



Published in final edited form as:

Drug Alcohol Depend. 2009 January 1; 99(1-3): 169–175. doi:10.1016/j.drugalcdep.2008.07.014.

Nicotine Dependence and Psychiatric and Substance Use Comorbidities in a Sample of American Indian Male Veterans

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1. Introduction

American Indians and Alaska Natives (A.I./A.N.) have the highest smoking rates compared to any other racial or ethnic group in the United States (American Lung Association, 2007) and experience significant tobacco-related disparities (Willsie and Foreman, 2006). A.I./A.N. also experience higher rates of some psychiatric disorders, including alcohol use disorders that have been shown in general populations to co-occur with nicotine dependence (Szlemko et al., 2006). Recent studies conducted in general U.S. populations have demonstrated significant psychiatric disorder and substance use disorder comorbidities in nicotine-dependent individuals (Grant et al., 2004, Breslau, 1995; Kendler, 1993).

To our knowledge, among A.I./A.N. smokers, alcohol use has been the only co-morbidity studied (Enoch et al., 2005, Henderson et al., 2005, Falk et al., 2006, Hodge et al., 1995). Utilizing the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), Falk et al. found that Native Americans/Alaska Natives had the highest rates of co-morbid alcohol use disorders and nicotine dependence based on DSM-IV criteria among the ethnic/racial groups studied. In a clinic based sample of Northern Plains and Southwest American Indians, individuals with a history of alcohol use (i.e., at least 12 drinks of any kind of alcoholic beverage in any one-year period) demonstrated higher odds of current smoking and former smoking in comparison to individuals who did not have histories of alcohol use (Henderson et al., 2005). Furthermore, in a sample of Northern California adult American Indians, current and prior histories of smoking were correlated with self-reported alcohol problems (Hodge et al., 1995). Also, smoking rates were marginally higher among Plains A.I. men and women with alcohol use disorders (62% and 40% respectively) than among Plains A.I. without alcohol use disorders (49% and 33% respectively) (Enoch et al., 2005). However, the smokers with alcohol use disorders had higher levels of nicotine addiction (as evidenced by higher Fagerstrom scores) compared to the smokers without alcohol use disorders. To our knowledge, studies analyzing the associations between nicotine dependence and drug use or psychiatric disorders in A.I./A.N. populations utilizing Diagnostic and Statistical Manual of Mental

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Disorders (DSM) criteria have not been reported. Further studies analyzing these associations among A.I./A.N. may increase our understanding of smoking behaviors in this population.

In the present study, we conducted secondary analyses with data from a community sample of 480 American Indian male veterans utilizing the approach taken by Grant et. al. (2004) in order to examine: 1) lifetime prevalence of comorbid substance use disorders and psychiatric disorders among nicotine dependent individuals, 2) lifetime prevalence of nicotine dependence among individuals with substance use disorders and psychiatric disorders, and 3) odds ratios for association between lifetime nicotine dependence and lifetime psychiatric and substance use disorders. In addition, current diagnoses were examined in the same manner.

2. Methods

2.1 Sample

Data collected in an earlier, larger study analyzing gambling disorders among American Indians was used in this community-based survey of 480 American Indian male veterans from the North Central region of the United States (Westermeyer et al., 2005). The survey was conducted during 1999-2001 and was structured to consist of 51% urban and 49% rural American Indian veterans. On the basis of census maps, counties and communities in which 10 or more American Indian veterans could be expected to be interviewed were chosen. All 480 veterans were recruited in community settings rather than in VA facilities in order to obtain a community-based setting. Interview sites included the veteran's residence, community setting or institution, a reservation/tribal office, powwow, or miscellaneous sites. Recruitment strategies were consistent throughout the recruitment sites and did not differ among tribal groups.

The original data set included American Indian males and females from both the North Central region and Southwest region of the U.S. However, due to an over sampling of non community-based American Indian veterans (veterans having a higher proportion of psychiatric disorders) in the original Southwest sample, this study focused its analyses in the North Central sample. Also, due their small number among veterans in the North Central region (n=78), females were also excluded from this study since an analysis by gender would not be feasible.

2.2 Exclusion and Inclusion Criteria

To be included in this study, American Indian veterans were required to have biological/ psychosocial identity as an American Indian based on both the subject's self-reported tribal identity and the judgment of the American Indian research assistants who interviewed participants. No information was obtained on blood quantum. To protect the confidentiality of these tribal members, we chose not to identify specific tribal groups (Norton and Manson, 1996).

2.3 Data Collection

After the study was described, written informed consent was obtained. Participants, guided by trained research assistants, completed a computer-based algorithmic diagnostic program, the Quick-Diagnostic Interview Schedule (Q-DIS), to determine DSM-III-R (American Psychiatric Association, 1987) Axis I diagnoses and one Axis II psychiatric diagnosis (antisocial personality disorder). The Q-DIS has demonstrated good to excellent sensitivity and specificity compared with the Diagnostic Interview Schedule (DIS) for most psychiatric diagnoses, although the Q-DIS may underestimate recent posttraumatic stress disorder (PTSD) (Bucholz et al., 1996). Nicotine dependence symptoms were queried with regard to tobacco use (e.g., cigarettes, chewing tobacco). All subjects were fluent in English and were able to complete the protocol. A small number of veterans requested help with specific words or

phases. This study was approved by a Veterans Administration Hospital located in the North Central region of the U.S. and received an IRB exemption from Yale University.

2.4 Statistical Analysis

Cross-tabulations were used to determine the prevalence and associations of nicotine dependence with other lifetime and current Axis I disorders and the Axis II disorder, antisocial personality disorder. In general, we examined diagnostic classes rather than individual diagnoses because of sample size constraints. Specifically, we examined lifetime and current (12-month) any drug use disorder (abuse or dependence), any alcohol use disorder (abuse or dependence), any affective disorder, and any anxiety disorder. Any lifetime or current affective disorders included major depressive disorder, bipolar mood disorder, and dysthymia. Any anxiety disorder included PTSD, phobic disorder, obsessive-compulsive disorder, panic disorder and generalized anxiety disorder. We also examined pathological gambling, due to a high prevalence observed in the original larger data set of American Indian veterans (Westermeyer et al., 2005) and PTSD, separately, due to its high prevalence among veterans. Odds ratios (OR) with 95% confidence intervals (CI) from chi-square analysis were used to study associations between nicotine dependence and these disorders. In order to account for any significant differences between subgroups within the sample, we examined rates of nicotine dependence based on tribal affiliation and age (deciles). Using logistic regression we also analyzed the prevalence and associations of nicotine dependence with other current Axis I disorders and the Axis II disorder, antisocial personality disorder, including tribal affiliation as a covariate. As with tribal affiliation, we conducted a series of logistic regressions introducing age as a covariate.

3. Results

3.1 Sample characteristics

The mean age for the sample of American Indian male veterans was 47.6 years (SD=12.6), and 40.4% were married or had a partner. With regard to education, 72.5% had a high school education or higher. With regard to employment, 46.2% had either full or part-time employment, 15.4% were disabled, 24.6% were unemployed, and 13.8% had other (i.e., student, retired, parenting small children) or unknown employment status. Two specific tribal groups were most prominently represented in this sample. One tribal group represented 58.7% of the sample and the other tribal group represented 17.5% of the sample. “Other tribes” represented the remaining 23.8% of the sample.

3.2 Prevalence of Lifetime Psychiatric Disorders and Substance Use Disorders

As shown in Table 1 (column 1), the lifetime prevalence of nicotine dependence among the sample of American Indian veterans is 23.3%. The prevalence of any lifetime alcohol use disorder was 30.8% and any lifetime drug use disorder was 12.6% among our respondents. The prevalence of any lifetime anxiety disorder and of any lifetime affective disorder was 22.3% and 8.8%, respectively. The lifetime prevalence of pathological gambling and of PTSD was 9.4% and 11.9%, respectively.

3.3 Prevalence of Lifetime Co-morbid Disorder Among Respondents

Among individuals with nicotine dependence (Table 1, column 2), any lifetime anxiety disorder (42.9%) was the most prevalent co-morbid disorder followed by any lifetime alcohol use disorder (41.1%). All other lifetime disorders were found among at least 20% of those with lifetime nicotine dependence, with the exception of gambling problems which were found among 17.1% of those with lifetime nicotine dependence.

As shown in Table 1 (column 3), the prevalence of lifetime nicotine dependence was high among individuals with a lifetime history of Axis I or antisocial personality disorder. The highest rate of lifetime nicotine dependence was observed for those with a lifetime history of affective disorders (61.9%) followed by antisocial personality disorder (45.3%) and any anxiety disorder (44.9%).

3.4 Associations between Lifetime Nicotine Dependence and Psychiatric Disorders

As shown in Table 1 (column 4), lifetime nicotine dependence was significantly associated with all studied co-morbid lifetime disorders. Affective disorders and PTSD had the highest odds ratios at 6.65 and 4.68 respectively.

3.5. Prevalence and Associations for Current Diagnoses

As shown in Table 2 (column 1), the current prevalence of nicotine dependence among the sample of American Indian veteran males is 19.0%. Note that this rate is higher than the current prevalence of 14.1% observed in the general U.S. male sample utilizing DSM criteria but lower than that found for American Indians and Alaska Natives males (26.4%) who participated in the survey (Grant et al., 2004). Analyses by tribal group indicated that current nicotine dependence in this sample of American Indian male veterans was significantly higher in one of the prominently represented tribal groups (21.2%) than in the other prominently represented tribal group (14.6%) or veterans from “other tribes” (11.9%), $\chi^2=6.6$, $p<.04$. Veterans from “Other tribes” demonstrated a greater likelihood of current drug dependence when compared to one of the more prominently represented tribal groups (OR=3.8, 95% CI=1.8-7.8). There were no tribal differences in likelihood of other current psychiatric disorders.

The prevalence of substance abuse and psychiatric diagnoses among individuals with current nicotine dependence is presented in Table 2, (column 2) and the prevalence of current nicotine dependence among respondents with current substance use or psychiatric disorders is presented in Table 2, (column 3). As shown in Table 2 (column 4), current nicotine dependence among respondents was significantly associated with any current affective disorder and current gambling disorder [OR=3.84 (1.9-7.9) and OR=2.32 (1.1-5.0), respectively]. The associations with any current alcohol use disorder or any current drug use disorder [OR=1.14 (0.6-2.0) and OR=1.43 (0.7-3.0), respectively] were not significant.

3.6 Post analysis/Estimation Exploratory Data Analysis: Prevalence of Lifetime and Current Psychiatric Disorders and Substance Use Disorders Based on Age Deciles

Lifetime prevalence rates of psychiatric and substance use disorders based on age deciles are shown in Table 3. Lifetime nicotine dependence prevalence rates were significantly higher in subjects in their 40's (28.2%) and 50's (27.2%) than in “other age groups” (17.4%) ($\chi^2 =7.1$, $p<0.03$). Older deciles demonstrated significantly lower rates of lifetime (60's OR=.11, CI=.02-.60) drug use dependency when compared to the youngest cohort. Veterans in their 40's and 50's demonstrated significantly higher rates of lifetime (50's OR=6.52, CI=1.5-28.7; 40's OR=6.3, CI=1.4-27.2) anxiety disorders compared to veterans in the youngest cohort. Similar patterns were observed when current diagnoses were considered (data not shown). Based on age deciles categorized by decade, age did not substantially modify the relationship between nicotine dependence and comorbid psychiatric and substance use disorders.

4. Discussion

Substantial co-morbidity was found between lifetime nicotine dependence and other substance abuse and psychiatric disorders in this sample of American Indians male veterans. When current diagnoses were considered, the pattern of associations was similar to those observed for lifetime diagnoses. However, only the associations between nicotine dependence with

affective and pathological gambling were statistically significant, most likely due to inadequate power to detect an association.

Substantial associations between nicotine dependence and psychiatric and substance use disorders have also been observed in general U.S. populations (Grant et al., 2004). However, specific smoking characteristics and risk factors unique to A.I./A.N. may have additional treatment implications. For example, A.I./A.N. are at higher risk for many tobacco-related health problems (Fagan et al., 2007; Oser et al., 2006; Struthers et al., 2006). In addition, various risk factors for smoking including lower socioeconomic status and high rates of unemployment and poverty are elevated among many A.I./A.N. populations (Castor et al., 2006; Fagan et al., 2007). These factors also influence access to smoking cessation interventions. Finally, high levels of stress exist in many A.I./A.N. communities as evidenced by high rates of suicide, homicide, violence, accidents, and unresolved historically-based traumas which may impede smoking cessation. Thus, in order to decrease smoking rates among A.I./A.N., important public health issues including access to care and the need for comprehensive psychiatric treatment services must be addressed.

As expected, there were significant associations between lifetime nicotine dependence and lifetime alcohol and other substance use disorders. This pattern has been seen in general population samples (Grant et al., 2004). These associations were not statistically significant for current diagnoses probably due to inadequate power given that rates of current diagnoses were lower than lifetime diagnoses. Also, our sample was older in general. Falk et al (2006) found that co-morbidity between alcohol and nicotine dependence was most prominent in young adults and declined in older adults using data from the NESARC, although this association was not examined specifically for A.I./A.N. participants.

Co-morbidity for affective disorders among those with nicotine dependence was found for both lifetime and current diagnoses in this sample of American Indian veteran males. The reciprocal relationship between tobacco use and depression is an area currently under investigation (Kiss et al., 2006) and history of a depression is a known risk factor for smoking cessation failure (Glassman et al., 1990; Hall et al., 1993; Kassel et al., 2007). From a clinical perspective, prescreening for depression and monitoring depressive symptoms during and after nicotine cessation treatment may aid in improving treatment outcomes among American Indian males.

Lifetime and current pathological gambling disorder were also found to be significantly associated with nicotine dependence. Recent studies have demonstrated that smokers with comorbid pathological gambling find it more difficult to quit smoking (Potenza et al., 2004). However, implementation of strict clean air laws in casinos could improve smoking quit rates. Clean air laws typically prohibit smoking in a wide range of public places thereby supporting social norms against smoking (Levy et al., 2004). An additional relevant tobacco control policy which may assist towards decreasing smoking rates in A.I./A.N. communities are cigarette taxes. A.I./A.N. tribes are considered sovereign nations and are not subject to state tobacco taxes (American Lung Association, 2007). A.I./A.N. may purchase tobacco products at lower prices, which can result in increased smoking rates in these groups. Thus, implementation of both clean air laws and cigarette taxes in A.I./A.N. communities has the potential to significantly decrease smoking rates in these groups. Further studies systematically comparing smoking rates between A.I./A.N. communities based on the implementation of these tobacco control policies, in addition to further studies analyzing the degree of community support with regards to tobacco control policies in A.I./A.N. communities are suggested.

Given that the sample was composed entirely of veterans who may have been exposed to combat related trauma, we examined associations between nicotine dependence and posttraumatic stress disorder. The odds of having a lifetime history of post-traumatic stress

disorder was substantially increased among those with lifetime nicotine dependence compared to those without nicotine dependence. This finding is consistent with accruing evidence for an association between nicotine dependence and PTSD, in which tobacco use may increase the risk of developing post-traumatic stress disorder (for a review, Rasumsson et al., 2006). In a study of 6742 male combat veteran twins, for example, the prevalence of nicotine dependence was 72% for those with PTSD, 52% in trauma-exposed subjects without PTSD, and 40% in nontraumatized individuals (Koenen et al., 2005). Using survival analysis with time-dependent covariates, nicotine dependence present prior to trauma exposure doubled the risk for subsequent development of PTSD in their sample (Koenen et al., 2005).

4.1 Limitations

The most significant limitation of this study is that it is composed entirely of American Indian veteran males in one region of the country and is not reflective of the 564 federally-recognized tribes in the U.S. Thus, generalizing these results to all American Indians is not possible. In addition, this sample was conducted only among veterans, a clinically-unique group, which is more likely to have experienced traumatic events and are known to experience high rates of some psychiatric disorders including PTSD and substance abuse (Chen et al., 2004; Gahm et al. 2007). Also, negative associations found between current nicotine dependence and substance use disorders demonstrated wide confidence ratios and are not conclusive since negative findings are generally less substantiated. We believe that lack of statistical significance for associations between current nicotine dependence with current affective disorders and pathological gambling are most likely due to a lack of statistical power given that the Odds Ratios were consistent with the results for lifetime diagnoses, but again with larger confidence intervals. In addition, the prevalence of smoking may have decreased since the time the survey was completed, consistent with national trends (Maurice et al., 2004). If so, the strength of the relationships between nicotine dependence and other psychiatric disorders may have changed. One might expect these associations to be stronger as smoking becomes less normative. In addition, this sample did not have psychotic disorder data.

The traditional use of tobacco among A.I. tribes should be considered in future studies of the relationship between alcohol use disorders and nicotine dependence. Tobacco is considered a natural sacred herb among American Indian tribes and is used for religious and ceremonial purposes (Struthers & Hodge, 2004). Unfortunately, we did not have an assessment of whether tobacco was used in this way.

Additional limitations include the unestablished cross-cultural validity and applicability of the Q-DIS for American Indians and the potential for the Q-DIS to underestimate current PTSD. The Q-DIS was one of the most up-to-date and efficient epidemiological instruments available at the time of this study. Nonetheless, further investigations will be necessary in order to better assess the practical utility of this instrument in these populations. In spite of these limitations, this study has identified potentially important associations between nicotine dependence and psychiatric disorders among a sample of American Indians.

4.2 Conclusions

In this sample of American Indian male veterans, substantial co-morbidity between nicotine dependence and other substance abuse and psychiatric disorders were found. Lifetime nicotine dependence was associated with all lifetime disorders studied, including alcohol use and drug use disorders, affective and anxiety disorders, PTSD, pathological gambling and antisocial personality disorder. Current nicotine dependence was associated with current affective disorders and gambling problems. Associations with other current psychiatric disorders, while not statistically significant, were similar to those observed for lifetime diagnoses. Additional studies investigating these associations may further our understanding of nicotine dependence

and associated psychiatric problems in the A.I./A.N. population. Studies in more diverse A.I./A.N. settings are suggested in addition to studies with regard to attitudes and beliefs of traditional tobacco use among A.I./A.N. smokers. In order to reduce the prevalence of smoking among A.I./A.N. populations, screening for co-morbid psychiatric problems is warranted. Public policy interventions should also be considered.

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Table 1
 Lifetime Prevalence Rates and Odds Ratios of Nicotine Dependence and Axis I and Axis II Psychiatric Disorders among American Indian Male Veterans

Co-Morbid Disorder	Prevalence of Comorbid Disorder		Lifetime Prevalence of Co-Morbid Disorder Among Respondents		Lifetime Prevalence of Nicotine Dependence with Comorbid Disorder, % (actual)	Odds Ratio of Nicotine Dependence and Comorbid Disorder (95% Confidence Interval) ^e
	No.	%	With Nicotine Dependence Actual	Without Nicotine Dependence Actual		
Nicotine Dependence	112	23.3	----	----	----	----
Any Alcohol Use Disorder ^a	148	30.8	41.1 (46/112)	27.7(102/368)	31.1 (46/148)	1.82 (1.2-2.8)
Any Drug Use Disorder ^b	72	12.6	26.8 (30/112)	11.4 (42/368)	41.7 (30/72)	2.84 (1.7-4.8)
Any Anxiety ^c	107	22.3	42.9 (48/112)	16.0 (59/368)	44.9 (48/107)	3.93 (2.5-6.3)
Any Affective ^d	42	8.8	23.2 (26/112)	2.7 (16/368)	61.9 (26/42)	6.65 (3.4-12.9)
Post Traumatic Stress	57	11.9	27.0 (30/111)	7.3 (27/368)	27.8 (10/36)	4.68 (2.6-8.3)
Antisocial Personality	53	11.0	21.4 (24/112)	7.9 (29/368)	45.3 (24/53)	3.19 (1.8-5.7)
Gambling	45	9.4	17.1 (19/111)	7.1 (26/368)	42.2 (19/45)	2.72 (1.4-5.1)

^a Alcohol use=alcohol abuse or dependence

^b Drug use=drug abuse or dependence

^c Any anxiety=panic disorder, generalized anxiety disorder, post traumatic stress disorder, obsessive compulsive disorder, and phobic disorder

^d Any affective=major depressive disorder, bipolar mood disorder, and dysthymia

^e Odds of the specific disorder among those with nicotine dependence relative to the odds of having the disorder among those without nicotine dependence

Table 2
12-Month Prevalence Rates and Odds Ratios of Nicotine Dependence and Axis I and Axis II Psychiatric Disorders among American Indian Male Veterans

Co-Morbid Disorder	Prevalence of Comorbid Disorder		12-Month Prevalence of Comorbid Disorder Among Respondents		12-Month Prevalence of Nicotine Dependence with Comorbid Disorder, % (actual)	Odds Ratio of Nicotine Dependence and Comorbid Disorder (95% Confidence Interval) ^e
	No.	%	With Nicotine Dependence (actual)	Without Nicotine Dependence (actual)		
Nicotine Dependence	91	19.0	----	----	----	----
Any Alcohol Use Disorder ^a	87	18.1	19.8 (18/91)	17.7 (69/389)	20.7 (18/87)	1.14 (0.6-2.0)
Any Drug Use Disorder ^b	41	8.5	11.0 (10/91)	8.0 (31/389)	24.4 (10/41)	1.43 (0.7-3.0)
Any Anxiety ^c	78	16.3	23.1 (21/91)	14.7 (57/389)	26.9 (21/78)	1.75 (1.0-3.1)
Any Affective ^d	34	7.1	16.5 (15/91)	4.9 (19/389)	44.1 (15/34)	3.84 (1.9-7.9)
Post Traumatic Stress	36	7.5	11.1 (10/90)	6.7 (26/389)	27.8 (10/36)	1.75 (0.8-3.8)
Antisocial Personality	16	3.3	6.6 (6/91)	2.6 (10/389)	37.5 (6/16)	2.68 (0.9-7.6)
Gambling	33	6.9	12.2 (11/90)	5.7 (22/389)	33.3 (11/33)	2.32 (1.1-5.0)

^a Alcohol use disorder =alcohol abuse or dependence

^b Drug use disorder =drug abuse or dependence

^c Any anxiety=panic disorder, generalized anxiety disorder, post traumatic stress disorder, obsessive compulsive disorder, and phobic disorder

^d Any affective=major depressive disorder, bipolar mood disorder, and dysthymia

^e Odds of the specific disorder among those with nicotine dependence relative to the odds of having the disorder among those without nicotine dependence

Table 3
 Lifetime Prevalence of Nicotine Dependence and Axis I and Axis II Psychiatric Disorders by Age Decile among American Indian Male Veterans.

Co-Morbid Disorder	Lifetime Prevalence of Co-morbid Disorder											
	Age 20 - 29		Age 30 - 39		Age 40 - 49		Age 50 - 59		Age ≥ 60			
	No.	%	No.	%	No.	%	No.	%	No.	%		
Nicotine Dependence	5	15.6	14	14.4	46	28.2	28	27.2	17	21.8		
Any Alcohol Use Disorder ^a	8	25.0	31	32.0	59	36.2	32	31.1	15	19.2		
Any Drug Use Disorder ^b	6	14.6	20	18.2	35	19.3	7	5.3	2	2.1		
Any Anxiety ^c	2	6.3	16	16.5	48	29.4	31	30.1	9	11.5		
Any Affective ^d	2	6.3	8	8.2	19	11.7	11	10.7	2	2.6		
Post Traumatic Stress	1	3.1	9	9.4	25	15.3	19	18.4	3	3.8		
Antisocial Personality	3	9.4	15	15.5	22	13.5	5	4.9	4	5.1		
Gambling	0	0.0	7	7.3	22	13.5	12	11.7	3	3.8		