionally, occasional smoking was associated with an increased likelihood of meeting criteria for an alcohol diagnoses (LR+ 3.31; 95% CI 3.00–3.73). In the current sample occasional smokers represented 17% of current smokers, which is consistent with other population studies that have reported rates of non-daily smoking at 18%–24% of current smokers.[34–36] It was typically assumed that these smokers were either transitioning in or out of daily use, but it has been demonstrated that many of these smokers have stable patterns of non-daily smoking.[37,38] We suspect that non-daily smoking is more likely to occur while drinking heavily, but this has yet to be investigated in a national population. In samples of young adults it has been found that intermittent smoking is most likely to occur during binge drinking.[39] Alcohol and tobacco are thought to potentiate each other's reinforcing effects [40, 41], and amounts consumed.[42] Laboratory based investigations have shown that nicotine decreases subjective intoxication and attenuates the sedating properties of alcohol[43], potentially allowing for larger quantities to be consumed. Our results point to the importance of assessing binge drinking in non-daily smokers.

Overall, the addition of former smokers to current smokers represented little added benefit in the ability to predict alcohol misuse. Among current and former smokers, 35% were likely to meet criteria for hazardous drinking, and the likelihood of hazardous drinking was increased 1.52 times. Former smokers, compared to never smokers, had increased risk for hazardous drinking (OR 1.19; CI 1.10–1.28) in the full sample, but not in the subset of drinkers, nor was

there increased risk for alcohol diagnoses. This suggests that former smokers comprised a larger percentage of non-hazardous drinkers. Given the cross-sectional nature of these data, however, we are unable to infer causality. It is possible that non-hazardous drinkers were more likely to be able to quit smoking. For example, alcohol use has been identified as a risk factor for poor smoking cessation outcome.[44] It is also possible that smoking cessation was then followed by reductions in alcohol consumption.[45]

Clinical care guidelines recommend routine screening and brief intervention for alcohol and tobacco use in primary and other health care settings. However, smoking behavior is more often assessed than alcohol use.[12–16] Some have suggested that screening for smoking behavior be elevated to the status of a vital sign.[46,47] In this regard, patients should be asked about their cigarette use to identify daily, occasional, or former smokers (e.g., '*Have you smoked any cigarettes in the past year*?' If no, '*Have you smoked prior to the last 12 months?*'). Our data suggest that smoking status provides an added benefit as an indicator of alcohol misuse. While the sensitivity was low to moderate, information provided about potential alcohol misuse is gained at no additional cost and with no risk as smoking status is already being assessed.

We are not suggesting that smoking status is a sufficient test of alcohol misuse. It's modest sensitivity is related to the fact that never smokers accounted for a sizeable proportion of those meeting criteria for hazardous drinking and alcohol diagnoses (approximately 40%). Our data highlight the importance of physicians adopting standard alcohol screening questions into their practice. NIAAA[1] suggests that screening methods for alcohol misuse can be as brief as a single question (*How many times in the past year have you had* [*5 or more* for men and *4 or more* for women] *drinks in a day*?; USDHHS, 2004). Identification of more than one binge episode in the past year has excellent sensitivity but lower specificity for alcohol diagnosis.[48]

Smoking status can be used to help identify primary care patients at higher risk for alcohol misuse (i.e., current smokers) and as a helpful mnemonic for alcohol screening in general. Smoking status and alcohol use should be assessed using the clinically relevant questions noted above. Better screening of alcohol use problems could lead to better assessment and intervention related to alcohol misuse. Brief interventions are particularly suitable for addressing problem drinking [7,8], but first the risk for these problems must be identified. Identifying those with alcohol misuse is increasingly valuable as evidence accumulates that medications such as naltrexone[49,50] can be effective treatments in primary care settings. The spectrum of problem drinking behaviors that are amenable to office-based treatment in primary care is expanding from non-dependent hazardous drinking to alcohol dependence.[50,51] Thus, improved screening approaches such as one that uses smoking behavior as a "trigger" to identify alcohol misuse becomes even more vital in promoting optimal patient management and outcomes.

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Table 1

Alcohol Misuse Outcomes by Smoking Status

	Full Sample							Drinkers Only Sample			
		Any Alcohol Diagnosis [a]			Hazardous Drinking [b]				Hazardous Drinking [c]		
Smoking Status	***All***	**no**	**yes**	**OR (95% CI)**	**no**	**yes**	**OR (95% CI)**	***All***	**no**	**yes**	**OR (95% CI)**
All (%)	42,374 (100.0%)	39,091 (91.5%)	3,283 (8.5%)		32,252 (73.9%)	10,122 (26.1%)		26,511 (100.0%) (65.5%)	16,389 (60.1%)	10,122 (39.9%)	
Never smoker	24,533 (56.0%)	23,312 (94.6%)	1,221 (5.4%)	ref [d]	20,333 (80.8%)	4,200 (19.2%)	ref	5,052 (50.5%)	9,532 (67.6%)	4,200 (32.4%)	ref
Former smoker	8,012 (19.5%)	7,574 (94.3%)	438 (5.7%)	1.06 (0.93–1.21)	6,359 (78.0%)	1,653 (22.0%)	1.19* (1.10–1.28)	5,221 (20.2%)	3,568 (67.6%)	1,653 (32.4%)	1.00 (0.92–1.09)
Daily smoker	8,166 (20.6%)	6,884 (83.2%)	1,282 (16.8%)	3.52* (3.19–3.90)	4,771 (56.6%)	3,395 (43.4%)	3.23* (3.02–3.46)	6,131 (24.1%)	2,736 (43.2%)	3,395 (56.8%)	2.74* (2.54–2.95)
Occasional smoker	1,663 (3.9%)	1,321 (76.5%)	342 (23.5%)	5.39* (4.60–6.31)	789 (44.2%)	874 (55.8%)	5.33* (4.70–6.04)	1,427 (5.2%)	553 (36.3%)	874 (63.7%)	3.65* (3.18–4.19)

Note: Unadjusted observation count is shown. All relative frequencies were calculated using sample weights.

[a] Any alcohol diagnosis includes both alcohol abuse and alcohol dependence vs. no diagnoses

[b] Full sample compares hazardous drinkers vs. non-hazardous drinkers + abstainers

[c] Drinkers only sample compares hazardous drinkers vs. non-hazardous drinkers

[d] Never smokers were reference category for logistic regression

* p<.001 compared to Never smokers

Table 2

Test Characteristics for Smoking Status as a Clinical Indicator for Alcohol Misuse

Smoking Status Risk	Sensitivity % (SE)	Specificity % (SE)	PPV % (SE)	NPV % (SE)	LR+ [95% C.I.]
A. Hazardous Drinking (hazardous drinkers vs. non-hazardous drinkers and abstainers)					
Occasional	8.3 (.27)	97.7 (.08)	55.8 (1.23)	75.1 (.21)	3.57 [3.25, 3.93]
+Daily[a]	42.5 (.47)	81.9 (.22)	45.3 (.49)	80.1 (.22)	2.34 [1.90, 2.89]
+Former[b]	59.0 (.47)	61.3 (.28)	35.0 (.35)	80.8 (.25)	1.52 [1.33, 1.74]
+Never (All)[c]	100.0	0.0	26.1 (.22)		1.00
B. Hazardous Drinking (hazardous drinkers vs. non-hazardous drinkers)					
Occasional	8.3 (.28)	96.9 (.13)	63.7 (1.29)	61.4 (.31)	2.65 [2.38, 2.94]
+Daily	42.5 (.48)	79.6 (.32)	58.0 (.56)	67.6 (.34)	2.08 [2.00, 2.16]
+Former	59.0 (.48)	56.8 (.39)	47.6 (.44)	67.6 (.40)	1.37 [1.33, 1.40]
+Never (All)	100.0	0.0	39.91 (.30)		1.00
C. Alcohol Diagnosis (any diagnosis vs. none)					
Occasional	10.7 (.54)	96.8 (.09)	23.5 (1.09)	92.1 (.13)	3.31 [3.00, 3.73]
+Daily	51.4 (.84)	78.0 (.21)	17.8 (.38)	94.5 (.13)	2.33 [2.25, 2.42]
+Former	64.5 (.79)	57.9 (.25)	12.4 (.35)	94.6 (.14)	1.53 [1.49, 1.57]
+Never (All)	100.0	0.0	8.5 (.14)		1.00

Note: All statistics calculated using sample weights. Standard errors (SE) are in parenthesis.

Positive Predictive Value (PPV); Negative Predictive Value (NPV); Positive Likelihood Ratio (LR+)

[a] Current Smoking (Occasional + Daily Smokers)

[b] Current or Prior Smoking (Occasional + Daily + Former Smokers)

[c] All subjects (Occasional + Daily + Former + Never Smokers)