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The latent class structure of substance use in US adults 50 years and older

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Abstract

Objective: Substance use rates have increased in adults 50 years and older, and substance use in this population is associated with significant consequences. Given that little is known about their underlying substance use patterns, the objective was to identify latent classes of adults 50 years and older by past-year substance use, past-month substance use, and past-year substance use disorder (SUD) diagnosis.

Methods: The National Survey on Drug Use and Health is an annual nationwide cross-sectional U.S. survey. Participants were 35,229 civilian, non-institutionalized U.S. residents, 50 years and older. Past-year and past-month alcohol, tobacco, marijuana, heroin, cocaine, methamphetamine use, and opioid, stimulant, and tranquilizer/sedative prescription drug misuse (PDM) were captured, as was past-year DSM-IV SUD from these substances. Correlates included mental health, physical health, and healthcare utilization variables.

Results: Latent class analysis indicated four past-year or past-month substance use subgroups (Alcohol-Only, Alcohol-Tobacco-Marijuana, Cocaine-Polydrug, PDM-Polydrug), with SUD prevalence rising from 3.2% to 17.3%, 68.8%, and 78.5% by past-year subgroup; similarly, rates of past-year suicidal ideation increased from 2.1%, to 4.8%, 12.0%, and 20.4% by past-year subgroup. For SUD, there were three subgroups (Low Nicotine Dependence [ND], High Alcohol Use Disorder, Multiple SUDs). Over 90% of adults were in a low-risk subgroup (i.e., Alcohol-Only and Low ND), but members of Cocaine-Polydrug, PDM-Polydrug, or Multiple SUDs latent classes had high rates of mental and physical health concerns.

Conclusions: Most adults 50 and older have lower risk profiles, but those engaged in PDM or cocaine use are heavily substance-involved and need screening and likely multi-disciplinary intervention.

KEYWORDS
older adults, prescription drug misuse, substance use, substance use disorder

Key points

- We found four similar latent classes for past-year and past-month substance use/prescription drug misuse (PDM) in adults 50 years and older: Alcohol-Only, Alcohol-Tobacco-Marijuana, Cocaine-Polydrug, and PDM-Polydrug

- While the Alcohol-Only classes were most of the sample, those in the Cocaine-Polydrug and the PDM-Polydrug were particularly high risk for mental and physical health problems, including suicidal ideation
- For substance use disorder (SUD), we found three classes: Low Nicotine Dependence, High Alcohol Use Disorder, and Multiple SUDs
- The Multiple SUD class was the highest risk group, with the highest rates of mental and physical health concerns

1 | INTRODUCTION

Despite having lower rates of alcohol, marijuana, other illicit drug use, and prescription drug misuse (PDM) than other age groups,[1] substance use prevalence rates in adults 50 years and older have increased in recent years. Past-year or past-month alcohol use, binge alcohol use, alcohol use disorders,[2,3] marijuana use,[4] PDM prevalence,[5,6] and co-use of tobacco and marijuana[7] all increased in adults 50 years and older from the early 2000s to the early or mid-2010s. In addition, past-year marijuana use increased in adults 65 and older from 2015 to 2017,[8] suggesting further increases in use.[4]

Substance use in adults 50 and older is linked to a concerning pattern of correlates, including higher rates of other substance use, substance use disorders (SUDs), and significant mental and physical health symptoms versus those who are not engaged in substance use.[8–13] Furthermore, aging adults experience significant consequences from substance use, such as increased rates of memory problems, falls and fractures, and other accidents, particularly from heavier alcohol use and opioid or benzodiazepine PDM.[14–16]

To date, research on substance use and PDM in adults 50 years and older has focused on single substances or specific, limited combinations (e.g., tobacco-marijuana), despite consistent links between use of one substance and others in aging adults.[4,7,10] To illustrate, at least one-third of past-year PDM in adults 50–79 years of age is poly-PDM, or PDM from two or more of prescription opioids, stimulants, or tranquilizer/sedatives.[17] Poly-PDM in adults 50 and older co-occurs with higher rates of past-year psychopathology, nicotine dependence, and overdose than opioid-only PDM,[17–19] and poly-substance use in other age groups is consistently associated with poorer outcomes.[20–23]

One approach that could further our understanding of patterns of substance use in adults 50 and older is latent class analysis (LCA). This type of mixture modeling takes a person-centered approach to uncovering underlying (or latent) subgroups based on observed variables,[24] and it has been used to identify substance use patterns across the population[25] and alcohol use patterns[26,27] in adults 50 and older. With different patterns of substance use endorsement or SUD diagnoses, LCA can classify multiple subgroups of respondents and allow for a personalized characterization of substance use. Such patterns of substance use can aid screening by identifying high-risk substance use and SUD profiles; in turn, identification of correlates of high-risk groups can aid treatment planning and provide intervention targets. As such, our aims were to quantify the latent class structure of past-year, past-month, and past-year SUD in US adults 50 years and older, using data from the 2015–2018 National Survey on Drug Use and Health (NSDUH).

2 | MATERIALS AND METHODS

The NSDUH is an annual survey of US civilian, non-institutionalized residents. It uses an independent, multistage area probability sampling design, with weighting to create nationally representative estimates of the US population. To maximize data validity, sensitive topics are queried using audio computer-assisted self-interviewing (ACASI); the NSUDH also contains consistency check questions, skip-outs, and pictures of assessed prescription drugs to maximize complete and accurate responding. Response rates are consistent with those of other large, nationally representative surveys[28]: the 2015–2018 weighted screening response rate range was 73.3%–79.7%, and the weighted interview rate range was 66.6%–69.7%. The Research Triangle International IRB approved all NSDUH procedures,[29] and the first author's IRB exempted this study. Please see[29] for more information on the NSDUH.

2.1 | Participants

Participants were NSDUH respondents 50 years of age and older (n = 35,229). The weighted sample was 53.3% female and 72.6% white, non-Hispanic/Latino, with 44.0% age 65 years and older. Black, non-Hispanic/Latino and Hispanic/Latino participants were 10.4% and 10.5% of the sample, respectively. For educational attainment, 31.6% were college graduates and 13.8% did not complete high school. Finally, 37.8% had annual household incomes of $75,000 or more, while 45.7% had incomes under $50,000.

2.2 | Measures: substance use

Lifetime, past-year, and past-month substance use/PDM are separately assessed for alcohol, tobacco, marijuana, heroin, cocaine, methamphetamine, prescription opioids, prescription stimulants, prescriptions sedatives, and prescription tranquilizers. Due to very low endorsement among those 50 years and older, hallucinogens and

inhalants were excluded, and prescription sedatives were aggregated with prescription tranquilizers, per previous research.[9] The past-year substance use measures have substantial reliability.[30] Binge alcohol use was defined as four (females) or five (males) alcoholic drinks during one occasion, per the US National Institute on Alcohol Abuse and Alcoholism.[31]

Substance use disorder (SUD) was assessed in all respondents endorsing use/PDM of a substance, via DSM-IV criteria for substance abuse or dependence[32]; the SUD assessment has moderate to strong reliability.[30] Nicotine dependence (ND) was assessed using the Nicotine Dependence Syndrome Scale (NDSS), a reliable and valid measure of ND.[33,34] An average item score of 2.75 or greater signified ND.[34] Modified predictive mean neighborhood imputation methods were used to impute all missing data for past-year and past-month substance use/PDM and past-year SUD.[35,36]

2.3 | Measures: correlates

Sociodemographic variables: sex, age group, sexual minority status (i.e., heterosexual or lesbian/gay/bisexual), race/ethnicity, household income, educational attainment, and population density. Only sexual minority status had missing data, with 605 respondents (1.7%) not completing this item; all other variables were imputed to remove missingness.

Mental health correlates: (all past-year) major depression, suicidal ideation, serious psychological distress (SPD), level of mental health impairment, and mental health treatment. Major depression was assessed based on the DSM-IV,[32] with strong reliability and validity.[37] SPD was from the K6 assessment of non-specific psychological distress,[38] and mental health impairment level comes from the World Health Organization's Disability Assessment Schedule, modified for ACASI methods.[39] For these variables, SPD and level of mental health impairment were imputed and have no missing data. Otherwise, missingness varied from 190 (0.5%) for suicidal ideation to 378 (1.1%) for major depression.

Physical health correlates: current insurance status, current difficulties with activities of daily living (ADLs), past-year emergency department (ED) utilization, past-year inpatient hospitalization, past-year sexually transmitted illness (STI), and six lifetime health conditions; these lifetime health conditions were self-reported diagnoses of chronic obstructive pulmonary disease (COPD), hepatitis B or C, heart problems, high blood pressure, cirrhosis, and cancer. Lifetime multi-morbidity was having two or more of the six captured lifetime diagnoses. Difficulties with ADLs was coded as "yes" if a participant noted "serious trouble" with one or more of: (1) concentrating, remembering, or making decisions; (2) walking or climbing stairs; (3) dressing or bathing; (4) doing errands alone, such as a doctor's appointment. Of these variables, only current insurance status was imputed and had no missing data. In the other variables, missingness varied from 118 (0.3%) for past-year STD diagnosis to 570 (1.6%) for ED utilization.

2.4 | Analyses

Analyses were conducted in Mplus 8.4 (Los Angeles, CA) and Stata 16.1 (College Station, TX), incorporating the complex survey design of the NSDUH. As recommended,[40] adjusted person-level weights (weight/4) were used for the pooled data. First, LCAs were conducted separately for past-year substance use/PDM, past-month substance use/PDM, and past-year SUD. For past-year and past-month latent classes, indicators were use/PDM of alcohol, tobacco, marijuana, heroin, cocaine, methamphetamine, and prescription opioids, stimulants, and tranquilizer/sedatives; for past-year SUD, indicators were SUD from the previous listed substances or nicotine dependence. At least 100,000 random starts were used to prevent local maxima from adversely affecting model estimation, and selected models had their best log-likelihood values replicated. In the best fitting LCA model, participants were assigned to their most likely latent class via a modal approach.[41]

Following LCA modeling, logistic regression estimated odds of each correlate by latent class. Those in the class with lowest substance use/PDM or SUD prevalence were chosen as the reference group, and all logistic regressions controlled for sex, age group (50-64 years or 65 and older), race/ethnicity, household income, highest educational attainment, and population density.

3 | RESULTS

3.1 | Model selection

Fit indices for each LCA model are presented in online-only Appendix Table S1. Bayesian Information Criterion (BIC)[42] was the primary indicator of model fit, with differences of 10 or more in BIC indicating that the lower BIC model was superior.[43] Entropy was also considered, with values above 0.8 reflecting "high" class separation,[44] and the final model was chosen by considering both model fit and interpretability.[45] For past-year and past-month substance use/PDM, BIC indicated that a four-class model was superior, while a three-class model was superior for past-year SUD (Table S1).

3.2 | Latent class structure and correlates: past-year substance Use/PDM

Class 1 (Alcohol-Only) had the lowest rates of all substance use/PDM (Figure 1). This class was marked by primary use of alcohol (60.5% of class members) and below average rates of all other substance use. Class 2 (Alcohol-Tobacco-Marijuana) was marked by high prevalence rates of alcohol (86.0%), tobacco (51.7%), and marijuana (91.0%) use but somewhat lower rates of other substance use and PDM. Class 3 (Cocaine-Polydrug) was marked by the highest prevalence rates of all substance use, except for marijuana

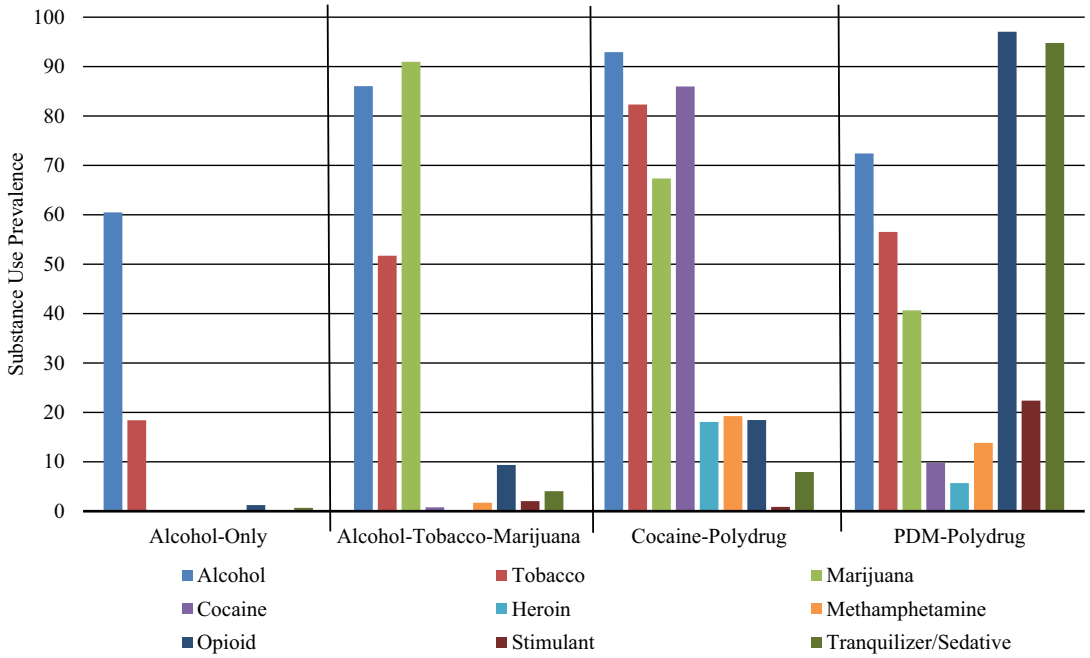

FIGURE 1 Prevalence of past-year substance use by class membership [Colour figure can be viewed at wileyonlinelibrary.com]

or PDM. Class 4 (PDM-Polydrug) was marked by the highest prevalence rates of past-year PDM and elevated rates of other substance use.

Versus the Alcohol-Only subgroup, adults 50 and older in the three other subgroups had significantly higher adjusted odds ratio (aOR) of 30-day binge alcohol use, any past-year SUD, and all examined mental health outcomes (Table 1). To illustrate, prevalence rates of any past-year SUD rose from 2.6% (Alcohol-Only class), to 15.2% (Alcohol-Tobacco-Marijuana), 49.1% (Cocaine-Polydrug), and 60.6% (PDM-Polydrug). Similarly, past-year suicidal ideation rates increased from 2.1% (Alcohol-Only), to 4.8% (Alcohol-Tobacco-Marijuana), 12.0% (Cocaine-Polydrug), and 20.4% (PDM-Polydrug).

In addition, members of these latent classes had higher aORs for difficulties with ADLs, poor or fair health, past-year ED utilization, past-year inpatient hospitalization, lifetime COPD, or lifetime Hepatitis B or C (Table 1). Those in the Alcohol-Tobacco-Marijuana and PDM-Polydrug classes had higher rates of past-year STIs. For lifetime Hepatitis B or C, prevalence rates ranged from 1.8% (Alcohol-Only), to 4.8% (Alcohol-Tobacco-Marijuana), 7.1% (Cocaine-Polydrug), and 11.3% (PDM-Polydrug); 5.5% of those in the PDM-Polydrug class had a past-year STI. Rates of multimorbidity were highest in the PDM-Polydrug class (62.0%), which was significantly higher than the other subgroups (Alcohol-Only = 52.6%, Alcohol-Tobacco-Marijuana = 50.3%, Cocaine-Polydrug = 45.0%). Finally, those not in the Alcohol-Only subgroup were more likely to be in the 50–64 age group, male, and a member of a sexual minority group (i.e., gay, lesbian or bisexual). Rates of past-year SUD and all mental health outcomes were highest in the PDM-Polydrug class, though they were not significantly different from the Cocaine-Polydrug class.

3.3 | Latent class structure and correlates: past-month substance Use/PDM

The past-month substance use/PDM latent classes (Figure 2) were similar to the past-year subgroups, with primarily use of alcohol (48.6%) in the Alcohol-Only subgroup and limited use of other substances. Notably, the Cocaine-Polydrug class had 100% endorsement of past-month cocaine use and the highest rates of past-month alcohol (91.7%), tobacco (91.9%), and marijuana (57.8%) use. The PDM-Polydrug class had the highest past-month rates of opioid (75.6%), stimulant (23.0%), and tranquilizer/sedative PDM (79.0%), and the highest rates of heroin (11.5%) and methamphetamine (28.9%) use.

As with the past-year latent classes, adults in the Alcohol-Tobacco-Marijuana, Cocaine-Polydrug, and PDM-Polydrug subgroups had significantly higher odds than the Alcohol-Only subgroup for 30-day binge alcohol use, past-year SUD, and all mental health outcomes (Table 2). Rates of any past-year SUD and all mental health variables were highest in the PDM-Polydrug group, though not significantly higher than the Cocaine-Polydrug subgroup. Past-year SUD rates rose from 3.2% to 17.3%, 68.8%, and 78.5% and rates of suicidal ideation rose from 2.2% to 5.7%, 14.9%, and 30.9% from the first to final latent classes, respectively. Also, 58% of those in the PDM-Polydrug class received past-year mental health treatment, and 31.7% met criteria for past-year serious psychological distress.

Rates of difficulties with ADLs, poor or fair self-reported health, and past-year ED utilization were all higher in the Alcohol-Tobacco-Marijuana, Cocaine-Polydrug, and PDM-Polydrug subgroups than the Alcohol-Only subgroup (Table 2). Past-year inpatient hospitalization, lifetime Hepatitis B or C, and lifetime multi-morbidity were all more common in the Alcohol-Tobacco-Marijuana and PDM-Polydrug latent classes than the Alcohol-Only latent class. The PDM-Polydrug

TABLE 1 Correlates of past-year class membership

	Class 1: Alcohol-only	Class 2: Alcohol-tobacco-marijuana	Class 3: Cocaine-polydrug	Class 4: Prescription drug misuse-polydrug
Sample size	32,233	2553	249	194
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Substance use				
30-Day binge alcohol use	1.00 (reference)	3.08 (2.76–3.44)***	7.43 (5.43–10.16)***	3.35 (2.44–4.60)***
Past-year any SUD[a]	1.00 (reference)	4.98 (4.28–5.78)***	23.23 (15.92–33.89)***	46.02 (31.46–67.34)***
Mental health				
Past-year SPD	1.00 (reference)	2.48 (2.06–2.99)***	3.88 (2.59–5.81)***	6.33 (4.27–9.38)***
Past-year MDD	1.00 (reference)	2.22 (1.79–2.76)***	2.59 (1.61–4.15)***	5.82 (3.80–8.90)***
Past-year suicidal ideation	1.00 (reference)	2.08 (1.62–2.67)***	4.64 (2.91–7.39)***	9.27 (6.30–13.65)***
Past-year mental health impairment	1.00 (reference)	1.91 (1.73–2.10)***	2.29 (1.69–3.09)***	7.23 (4.43–11.83)***
Past-year mental health treatment	1.00 (reference)	2.30 (2.03–2.60)***	3.04 (2.09–4.41)***	5.30 (3.76–7.48)***
Physical health				
Current difficulties with ADLs	1.00 (reference)	1.48 (1.29–1.70)***	2.06 (1.50–2.83)***	2.46 (1.66–3.63)***
Currently uninsured	1.00 (reference)	1.20 (0.98–1.46)	1.80 (1.14–2.84)*	1.72 (0.89–3.33)
Current poor/Fair self-reported health	1.00 (reference)	1.41 (1.25–1.59)***	1.54 (1.13–2.11)**	1.65 (1.09–2.49)*
Past-year ED visit	1.00 (reference)	1.24 (1.08–1.42)**	1.55 (1.10–2.17)*	1.81 (1.24–2.64)**
Past-year inpatient hospitalization	1.00 (reference)	1.37 (1.18–1.58)***	1.48 (1.03–2.14)*	1.82 (1.13–2.93)*
Past-year STI	1.00 (reference)	1.83 (1.33–2.51)***	2.25 (0.93–5.46)	4.00 (1.82–8.79)***
Lifetime COPD	1.00 (reference)	1.48 (1.27–1.72)***	1.88 (1.14–3.12)*	2.67 (1.65–4.32)***
Lifetime hepatitis B or C	1.00 (reference)	2.31 (1.74–3.06)***	2.81 (1.65–4.79)***	5.46 (3.36–8.86)***
Lifetime multimorbidity[b]	1.00 (reference)	1.09 (0.98–1.22)	0.97 (0.66–1.43)	1.88 (1.34–2.64)***
Demographics				
65 and older	1.00 (reference)	0.31 (0.27–0.36)***	0.07 (0.04–0.13)***	0.15 (0.09–0.27)***
Male sex	1.00 (reference)	1.81 (1.65–1.99)***	3.12 (2.31–4.19)***	1.58 (1.08–2.32)*
Sexual minority[c]	1.00 (reference)	2.44 (1.83–3.26)***	2.98 (1.52–5.71)**	4.31 (2.46–7.54)***

Note: Data: 2015–18 National Survey on Drug Use and Health (NSDUH). Analyses control for sex, race/ethnicity, age group (i.e., 50–64 years vs. 65 and older), household income, educational attainment, and population density except when the demographic characteristic is the variable of focus (e.g., age group and sex).

Abbreviations: ADLs, activities of daily living; aOR, adjusted odds ratio; ED, Emergency Department; MDD, major depressive disorder; SPD, serious psychological disorder; SUD, substance use disorder; 95% CI = 95% confidence interval.

[a]Past-Year Any SUD was DSM-IV Abuse or Dependence from one or more of alcohol, tobacco, marijuana, cocaine, heroin, and methamphetamine use, and prescription opioid, stimulant, and tranquilizer/sedative misuse.

[b]Lifetime Multimorbidity is two or more lifetime diagnoses of Cancer, Cirrhosis, COPD, Hepatitis B or C, Heart Problems, High Blood Pressure.

[c]Sexual Minority individuals self-reported lesbian, gay, or bisexual sexual identity.

*denotes $p \leq 0.05$, **denotes $p \leq 0.01$, and ***denotes $p \leq 0.001$.

latent class had the highest rates of many physical health outcomes: 15.0% had lifetime Hepatitis B or C (Alcohol-Only = 1.9%, Alcohol-Tobacco-Marijuana = 6.4%, Cocaine-Polydrug = 5.1%), and 72.0% met criteria for multi-morbidity (Alcohol-Only = 52.4%, Alcohol-Tobacco-Marijuana = 52.3%, Cocaine-Polydrug = 48.1%). As with the past-year latent classes, members of subgroups other than the Alcohol-Only class were more likely to be 50-64 years of age, male, and a member of a sexual minority group.

3.4 | Latent class structure and correlates: past-year SUD

There were three past-year SUD latent classes (Figure 3): Low ND, High Alcohol Use Disorder (AUD), and Multiple SUDs. The Low ND class was marked by 0% SUD prevalence for all non-tobacco substances with only 5.7% meeting past-year ND criteria. All members of the High AUD class met criteria for a past-year AUD,

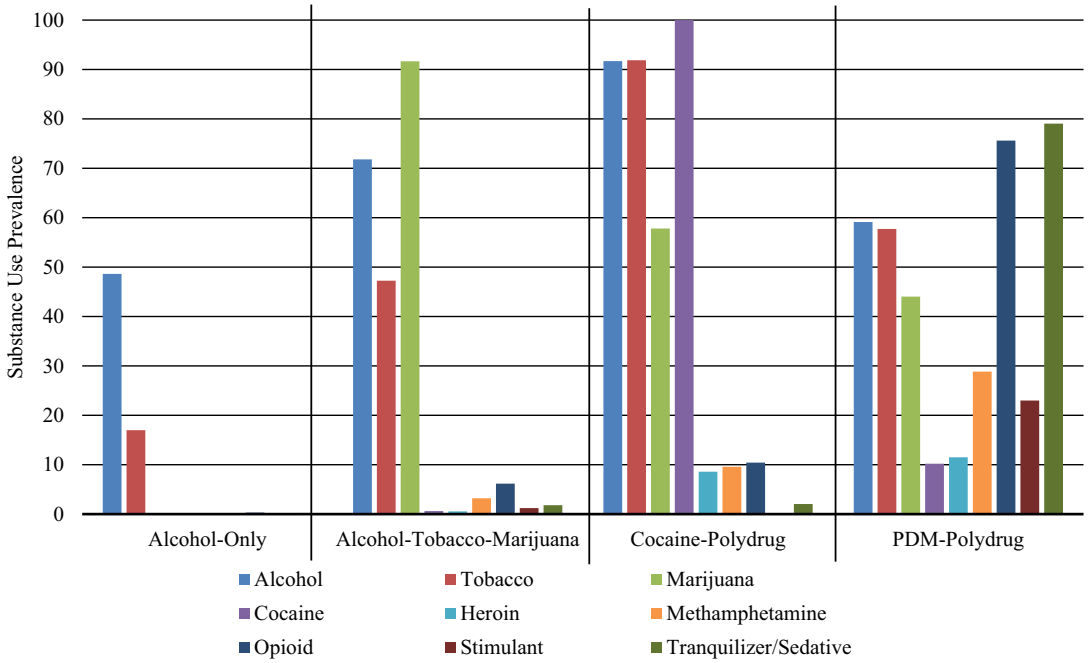

FIGURE 2 Prevalence of past-month substance use by class membership [Colour figure can be viewed at wileyonlinelibrary.com]

had elevated ND rates (16.5%), and low rates of other SUDs (<2%). Finally, the Multiple SUDs latent class had the highest rates of non-AUD use disorders: ND (38.9%), cannabis (27.6%), cocaine (15.9%), heroin (9.5%), methamphetamine (17.0%), prescription opioid (44.9%), prescription stimulant (6.1%), and prescription tranquilizer/sedative (14.9%).

While the High AUD latent class had the highest aOR of past-month binge alcohol use (aOR = 13.5) versus the Low ND class, all mental health outcomes were most likely in the Multiple SUD class (Table 3). Notably, these mental health outcomes had significantly higher prevalence rates in the Multiple SUDs class than in the High AUD class, after controlling for sociodemographics (all *ps* ≤ 0.001). Both the High AUD and Multiple SUDs classes had higher odds of the examined mental health outcomes, male sex, and younger age than the Low ND class. As an example, rates of past-year suicidal ideation ranged from 2.1% (Low ND) to 17.5% (Multiple SUDs), with the High AUD subgroup intermediate (6.9%).

For physical health, members of the High AUD and Multiple SUDs classes had significantly higher aORs for difficulties with ADLs, past-year ED use, past-year inpatient hospitalization, past-year STI, and lifetime Hepatitis B or C, versus the Low ND class. The Multiple SUDs subclass had the highest aORs of all examined outcomes, save lifetime cancer. To illustrate, over four times as many individuals in the Multiple SUDs class had lifetime Hepatitis B or C (8.7%), than the Low ND class (2.1%). Finally, the prevalence of lifetime multimorbidity was significantly higher in the Multiple SUDs subclass (57.8%) than in the Low ND (52.5%) or High AUD (48.7%) subgroups.

4 | DISCUSSION

Among U.S. adults 50 years and older, we found four latent classes based on past-year or past-month substance use/PDM: Alcohol-Only, Alcohol-Tobacco-Marijuana, Cocaine-Polydrug, PDM-Polydrug. We also found three based on past-year SUD: Low ND, High AUD, Multiple SUDs. For the past-year and past-month subgroups, there was a large group engaged primarily in alcohol use (60.5% and 48.6%, respectively), with slightly less than one in five also engaged in tobacco use. These Alcohol-Only latent classes rarely engaged in other substance use and had population average or below average rates of mental health symptoms, past-year SUD, physical health limitations, and healthcare utilization.[1] Members of this group were also more likely to be female, older, and heterosexual. For past-year SUD, the Low ND class was similar. Thus, over 90% of adults 50 and older are lower risk, with nearly all adults engaged in non-disordered alcohol use or non-use.

In contrast, those in the other past-year, past-month, or SUD latent classes have elevated rates of substance use, mental health symptoms, and physical health limitations, as compared to the Alcohol-Only or Low ND classes. Within the past-year latent classes, odds of mental health symptoms increased from the Alcohol-Tobacco-Marijuana to the PDM-Polydrug class, with the Cocaine-Polydrug class intermediate. With that said, the only significant differences in mental health variables were generally between the Alcohol-Tobacco-Marijuana and PDM-Polydrug classes. Adjusted odds ratios of physical health concerns, including lifetime multimorbidity, were all highest in the PDM-Polydrug class, highlighting a particular need for evaluation and treatment in this latent class.

TABLE 2 Correlates of 30-day class membership

	Class 1: Alcohol-only	Class 2: Alcohol-tobacco-marijuana	Class 3: Cocaine-polydrug	Class 4: Prescription drug misuse-polydrug
Sample size	33,340	1724	107	58
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Substance use				
30-Day binge alcohol use	1.00 (reference)	2.75 (2.38–3.15)***	11.82 (6.89–20.27)***	2.01 (1.18–3.45)*
Past-year any SUD[a]	1.00 (reference)	4.66 (3.91–5.53)***	43.51 (23.43–80.79)***	72.92 (31.16–170.66)***
Mental health				
Past-year SPD	1.00 (reference)	2.67 (2.16–3.31)***	4.82 (3.02–7.70)***	7.93 (4.13–15.22)***
Past-year MDD	1.00 (reference)	2.47 (1.98–3.09)***	3.48 (1.92–6.30)***	5.63 (2.64–12.02)***
Past-year suicidal ideation	1.00 (reference)	2.29 (1.74–3.02)***	5.19 (2.77–9.73)***	13.23 (7.20–24.33)***
Past-year mental health impairment	1.00 (reference)	1.94 (1.71–2.21)***	2.54 (1.64–3.94)***	3.89 (1.98–7.65)***
Past-year mental health treatment	1.00 (reference)	2.41 (2.06–2.82)***	2.59 (1.63–4.11)***	8.48 (4.42–16.28)***
Physical health				
Current difficulties with ADLs	1.00 (reference)	1.52 (1.31–1.76)***	2.31 (1.44–3.70)**	3.04 (1.53–6.01)**
Currently uninsured	1.00 (reference)	1.25 (0.99–1.59)	2.85 (1.53–5.32)***	1.06 (0.38–2.95)
Current poor/Fair self-reported health	1.00 (reference)	1.48 (1.28–1.70)***	1.86 (1.20–2.90)**	2.35 (1.33–4.15)**
Past-year ED visit	1.00 (reference)	1.20 (1.03–1.41)*	1.66 (1.06–2.58)*	2.05 (1.18–3.59)*
Past-year inpatient hospitalization	1.00 (reference)	1.34 (1.13–1.59)**	1.56 (0.96–2.52)	2.52 (1.28–4.96)**
Past-year STI	1.00 (reference)	1.14 (0.70–1.86)	3.28 (1.29–8.31)*	0.88 (0.11–7.24)
Lifetime COPD	1.00 (reference)	1.67 (1.43–1.95)***	1.02 (0.44–2.35)	2.31 (0.99–5.41)
Lifetime hepatitis B or C	1.00 (reference)	2.97 (2.10–4.20)***	1.85 (0.56–6.19)	6.49 (2.77–15.21)***
Lifetime multimorbidity[b]	1.00 (reference)	1.20 (1.05–1.36)**	1.13 (0.67–1.91)	3.06 (1.56–5.99)**
Demographics				
65 and older	1.00 (reference)	0.29 (0.24–0.35)***	0.03 (0.01–0.09)***	0.03 (0.01–0.13)***
Male sex	1.00 (reference)	2.00 (1.75–2.28)***	2.44 (1.49–4.00)***	2.62 (1.39–4.92)**
Sexual minority[c]	1.00 (reference)	2.51 (1.80–3.50)***	2.67 (1.08–6.59)*	2.93 (1.02–8.43)*

Note: Data: 2015–18 National Survey on Drug Use and Health (NSDUH). Analyses control for sex, race/ethnicity, age group (i.e., 50–64 years vs. 65 and older), household income, educational attainment, and population density except when the demographic characteristic is the variable of focus (e.g., age group and sex).

Abbreviations: ADLs, activities of daily living; aOR, adjusted odds ratio; ED, Emergency Department; MDD, major depressive disorder; SPD, serious psychological disorder; SUD, substance use disorder; 95% CI = 95% confidence interval.

[a]Past-Year Any SUD was DSM-IV Abuse or Dependence from one or more of alcohol, tobacco, marijuana, cocaine, heroin, and methamphetamine use, and prescription opioid, stimulant, and tranquilizer/sedative misuse.

[b]Lifetime Multimorbidity is two or more lifetime diagnoses of Cancer, Cirrhosis, COPD, Hepatitis B or C, Heart Problems, High Blood Pressure.

[c]Sexual Minority individuals self-reported lesbian, gay, or bisexual sexual identity.

*denotes $p \leq 0.05$, **denotes $p \leq 0.01$, and ***denotes $p \leq 0.001$.

A similar pattern emerged in the past-month latent classes, with the highest rates of mental health symptoms, physical health problems, and past-year SUD in the PDM-Polydrug class. For the SUD latent classes, both the High AUD and Multiple SUD subgroups had significantly higher odds of all mental health outcomes, difficulties with ADLs, healthcare utilization, past-year STI, lifetime hepatitis B or C, male sex, and being 50-64 years of age. Mental health outcomes clearly differentiated the High AUD and Multiple SUD subgroups, with significantly higher odds of all examined outcomes in the Multiple SUD latent class.

Clinically, these results suggest that over 90% of adults 50 and older are members of a relatively healthy subgroup, in terms of substance use; indeed, tobacco use cessation is likely to be the key treatment need in this large subpopulation. Similarly, in the past-year SUD analyses, those in the Low ND class are less impacted by mental health or physical health concerns, with roughly 6% endorsing

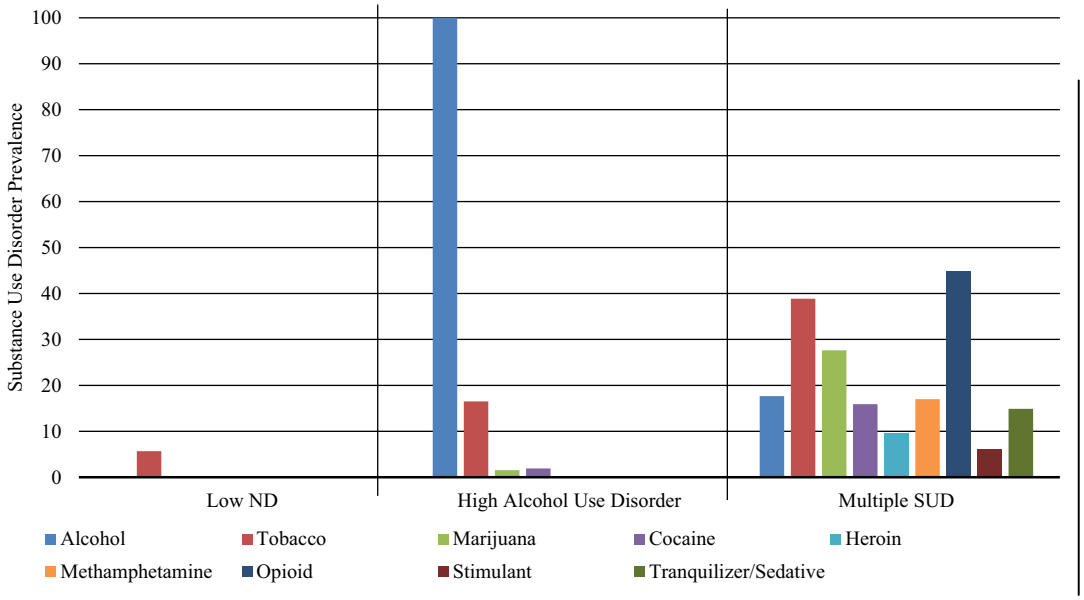

FIGURE 3 Prevalence of past-year substance use disorder by class membership [Colour figure can be viewed at wileyonlinelibrary.com]

nicotine dependence and in need of smoking cessation. The relatively low levels of heavier substance use and SUD diagnoses in those 50 and older are consistent with past research across the population suggesting that adults 60 and older are less likely to be in poly-substance use latent classes[46] and that older adults are less likely to be in latent classes with high prevalence rates of SUD.[25] Further research is needed, however, to replicate and extend our results specifically in older adults.

In contrast, those in the polysubstance use classes (i.e., latent classes other than the Alcohol-Only or Low ND classes) will have varied and significant treatment needs that include psychiatric evaluation and treatment, including for an addiction medicine treatment, and for referrals for treatment of physical health conditions. These aging adults are highly substance-involved and likely to exert disproportionate demand on healthcare systems, requiring multidisciplinary care. Over 60% of those in the past-year PDM-Polydrug and the past-month Cocaine-Polydrug and PDM-Polydrug latent classes had a past-year SUD diagnosis, and 15%–31% of members of those classes endorsed past-year suicidal ideation. They also had at least 2.3 times greater adjusted odds of difficulties with ADLs, versus the Alcohol-Only reference groups.

Together, this suggests the need for psychiatric, addiction medicine, and physical rehabilitation interventions will be common in these aging adults. This is most clearly illustrated by the significantly higher rates of lifetime multimorbidity in both PDM-Polydrug classes (62.0% for past-year and 72.0% for past-month) the Multiple SUDs class (57.8%), versus other latent classes. Importantly, members of the Cocaine-Polydrug subgroups were more likely to be uninsured than the Alcohol-Only group, highlighting a treatment barrier that will need to be addressed. Consistent with the recent U.S. Preventive Services Task Force recommendations for substance use screening in all adults,[47] screening to identify these vulnerable adults is warranted, and screening for PDM or cocaine use may be a simple but effective way to identify members of these most substance-involved and impaired subgroups. Cocaine use prevalence was 85% or greater in the Cocaine-Polydrug classes, and opioid or tranquilizer/sedative PDM rates were 75% or greater in the PDM-Polydrug classes.

4.1 | Limitations

The NSDUH is a cross-sectional survey, with data that do not allow for causal inference. Also, the NSDUH is subject to self-report and self-selection bias. Nonetheless, self-report substance use data are likely both reliable and valid,[48,49] and the NSDUH incorporates weighting for non-response, ACASI interviewing, and consistency checks to improve data validity.[39] Reliability values for some SUD diagnoses were only fair, and this study was limited by the assessments available in the NSDUH. Given that the NSDUH samples the civilian, non-institutionalized US population, these results are not generalizable to groups not included in the study (e.g., homeless), and adults in nursing facilities and other controlled access dwellings are under-represented.[50] Finally, entropy was somewhat lower for the past-year latent classes (0.78) than the ideal of 0.8 or greater, but this still reflected good separation.

5 | CONCLUSIONS

Across past-year or past-month substance use/PDM, this research suggests that there is a very large subgroup of adults 50 and older where roughly half or more are engaged in alcohol use and 17%–18% in tobacco use. These individuals have lower than average rates of

TABLE 3 Correlates of SUD class membership

	Class 1: Low nicotine dependence	Class 2: High alcohol use disorder	Class 3: Multiple SUDs
Sample size	33,722	1152	355
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Substance use			
30-Day binge alcohol use	1.00 (reference)	13.52 (11.12–16.45)***	1.94 (1.40–2.68)***
Mental health			
Past-year SPD	1.00 (reference)	3.33 (2.71–4.09)***	7.99 (6.18–10.32)***
Past-year MDD	1.00 (reference)	2.72 (2.07–3.57)***	5.82 (4.08–8.30)***
Past-year suicidal ideation	1.00 (reference)	3.10 (2.20–4.38)***	7.34 (5.27–10.23)***
Past-year mental health impairment	1.00 (reference)	3.46 (2.86–4.20)***	7.05 (4.89–10.16)***
Past-year mental health treatment	1.00 (reference)	2.49 (2.09–2.96)***	5.95 (4.55–7.78)***
Physical health			
Current difficulties with ADLs	1.00 (reference)	1.70 (1.45–1.99)***	2.82 (2.08–3.83)***
Currently uninsured	1.00 (reference)	1.01 (0.74–1.37)	1.46 (0.95–2.24)
Current poor/Fair self-reported health	1.00 (reference)	1.10 (0.89–1.36)	1.91 (1.33–2.74)***
Past-year ED visit	1.00 (reference)	1.35 (1.13–1.61)**	1.93 (1.47–2.54)***
Past-year inpatient hospitalization	1.00 (reference)	1.54 (1.25–1.91)***	1.98 (1.51–2.59)***
Past-year STI	1.00 (reference)	2.44 (1.61–3.71)***	3.28 (1.77–6.09)***
Lifetime COPD	1.00 (reference)	1.20 (0.92–1.55)	2.44 (1.79–3.33)***
Lifetime hepatitis B or C	1.00 (reference)	1.50 (1.06–2.11)*	3.38 (2.13–5.37)***
Lifetime multimorbidity[a]	1.00 (reference)	1.02 (0.87–1.20)	1.59 (1.20–2.10)**
Demographics			
65 and older	1.00 (reference)	0.35 (0.30–0.40)***	0.14 (0.09–0.23)***
Male sex	1.00 (reference)	2.57 (2.18–3.03)***	2.10 (1.63–2.70)***
Sexual minority[b]	1.00 (reference)	1.31 (0.98–1.75)	1.52 (0.85–2.72)

Note: Data: 2015–18 National Survey on Drug Use and Health (NSDUH). Analyses control for sex, race/ethnicity, age group (i.e., 50–64 years vs. 65 and older), household income, educational attainment, and population density except when the demographic characteristic is the variable of focus (e.g., age group and sex).

Abbreviations: ADLs, activities of daily living; aOR, adjusted odds ratio; ED, Emergency Department; MDD, major depressive disorder; SPD, serious psychological disorder; SUD, substance use disorder; 95% CI = 95% confidence interval.

[a]Lifetime Multimorbidity is two or more lifetime diagnoses of Cancer, Cirrhosis, COPD, Hepatitis B or C, Heart Problems, High Blood Pressure.

[b]Sexual Minority individuals self-reported lesbian, gay, or bisexual sexual identity.

*denotes $p \leq 0.05$, **denotes $p \leq 0.01$, and ***denotes $p \leq 0.001$.

mental and physical health complaints or healthcare utilization, and the main treatment need identified here is for smoking cessation in the 17%–18% within those classes who are engaged in tobacco use. In contrast, three past-year or past-month latent classes had high rates of polysubstance use and above average rates of mental health complaints, SUD, physical health limitations, and healthcare utilization. For past-year SUD, those in the Multiple SUD class were the most in need of treatment, though those with AUD only (i.e., the AUD class) also warrant attention. Many of these individuals will need multidisciplinary and coordinated care to address their high rates of multimorbidity and complex health profiles. Future research should examine three key areas: first, latent classes of substance use within specific non-White racial/ethnic groups in order to identify potential health disparities; second, optimal screening practices to identify members of the more vulnerable classes; and third, identification of trajectories leading to class membership via longitudinal methods. This research can help limit the morbidity and mortality associated with substance use and PDM in adults 50 years and older.

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CONFLICTS OF INTEREST

The authors report no conflicts of interest.

DATA AVAILABILITY STATEMENT

The National Survey on Drug Use and Health is a publicly available dataset, found at https://www.datafiles.samhsa.gov/study-series/national-survey-drug-use-and-health-nsduh-nid13517.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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