Nonmedical Prescription Drug Use in a Nationally Representative Sample of Adolescents

Evidence of Greater Use Among Rural Adolescents

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Objectives: To compare the prevalence of nonmedical prescription drug use among adolescents residing in urban, suburban, and rural areas of the United States and to determine factors independently associated with rural nonmedical prescription drug use among adolescents aged 12 to 17 years.

Design: Cross-sectional, population-based survey.

Setting: Noninstitutionalized residents in the United States.

Participants: Participants included adolescents aged 12 to 17 years (N=17,872), most of whom were residing in urban areas (53.2%), male (51%), and white (59%).

Main Exposure: Living in rural compared with urban area.

Main Outcome Measures: Nonmedical use of prescription drugs (pain relievers, tranquilizers, sedatives, and stimulants). Data were from the 2008 National Survey on Drug Use and Health.

Results: Rural adolescents were 26% more likely than urban adolescents to have used prescription drugs nonmedically (adjusted odds ratio, 1.26; 95% confidence interval, 1.01-1.57) even after adjustment for race, health, and other drug and alcohol use. When examining the rural adolescents in particular, factors positively associated with nonmedical use of prescription drugs included decreased health status, major depressive episode(s), and other drug (marijuana, cocaine, hallucinogens, and inhalants) and alcohol use. Protective factors for nonmedical prescription drug use among rural adolescents included school enrollment and living in a 2-parent household.

Conclusions: Rural adolescents were significantly more likely than urban adolescents to report nonmedical prescription drug use. However, these results suggest there are multiple potential points of intervention to prevent initiation or progression of use among rural adolescents including preventing school dropout, increased parental involvement, and increased access to health, mental health, and substance abuse treatment.


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ADOLESCENT NONMEDICAL prescription drug use (NMPDU) is prevalent in the United States. According to national surveys of illicit drug use, the prevalence of adolescent prescription pain reliever use is second only to marijuana.1 From 1992 to 2003, NMPDU among adolescents younger than 18 years increased 212%, a rate 2.6 times higher than that of individuals older than 18 years.2 Among a nationally representative sample of US high school seniors, nearly 1 in 8, or 12.3%, reported lifetime nonmedical use of prescription opioids.3 During adolescence, NMPDU is particularly problematic given its association with use of other illicit drugs such as cocaine and heroin,4 as well as engagement in problem behaviors such as gambling, increased sexual activity, and impulsivity.5 Moreover, individuals who use prescription drugs earlier in life have a greater chance of later developing prescription drug dependence.6,7

The growing burden of nonmedical prescription drug use among rural populations has gained increasing recognition8; however, the data on rural adolescents is scant. Though numerous studies have examined substance abuse among urban adolescents, conclusions drawn from research conducted in urban settings may not be generalizable to those residing in rural areas owing to a unique set of contextual influences.9 According to a review by Dew and colleagues,10 the vulnerability of rural communities to the growing...
burden of drug use can be attributed to a number of distinctive economic, social, and structural characteristics. The decimation of rural economies, precipitated by declines in the agricultural, manufacturing, and mining industries and evidenced by high rates of unemployment, has influenced communities’ susceptibility to drug use. Owing to expansions in internet access and the growth of transportation systems, rural communities are decreasingly isolated and have become “another frontier for illicit drug production and distribution.” The authors also cite the destabilization of traditional family structures and the weakening of parental bonds as contributing to the growing problem of rural drug use.10

The cultural, structural, and social realities of rural life can not only affect the prevalence of drug use but also exacerbate its consequences. The isolation and self-reliance of rural communities can negatively affect care-seeking behavior, particularly regarding mental health and substance abuse services. Barriers to care seeking in rural areas are both attitudinal and structural. Factors such as perceived stigma and mistrust in assurances of confidentiality as well as obstacles to transportation, lack of insurance coverage, and unavailability of local detoxification and psychiatric services can all inhibit rural residents’ willingness and ability to seek care.

In light of the distinctive factors that influence susceptibility to substance use in rural communities, epidemiologic research providing comparative analyses of rural and urban drug use and examining rurality as an independent risk factor is warranted. The growing burden of NMPDU and the dearth of information on NMPDU among rural adolescents, in particular, are areas that demand more attention. One study conducted in rural Vermont reported high rates of nonmedical prescription pain reliever use among high school students but did not compare these rates to those of urban adolescents.11 To our knowledge, only 3 studies have described rural-urban differences in adolescent NMPDU in nationally representative samples.12-14 However, none of these studies focused on rural residence as the primary independent variable. Further, apart from reporting the finding, none of the analyses explored factors associated with NMPDU among rural adolescents in particular. Therefore, the purpose of this analysis is to determine whether rural residence is independently associated with lifetime nonmedical prescription drug use in a nationally representative sample of adolescents aged 12 to 17 years. We will also describe the factors that are independently associated with nonmedical use among the rural adolescents included in the sample, to potentially target intervention and prevention efforts.

**METHODS**

**STUDY DESIGN**

The sample was drawn from the 2008 National Survey on Drug Use and Health (NSDUH).1 The NSDUH is an annual survey designed to determine the prevalence and correlates of lifetime and recent substance use among a nationally representative sample of noninstitutionalized adolescents and adults aged 12 years and older. The study used stratified, multistage cluster sampling to identify potential participants. To maximize the validity of self-reported responses, a combination of computer-assisted and audio computer-assisted self-interviewing was used.1 The weighted response rate was 89% and included a final sample size of 68,736 respondents. For the purposes of the current analysis, only adolescents aged 12 to 17 years were included (N=17,842). To account for nonresponse, sampling weights were developed by taking the inverse of the probability of being selected for interview.1

**MEASURES**

Lifetime nonmedical use of the following prescription drugs was assessed for the purposes of the current study: pain relievers (eg, opioid analgesics), tranquilizers (eg, benzodiazepines and muscle relaxers), sedatives (eg, barbiturates, Quaaludes), and stimulants (eg, methylphenidate). A composite variable was created by the Substance Abuse and Mental Health Services Administration that encapsulated use of any of these broad drug classes. To determine nonmedical use of prescription pain relievers, for example, participants were asked, “Have you ever, even once, used any type of prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?” Lifetime use of illicit drugs examined in the current analysis included marijuana, cocaine, crack cocaine, heroin, hallucinogens, inhalants, and methamphetamine. A composite variable was also created that encapsulated any illicit substance use. To determine illicit drug use such as heroin in the NSDUH, respondents were asked, “Have you ever, even once, used heroin?” These questions are about heroin. “Have you ever, even once, used heroin?” This question was repeated for all of the aforementioned illicit drugs.

To determine geographic residence, a variable describing the county type was used. Urban or large metro areas are defined in the NSDUH as having at least 1,000,000 residents according to the Office of Management and Budget.13 Suburban or small metro areas are those that contain less than 1,000,000 residents but reside within a metropolitan statistical area (50,000 or more residents). Finally, rural or nonmetro counties comprise areas with less than 1,000,000 residents and are outside of a metropolitan statistical area.13 Sociodemographic variables included in the analysis included sex, age, race/ethnicity (non-Hispanic white, African American, Hispanic, and other race/ethnicity), current school enrollment (yes/no), total household income (<=50,000, 50,000-75,000, and >75,000), and self-reported health status (excellent, very good, good, and fair/poor). Finally, the NSDUH also has an indicator for adolescent lifetime history of a major depressive episode using criteria from the Sheehan Disability Scale16 that was analyzed in this study.

**SAMPLE**

Of the 17,842 adolescents interviewed in 2008, most were male (51%). The largest proportion of adolescents were interviewed in urban/large metro areas (53.2%), followed by suburban/small metro (29.7%) and rural/nonmetro areas (17.1%). By design, similar proportions of those aged 12 to 17 years were interviewed across the 3 geographic areas. However, there was a significantly larger proportion of non-Hispanic white respondents in the rural/nonmetro areas (74.5% vs 50.7% in the urban/large metro areas). Similarly, income was significantly less in the rural/nonmetro areas and there was a greater proportion of adolescents not enrolled in school among the respondents from rural counties compared with those residing in urban/large metro or suburban/small metro counties. A significantly larger proportion of those in urban/large metro areas and sub-
urban/small metro areas also identified as having excellent health compared with those in rural/nonmetro areas. There were no differences in the prevalence of major depressive episodes across the geographic regions where the adolescents resided at the time of the study.

STATISTICAL ANALYSIS

Owing to the complex survey design, weighted analyses were conducted that use Taylor series linearization. The `svy` command in STATA, version 10.0 (College Station, Texas) was used for all analyses. Weighted \( \chi^2 \) analyses were used to determine differences in nonmedical and illicit drug use by county status (urban/large metro, suburban/small metro, rural/nonmetro), weighted, unadjusted logistic regression analyses were conducted first, comparing urban/rural, then urban/suburban, and finally suburban/rural. A weighted, multivariable logistic regression model was constructed to examine the independent associations of any nonmedical prescription drug use with county residence (urban, suburban, rural) as the primary independent variable of interest. Adjusted odds ratios and 95% confidence intervals are presented.

Once it was determined that rural residence was independently associated with nonmedical prescription drug use among all adolescents included in the study, another weighted logistic model was constructed to determine the independent correlates of lifetime nonmedical prescription drug use among only the rural adolescents to identify factors that could be potential targets for intervention. Given that there were 2 distinct sets of independent variables—those associated with sociodemographics/health status, and those indicating prior drug and/or alcohol use—a hierarchical logistic regression model was used in which the first block of variables consisted of sociodemographic and health characteristics while the second block included other illicit drug use and alcohol variables. Because we were conducting weighted analyses, use of pseudo-\( R^2 \) was not appropriate. Therefore, to determine whether the specific blocks of variables significantly explained the variance in any nonmedical prescription drug use, the \( F \) statistic is presented for each block and the overall model. Finally, to ensure that the drug use variables in the second block were not collinear, we examined the variance inflation factors for each variable, none of which were greater than 2, indicating low levels of colinearity.

There were no statistically significant differences between county residence and any of the illicit drugs examined including the composite "any illicit drug use" variable (Table 1). However, when examining nonmedical use of prescription drugs, compared with adolescents who resided in urban/large metro areas, those in rural/nonmetro areas were significantly more likely to have ever used prescription pain relievers and/or tranquilizers nonmedically. The same is true for any nonmedical prescription drug use, as 13% of rural adolescents and only 10% of urban adolescents report lifetime use (\( P = .002 \)). Even when modeled adjusting for sociodemographics, health status, and other lifetime substance use (Table 2), rural adolescents were still 26% more likely than urban adolescents to indicate NMPDU (adjusted odds ratio, 1.26; 95% confidence interval, 1.01-1.57).

The rural adolescents in the sample (n=4106) were more likely to be male (51.7%) and non-Hispanic white (74.5%). Results from the first block (sociodemographics/health) of the hierarchical model limited to only the rural adolescents indicated that dropping out of school (adjusted odds ratio, 2.22; 95% confidence interval, 1.25-3.96) was a strong correlate of lifetime nonmedical prescription drug use, as was health status (Table 3). Though not significant in the model including all of the adolescents, having at least 1 lifetime major depressive episode was independently associated with nonmedical prescription drug use among rural adolescents. Finally, living in a 2-parent household was found to protect against nonmedical use of prescription drugs, as rural adolescents were 32% less likely to use if they were residing with 2 parents as opposed to 1. As a block, this group of variables was found to be significantly associated with

### Table 1. Lifetime Drug Use Characteristics of Adolescents Living in Urban/Large Metro, Suburban/Small Metro, and Rural/Nonmetro Areas in a 2008 NSDUH Sample (N=17842)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rural/Nonmetro</th>
<th>Suburban/Small Metro</th>
<th>Urban/Large Metro</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetime alcohol use</td>
<td>40.3 (40.0-42.6)</td>
<td>38.0 (36.4-39.7)</td>
<td>37.8 (36.2-39.5)</td>
<td>.22</td>
</tr>
<tr>
<td>Lifetime illicit drug use</td>
<td>25.3 (23.6-27.0)</td>
<td>27.0 (25.2-29.0)</td>
<td>26.0 (24.8-27.3)</td>
<td>.42</td>
</tr>
<tr>
<td>Marijuana</td>
<td>15.0 (14.2-17.0)</td>
<td>17.3 (15.8-19.0)</td>
<td>16.5 (15.4-17.7)</td>
<td>.20</td>
</tr>
<tr>
<td>Cocaine</td>
<td>1.4 (1.00-1.90)</td>
<td>2.1 (1.60-2.70)</td>
<td>1.8 (1.30-2.30)</td>
<td>.24</td>
</tr>
<tr>
<td>Crack cocaine</td>
<td>0.2 (0.09-0.40)</td>
<td>0.3 (0.20-0.58)</td>
<td>0.3 (0.16-0.47)</td>
<td>.50</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>0.4 (0.25-0.71)</td>
<td>0.9 (0.56-1.36)</td>
<td>0.6 (0.39-0.93)</td>
<td>.12</td>
</tr>
<tr>
<td>Heroin</td>
<td>0.3 (0.15-0.69)</td>
<td>0.3 (0.20-0.47)</td>
<td>0.2 (0.11-0.49)</td>
<td>.63</td>
</tr>
<tr>
<td>Inhalants</td>
<td>10.2 (9.05-11.6)</td>
<td>9.4 (8.42-10.5)</td>
<td>8.7 (7.92-9.59)</td>
<td>.12</td>
</tr>
<tr>
<td>Hallucinogens</td>
<td>3.8 (2.98-4.80)</td>
<td>4.5 (3.85-5.31)</td>
<td>3.7 (3.25-4.27)</td>
<td>.20</td>
</tr>
<tr>
<td>Any NMPDU</td>
<td>13.0 (11.6-14.5)</td>
<td>11.5 (10.3-12.9)</td>
<td>10.3 (9.47-11.3)</td>
<td>.02</td>
</tr>
<tr>
<td>Pain relievers</td>
<td>11.5 (10.1-12.9)</td>
<td>10.0 (8.96-11.2)</td>
<td>8.6 (7.76-9.47)</td>
<td>.004</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>3.5 (2.92-4.10)</td>
<td>3.5 (2.97-4.11)</td>
<td>2.5 (2.13-2.91)</td>
<td>.002</td>
</tr>
<tr>
<td>Stimulants</td>
<td>2.6 (2.13-3.15)</td>
<td>3.0 (2.25-3.88)</td>
<td>2.3 (1.87-2.96)</td>
<td>.31</td>
</tr>
<tr>
<td>Sedatives</td>
<td>1.0 (0.64-1.48)</td>
<td>0.7 (0.45-0.97)</td>
<td>0.8 (0.57-1.18)</td>
<td>.46</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; NMPDU, nonmedical prescription drug use; NSDUH, 2008 National Survey on Drug Use and Health.
Findings from the current analysis revealed that the prevalence of lifetime nonmedical prescription drug use was significantly greater among rural adolescents when compared with urban adolescents. Even in the multivariable model adjusted for sociodemographics, health, and other lifetime drug use, residing in a rural county was independently associated with lifetime NMPDU. Data support that one reason for the higher prevalence of NMPDU in rural areas may be the lack of availability of drugs such as heroin that are easily accessed in urban areas.17,18 These results are particularly interesting given that the prevalence of all other illicit drug and alcohol use was similar across geographic residence. Increased prevalence of nonmedical prescription drug use has been noted in 2 other nationally representative studies of adolescents.13,14 However, this is the first to focus specifically on the factors associated with nonmedical use among rural adolescents to attempt to target areas for prevention and intervention.

Among rural adolescents in particular, those who reported being enrolled in school were significantly less likely to indicate that they had ever used prescription drugs nonmedically. This is not surprising, given that the literature consistently report that increased involvement in substance use is detrimental to school performance19,20 and school enrollment,21,22 specifically among rural adolescents.24 Given that the nonmedical prescription drug use rates in this study are similar to those of school-based studies,1,3 it is likely that initial nonmedical use of prescription drugs in particular began while still enrolled. Therefore, there are multiple targets for intervention; preventing ini-
tiation of drug use and nonmedical prescription drug use may be one avenue, while, given that school enrollment is already significantly less among rural adolescents in this sample, increasing school retention through intervention may be another potential solution.

Residing in a household with 2 parents was associated with a 32% reduction in the odds of NMPDU. This finding was expected, as several studies have shown that increased parental involvement and strong familial bonds predict lower rates of substance use. With regard to NMPDU, Ford found that strong bonds to family were protective against lifetime use. These findings also provide support to the assertion by Dew and colleagues that changes in traditional family structures and weakening of parental bonds may especially contribute to substance abuse in rural areas. These results suggest that interventions aimed at family involvement may be beneficial in preventing or reducing NMPDU.

Having a history of at least 1 major depressive episode was also independently associated with nonmedical use of prescription drugs among the rural adolescents. This is supported by many epidemiologic and genetic studies demonstrating overlapping etiology between mental and substance disorders. Martins and colleagues found that those with MDD were 3 times more likely than those without to use prescription opioid analgesics nonmedically. Further, those with MDD were also more likely to go on to develop prescription opioid dependence. Decreased access to mental health treatment could also contribute to an increase in self-medication with prescription drugs such as opioid analgesics. Hauenstein and colleagues suggest large gaps in access to care between rural and urban residents. Similarly, in a study by Anderson and Gittler of rural adolescents, it was found that there were high rates of unmet treatment needs, especially for those with co-occurring disorders. Another potential source of treatment, namely school-based counseling for mental health and substance use, is also less prevalent in rural areas.

Another interesting finding was that, as self-indicated health status declined, the odds of NMPDU significantly increased. Though this finding is consistent with other studies of adolescent NMPDU, the rural context gives the finding a degree of complexity and novelty. It has been suggested that the prevalence of chronic nonmalignant pain may be greater in rural areas, which may account for the greater prevalence of nonmedical prescription drug use among rural adolescents. A study by Lehmann and colleagues found that, among rural adolescents discharged from emergency departments without diagnoses, 78% indicated nonspecific pain. In addition, a high prevalence of unmet health care needs and foregone care among rural adolescents may also lead to increased rates of self-medicating for pain. In a recent study by McCabe and colleagues, they found that one of the most common motives for use of nonmedical use of prescription drugs was to “relieve physical pain.” Thus, those who consider themselves in fair or poor health may use prescription drugs, in particular opioid analgesics, nonmedically to relieve pain. Thus, increasing access to health care among rural adolescents could potentially reduce nonmedical use by those self-medicating for pain.

Finally, use of other illicit drugs and alcohol was most strongly associated with lifetime nonmedical prescription drug use. This is consistent with other studies using NSDUH data and other nationally representative samples of adolescents. Therefore, interventions targeting adolescents who have already initiated substance use may still be effective in reducing use, or even preventing abuse and dependence on prescription drugs.

This study is not without limitations. Data are based on self-report and may have been subject to response bias, especially among adolescents concerned with admitting drug use. However, potential for bias is minimized owing to the use of Audio Computer Assisted Self-interview for the more sensitive questions related to substance use. Use of Audio Computer Assisted Self-interview has been shown to increase valid responses when used in the context of eliciting sensitive data. The cross-sectional study design also precludes us from determining the causal mechanisms underlying nonmedical prescription drug use among adolescents. However, these results from a nationally representative sample of adolescents suggest that further study into these associations is warranted, especially of those residing in rural areas.

Withstanding these limitations, this study was among the first to demonstrate a higher prevalence of nonmedical prescription drug use among rural adolescents from a nationally representative sample and to describe the characteristics of rural adolescent nonprescription drug users. The implications for these findings are that rural adolescents may be at increased risk for nonmedical prescription drug use and opioid pain relievers and tranquilizers in particular. However, this is merely a first step. Further analyses examining the factors associated with use of pain relievers and tranquilizers are a next logical step. While we were able to identify potential targets for intervention such as increased access to health, mental health, and substance abuse treatment, this may be difficult for rural areas where such resources are in short supply or nonexistent. Research into the causal mechanisms surrounding initiation of nonmedical prescription drug use in rural adolescents is necessary to develop tailored interventions for this population.

Accepted for Publication: August 11, 2010.
Published Online: November 1, 2010. doi:10.1001/archpediatrics.2010.217

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Financial Disclosure: None reported.