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BRIEF REPORT

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Recent trends in prescription drug misuse in the United States by age, race/ethnicity, and sex

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Abstract

Background and Objectives: To examine changes in United States past-year opioid, stimulant, and benzodiazepine prescription drug misuse (PDM) and poly-PDM by demographics.

Methods: Data were from the 2015–2019 National Survey on Drug Use and Health (N = 282,768), examining annualized PDM change by demographics.

Results: Opioid and poly-PDM significantly declined among those under 35 years, White, and multiracial residents.

Discussion and Conclusions: Age and race/ethnicity are important moderators of recent PDM trends, warranting investigation of mechanisms.

Scientific Significance: Results highlight ongoing PDM declines in younger groups but expand the literature by showing limited changes in adults 35 and older and non-opioid PDM.

INTRODUCTION

Prescription drug misuse (PDM) is associated with other substance use, substance use disorders, psychopathology, overdose, and poorer health.[1,2] PDM is often defined as medication use in ways not intended by the prescriber or without a prescription and includes misuse of opioid, stimulant, or benzodiazepine medication. Past-year PDM prevalence increased in the early or mid-2010s,[3,4] but recent evidence suggests opioid PDM has declined,[5] with limited evidence of changes in stimulant or benzodiazepine PDM.[1,5] The declines appear concentrated in young adults (18–25 years),[5] but less is known about changes within other age groups or trends by sex and race/ethnicity, despite higher rates in non-Hispanic White individuals and males.[1,6]

Prescription opioid misuse was a major contributor to the early opioid overdose epidemic before heroin or illicit fentanyl use became the primary cause of overdose.[7] Declines in opioid PDM co-occurred with increases in heroin and illicit fentanyl overdoses, with the conjecture that federal- and state-level efforts to reduce opioid prescribing rates resulted in increased use of illicit opioids among those who previously used prescription opioids.[7] At the federal level, the 2016 CDC guidelines for opioid prescribing for chronic pain were

a major policy change, and at a state level, these efforts include prescribing limits, prescription drug monitoring programs (PDMPs), and pain management clinic regulations.[8]

Despite potential declines, prescription opioid misuse precedes heroin use in the vast majority of cases,[7,9] prescription opioid-involved overdoses were responsible for over one-quarter (28.4%) of opioid overdose deaths, and benzodiazepine medication contributed to nearly 20% of opioid overdose deaths.[10] Furthermore, any PDM in adolescence, early, or middle adulthood is associated with an elevated likelihood of having two or more substance use disorder symptoms at age 50.[11]

In contrast to opioid PDM, both benzodiazepine and stimulant PDM are less well studied, and trends in their misuse are unclear. Rates of prescription stimulant prescribing rose from 2014 to 2019 in adults 20 years and older, with greater increases in females.[12] Similarly, benzodiazepine prescribing rates increased from 2003 to 2015 in the United States, with significant increases across all age groups, all racial/ethnic groups, and both sexes. Over the same period, rates of opioid-benzodiazepine co-prescribing increased by roughly 300%.[13] Increased prescription opioid availability was associated with increases in opioid PDM,[7] and evidence suggests that receipt of a benzodiazepine prescription is a risk factor for later benzodiazepine PDM. Changes in opioid, stimulant and benzodiazepine prescribing practices may have affected medication availability, which can increase opportunities for PDM.[6] Together, this suggests a need for continued investigation of trends in PDM.

To understand recent trends in past-year PDM, we used data from the 2015–2019 US National Survey on Drug Use and Health (NSDUH). Data before 2015 were excluded because of changes to the PDM assessment preventing comparison to 2015–2019 data.[14] To aid in targeting screening for and prevention of PDM, our primary aim was to evaluate trends in past-year opioid, benzodiazepine, stimulant PDM, and poly-PDM (i.e., misuse of multiple medication classes) by age, race/ethnicity, and sex over the 2015–2019 period. As noted above, while rates of opioid prescribing have declined in recent years, rates of both stimulant and benzodiazepine prescribing have increased, with large increases in opioid-benzodiazepine co-prescribing. Given that increased medication availability has been linked to increased PDM, these results could inform both policymakers and prescribers about new or ongoing needs for regulations on opioid, stimulant, and benzodiazepine prescribing, ultimately aimed at reducing the harms associated with PDM.

METHODS

The NSDUH is an annual survey of US civilian, noninstitutionalized residents, with oversampling of individuals 25 years and younger. It uses an independent, multistage area probability sampling design, with weighting to create nationally representative estimates of the US population. Households are selected for screening, and an in-person screening to identify individuals aged 12 and older is conducted. Following the identification of eligible households, full interviews are conducted on a random sample of household residents, and all interviews occur during the calendar year. To maximize data validity, sensitive topics are queried using audio computer-assisted self-interviewing (ACASI). For ACASI items, the participant wears headphones to hear all questions and the field interviewer remains out of view of the computer screen to preserve privacy and increase the probability of honest responding to sensitive questions. The NSUDH also contains consistency check questions, skip-outs, pictures of assessed prescription drugs, and a variety of generic and trade names for medications to further maximize complete and accurate responses. For 2015–2019, 282,768 individuals participated in the NSDUH, and the weighted sample was 51.5% female, 62.8% non-Hispanic White, 16.8% Hispanic, 12.0% non-Hispanic Black; also, it was 9.2% adolescent (12–17 years), 12.6% young adult (18–25 years), with 36.9% age 26–49 years, and 41.3% who were 50 years or older.

The primary outcome was past-year PDM, defined as opioid, stimulant, or benzodiazepine use: "in any way, a doctor did not direct…including: without a prescription of your own; in greater amounts, more often, or longer than you were told to take it; in any other way a doctor did not direct." PDM was assessed separately by medication class. Also, pictures of medications, use indications, and medication trade and generic names were provided to promote accurate recall. Poly-PDM was defined as PDM from more than one medication class in the past year. Age, race/ethnicity, sex, household income, and population density were also assessed.

Analyses occurred in Stata 16.1 and incorporated the NSDUH complex survey design and an adjusted person-level weight, as recommended.[14] Weighted cross-tabulations estimated prevalence and 95% confidence intervals (95% CIs) of past-year opioid, stimulant, or benzodiazepine PDM by age, race/ethnicity, and sex. Interactions between two of the demographic characteristics were also examined. Annualized trends were calculated, with 95% CIs. Analyses controlled for age group, sex, race/ethnicity, household income, current insurance status, and population density, except when that characteristic was the outcome variable. Each of these variables has been linked to PDM prevalence.[1,2,6,15] Household income was a four-level variable with cut points every $25,000 and the highest category of $100,000 or greater. Current insurance status assesses current insurance from a variety of sources that include private insurance, Medicaid, Medicare, and TRICARE/VA/CHAMPUS. The population density was based on US Census Core-Based Statistical Area (CBSA) categorization, with three levels: (1) residence in a CBSA ≥ 1 million persons; (2) residence in a CBSA between 1 million and 10,000 persons; and (3) residence in a non-CBSA area. Hawaiian/Pacific Islander individuals were excluded due to sample size.

RESULTS

Significant declines in past-year opioid PDM and poly-PDM occurred in adolescents, young adults, and adults 26–34 years over 2015–2019 (Table 1). The greatest annual declines were in young

TABLE 1 Past-year prescription drug misuse (PDM) prevalence rates and annualized change by age group

	2015	2016	2017	2018	2019	Annualized change[a]
Prescription opioids						
12–17 years	**4.0%*** (3.6, 4.4%)**	**3.5%*** (3.2, 3.9%)**	**3.1%** (2.7, 3.4%)**	2.8% (2.4, 3.2%)	2.3% (2.0, 2.7%)	**−0.40% (−0.53, −0.27%) *p* < .0001**
18–25 years	**8.5%*** (7.9, 9.1%)**	**7.0%*** (6.4, 7.6%)**	**7.2%*** (6.7, 7.6%)**	5.5% (4.9, 6.2%)	5.3% (4.8, 5.8%)	**−0.79% (−1.00, −0.58%) *p* < .0001**
26–34 years	**7.4%*** (6.8, 8.1%)**	**7.2%** (6.5, 8.0%)**	6.1% (5.3, 6.9%)	5.7% (5.2, 6.3%)	5.4% (4.8, 6.1%)	**−0.47% (−0.69, −0.24%) *p* = .0001**
35–49 years	4.9% (4.4, 5.5%)	4.4% (4.0, 4.8%)	4.4% (4.0, 4.9%)	4.0% (3.6, 4.6%)	4.4% (3.9, 4.9%)	−0.10% (−0.25, 0.05%) *p* = .19
50–64 years	3.4% (2.8, 4.1%)	3.6% (3.1, 4.3%)	2.8% (2.4, 3.3%)	3.2% (2.7, 3.8%)	2.7% (2.2, 3.4%)	−0.14% (−0.34, 0.05%) *p* = .15
65 and older	1.2% (0.9, 1.6%)	1.2% (0.8, 1.7%)	1.5% (1.2, 1.8%)	1.3% (0.9, 1.9%)	1.6% (1.1, 2.2%)	0.10% (−0.06, 0.26%) *p* = .22
Prescription benzodiazepines						
12–17 years	1.5% (1.3, 1.8%)	1.7% (1.4, 1.9%)	1.8% (1.6, 2.1%)	1.6% (1.4, 1.9%)	1.6% (1.3, 2.1%)	0.02% (−0.08, 0.12%) *p* = .67
18–25 years	**5.2%*** (4.8, 5.6%)**	**5.2%*** (4.7, 5.8%)**	**5.2%*** (4.7, 5.8%)**	4.5% (4.0, 5.0%)	3.8% (3.4, 4.3%)	**−0.34% (−0.49, −0.18%) *p* = .0001**
26–34 years	3.4% (3.0, 3.8%)	3.3% (2.9, 3.8%)	3.1% (2.7, 3.6%)	3.5% (3.0, 4.1%)	2.9% (2.5, 3.5%)	−0.04% (−0.20, 0.12%) *p* = .64
35–49 years	1.7% (1.4, 2.1%)	1.7% (1.5, 2.0%)	1.8% (1.5, 2.0%)	1.8% (1.5, 2.1%)	1.6% (1.4, 1.9%)	<0.01% (−0.08, 0.08%) *p* = .91
50–64 years	1.3% (1.0, 1.7%)	1.4% (1.0, 1.9%)	1.3% (1.0, 1.7%)	1.4% (1.0, 1.9%)	1.4% (1.0, 1.9%)	0.02% (−0.11, 0.15%) *p* = .79
65 and older	0.6% (0.3, 0.9%)	0.6% (0.3, 1.0%)	0.8% (0.5, 1.3%)	0.4% (0.2, 0.9%)	0.5% (0.3, 0.9%)	−0.03% (−0.13, 0.07%) *p* = .54
Prescription stimulants						
12–17 years	1.9% (1.6, 2.1%)	1.7% (1.5, 2.0%)	1.9% (1.6, 2.3%)	1.4% (1.2, 1.7%)	1.8% (1.4, 2.2%)	−0.05% (−0.13, 0.03%) *p* = .24
18–25 years	**7.4%*** (6.7, 8.1%)**	**7.6%*** (7.0, 8.3%)**	**7.5%*** (6.8, 8.1%)**	6.5% (5.8, 7.2%)	5.8% (5.2, 6.5%)	**−0.41% (−0.61, −0.22%) *p* = .0001**
26–34 years	3.4% (3.0, 3.9%)	3.9% (3.3, 4.6%)	4.0% (3.5, 4.6%)	3.8% (3.3, 4.4%)	3.5% (3.1, 4.0%)	0.02% (−0.13, 0.16%) *p* = .82

TABLE 1 (Continued)

	2015	2016	2017	2018	2019	Annualized change[a]
35–49 years	**1.0%* (0.8, 1.3%)**	1.3% (1.0, 1.6%)	1.5% (1.3, 1.7%)	1.3% (1.1, 1.6%)	1.4% (1.1, 1.7%)	**0.08% (0.01, 0.15%) *p* = .02**
50–64 years	0.5% (0.3, 0.7%)	0.5% (0.3, 0.8%)	0.4% (0.3, 0.7%)	0.2% (0.1, 0.4%)	0.5% (0.3, 0.7%)	−0.02% (−0.09, 0.05%) *p* = .53
65 and older	0.02% (0.002, 0.1%)	0.1% (0.1, 0.4%)	0.03% (0.01, 0.1%)	0.1% (0.03, 0.3%)	0.05% (0.01, 0.2%)	<0.01% (−0.02, 0.03%) *p* = .87
Poly-PDM						
12–17 years	1.3% (1.1, 1.6%)	1.4% (1.2, 1.6%)	**1.5%* (1.3, 1.7%)**	1.0% (0.8, 1.1%)	1.0% (0.8, 1.4%)	**−0.10% (−0.17, −0.03%) *p* = .01**
18–25 years	**4.8%*** (4.3, 5.3%)**	**4.3%*** (3.8, 4.8%)**	**4.4%*** (4.0, 4.9%)**	3.4% (3.0, 3.9%)	2.9% (2.5, 3.3%)	**−0.47% (−0.62, −0.32%) *p* < .0001**
26–34 years	**3.0%* (2.6, 3.4%)**	2.8% (2.4, 3.3%)	2.5% (2.2, 2.9%)	2.6% (2.2, 3.1%)	2.2% (1.8, 2.6%)	**−0.16% (−0.29, −0.03%) *p* = .02**
35–49 years	1.2% (0.9, 1.5%)	1.2% (1.0, 1.4%)	1.3% (1.1, 1.5%)	1.1% (0.9, 1.3%)	1.0% (0.8, 1.3%)	−0.02% (−0.08, 0.04%) *p* = .45
50–64 years	0.5% (0.3, 0.7%)	0.7% (0.5, 1.1%)	0.6% (0.4, 0.9%)	0.6% (0.4, 0.9%)	0.5% (0.3, 0.8%)	<0.01% (−0.06, 0.07%) *p* = .85
65 and older	0.1% (0.02, 0.3%)	0.1% (0.02, 0.4%)	0.1% (0.1, 0.2%)	0.1% (0.02, 0.4%)	0.2% (0.1, 0.5%)	0.03% (−0.02, 0.08%) *p* = .27

Note: Boldface indicates statistical significance (within columns, statistically significant differences are noted from 2019 prevalence rates as *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$), controlling for sex, race/ethnicity, household income and population density in area of residence.

[a]Annualized Change is calculated using logistic regression analyses within age group, controlling for sex, race/ethnicity, household income, insurance status, and population density in area of residence.

Source: 2015–2019 National Survey on Drug Use and Health (NSDUH).

adults, at −0.79% (95% CI = −1.00%, −0.58%) for opioid PDM and −0.47% (95% CI = −0.62%, −0.32%) for poly-PDM. In contrast, nonsignificant declines in past-year opioid PDM occurred in adults 35–64 years, with a nonsignificant increase in those 65 and older. Poly-PDM was also unchanged in adults 35 years and older. For past-year benzodiazepine and stimulant PDM, significant annualized rate declines were observed only in young adults: −0.34% (95% CI = −0.49%, −0.18%) for benzodiazepine PDM and −0.41% (95% CI = −0.61%, −0.22%) for stimulant PDM. Notably, stimulant PDM increased 0.08% annually in adults 35–49 years (95% CI = 0.01%, 0.15%). In all other age groups, changes in past-year benzodiazepine and stimulant PDM were nonsignificant and between 0.05% and −0.05% annually (Table 1).

Significant declines in past-year opioid PDM were observed in non-Hispanic White, Hispanic, and Multiracial participants, with the greatest decline in Multiracial individuals (−0.73%, 95% CI = −1.25%, −0.22%). While nonsignificant, American Indian/Alaskan Native participants had a 0.09% annualized increase in past-year opioid PDM, with smaller nonsignificant increases for benzodiazepines and stimulants. One other significant single medication class PDM decline was observed over 2015–19, which was in non-Hispanic Black participants for benzodiazepine PDM (−0.14%, 95% CI = −0.23%, −0.05%). For poly-PDM, significant declines in both non-Hispanic White and Multiracial respondents were observed, with the greatest decline in Multiracial individuals (−0.50%, 95% CI = −0.83%, −0.18%).

Both females and males displayed significant decreases in past-year opioid PDM and poly-PDM over 2015–19, with a greater magnitude of change in males than females for both (−0.33% vs. −0.17% annually), though the difference was nonsignificant. For benzodiazepines and stimulants, past-year PDM rates declined non-significantly in both sexes by 0.07% or less. For tables by race/ethnicity or sex, please see https://digital.library.txstate.edu/handle/10877/14637.

Demographic interactions

One significant age by racial/ethnic interaction was found for young adult opioid misuse (odds ratio [OR] = 1.02, 95% CI = 1.00, 1.03, $t = 2.22$, $p = .031$). The rate of change declined from non-Hispanic White young adults (−1.05%, 95% CI = −1.30%, −0.80%) to non-Hispanic Black young adults (−0.67%, 95% CI = −1.04%, −0.30%), with Hispanic/Latino young adults evidencing the smallest and nonsignificant change (−0.35%, 95% CI = −0.83%, 0.14%).

Two age by sex interactions were found, both for opioid PDM. In young adults, males (−1.06%, 95% CI = −1.37%, −0.74%) experienced greater declines in opioid PDM than females (−0.52%, 95% CI = −0.75%, −0.28%; OR = 1.07, 95% CI = 1.01, 1.13, $t = 2.53$, $p = .015$). Similarly, males in the 26 to 34 year age group (−0.80%, 95% CI = −1.13%, −0.46%) evidenced greater declines in opioid PDM than the nonsignificant decline in females of the same age group (−0.14%, 95% CI = −0.43%, 0.14%; OR = 1.09, 95% CI = 1.02, 1.18, $t = 2.50$, $p = .02$). There were no significant race/ethnicity by sex interactions, nor any involving poly-PDM. Finally, the interaction results are not captured in a table.

DISCUSSION

Unlike opioid PDM, past-year stimulant and benzodiazepine PDM evidenced limited changes over the 2015–2019 period. Furthermore, the primary driver of changes in PDM was declined in young adults, aged 18–25. For opioid PDM and poly-PDM, declines in adolescents and adults 26–34 years of age were also significant contributors to declining rates. Declines in opioid PDM were observed in non-Hispanic White, Hispanic, and Multiracial residents, and males had a greater magnitude of decline in both opioid and poly-PDM than females, though the difference was nonsignificant. In contrast, changes in past-year benzodiazepine and stimulant PDM were largely confined to young adults, with no evidence of changes by sex and few significant changes by race/ethnicity.

Otherwise, the prevalence of past-year PDM by medication class was largely unchanged from 2015–2019. PDM and poly-PDM rates in adults 35 years and older did not significantly change, except for an increase in stimulant PDM in adults 35–49 years. While the lack of change in adults 35 and older may be a function of floor effects, the absolute difference between 2015 and 2019 was 0.7% or less for opioid PDM in subgroups of adults 35 and older; similarly, differences were 0.1% or less for past-year benzodiazepine or stimulant PDM, except for the 0.5% *increase* in stimulant PDM among adults 35–49 years. Absolute differences were much larger in younger groups.

PDM trends by age may be influenced by differences in perceived peer substance use, perceived harm from PDM, and substance availability. Monitoring the Future panel data found declines from 2015 to 2019 in the estimated percentage of friends who used non-marijuana illicit drugs among those 26 years and younger, with limited changes in adults 27–35 years and increases in adults 40–60 years.[16] Perceived availability of opioid, stimulant, and sedative medication declined from 2015 to 2019, while perceived harm from PDM increased most clearly for opioid PDM and less so for stimulants or sedatives; please note that availability and harm data were only available for those 30 and younger.[16] These declines in perceived availability in younger adults may have resulted from ongoing federal and state efforts to restrict prescribing, particularly of opioid medication,[8] leading to lower opioid PDM. The limited PDM changes among those 35 and older highlight a need for greater study of these adults, especially given high rates of prescription opioid overdose in adults 35–64 years[17] and greater potential for adverse effects from opioid and benzodiazepine medication in older adults.[2]

For race/ethnicity, declines in opioid PDM among non-Hispanic White, Hispanic, and Multiracial individuals (and of poly-PDM in non-Hispanic White and Multiracial respondents) were counterbalanced by a lack of change in non-Hispanic Black and American Indian/Alaskan Native individuals. Notably, the previously lower rates of past-year opioid PDM in non-Hispanic Black individuals, versus non-Hispanic White or Hispanic individuals, have largely disappeared.

American Indian individuals have the second highest rates of prescription opioid overdose, following non-Hispanic White individuals, and Black non-Hispanic individuals did not evidence significant declines in overdose from 2017 to 2018, unlike other racial/ethnic groups.[17] As such, greater attention to the intersection of PDM and race/ethnicity is needed, with particular focus on American Indian/Native American and Multiracial individuals, given their relatively high rates of opioid PDM. Finally, males had consistently higher rates of past-year PDM than females, though declines were similar across classes.

Limitations include cross-sectional data, self-report, and self-selection bias. Nonetheless, self-report substance use surveys are likely reliable and valid,[18] and the NSDUH takes steps to ensure data validity and reliability (e.g., audio computer-assisted self-interviewing, medication pictures). The NSDUH samples the US civilian, non-institutionalized population, so results cannot be generalized to other groups. Other misused medications (e.g., antidepressants, bupropion) were not assessed, and we excluded Z-drugs due to low rates of misuse. The NSDUH may inadequately capture more severe substance use (e.g., heroin use) through sampling limitations and participant misreporting, which could impact these estimates.[19] Finally, alterations to the NSDUH PDM assessment in 2015 precluded comparison to prior years,[14] so observed changes could have started before 2015.

These results suggest an uneven pattern of changes in past-year PDM and poly-PDM: large declines in young adults that are absent in adults 35 and older, inconsistent patterns of declines by race/ethnicity, and no notable change in stimulant or benzodiazepine PDM. These findings may indicate that increased restrictions on opioid prescribing contributed to declines in opioid PDM, though these declines may have had unintended harms that include increased use of illicit opioids.[20] Conversely, the lack of declines in stimulant and benzodiazepine PDM co-occurred with recent increases in prescribing of these medications and of increased opioid-benzodiazepine co-prescribing. Policymakers should consider adjustments to regulations on prescribing of these medications to better balance the risk for PDM with the clear clinical benefits of these medications. A particular target should be opioid-benzodiazepine co-prescribing, which has both increased and has significant dangers,[2,13] especially in older adults. Prescribers should also adequately screen for PDM risk factors before prescribing these medications and should consider nonpharmacological and noncontrolled substance treatment alternatives. Furthermore, investigations of the etiology of PDM patterns by different age or racial/ethnic groups could help target screening, prevention, and intervention to the groups that are most vulnerable to PDM and its consequences.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

1. Votaw VR, Geyer R, Rieselbach MM, McHugh RK. The epidemiology of benzodiazepine misuse: a systematic review. *Drug Alcohol Depend*. 2019;200:95-114.
2. Maree RD, Marcum ZA, Saghafi E, Weiner DK, Karp JF. A systematic review of opioid and benzodiazepine misuse in older adults. *Am J Geriatr Psychiatry*. 2016;24(11):949-963.
3. Dart RC, Surratt HL, Cicero TJ, et al. Trends in opioid analgesic abuse and mortality in the United States. *N Engl J Med*. 2015;372(3):241-248.
4. Han B, Jones CM, Blanco C, Compton WM. National trends in and correlates of nonmedical use of prescription stimulants, nonmedical use frequency, and use disorders. *J Clin Psychiatry*. 2017;78(9): e1250-e1258.
5. Center for Behavioral Health Statistics and Quality. *Key Substance Use and Mental Health Indicators in the United States: Results From the 2019 National Survey on Drug Use and Health* (HHS Publication No. PEP20-07-01-001, NSDUH Series H-55). Substance Abuse and Mental Health Services Administration; 2020.
6. Schepis TS, Klare DL, Ford JA, McCabe SE. Prescription drug misuse: taking a lifespan perspective. *Subst Abuse*. 2020;14: 1178221820909352.
7. Compton WM, Jones CM, Baldwin GT. Relationship between nonmedical prescription-opioid use and heroin use. *New England Journal of Medicine*. 2016;374(2):154-163.
8. Martins SS, Bruzelius E, Stingone JA, et al. Prescription opioid laws and opioid dispensing in US counties: identifying salient law provisions with machine learning. *Epidemiology*. 2021;32(6): 868-876.
9. Wall M, Cheslack-Postava K, Hu MC, Feng T, Griesler P, Kandel DB. Nonmedical prescription opioids and pathways of drug involvement in the US: generational differences. *Drug Alcohol Depend*. 2018;182: 103-111.
10. National Institute on Drug Abuse. *Overdose Death Rates*. National Institute on Drug Abuse. 2021. Updated January 29, 2021. Accessed December 16, 2021. https://www.drugabuse.gov/drug-topics/trends-statistics/overdose-death-rates
11. McCabe SE, Schulenberg JE, Schepis TS, et al. Trajectories of prescription drug misuse among US adults from ages 18 to 50. *JAMA Network Open*. 2022;5(1):e2141995.
12. Board AR, Guy G, Jones CM, Hoots B. Trends in stimulant dispensing by age, sex, state of residence, and prescriber speciality—United States, 2014-2019. *Drug Alcohol Depend*. 2020;217:108297.
13. Agarwal SD, Landon BE. Patterns in outpatient benzodiazepine prescribing in the United States. *JAMA Netw Open*. 2019;2(1):e187399.
14. Center for Behavioral Health Statistics and Quality. *2019 National Survey on Drug Use and Health Public Use File Codebook*. Substance Abuse and Mental Health Services Administration; 2020.
15. Rigg KK, Monnat SM. Urban vs. rural differences in prescription opioid misuse among adults in the United States: informing region specific drug policies and interventions. *Int J Drug Policy*. 2015;26(5): 484-491.

16. Schulenberg JE, Patrick ME, Johnston LD, O'Malley PM, Bachman JG, Miech RA. *Monitoring the Future National Survey Results on Drug Use, 1975–2020: Volume II, College Students and Adults Ages 19–60*. Institute for Social Research, The University of Michigan; 2021.
17. Wilson N, Kariisa M, Seth P, Smith HT, Davis NL. Drug and opioid-involved overdose deaths—United States, 2017–2018. *MMWR Morb Mortal Wkly Rep*. 2020;69(11):290-297.
18. Johnston LD, O'Malley PM. Issues of validity and population coverage in student surveys of drug use. *NIDA Res Monogr*. 1985;57:31-54.
19. Reuter P, Caulkins JP, Midgette G. Heroin use cannot be measured adequately with a general population survey. *Addiction*. 2021; 116(10):2600-2609.
20. Kertesz SG, McCullough MB, Darnall BD, Varley AL. Promoting patient-centeredness in opioid deprescribing: a blueprint for de-implementation science. *J Gen Intern Med*. 2020;35(suppl 3): 972-977.

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