



Published in final edited form as:

Addict Behav. 2019 March ; 90: 119–123. doi:10.1016/j.addbeh.2018.10.034.

Cigarette smoking rates among veterans: Association with rurality and psychiatric disorders

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Abstract

Aims: Compared to the general U.S. population, military veterans and those living in rural areas disproportionately smoke cigarettes at higher rates, leading to increased health consequences. In the current study, prevalence and severity of cigarette smoking in Iraq and Afghanistan era veterans was assessed across rural and urban areas and comorbid mental health disorders.

Method: Iraq/Afghanistan era veterans who participated in the Post-Deployment Mental Health study from 2005–2017 (N = 3229) were cross-sectionally assessed for the probability of being a current cigarette smoker based on locality status and psychiatric comorbidity. Multivariate logistic and linear regressions, adjusted for demographic characteristics, were used to model the odds of being a current smoker and the severity of nicotine dependence, respectively.

Results: Veterans residing in rural regions, veterans with psychiatric comorbidities, and the interaction of locality and psychiatric disorders were significantly associated with smoking rates. Those veterans living in extremely rural areas and, independently, those living with psychiatric comorbidities were also more severely dependent on nicotine compared to urban veterans and veterans without psychiatric conditions.

Conclusions: Rural veterans and veterans with psychiatric comorbidities are at increased risk of smoking and are more severely dependent on nicotine than urban veterans. These findings underscore the need to reduce barriers for treatment both for smoking cessation and mental healthcare for veterans residing in the most rural areas.

Keywords

Rural; urban; psychiatric burden; veteran; cigarette smoking; nicotine dependence

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Conflicts of Interest: none declared.

Introduction

Veterans smoke cigarettes at a higher rate than the general U.S. population with estimates of nearly 1 in 5 veterans smoking compared to 1 in 7 individuals in the nonveteran population (Wagner et al. 2007). Rates of smoking are even greater in the new generation of Iraq/Afghanistan era veterans with estimates approaching 1 in 3 veterans (Kirby et al. 2008; Brown 2010; Cypel et al. 2016). Higher rates of smoking among veterans are compounded by increasing prevalence of psychiatric disorders in this population (Seal et al. 2009). In veterans with co-occurring psychiatric disorders, rates of current smoking are nearly 1 in 2 (McClernon et al. 2013).

The situation is further complicated by the influence of residence locality. Evidence suggests higher rates of cigarette smoking in rural compared to urban areas among the general U.S. population (Gfroerer, Larson, and Colliver 2007; Doescher et al. 2006; Roberts et al. 2016). Reasons for increased smoking in more rural areas include less access to treatment (Fortney et al. 1999; Weeks et al. 2005), especially specialty services (Rost et al. 1998), less recognition of problematic use (Warner and Leukefeld 2001), and higher rates of unemployment or underemployment (Doescher et al. 2006). Unlike rates of smoking, psychiatric disorders are reportedly less prevalent in rural than urban areas both in veterans (Wallace et al. 2006; Weeks et al. 2004) and the general U.S. population (Peen et al. 2010). However, psychiatric disorders in rural veterans are associated with greater declines in quality of life compared to their urban counterparts (Wallace et al. 2006; Weeks et al. 2004). Greater impairment may be due, at least in part, to lower quality of mental healthcare (Fortney et al. 1999) including possible underdiagnosis of less severe problems, restricted access to specialty mental healthcare services leading to less effective treatment (Rost et al. 1998), and receiving less services due to greater distance to care (Fortney et al. 1999; Weeks et al. 2005).

A challenge to treating cigarette smoking in returning Iraq/Afghanistan era veterans is providing interventions to those in need regardless of where they reside. Treatment may be disproportionately burdensome due to distance from Veterans Health Administration (VHA) healthcare facilities with specialty services. Moreover, areas with disparately high need for smoking cessation treatment either due to high rates or greater severity of nicotine use disorder necessitate increased preventative and treatment-oriented efforts on the behalf of the VHA. The primary mission of the VA Office of Rural Health is to improve rural veterans' health and well-being by increasing access to services. Notably, the Office of Rural Health has been instrumental in implementing telehealth services, where veterans can meet with treatment providers over real-time video conference instead of traveling to the VA. Despite this promising and innovative strategy to better serve rural veterans, smoking cessation is not yet formally recognized as a telehealth service offered through the VHA (Office of Public Affairs: Media Relations).

To help clarify the need for smoking cessation services for rural residents, this study provides the first assessment of the distribution across localities of cigarette smoking and severity of nicotine dependence in Iraq/Afghanistan era veterans. Specifically, we evaluated

the impact of rural-urban locality and psychiatric comorbidity on nicotine use disorder risk among Iraq/Afghanistan era veterans. We hypothesized that more rural settings would be associated with higher rates and greater severity of nicotine use and that locality would moderate the effect of psychiatric comorbidities on rates and severity of nicotine use.

Methods

Participants included 3,229 U.S. Iraq/Afghanistan era veterans who participated from November 2005 to September 2017 in the ongoing multisite VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center (MIRECC) Registry Database for the Study of Post-Deployment Mental Health (PDMH). Recruitment and study methods for the study are documented in detail elsewhere (Brancu et al. 2017). In brief, the Mid-Atlantic MIRECC PDMH study includes veterans and military service members who served in the U.S. Armed Forces after September 11, 2001. Study participants were recruited through mailings, advertisements, and clinician referrals and were compensated \$175 for completing the assessments. Study procedures were approved by the institutional review boards at the Durham, Salisbury, Richmond, and Hampton VA medical centers.

Demographic characteristics.

Demographic variables including age, years of education, sex, ethnicity (Hispanic or non-Hispanic), race (black, white, or other), and working status (not employed, part-time, or full-time employment) were assessed.

Locality status.

Veteran locality was based on the home zip code of the veteran provided at the time of participation. Locality status was determined by linking the participant zip code to its Rural-Urban Commuting Area (RUCA) zone (Morrill, Cromartie, and Hart 1999; Economic Research Service. Rural-Urban Commuting Area Codes, 2013) based on the 2010 decennial census and the 2006–10 American Community Survey to delineate subcounty components of rural and urban area codes. Using zip codes to determine rural-urban status provides a finer geographic unit than other county-based categorization systems such as the Office of Management and Budget's Metro, Non-Metro taxonomy. Several federal programs use RUCA codes to determine locality, including the U.S. Department of Health and Human Services. For the purposes of the current study, RUCA codes were used to define locality status of veterans such that the primary 10-category RUCA codes were aggregated into three categories: (1) urban (metropolitan; RUCA = 1–3, area population size 50,000; n = 2742), (2) moderately rural (micropolitan rural; RUCA = 4–6, area population size 10,000–49,999; n = 279), and (3) extremely rural (nonmicropolitan rural; RUCA = 7–10, area population size 9,999; n = 208).

Clinical factors.

Cigarette smoking was assessed by asking veterans to describe their current cigarette smoking status and classified as current (n = 820) or not current (n = 2409) cigarette smokers. Co-occurring psychiatric disorders were assessed using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I), a semistructured clinical diagnostic

interview (First et al. 1994). The SCID-I was administered by research personnel, who received extensive training and supervision. Participants were classified based on whether they met current diagnostic criteria for a psychiatric disorder based on DSM-IV criteria for Axis I disorders, excluding nicotine use disorder.

Severity of nicotine dependence was measured using the Fagerström Test of Nicotine Dependence (FTND; Heatherton et al. 1991) for current cigarette smokers. The FTND is a six-item questionnaire to assess severity of tobacco use disorders. The scores range from 0 to 10 with higher values indicating greater severity.

Analysis

Bivariate associations between current cigarette smoking and various demographic characteristics were calculated using two sample *t*-tests and Chi-square tests for continuous and categorical variables, respectively. Multivariate logistic regression was used to examine the independent association of demographic, locality status, psychiatric comorbidities, and the interaction between locality and psychiatric status with smoking status. Variables that were found to be statistically significant ($p < .05$) in bivariate results were included in the logistic regression model. Similarly, severity of nicotine dependence as measured using the FTND was assessed using the same predictor variables as the aforementioned model using multivariate linear regression.

Results

A summary of demographic information by smoking status, including age, education, minority status, and working status are provided in Table 1. Compared to those who were not currently smoking, veterans who currently smoked were younger ($p < 0.001$), less educated ($p < 0.001$), more likely to be male ($p < 0.001$), white ($p < 0.001$), less likely to be employed ($p < 0.001$), more likely to live in more rural locality ($p = 0.02$), and more likely to have one or more psychiatric diagnoses ($p < 0.001$). Ethnicity was not significantly associated with smoking ($p = 1$, *ns*). Current posttraumatic stress disorder was the most prevalent psychiatric disorder in the study sample (31%) followed by current major depressive disorder (20%).

Variables that were significantly associated with smoking status (i.e. age, education, sex, race, and employment status) were modeled alongside locality status, presence of psychiatric comorbidities, and the interaction of locality status and psychiatric comorbidities using a multivariate logistic regression to predict smoking status. Given the significant interaction term in the cigarette smoking prevalence model, a model without the interaction term was run in order to interpret the main effects of locality and psychiatric comorbidity. In the model without the interaction term, moderately rural veterans (odds ratio [OR] = 2.06, 95% confidence interval [CI] = 1.34–3.10, $p = 0.02$) were significantly more likely than urban veterans to be current cigarette smokers. In this sample, a significant difference was not detected for extremely rural veterans compared to urban veterans (OR = 1.20, CI = 1.20–3.11, $p = 0.07$, *ns*). Consistent with prior work (Lasser et al. 2000; McClernon et al. 2013; Grant et al. 2004), psychiatric comorbidities were also associated with a significant increase in cigarette smoking (OR = 2.06, CI = 1.71–2.50, $p < 0.001$).

The main effects of smoking prevalence were qualified by a significant interaction between rural veterans and psychiatric comorbidities (moderately rural OR = 0.50, CI = 0.28–0.88, $p=0.04$, and extremely rural OR = 0.52, CI = 0.28–0.99, $p=0.01$) compared to urban veterans with no co-occurring mental health diagnoses. To visualize the main and interaction effects of locality status and psychiatric comorbidities the adjusted probabilities of smoking based on locality status and presence of psychiatric comorbidities are shown in Figure 1. The interaction between locality status and psychiatric comorbidities showed a greater risk of smoking for urban veterans with psychiatric comorbidities and for rural veterans regardless of psychiatric status. Specifically, psychiatric comorbidities in urban veterans were associated with a 12% difference in estimated adjusted probability of smoking (17% in urban, no psychiatric diagnoses and 29% in urban, psychiatric diagnoses). By comparison, the probability of smoking only differed by 1–2% (ranging between 28–30%) for moderately and extremely rural veterans with and without psychiatric conditions.

A multiple linear regression assessed the severity of nicotine dependence among current smokers based on the same predictors included in the above model. The omnibus model was significant ($F(12,699) = 7.33$, $p < 0.001$), with an $R^2 = 0.10$. Extremely rural veteran smokers were significantly more nicotine dependent than urban veteran smokers ($t=2.43$, $p=0.02$); however, no significant difference was detected in addiction severity between moderately rural and urban veterans ($t=0.04$, $p=0.97$, ns ; see Figure 2).

A significant main effect of psychiatric comorbidity was also detected such that those veterans with co-occurring, comorbid mental health diagnoses were more dependent on nicotine ($t=2.08$, $p=0.04$). With regard to severity of nicotine dependence among smokers, there were no significant interactions between locality status and psychiatric comorbidity.

Discussion

This study examined the relationships between locality, psychiatric comorbidity, and smoking status and severity in veterans. A higher rate of cigarette smoking was associated with living in rural compared to urban areas especially among those with psychiatric comorbidities. This finding is consistent with previous work showing higher rates of smoking in rural regions among the U.S. population (Gfroerer, Larson, and Colliver 2007; Doescher et al. 2006) and extends these findings to veterans with co-occurring mental health disorders. The effect of locality and psychiatric comorbidity persisted even after adjusting for demographic characteristics such as age, education, race, and employment status. Although significantly higher odds of smoking were observed for moderately rural veterans ($p=0.02$) but not extremely rural veterans ($p=0.07$), this may be due to the relatively small size of the extremely rural group (6.89% of the total sample). The significant interaction between locality status and psychiatric comorbidity illustrates that veterans living in rural regions are at disparately higher risk of cigarette smoking, specifically when compared to urban veterans without mental health disorders (see Figure 1).

Among cigarette smokers, those living in the most remote rural areas reported the greatest nicotine dependence. Severity of nicotine dependence is predictive of short-term (Fagerström et al. 2012) and long-term (Cosci et al. 2009) smoking cessation outcomes. As

such, veterans who live in the most rural areas may be least likely to successfully quit smoking even if they have access to gold standard smoking cessation treatments.

Prior work has documented higher rates of psychiatric comorbidities among veterans who smoke (McClernon et al. 2013) and greater psychiatric disease burden among rural veterans than urban veterans (Wallace et al. 2006). In addition, nicotine dependence is higher in those with comorbid psychiatric conditions, independent of locality status (McClernon et al. 2013). Consistent with these previous findings, in the current study cigarette smokers with psychiatric conditions and living in rural regions were among the most severely addicted. Additional research into how the combination of locality, smoking, and psychiatric comorbidity impact quality of life and contribute to urban-rural health disparities may help to better serve the rural veteran population. Findings of the current study should be interpreted with caution given that the sample includes only those individuals that elected to participate and as such may not be representative of all Iraq/Afghanistan era veterans. In addition, smoking status was self-reported by veterans which may be less reliable than biochemically verified measurement techniques.

Cigarette smoking continues to be a leading cause of preventable morbidity and mortality in the U.S. (Johnson et al. 2014). Providing accessible and effective interventions for veterans who live rurally or have psychiatric disorders can provide meaningful improvements in length and quality of life. Targeting interventions towards veterans who are smoking and diagnosed with one or more psychiatric disorders as they return from service may help to reduce disease burden among this subset of our military population. In addition, campaigns to increase awareness of services provided by regional VAs and VHA contractors in addition to an increased focus on promotion and provision of accessible and effective treatment to rural veterans will help to reach those who live in more remote regions. Specifically, an increase in priority level and funding within VHA for telehealth staffing and training of empirically-supported smoking cessation interventions is both consistent with a recent VHA commitment to expand telehealth services (Clancy 2018) and may be the best option to provide rural veterans with comparable treatment to those residing in urban regions.

Acknowledgements:

The VA Mid-Atlantic Mental Illness Research, Education and Clinical Center (MIRECC) Workgroup for this manuscript includes the following: Mira Brancu, Eric A. Dedert, Eric B. Elbogen, John A. Fairbank, Jason D. Kilts, Nathan A. Kimbrel, Angela C. Kirby, Christine E. Marx, Scott D. Moore, Rajendra A. Morey, Jennifer C. Naylor, Cindy M. Swinkels, Steven T. Szabo, Larry A. Tupler, and Elizabeth E. Van Voorhees, Durham VA Health Care System, Durham, North Carolina; Scott D. McDonald and Treven C. Pickett, Hunter Holmes McGuire Department of Veterans Affairs Health Care System, Richmond, Virginia; Robin A. Hurley, Jared Rowland, Katherine H. Taber, and Ruth Yoash-Gantz, W. G. (Bill) Hefner VA Medical Center, Salisbury, NC. We would like to thank the participants who volunteered to participate in this study. The views expressed in this presentation are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

Funding: This work was supported primarily by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development Clinical Science. This work was also supported by the VA Mid-Atlantic Mental Illness Research, Education and Clinical Center; a VA Career Development Award from VA Health Services Research and Development (IK2HX002398) (Dr. Wilson); and a VA Research Scientist Award from the VA Office of Research and Development (ORD) Clinical Sciences Research and Development Service (IK6CX001494) (Dr. Beckham).

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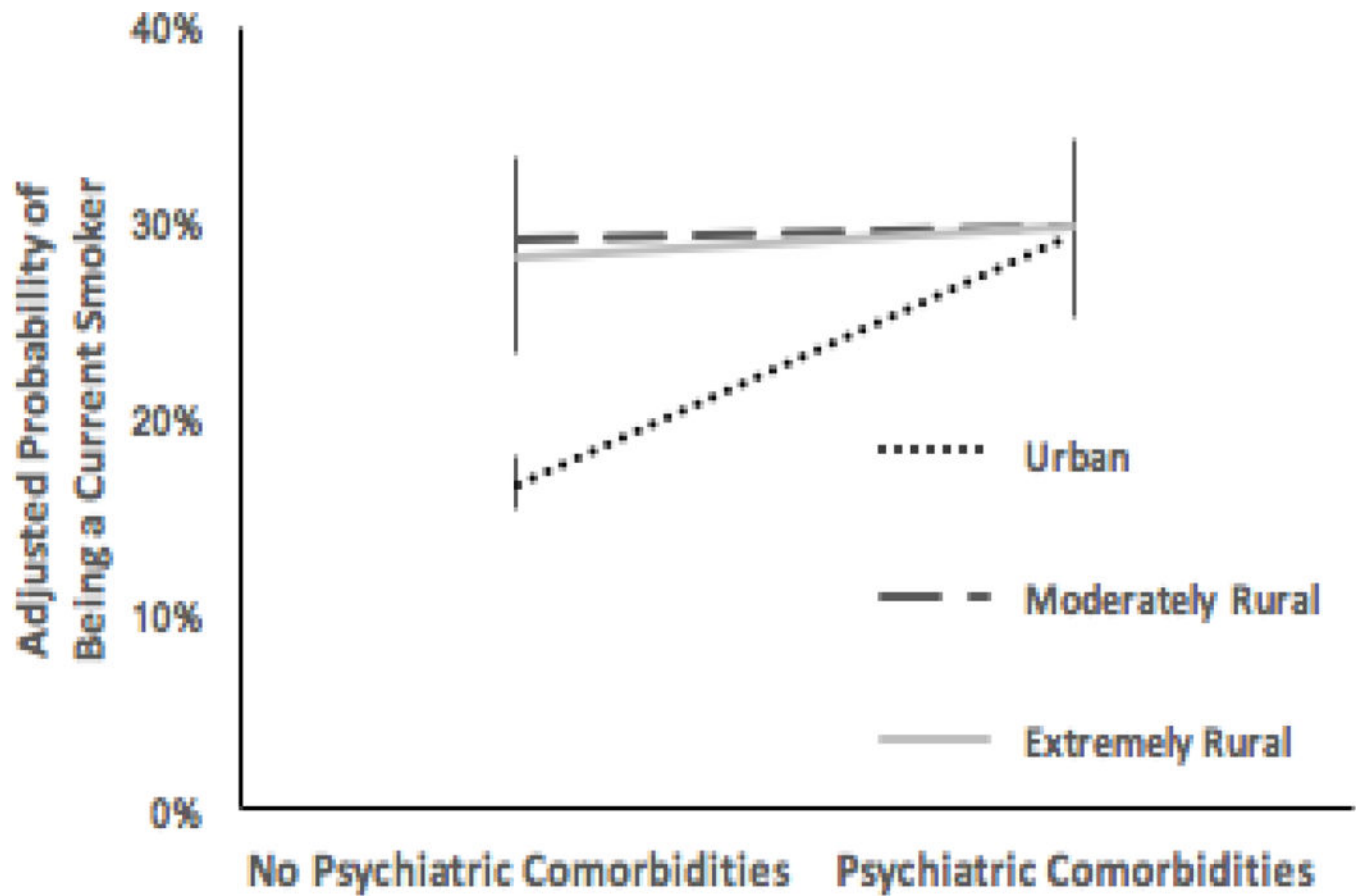


Figure 1:
Interaction between psychiatric comorbidities and locality status

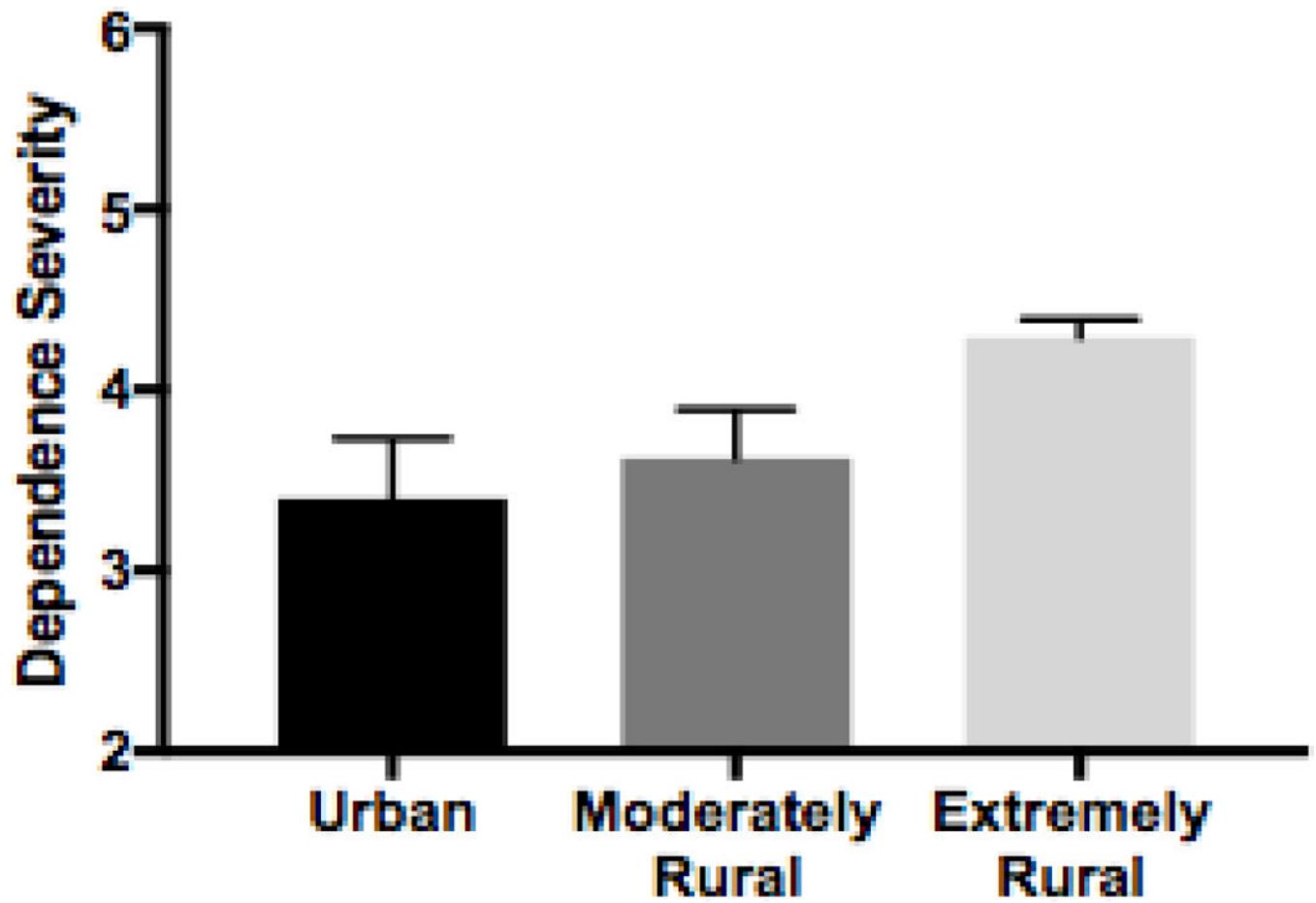


Figure 2:
Severity of nicotine dependence by locality status as measured by the FTND scale

Table 1:

Demographic information by group

Variable	Current Smoker n = 820 (25%)			Non Smoker n = 2409 (75%)			Test statistic
	M	SD	%	M	SD	%	
Age	34.42	9.43		38.38	10.31		$t=-10.16, p<0.001$
Years of Education	12.81	3.10		13.71	3.80		$t=-6.71, p<0.001$
Sex							$\chi^2=11.90, p<0.001$
% male			83.90			78.21	
Race							$\chi^2=15.37, p<0.001$
% white			55.14			47.27	
% black			42.01			49.87	
% other			2.85			2.85	
Ethnicity							$\chi^2=0.09, ns$
% not Hispanic			94.91			94.56	
Employment							$\chi^2=49.10, p<0.001$
Full-time			39.61			53.54	
Part-time			12.10			10.61	
Not employed			48.29			35.86	
Locality Status							$\chi^2=8.19, p=0.02$
Urban			81.83			85.97	
Moderately Rural			10.37			8.05	
Extremely Rural			7.80			5.98	
Psychiatric Diagnosis							$\chi^2=80.04, p<0.001$
One or more			63.41			45.25	