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Initiation of Nonmedical Use of Prescription Opioids among High School Students – Virginia, 2017

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Abstract

Background: Nonmedical use of prescription opioids (NUPO) is associated with heroin use and other adverse outcomes among adolescents. To inform the timing of substance use prevention activities and which substances to target, we examined age at NUPO initiation, associations between substance use initiation and current (past 30-day) NUPO, and order of NUPO initiation relative to other substances.

Methods: Data from 2,834 students 15 or older participating in the 2017 Virginia Youth Survey, the first Youth Risk Behavior Surveillance System survey to assess age at NUPO initiation and current NUPO, were analyzed in 2019. Students reported current NUPO and ages at initiation for cigarettes, alcohol, marijuana, and NUPO (categorized as 12 or younger, 13 or 14, 15 or older, or never). Associations between age at substance use initiation and current NUPO were examined using adjusted prevalence ratios (aPRs) and 95% confidence intervals (CI).

Results: Overall, 12% of students reported lifetime NUPO, with 2.4%, 4.0% and 5.6% initiating at 12 or younger, 13 or 14, and 15 or older, respectively; 5.3% reported current NUPO. Initiating cigarettes, alcohol, and marijuana at each age category (compared with never) was associated with an increased prevalence of current NUPO after adjusting for demographics and initiation of other substances. Among students initiating NUPO, initiating NUPO at 12 or younger (compared

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with 15 or older) was associated with an increased prevalence of current NUPO after adjusting for demographics (aPR=1.54, 95% CI: 1.10–2.16), but not after further adjustment for initiation of other substances (aPR=1.38, 95% CI=0.97–1.97). Among students initiating NUPO, 45.4% initiated NUPO before or during the same age as other substances.

Conclusions: More than 6% of students initiated NUPO at 14 or younger. Younger substance use initiation was associated with current NUPO, suggesting some students may benefit from prevention activities during early adolescence that address multiple substances.

Keywords

nonmedical use of prescription opioids; adolescents; Youth Risk Behavior Surveillance System; age at substance use initiation

INTRODUCTION

Nonmedical use of prescription opioids (NUPO) among adolescents has been associated with risky behaviors including heroin use,[1–3] sexual risk taking,[3, 4] and suicidal thoughts and behaviors.[3] In 2016, prescription opioids were involved in approximately one-third of opioid-involved overdose deaths among adolescents in the US.[5]

Understanding the age at NUPO initiation and the order of NUPO initiation relative to other substances (e.g., cigarettes, alcohol, and marijuana) may inform timing of adolescent substance use prevention programs, and which substances to target. Studies among adolescents and young adults suggest NUPO initiation frequently occurs between ages 14 and 18.[1, 6–11] Few studies have examined NUPO initiation relative to other substances and, among them, have reported conflicting results. For example, a study among adolescents found similar mean ages at initiation for NUPO (13.3 years), alcohol (13.1 years) and marijuana (13.6 years).[9] Another study found young adults reported initiating alcohol and cigarettes first, followed by marijuana and then NUPO.[12]

Early initiation (i.e., age 15 or younger) of cigarettes, alcohol, and marijuana is a risk factor for continuing substance use, developing substance use disorders, and using other substances,[13–15] including NUPO.[8, 9, 16–18] Only three studies have examined associations between age at NUPO initiation and later NUPO, [8, 17, 19] generally finding younger initiation was associated with increased use or opioid use disorder (OUD). Importantly, these studies varied in their control of other substance use behaviors; utilized data from more than 10 years ago, which may not reflect adolescents' current behaviors, [8, 17, 19]; or were among adults, whose responses may be influenced by long recall periods.[17, 19]

The 2017 Virginia Youth Survey (VYS) was the first of the Centers for Disease Control and Prevention's (CDC) Youth Risk Behavior Surveillance System's (YRBSS) surveys to assess age at NUPO initiation and current (i.e., past 30-day) NUPO, providing an opportunity to estimate NUPO initiation and examine associations between substance use initiation and current NUPO among a recent, representative sample of youth. Therefore, we examined age at NUPO initiation, associations between age at cigarette, alcohol, marijuana, and NUPO initiation and current NUPO, and order of NUPO initiation relative to other substances.

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This information might inform the timing and targeting of youth substance use prevention activities.

METHODS

Study Design

As part of the YRBSS, the 2017 VYS collected information from high school students on substance use and other priority health risk behaviors. Students completed a 93-item, self-administered questionnaire during a regular, 45-minute class period; participation was voluntary and anonymous. Additional information about YRBSS survey methodology is available elsewhere.[20] State procedures were used to review the VYS, and state and local procedures were followed to obtain parental consent. Data used in this study were approved by CDC as research not involving identifiable human subjects.

The VYS used a two-stage, cluster sample design to produce representative estimates of 9^{th}–12^{th} grade students in Virginia public and charter schools. The 2017 VYS achieved 100% school-level and 82% student-level response rates. Of 3,697 completed surveys, analyses were limited to 3,003 students aged 15 or older to allow for categorization into the initiation variables described below. Students with missing current, lifetime, or NUPO initiation (n=113) or with inconsistent NUPO information (e.g., reporting current NUPO, but reporting never initiating NUPO; n=56) were excluded. The analytic sample consisted of 2,834 students.

Measures

Age at initiation for cigarettes, alcohol, marijuana and NUPO were assessed by asking "How old were you…": "…when you first tried cigarette smoking, even one or two puffs?"; "…when you had your first drink of alcohol other than a few sips?"; "…when you tried marijuana for the first time?"; and "…the first time you took a prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it? (Count drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet.)", respectively. Response options included never using that substance, 8 years or younger, 9 or 10 years old, 11 or 12 years old, 13 or 14 years old, 15 or 16 years old, and 17 years or older; based on the distribution of responses, each variable's responses were re-categorized as age 12 or younger, ages 13 or 14, age 15 or older, or never having initiated.

Lifetime NUPO was assessed by asking "During your life, how many times have you taken prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it? (Count drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet.)." Current NUPO was assessed using a similar question, but "During the past 30 days…" replaced "During your life…". Responses to each question were dichotomized to reflect lifetime NUPO (yes versus no) and current NUPO (yes versus no).

Although the psychometric properties of these NUPO-related questions have not been evaluated, YRBSS substance use questions have demonstrated substantial test-retest reliability,[21] and all survey items are reviewed for appropriate complexity and reading-level for high school-aged youth.[20]

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Analysis

Mean age at NUPO initiation was estimated by using the midpoint of the original initiation responses. Prevalence of current NUPO, lifetime NUPO, and age at NUPO initiation were estimated and differences in proportions were evaluated using Chi-square tests. Associations between age at cigarette initiation and current NUPO, age at alcohol initiation and current NUPO, and age at marijuana initiation and current NUPO were examined using unadjusted and adjusted prevalence ratios (PRs and aPRs, respectively) and 95% confidence intervals (CIs) estimated from logistic regression models; never initiated was the referent. A three-step procedure was used to examine each association. First, PRs were estimated for each association. Second, aPRs were estimated that controlled for demographics. Third, aPRs were estimated that controlled for demographics and initiation at age 12 or younger of the three other substances. Dose-response relationships between age at initiation categories were tested using linear contrasts.

Among students reporting lifetime NUPO (n=320), associations between age at NUPO initiation and current NUPO were examined using a procedure similar to that previously described; initiating NUPO at 15 or older was the referent. Dose-response relationships between age at initiation categories were tested using linear contrasts. The originally-reported age at initiation responses were used to identify NUPO initiation before, during the same two-year age period, or after cigarettes, alcohol, or marijuana among students reporting lifetime NUPO.

Analyses were conducted using SAS 9.4 with SAS-callable SUDAAN 11 to account for the complex sample design and survey weights utilized by VYS. Statistical tests were considered significant *a priori* when $p<0.05$ (for Chi-Square and linear contrasts) or the 95% CI did not include 1.0 (for PRs and aPRs).

RESULTS

Overall, 12.0% of students reported lifetime NUPO and the mean age at initiation was 13.8 years (95% CI: 13.5, 14.2). Overall, 2.4%, 4.0%, and 5.6% of students initiated NUPO at age 12 or younger, 13 or 14, and age 15 or older, respectively ($p<0.001$ Table 1); age at initiation varied by age and grade ($p<0.001$ for both). Overall, 5.3% of students reported current NUPO; older students more frequently reported current NUPO ($p=0.038$).

Initiating cigarettes, alcohol, and marijuana at ages 12 or younger, 13 or 14, and 15 or older, compared with never initiating, were each associated with a significantly increased prevalence of current NUPO (Table 2). For example, students initiating alcohol at 12 or younger, 13 or 14, and 15 or older had 11.53 (95% CI=4.60, 28.95), 9.10 (95% CI=3.70, 22.38) and 6.53 (95% CI=3.02, 14.11) times the prevalence of current NUPO, respectively, compared with students never initiating alcohol, and after adjusting for demographics and initiation of cigarettes, marijuana, and NUPO at 12 or younger. Initiating alcohol or marijuana at age 12 or younger was more strongly associated with current NUPO than initiating those substances at age 15 or older, but only in fully adjusted models.

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Among students reporting lifetime NUPO (n=320; Table 3), initiating NUPO at age 12 or younger, compared with 15 or older, was associated with a significantly increased prevalence of current NUPO in unadjusted models (aPR=1.53, 95% CI=1.11, 2.10), and models adjusted for demographics (aPR=1.54, 95% CI=1.10, 2.16); however, this association was not statistically significant after further adjustment for initiation of cigarettes, alcohol, and marijuana at 12 or younger.

Among students reporting lifetime NUPO (n=320), 21.0% reported initiating NUPO before cigarettes, alcohol, or marijuana; 24.4% reported initiating NUPO and cigarettes, alcohol, and/or marijuana during the same age period; and 54.7% reported initiating cigarettes, alcohol and/or marijuana before initiating NUPO.

DISCUSSION

Overall, 2.4%, 4.0% and 5.6% of students reported initiating NUPO at 12 or younger, 13 or 14, and 15 or older, respectively, and 45.4% initiated NUPO before or during the same age period as other substances. Although age at NUPO initiation was not associated with current NUPO in the fully adjusted model, initiating cigarettes, alcohol, or marijuana at age 12 or younger, 13 or 14, and 15 or older (compared with never initiating) were each associated with an increased prevalence of current NUPO, and earlier alcohol and marijuana initiation were more strongly associated with current NUPO than later initiation.

Our findings are consistent with studies reporting early initiation of cigarettes, alcohol, or marijuana were associated with a higher likelihood of lifetime NUPO or OUD.[8, 9, 16–18] Our finding that NUPO initiation occurred at a mean age of 13.8 also aligns with studies reporting initiation between ages 14 and 18.[1, 6–11] However, previous studies have also reported early NUPO initiation was associated with later use or OUD,[8, 9, 17, 19] which is in contrast with our findings. Specifically, we found initiating NUPO at age 12 or younger was associated with current NUPO in unadjusted models and in models adjusted for demographics, but not after further adjustment for early initiation of other substances. Notably, the direction and magnitude of associations were similar between all models, suggesting limited sample sizes might have prevented us from detecting statistically significant associations in fully adjusted models.

The Gateway Hypothesis suggests tobacco or alcohol use typically precede marijuana use and other illicit substance use.[22] Despite this, we did not find a clear pattern of substance use initiation: 21.0% of students initiated NUPO before cigarettes, alcohol or marijuana, 24.4% initiated NUPO and other substances during the same age period, and 54.7% initiated other substances before NUPO. Previous studies examining NUPO initiation relative to other substances have also reported inconsistent results.[9, 12] Substance use initiation patterns may be influenced by multiple factors, including availability,[23, 24] and, notably, prescribed use of opioids during adolescence has been associated with future opioid misuse.[25] Further research may be needed to understand how NUPO initiation aligns with the Gateway Hypothesis and factors that might influence initiation patterns.

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Our findings that 6.4% of students initiated NUPO at age 14 or younger, and early cigarette, alcohol, and marijuana initiation were associated with current NUPO suggests some students might benefit from prevention activities during late-childhood or early-adolescence that address multiple substances. Although youth participation in prevention programs has decreased in recent years,[26] programs that promote protective factors (e.g., self-esteem, strong family relationships), address risk factors (e.g., early aggression, poor school performance), and include individual-, family-, and community-level components have demonstrated reductions in youth substance use.[27, 28] Notably, programs incorporating both family-focused and school-based interventions during middle school have shown short- and long-term reductions in substance use behaviors, including prescription drug misuse.[29, 30]

Limitations

This study had limitations. Age at initiation was reported in two-year increments, which precluded us from identifying specific ages substances were initiated; initiation was also reported retrospectively, which may be subject to recall or memory biases. Although self-reported data may be under- or over-reported, YRBSS surveys have shown good test-retest reliability.[21] Adverse childhood experiences, socioeconomic status, and other family characteristics might influence associations between age at substance use initiation and NUPO; we were unable to control for these factors because they were not assessed. Additionally, we could not examine frequency of NUPO due to limited sample sizes. Although the VYS is representative of Virginia public and charter school students, results may not be generalizable to other populations. Furthermore, data were collected only from youth attending schools and youth not in school may be more likely to engage in substance use,[31] potentially underestimating these behaviors. Finally, the VYS is a cross-sectional survey, which makes it impossible to determine the direction of association in our analyses; therefore, associations do not represent causal relationships.

CONCLUSION

More than 6% of high school students initiated NUPO before age 15, and many initiated NUPO before, or around the same age as, other substances. Although age at NUPO initiation was not associated with current NUPO, early initiation of cigarettes, alcohol, and marijuana was associated with current NUPO. These findings suggest some students might benefit from prevention activities during early adolescence that address multiple substances.

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Table 1:

Prevalence of Lifetime NUPO, Age at NUPO Initiation, and Current NUPO by Characteristics – VYS, 2017

	Total Population				Age at NUPO Initiation (in years)						
Characteristic	**n**	**% (95% CI)**	**Lifetime NUPO n=320 % (95% CI)**	***P***	**12 or younger n=65 % (95% CI)**	**13 or 14 n=109 % (95% CI)**	**15 or older n=146 % (95% CI)**	**Never n=2514 % (95% CI)**	***P***	**Current NUPO n=135 % (95% CI)**	***P***
Total	2,834	100.0	12.0 (10.8, 13.4)		2.4 (1.8, 3.2)	4.0 (3.4, 4.7)	5.6 (4.6, 6.9)	88.0 (86.6, 89.2)		5.3 (4.3, 6.5)	
Sex											
Male	1,381	51.3 (48.2, 54.5)	11.2 (9.6, 13.0)	0.092	2.4 (1.6, 3.6)	3.8 (2.7, 5.2)	5.0 (4.0, 6.2)	88.8 (87.0, 90.4)	0.305	5.7 (4.4, 7.4)	0.321
Female	1,442	48.7 (45.5, 51.8)	13.0 (11.4, 14.8)		2.4 (1.7, 3.5)	4.2 (3.3, 5.3)	6.4 (4.7, 8.5)	87.0 (85.2, 88.6)		4.9 (3.8, 6.3)	
Race/ethnicity											
Non-Hispanic white	1339	52.5 (45.7, 59.2)	12.7 (10.9, 14.8)	0.368	1.9 (1.3, 2.8)	4.0 (3.1, 5.1)	6.9 (5.4, 8.6)	87.3 (85.2, 89.1)	0.147	5.2 (3.8, 7.2)	0.537
Non-Hispanic black	439	21.3 (16.2, 27.6)	10.5 (8.9, 12.4)		2.5 (1.3, 4.9)	3.7 (2.5, 5.5)	4.3 (2.8, 6.6)	89.5 (87.6, 91.1)		5.3 (3.7, 7.5)	
Hispanic	529	14.1 (11.0, 17.8)	12.2 (9.3, 15.8)		2.9 (1.5, 5.3)	5.3 (3.3, 8.6)	4.0 (2.3, 6.9)	87.8 (84.2, 90.7)		7.0 (4.5, 10.6)	
Other	475	12.1 (10.2, 14.3)	11.7 (8.5, 15.8)		4.3 (2.4, 7.7)	3.1 (1.7, 5.6)	4.3 (2.7, 6.7)	88.3 (84.2, 91.5)		4.0 (2.2, 7.3)	
Age											
15 years	930	30.9 (25.5, 37.0)	9.7 (8.0, 11.7)	0.066	3.0 (2.0, 4.6)	4.5 (3.4, 6.0)	2.1 (1.3, 3.6)	90.3 (88.3, 92.0)	**<0.001**	3.7 (2.6, 5.2)	0.038
16 years	896	30.8 (27.2, 34.6)	11.5 (9.5, 13.8)		2.1 (1.3, 3.6)	4.5 (3.2, 6.3)	4.8 (3.6, 6.5)	88.5 (86.2, 90.5)		5.7 (4.1, 7.8)	
17 years	826	31.0 (26.3, 36.1)	13.7 (10.9, 17.1)		1.4 (0.7, 2.6)	3.3 (2.2, 5.0)	9.0 (6.8, 11.7)	86.3 (82.9, 89.1)		6.0 (4.0, 9.0)	
18 years or older	182	7.3 (5.5, 9.6)	17.1 (11.9, 23.9)		5.3 (2.5, 10.8)	2.3 (0.5, 9.0)	9.5 (6.4, 14.0)	82.9 (76.1, 88.1)		7.8 (4.5, 13.1)	
Grade											
9	184	8.2 (5.7, 11.9)	12.6 (8.1, 19.0)	0.083	4.4 (2.0, 9.5)	5.2 (2.5, 10.6)	3.0 (1.2, 6.9)	87.4 (81.0, 91.9)	**<0.001**	6.8 (3.5, 12.8)	0.246
10	973	31.2 (25.0, 38.1)	9.6 (7.1, 12.7)		2.9 (1.6, 4.9)	4.0 (3.0, 5.2)	2.8 (1.6, 4.8)	90.4 (87.3, 92.9)		3.9 (2.7, 5.6)	
11	893	30.3 (25.6, 35.6)	11.5 (9.5, 13.9)		1.5 (0.8, 2.8)	4.8 (3.6, 6.3)	5.3 (3.8, 7.2)	88.5 (86.1, 90.5)		5.1 (3.8, 6.8)	
12	756	30.2 (23.9, 37.5)	14.7 (12.3, 17.4)		2.1 (1.2, 3.6)	2.9 (1.9, 4.4)	9.7 (7.7, 12.0)	85.3 (82.6, 87.7)		6.4 (4.7, 8.7)	

Note: Boldface indicates statistical significance ($p<0.05$)

NUPO, nonmedical use of prescription opioids; VYS, Virginia Youth Survey

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Table 2:

Associations Between Age at Cigarette, Alcohol and Marijuana Initiation and Current NUPO – VYS, 2017

	n	% (95% CI)	Current NUPO n=135 % (95% CI)	Unadjusted Prevalence Ratio (95% CI)	Adjusted[a] Prevalence Ratio (95% CI)	Adjusted[b] Prevalence Ratio (95% CI)
Age at Cigarette Initiation						
12 years or younger	197	7.8 (6.4, 9.5)	19.2 (13.6, 26.4)	**8.68 (4.97, 15.14)**[c]	**8.65 (4.93, 15.17)**[c]	**2.73 (1.46, 5.12)**[c]
13 or 14 years	159	6.3 (5.2, 7.5)	17.6 (12.1, 24.9)	**7.96 (4.43, 14.34)**[c]	**8.12 (4.55, 14.51)**[c]	**4.51 (2.52, 8.05)**[c]
15 years or older	236	8.7 (7.2, 10.3)	11.4 (7.3, 17.5)	**5.18 (3.14, 8.52)**[c]	**4.78 (2.81, 8.12)**[c]	**3.87 (2.31, 6.50)**[c]
Never	2,222	77.3 (74.4, 79.9)	2.2 (1.5, 3.2)	*Referent*	*Referent*	*Referent*
Age at Alcohol Initiation						
12 years or younger	357	13.7 (12.2, 15.4)	17.1 (12.7, 22.6)	**27.59 (11.87, 64.13)**[c, d, e]	**26.69 (11.39, 62.56)**[c, d, e]	**11.53 (4.60, 28.95)**[c, e]
13 or 14 years	379	13.8 (12.2, 15.5)	9.0 (5.8, 13.5)	**14.48 (6.25, 33.55)**[c]	**14.79 (6.32, 34.62)**[c]	**9.10 (3.70, 22.38)**[c]
15 years or older	598	22.0 (19.7, 24.5)	6.1 (4.6, 8.0)	**9.88 (4.56, 21.41)**[c]	**9.00 (4.16, 19.49)**[c]	**6.53 (3.02, 14.11)**[c]
Never	1,440	50.5 (48.0, 53.0)	0.6 (0.3, 1.4)	*Referent*	*Referent*	*Referent*
Age at Marijuana Initiation						
12 years or younger	124	5.0 (4.0, 6.4)	31.9 (24.9, 39.8)	**21.04 (12.29, 36.02)**[c, d, e]	**20.60 (11.78, 36.03)**[c, d, e]	**7.99 (4.18, 15.29)**[c, e]
13 or 14 years	264	9.9 (8.2, 11.9)	14.9 (10.7, 20.4)	**9.83 (5.84, 16.56)**[c, e]	**9.18 (5.48, 15.38)**[c, e]	**5.55 (3.32, 9.25)**[c]
15 years or older	401	15.1 (13.0, 17.4)	7.7 (5.3, 10.9)	**5.05 (2.84, 8.99)**[c]	**4.69 (2.63, 8.38)**[c]	**3.43 (1.98, 5.94)**[c]
Never	2,022	70.0 (66.9, 73.0)	1.5 (0.9, 2.4)	*Referent*	*Referent*	*Referent*

Note: Boldface indicates statistically significance (95% CI do not include 1.0)

[a]Adjusted for sex, race/ethnicity, and grade

[b]Adjusted for sex, race/ethnicity, grade and initiation at age 12 or younger of the other three substances (e.g., when examining the association between age at cigarette initiation and current NUPO, this model adjusted for sex, race/ethnicity, grade, initiation of alcohol at age 12 or younger, initiation of marijuana at age 12 or younger, and initiation of NUPO at age 12 or younger)

[c]Significantly different ($p<0.05$) than "Never" category based on linear contrast test

[d]Significantly different ($p<0.05$) than "13 or 14 years" category based on linear contrast test

[e]Significantly different ($p<0.05$) than "15 years or older" category based on linear contrast test

NUPO, nonmedical use of prescription opioids; VYS, Virginia Youth Survey

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Table 3:

Associations Between Age at NUPO Initiation and Current NUPO, Among Students Initiating NUPO – VYS, 2017

	n	% (95% CI)	Current NUPO n=135 % (95% CI)	Unadjusted Prevalence Ratio (95% CI)	Adjusted[a] Prevalence Ratio (95% CI)	Adjusted[b] Prevalence Ratio (95% CI)
Age at NUPO Initiation						
12 years or younger	65	20.0 (15.2, 26.0)	57.4 (44.0, 69.8)	**1.53 (1.11, 2.10)**[c]	**1.54 (1.10, 2.16)** [c]	1.38 (0.97, 1.97)
13 or 14 years	109	33.1 (28.3, 38.4)	45.4 (35.8, 55.3)	1.20 (0.88, 1.65)	1.24 (0.87, 1.76)	1.14 (0.81, 1.61)
15 years or older	146	46.8 (40.1, 53.6)	37.7 (28.7, 47.6)	*Referent*	*Referent*	*Referent*

Note: Boldface indicates statistical significance (95% CI does not include 1.0).

[a]Adjusted for sex, race/ethnicity, and grade

[b]Adjusted for sex, race/ethnicity, grade and initiation of cigarettes at age 12 or younger, initiation of alcohol at age 12 or younger, and initiation of marijuana at age 12 or younger

[c]Significantly different (p<0.05) than “15 years or older” category based on linear contrast test

NUPO, nonmedical use of prescription opioids; VYS, Virginia Youth Survey