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Substance Use and Psychological Distress as Correlates of Mental Illness in Older Adults: A Nationally Representative Analysis

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Abstract

Purpose: Mental illness (MI) is a substantial and under-recognized burden among older adults in the United States. Despite this, limited research has examined how specific behavioral risk factors, including binge drinking, prescription misuse, and psychological distress, are associated with MI among adults aged 65 and older. Grounded in the stress-vulnerability model and the life course perspective, this study examines these associations using nationally representative data.

Methodology: This study analyzed national survey data to investigate the relationship between substance use, distress, and the presence of MI among individuals aged 65 and older. Using data from the 2023 National Survey on Drug Use and Health (NSDUH), the analysis was restricted to adults aged 65 and older (N = 5,060) and estimated four logistic regression models on a common specification: a complete-case weighted model, a primary Taylor-linearized survey design model (strata VESTR_C, primary sampling unit (PSU) VEREP, 50 design degrees of freedom (df)), a multiple imputation by chained equations model ((MICE), m = 20, Rubin's rules), and a Firth penalized model, adjusting for sex, race and ethnicity, education, income, and poverty. The primary outcome was any MI past year (AMIPY): a co-occurring MI and substance use disorder (SUD) indicator was examined as a secondary outcome. Predictors were past-30-day binge drinking, past-year prescription misuse, and the full validated six-item Kessler (K6) distress scale.

Findings: The weighted prevalence of MI was 11.68% (95% confidence intervals (CI) 10.36 to 13.01), with past-30-day binge drinking at 12.04% and past-year prescription misuse at 2.79%. In the primary design-based model, psychological distress and prescription misuse were significantly associated with MI, while binge drinking was not once the outcome was restricted to MI alone; its association appeared only against the co-occurring outcome, indicating it was carried by the SUD component. Distress had the strongest association: each one-standard-deviation (SD) increase on the full K6 distress scale corresponded to roughly 5.6 times the odds of any MI (per-SD odds ratio (OR) = 5.65, 95% CI 4.73 to 6.75). Because a one-point increment is not comparable across the three- and six-item scales, the per-SD OR is reported as the primary effect size. Because the study design is cross-sectional, causal inferences cannot be drawn; however, the associations identified suggest that targeted screening for substance misuse and psychological distress among older adults may support earlier identification of psychiatric risk and inform integrated behavioural health interventions.

Originality: This study contributes to the literature by jointly examining substance use, psychological distress, and any MI in a nationally representative sample of older adults, an analysis that has received limited empirical attention. The theoretical grounding in the stress-vulnerability model and life course perspective further distinguishes this work from predominantly descriptive analyses of older adult substance use. The central contribution is population-specific: although the

links among substance use, distress, and MI are established in general adult samples, they have rarely been examined jointly in a nationally representative sample of adults aged 65 and older, and prior older-adult work has been largely descriptive or limited in scope.

Keywords

Older adults, Binge drinking, Prescription misuse, Psychological distress, Survey design, Multiple imputation

Introduction

MI in older adults: burden and correlates

MI is a growing and under-recognized concern among older adults (often defined as those aged 65+ in the United States. However, the behavioral factors associated with MI in this population remain incompletely understood. In recent years, rising substance use (especially alcohol misuse), increasing psychological distress, and sustained socioeconomic inequities may further elevate mental health risk among older adults. Understanding these intersecting risks requires a theoretical framework that situates individual vulnerability within both biological and biographical contexts. The stress-vulnerability model [1] provides a foundational organizing lens, positing that MI emerges from the interaction between an individual's biological predisposition and the accumulation of environmental stressors. Among older adults, substance misuse and psychological distress constitute meaningful stressors that may trigger or exacerbate psychiatric symptoms, particularly in the context of age-related physiological decline, reduced metabolic reserve, and increased polypharmacy. The life course perspective [2] complements this model by highlighting the cumulative nature of risk over time. Behavioural patterns established earlier in life, including substance use trajectories, do not resolve at retirement age but continue to shape health outcomes in late life. This is particularly relevant for the baby boomer cohort, who entered adulthood during periods of elevated substance use normalization and are now aging into a population with higher baseline rates of alcohol and prescription drug misuse than prior older adult generations. Taken together, these frameworks suggest a conceptual pathway in which long-standing behavioral risks interact with age-related vulnerability to elevate the likelihood of MI.

The mental health burden borne by older adults is substantial and, in many respects, under-recognized. The World Health Organization estimates that more than 20% of adults aged 60 and older experience a psychiatric or neurological disorder, and that these conditions account for approximately 6.6% of all disability in this population [3]. This burden is poised to grow: the global population aged 65 and older is projected to roughly double to 1.5 billion by 2050, shifting from one in eleven people in 2019 to one in six, which places late-life mental health increasingly at the centre of health care [3]. The consequences of these disorders extend well beyond psychiatric symptoms themselves. Mental disorders in older adults are a leading cause of suffering and disability worldwide, impairing social functioning and economic productivity, undermining adherence to co-prescribed medical treatments, and increasing the risk for loss of independence and early mortality from both suicide and physical illness [4]. Late-life major depression illustrates the severity of this impact: it is among the leading causes of disability, co-occurs with physical illness and frailty, and carries a lifetime suicide risk far exceeding that of the general population, with the highest rates among older adults [4]. Yet care tailored to the mental health needs of older adults continues to lag behind other areas of medicine, and under-identification of illness together with reluctance to seek help further impedes effective treatment [3]. Compounding these gaps, much of the existing research on late-life MI has concentrated on dementia, leaving other conditions, including mood disorders and SUD, comparatively understudied [3, 4]. Taken together, the high prevalence of psychiatric illness in later life, its far-reaching functional and mortality consequences, and the persistent gaps in recognition and research underscore the need to better characterize the behavioral and psychological factors associated with MI in this age group. Notably, the scarcity of dedicated mental health services for older adults compounds this issue, leaving psychiatric needs unmet in outpatient and primary care settings.

Substance use and binge drinking: newer evidence

Alcohol use, binge drinking, and alcohol use disorder (AUD)

Although the myth that older adults do not use mood-altering substances persists, evidence suggests that substance use in this population has been under identified for decades, with prevalence projected to rise as the baby boom generation ages [5]. Alcohol remains the most extensively studied substance among older adults, yet misuse of prescription opioids and benzodiazepines has also been increasing in this population, attributable in part to polypharmacy, overprescription, and the routine medical exposure to abuse potential medications that accompanies management of multiple chronic conditions [5]. Recent national data indicate that approximately one in ten older adults currently engages in binge drinking, underscoring that this is not a marginal behavior but a measurable and ongoing public health concern in this age group [6].

For external national context, the National Institute on Alcohol Abuse and Alcoholism reports the following 2023 - 2024 estimates for adults aged 65 and older;

In 2023, among people aged ≥65:

- 56.9% reported past-year alcohol use (33.0 million),
- 43.7% reported past-month use (25.3 million),
- 7.0 million (12.0%) reported binge drinking in the past month,
- 1.9 million (3.3%) reported heavy alcohol use in the past month, and
- 2.7 million (4.6%) met criteria for past-year alcohol use disease.

Within the 2024 provisional estimates:

- 6.8 million (11.4%) reported binge drinking,
- 1.5 million (2.5%) reported heavy use,

- 2.9 million (4.8%) met criteria for AUD, and
- 40.9% of all alcohol-attributable deaths in 2022 - 2023 occurred among those aged 65+ [7].

These data confirm that alcohol misuse is significant among older adults and that the aging cohort has an increasing number of older drinkers. Between 2002 and 2019, the share of 65+ persons drinking monthly rose ~16%, but the absolute number of drinkers increased ~80% due to growth of the cohort [8].

One Chicago study during the COVID-19 era assessed hazardous drinking among older adults. Hazardous drinking was defined as high scores on the AUD identification test-consumption (AUDIT-C) tool. The AUDIT-C is a three-question screening tool used by healthcare professionals to identify people who may be drinking at risky levels or have an AUD. The study results found that early in the pandemic, nearly half of the cohort engaged in hazardous drinking; over time this declined, but even at lowest prevalence >19% reported hazardous patterns. Notably, pandemic stress, depression, or social isolation did not correlate with hazardous drinking in that sample [9].

Other substance use and SUD treatment trends

Research demonstrates that older adults are more likely to engage in varying degrees of substance use. A mixed-methods study published in 2025 examined SUDs in mid-to-late life (≥50). The authors noted that over the past two decades, the number of older people with SUDs has tripled, especially driven by opioid use disorder (OUD). They reported barriers in treatment access for older people and highlighted need for age-tailored SUD services [10]. According to the Treatment Episode Data Set (TEDS), between 2008 and 2018, the proportion of older adults (55+) entering substance use treatment for the first time continued to increase relative to younger adults. Furthermore, among older first-time admissions, the proportion involving illicit drugs rose over time, suggesting a shift in the substance mix in older cohorts [11]. Among individuals aged ≥50 with severe visual impairment, a JAMA Ophthalmology study [12] revealed increased prevalence of misuse of prescription opioids and tranquilizers, and higher likelihood of SUD diagnoses. The authors posit that sensory impairment may lead to social isolation, depression, and increased substance misuse and risk of injuries from intoxication.

A projection study (2002 - 2006 base) estimated that SUD among adults 50+ would increase from 2.8 million to 5.7 million by 2020—driven largely by baby boom cohort aging [13]. That projection appears on track with observed treatment and cross-sectional survey trends. These recent studies suggest that not only is alcohol misuse persistently significant in older age, but other substance use (opioids, prescription misuse) is accelerating, particularly in older cohorts who may have integrated substance use into their life course.

Psychological distress and mental health: prevalence and associations

While large U.S. national surveys provide limited age-stratified data for serious psychological distress (SPD) in ≥65, some community-based research continues to document meaningful prevalence in older age. In a U.S. community-dwelling older adult sample (n ≈ 9,957), 4.7% reported SPD [14]. In National Health Interview Survey data [15], SPD over past 30 days was ~2.8% among women aged ≥65 and ~1.7% among men in that age group, lower than in younger adults.

Psychological distress remains similarly underexplored as a distinct correlate of MI in this age group. Depression, one of the most prevalent MI in later life, is frequently underrecognized and undertreated: help-seeking among older adults with depression is often delayed, which prolongs the duration of untreated symptoms and contributes to poorer health outcomes and greater healthcare use, with stigma, ageism, and difficulty obtaining an initial diagnosis identified as primary barriers to seeking care [16]. Distress does not always correspond with a formal diagnosis. A 2023 analysis of national survey data found that functional impairment was associated with greater psychological distress independent of depression diagnosis status, and argued that reliance on clinical diagnosis alone as a gateway to care risks overlooking older adults whose distress remains clinically unrecognized [17]. This finding raises the possibility that behavioral indicators, distress measures, and diagnosed MI capture overlapping but distinct populations of at-risk older adults, a distinction that has not been well disentangled in the existing literature. Despite the scale of this pattern, comparatively little research has examined the upstream behavioral risk factors that may contribute to MI in this population [18].

Socioeconomic status (SES), age stratification, and demographic modifiers

Age subgroups (>65 stratification)

Recent data emphasize that aggregated "≥65" classification masks steep gradients. For instance, age-related dementia data (2020 - 2022) show rates increasing dramatically with age (11.9 → 45.7 → 148 per 1,000), with higher morbidity in the highest strata [19].

Other studies (e.g., clinic-based OUD, TEDS admissions) suggest that older-old (≥75) and late-onset substance use patients may differ in comorbid burden, and risk tolerance [20, 21].

SES and disparities

In substance use latent-class analyses of U.S. adults aged ≥50, lower education and lower SES were associated with higher-risk latent classes (greater polysubstance use, higher SUD risk) [22]. In treatment admissions (TEDS, 2008 - 2018), older first-time admissions were more likely to come from Medicaid or lower-income populations, reflecting disparities in access and progression to treatment [11]. Furthermore, insurance discrepancies also impact these trends. Thus, lower SES likely contributes as a risk factor for distress and substance misuse and limits access to outpatient care alternatives.

Integrated mechanisms and the impact of MI

Consequently, older adults in the United States face compounding behavioral-health risk rooted in SPD and SUD. The cohort risk is particularly evident among baby boomers

entering older age, who bring higher baseline substance use histories than prior generations, resulting in elevated prevalence of misuse in late life. The literature demonstrates that substance misuse is disproportionately prevalent in this age group. Alcohol misuse remains the dominant substance-related risk, but prescription drug misuse and illicit substances, including opioids and tranquilizers, are rising as evidenced in treatment admissions and outpatient study samples. Older adults have reduced metabolic reserve, greater comorbid disease burden, polypharmacy, and increased fall risk. As a result, a given level of alcohol or drug use may cause injury, decompensation, or hospitalization more readily than in younger populations. Consistent with the stress-vulnerability model, psychological distress may worsen chronic disease control, impair treatment adherence, and precipitate psychiatric crises or overdoses. In conjunction with substance use, the combined burden compounds risk. Lower SES further magnifies these risk factors and reduces access to preventive and outpatient care. Despite the clear burden of MI in this population, few studies have examined substance use, psychological distress, and MI jointly in a nationally representative sample of older adults, and prior older-adult work has been largely descriptive or limited in scope. The present study addresses this gap by analyzing 2023 NSDUH data to identify correlates of any MI among adults aged 65 and older. Grounded in the stress vulnerability model, which conceptualizes MI as emerging from the interaction between underlying vulnerability and cumulative stress exposure, and the life course perspective, which situates later life mental health within a trajectory of accumulated advantage, disadvantage, and prior exposures, this study examines the associations between binge drinking, prescription misuse, and psychological distress and the presence of MI among adults aged 65 and older.

Materials and Methods

An analysis of the NSDUH public access data was conducted to examine relationships with MI presentations. The authors examined the data prior to completing regression analyses and independent t-tests to examine the relationships between age, distress level, and substance use on MI among older adults. The initial dataset, cleaned and analyzed with Python 3.12.6 (N = 52,104), was tailored to focus on individuals who were age 65+ (N = 5,060; NSDUH age recode AGE3 = 11), as unweighted cases. For the analysis, all of the descriptive estimates and the logistic regression model itself included the analyzed weight 2 - calibrated (ANALWT2-C) so that the overall results can be generalized for older adults in the United States population. Data cleaning consisted of zero-coding the binge drinking days to 0 for the participants who had no past 30-day alcohol use when the binge drinking variable was missing and setting the past 30-day marijuana use days as zero for individuals who reported being a lifelong abstainer. Any values that were out of logical range for the variable, like >30 days in the past 30-days, were considered to be missing variables and excluded. The prescription misuse variable was then coded as binary as any past-year misuse across four classes (pain relievers, tranquilizers, stimulants, and sedatives) using the imputation-revised misuse-recency re-codes (IRPNRNMREC, IRTRQNMREC, IRSTMNMREC, and IRSEDNMREC). The psychological distress variable was constructed from the full validated K6 scale: felt nervous, felt hopeless, felt restless or fidgety, felt so depressed that nothing could cheer you up, felt that everything was an effort, and felt worthless (DSTNRV30, DSTHOP30, DSTRST30, DSTCHR30, DSTEFF30, DSTNGD30). Each item was likert-scaled at 1 - 5 and reverse-scored so that higher values indicated greater distress, and the items were summed into a 6 - 30 index (K6_6item_sum). A three-item variant of this index (K6_3item_sum), which arose during analytic-file construction, was retained only as a sensitivity analysis. Full variable definitions and coding rules are provided in Table 1. Some socioeconomic/demographic variables were included, specifically, family income and poverty status. The primary model used design-based estimation (Taylor linearization with strata VESTR_C and PSU VEREP, 50 design df), and complete-case and Firth-penalized models were estimated as sensitivity analyses; missing-data handling is described below. The primary outcome was any MI alone (AMIPY); a

Table 1: Derived analysis variables, sources, and coding rules.

Variable	Source	Coding rule	Levels
AMI (primary)	AMIPY	1 = any past-year MI, else 0	0 = no, 1 = yes
AMI + SUD (secondary)	AMISUD5ANY	1 = co-occurring MI and past-year diagnostic and statistical manual of mental disorders-5 SUD	0 = no, 1 = yes
Binge (30-day)	ALCBNG30D	1 if 1 - 30 binge days; structural zeros → 0	0 = no, 1 = yes
Rx misuse (year)	IR{PNR, TRQ, STM, and SED}NMREC	1 if any class misused in past 12 months	0 = no, 1 = yes
K6 distress index	DSTNRV30, DSTHOP30, DSTRST30, DSTCHR30, DSTEFF30, and DSTNGD30	Reverse-scored sum of the full validated six-item K6, higher = more distress	6 - 30
Sex	IRSEX	Label map	Male, female (reference code(ref))
Race/ethnicity	NEWRACE2	7 → 4 collapse (sparse cells)	White (ref), Black, Hispanic, other
Education	IREDUHIGHST2	11 → 4 collapse (0-event cell)	<High school (HS), HS/general educational development (GED), some college, college grad+ (ref)
Poverty	POVERTY3	Label map	In poverty, ≤2x, >2x (ref)
Income	IRPINC3	Label map, 7 levels	<$10 - $75k+ (ref)

co-occurring MI and SUD indicator (AMISUD5ANY) was examined as a secondary outcome. Covariates were sex, race and ethnicity, education, income, and poverty.

Missing data

Missing data arose almost entirely from item non-response on the covariates and the K6 distress items; the outcome, survey-design, and weight variables were complete for all 5,060 respondents aged 65 and older. Two analytic frames follow from this pattern. Reliability and descriptive distress analyses required only that all six K6 items be present and were therefore conducted on the 4,950 respondents (97.8%) with a complete distress scale. The adjusted regression models additionally required complete data on every covariate (sex, race and ethnicity, education, income, and poverty) and, under listwise deletion, were fit on the 4,882 respondents (96.5%) with complete data across the full specification. The reduction from 5,060 to 4,882 thus reflects a loss of 178 cases (3.5%), driven by item non-response on the income, education, and poverty measures rather than on the behavioral predictors or the outcome.

Missing data were addressed with MICE, generating m = 20 imputed datasets. Each incomplete variable was imputed from a model conditioned on the other analytic variables, the behavioral predictors, and the outcome, so that the imputation model was at least as rich as the analysis model and preserved the associations under study. The full survey-design specification (Taylor linearization; strata VESTR_C, PSU VEREP; person-level weight ANALWT2C) was fit within each of the 20 completed datasets, and the resulting estimates and standard errors were combined using Rubin's rules, which propagate both within- and between-imputation variance into the pooled CI. Because MICE recovers the full analytic sample rather than deleting incomplete cases, the multiply-imputed model (M2) serves as the study's principal check on whether the listwise-deleted complete-case models are distorted by the cases they drop.

The multiple-imputation procedure supports a missing-at-random assumption, under which the probability of missingness depends on observed rather than unobserved information; this assumption is untestable but is made more plausible here because the variables most predictive of missingness—income, education, and poverty—are themselves observed for the large majority of respondents and are included in the imputation model. Two features of the results indicate that the missing data did not meaningfully bias the reported associations. First, the fractions of missing information from the pooled MICE estimates were low (approximately 0.09 to 0.12 across model terms), indicating that the imputation added little additional uncertainty and that the observed data were highly informative about the missing values. Second, the multiply-imputed estimates were substantively identical to the complete-case, design-based, and Firth-penalized estimates in both direction and significance for every predictor, which is the pattern expected when the cases lost to listwise deletion do not differ systematically from those retained on the modelled relationships. Together, these results indicate that the study's conclusions are robust to the handling of missing data, although, as with any observational analysis, bias from selection on unobserved characteristics cannot be entirely excluded.

Analyses proceeded in three stages. First, weighted and unweighted prevalence estimates were computed for any MI (AMIPY), past-30-day binge drinking (ANY_BINGE30), and past-year prescription misuse (PRESC_MISUSE), with design-based CI for the weighted estimates. Second, unadjusted group differences in distress by MI status were examined using independent-samples t-tests on the K6 items and the summed index; t-tests were used because distress was treated as an approximately continuous measure compared across two groups, and they are reported as descriptive context rather than as the study's inferential test. Third, the adjusted associations were estimated with logistic regression, which was selected because the outcome is binary; the four estimators described above were fit to a single, common specification. All predictors were entered simultaneously in one model. The principal independent variables were binge drinking, prescription misuse, and the six-item K6 distress index; sex, race and ethnicity, education, income, and poverty were entered as covariates to adjust for confounding. No interaction terms were included, as the study aimed to estimate the independent adjusted association of each behavioral predictor rather than effect modification; testing interactions was left to future work given the low outcome frequency. Multicollinearity was examined using generalized variance inflation factors (GVIF), which appropriately handle multi-category predictors; all values were well below conventional thresholds (maximum GVIF^(1/(2·df)) = 1.26, well below the $\sqrt{2} \approx 1.41$ threshold). The distress measure was the full validated six-item K6, and its psychometric properties were evaluated rather than assumed. Internal consistency was assessed with Cronbach's alpha and McDonald's omega, and corrected item-total correlations were examined for each item; the scale showed good reliability, and results are reported in the results section below.

Results

Descriptive statistics

Among adults aged 65 and older, the weighted prevalence of any past-year MI (AMIPY, the primary outcome) was 11.68% (95% CI 10.36 to 13.01), and the weighted prevalence of the co-occurring MI and SUD indicator (AMISUD5ANY, the secondary outcome) was 2.15% (95% CI 1.44 to 2.86). Past-30-day binge drinking was reported by 12.04% (95% CI 10.85 to 13.23; among the 4,990 respondents with past-30-day alcohol-use data) and past-year prescription misuse by 2.79% (95% CI 2.17 to 3.40). On the full six-item K6, the weighted mean distress score was 8.58 (95% CI 8.45 to 8.71) overall (Table 2 and Figure 1). In short, MI alone was common in this age group, the co-occurring form was comparatively rare, and distress was low on average across the full sample.

Distress by MI status

Psychological distress was substantially higher among older adults with MI on both outcomes. Across all six K6 items, mean item scores were higher in the group with MI

Table 2: Weighted descriptive characteristics of adults aged 65 and older, NSDUH 2023 (N = 5,060).

Characteristics	Weighted % (95% CI)
AMI	11.68 (10.36 - 13.01)
Past-30-day binge	12.04 (10.85 - 13.23)
Past-year Rx misuse	2.79 (2.17 - 3.40)
Female	54.42 (52.13 - 56.71)
Male	45.58 (43.29 - 47.87)
K6 distress index, mean (6 - 30)	8.58 (8.45 - 8.71)

Note: Weighted percentages use ANALWT2_C with design-based 95% CIs. Descriptive estimates are computed on the full 65+ frame (N = 5,060); reliability analyses use the 4,950 respondents with all six K6 items present, and the adjusted regression models use the 4,882 respondents with complete covariate data (listwise deletion).

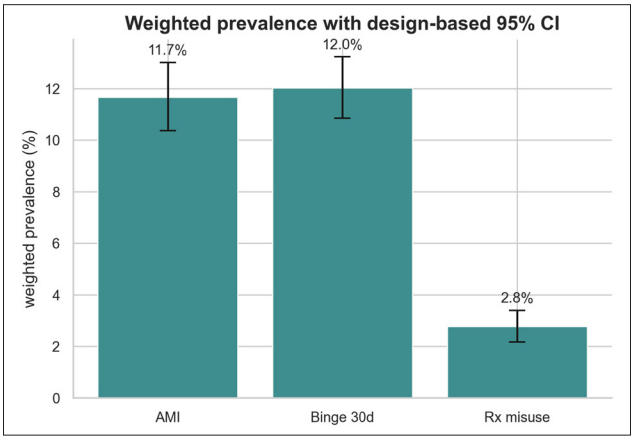


Figure 1: Weighted prevalence of MI, binge drinking, and prescription misuse with design-based 95% CI.

than in the group. For the primary outcome, the summed six-item index (range 6 - 30) was markedly higher among those with any MI (M = 14.31) than among those without (M = 7.84; t = 31.43, p < 0.001). For the secondary co-occurring outcome, the index was likewise elevated in positive cases (M = 15.87) vs negative cases (M = 8.42; t = 14.43, p < 0.001). The gap of roughly seven to eight scale points on both outcomes signals that distress separates affected from unaffected older adults cleanly, well before any modelling. These independent-samples t-tests are reported as descriptive context rather than as the study's inferential test.

Reliability and scale sensitivity

The full six-item K6 distress scale showed good internal consistency (Cronbach's α = 0.85, McDonald's ω = 0.86), with corrected item-total correlations ranging from 0.60 to 0.69 Figure 2, indicating the six items measure a single coherent distress construct. A three-item variant that arose during analytic-file construction was retained as a sensitivity analysis. It correlated almost perfectly with the full scale (Pearson r = 0.95, Spearman ρ = 0.95), and the two indices produced equivalent per-SD associations for both outcomes: for AMIPY, per-SD OR 5.65 (six-item) vs 4.73 (three-item); for the co-occurring outcome, per-SD OR 2.91 (six-item) vs 2.84 (three-item). Because a one-point increment is not comparable across the three-item (3 - 15) and six-item (6 - 30) scales, per-SD OR are reported as the primary distress effect

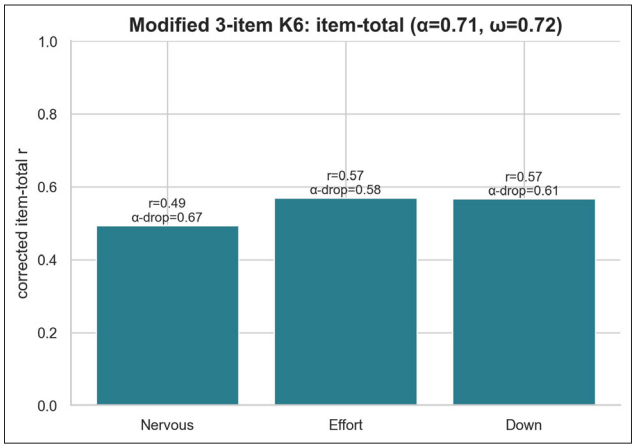


Figure 2: Corrected item-total correlations for the six-item K6 distress scale (α = 0.85, ω = 0.86, n = 4,950).

size. The near-identical estimates confirm that the distress association does not depend on which version of the scale is used (Figure 3).

Adjusted models

The adjusted associations were estimated with logistic regression under four estimators fit to a single common specification: a complete-case weighted model (M0), a design-based survey model treated as the primary specification (M1), a multiply-imputed model (M2, MICE, m = 20), and a Firth-penalized model (M3). Each estimator was applied to both the primary outcome (AMIPY) and the secondary co-occurring outcome (AMISUD5ANY) on an analytic sample of N = 4,882 (538 AMIPY events; 90 co-occurring events). The four estimators are presented in sequence so that the primary result can be judged against three deliberate stress tests of its assumptions. Full coefficients for every model, outcome, and covariate appear in Table 3, and the four-model comparison is displayed in Figure 4.

Model M1: Design-based survey model (primary specification). In the primary model, psychological distress and prescription misuse were significantly associated with any MI, while binge drinking was not. Each one-SD increase in K6 distress was associated with 5.65 times the odds of MI (per-SD OR = 5.65, 95% CI 4.73 to 6.75, p < 0.001; per-point OR = 1.68, 95% CI 1.59 to 1.77), making distress by

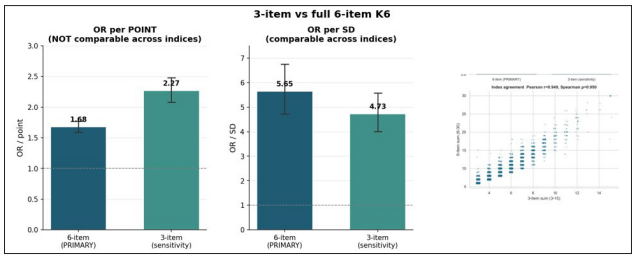


Figure 3: Sensitivity comparison of the three-item and six-item K6 distress indices; per-point ORs (not comparable across indices), per-SD ORs for any MI (comparable across indices: six-item 5.65 vs three-item 4.73), and index agreement (Pearson r = 0.95, Spearman ρ = 0.95), confirming the distress association does not depend on scale length.

Table 3: ORs (95% CI) for the principal predictors of AMI across four models, primary AMIPY outcome.

Predictor	M0 complete-case	M1 survey (primary)	M2 MICE (m = 20)	M3 Firth
K6 distress (per point; per SD OR 5.65, 4.73 - 6.75)	1.68 (1.62 - 1.74), <.001	1.68 (1.59 - 1.77), <.001	1.66 (1.58 - 1.75), <0.001	1.65 (1.60 - 1.72), <0.001
Rx misuse (past year)	2.37 (1.32 - 4.25), 0.004	2.37 (0.95 - 5.95), 0.065	2.85 (1.28 - 6.38), 0.011	2.68 (1.54 - 4.59), <0.001
Binge (past 30 days)	0.79 (0.53 - 1.17), 0.239	0.79 (0.47 - 1.30), 0.342	0.89 (0.56 - 1.41), 0.615	0.85 (0.56 - 1.25), 0.402
Sex: male (ref female)	0.58 (0.45 - 0.75), <0.001	0.58 (0.37 - 0.92), 0.022	0.57 (0.37 - 0.88), 0.010	0.76 (0.59 - 0.97), 0.026
Race: Black (ref White)	0.95 (0.62 - 1.46), 0.820	0.95 (0.40 - 2.28), 0.909	0.85 (0.37 - 1.95), 0.710	0.89 (0.56 - 1.38), 0.598
Race: Hispanic	1.12 (0.73 - 1.74), 0.600	1.12 (0.52 - 2.43), 0.762	1.14 (0.58 - 2.26), 0.700	1.27 (0.81 - 1.97), 0.298
Race: other	1.68 (1.11 - 2.56), 0.015	1.68 (0.81 - 3.49), 0.160	1.63 (0.81 - 3.28), 0.168	1.29 (0.82 - 2.00), 0.265
Educ: <HS (ref college grad+)	0.92 (0.58 - 1.44), 0.702	0.92 (0.45 - 1.88), 0.807	0.91 (0.47 - 1.76), 0.780	0.86 (0.54 - 1.35), 0.490
Educ: HS/GED	0.75 (0.54 - 1.05), 0.095	0.75 (0.41 - 1.37), 0.341	0.75 (0.42 - 1.34), 0.327	0.66 (0.46 - 0.93), 0.017
Educ: Some college	1.01 (0.73 - 1.39), 0.953	1.01 (0.65 - 1.57), 0.965	1.13 (0.75 - 1.70), 0.562	1.09 (0.81 - 1.48), 0.563
Pov: ≤2x poverty (ref >2x)	0.94 (0.65 - 1.36), 0.738	0.94 (0.53 - 1.66), 0.824	0.96 (0.56 - 1.65), 0.880	0.81 (0.56 - 1.18), 0.278
Pov: in poverty	0.97 (0.61 - 1.53), 0.894	0.97 (0.42 - 2.23), 0.940	0.97 (0.44 - 2.16), 0.944	1.04 (0.64 - 1.70), 0.829
Inc: <$10k (ref $75k+)	1.88 (0.99 - 3.59), 0.054	1.88 (0.76 - 4.65), 0.165	2.08 (0.89 - 4.83), 0.089	1.24 (0.66 - 2.32), 0.505
Inc: $10 - 20k	3.42 (1.94 - 6.06), <0.001	3.42 (1.64 - 7.16), 0.002	3.41 (1.72 - 6.75), <0.001	2.08 (1.25 - 3.46), 0.005
Inc: $20 - 30k	2.20 (1.23 - 3.95), 0.008	2.20 (1.02 - 4.74), 0.044	2.45 (1.22 - 4.94), 0.012	1.98 (1.21 - 3.25), 0.006
Inc: $30 - 40k	2.43 (1.38 - 4.27), 0.002	2.43 (1.19 - 4.95), 0.016	2.48 (1.25 - 4.90), 0.009	2.05 (1.28 - 3.29), 0.003
Inc: $40 - 50k	3.09 (1.76 - 5.45), <0.001	3.09 (1.53 - 6.24), 0.002	3.51 (1.83 - 6.71), <0.001	1.45 (0.87 - 2.38), 0.150
Inc: $50 - 75k	3.39 (1.96 - 5.85), <0.001	3.39 (1.79 - 6.41), <0.001	3.69 (1.99 - 6.87), <0.001	2.04 (1.30 - 3.23), 0.002

Note: M1 is the primary design-based model (Taylor linearization; ANALWT2_C, VESTR_C, VEREP; 50 design df). Binge drinking is significant against the composite outcome but null against MI alone in all four models.

far the strongest correlate in the model. Prescription misuse carried 2.37 times the odds (OR = 2.37, 95% CI 0.95 to 5.95, p = 0.065), and binge drinking showed no association (OR = 0.79, 95% CI 0.47 to 1.30, p = 0.342). Among covariates, male sex was associated with lower odds (OR = 0.58, 95% CI 0.37 to 0.92, p = 0.022), and income was the most consistent sociodemographic correlate, with several lower-income bands relative to $75k+ showing roughly two- to three-fold elevated odds (adjusted ORs approximately 2.2 to 3.4, most significant); the pattern was elevated but non-monotonic rather than a clean gradient, and race, ethnicity, education, and poverty were not significant. For the co-occurring outcome, distress remained significant (per-point OR = 1.38, 95% CI 1.29 to 1.46, p < 0.001; per-SD OR = 2.91), and the two substance-use predictors became strongly associated: binge drinking OR = 3.25 (95% CI 1.72 to 6.16, p < 0.001) and prescription misuse OR = 10.67 (95% CI 3.93 to 28.94, p < 0.001). The contrast is informative: binge drinking predicts the outcome only when a SUD component is present, whereas distress predicts MI regardless of that component.

Model M0: Complete-case weighted model. Restricting to complete cases without survey weighting reproduced the primary findings almost exactly. For AMIPY, distress OR = 1.68 (95% CI 1.62 to 1.74, p < 0.001), prescription misuse OR = 2.37 (95% CI 1.32 to 4.25, p = 0.004), and binge drinking OR = 0.79 (95% CI 0.53 to 1.17, p = 0.239). For the co-occurring outcome, distress OR = 1.38 (95% CI 1.31 to 1.44, p < 0.001), binge drinking OR = 3.25 (95% CI 1.87 to 5.66, p < 0.001), and prescription misuse OR = 10.67 (95% CI 5.41 to 21.03, p < 0.001). The close agreement with the design-based model indicates the weighting and design adjustments did not materially change the behavioral associations.

Model M2: Multiply-imputed model (MICE, m = 20). Imputing missing covariate data across the full sample again produced substantively identical estimates. For AMIPY, distress OR = 1.66 (95% CI 1.58 to 1.75, p < 0.001), prescription misuse OR = 2.85 (95% CI 1.28 to 6.38, p = 0.011), and binge drinking OR = 0.89 (95% CI 0.56 to 1.41, p = 0.615). For the co-occurring outcome, distress OR = 1.34 (95% CI 1.27 to 1.42, p < 0.001), binge drinking OR = 3.62 (95% CI 2.00 to 6.55, p < 0.001), and prescription misuse OR = 13.10 (95% CI 4.79 to 35.79, p < 0.001). Fractions of missing information were low (approximately 0.09 to 0.12 across terms), so recovering the cases lost to listwise deletion added little uncertainty and did not shift the conclusions, which is the central evidence that the missing data are not driving the results.

Model M3: Firth-penalized model. Firth penalization, applied to reduce small-sample and separation bias, confirmed the primary findings and is the preferred specification for the rare co-occurring outcome. For AMIPY, distress OR = 1.65 (95% CI 1.60 to 1.72, p < 0.001), prescription misuse OR = 2.68 (95% CI 1.54 to 4.59, p < 0.001), and binge drinking OR = 0.85 (95% CI 0.56 to 1.25, p = 0.402). For the co-occurring outcome, distress OR = 1.37 (95% CI 1.31 to 1.44, p < 0.001), binge drinking OR = 4.73 (95% CI 2.76 to 7.98, p < 0.001), and prescription misuse OR = 7.58 (95% CI 3.77 to 14.53, p < 0.001). As expected in low-event data, penalization pulled the most extreme unpenalized estimates

toward the null while leaving the direction and significance of every behavioral predictor unchanged, which is reassuring given the small number of co-occurring events (events-per-variable ≈ 5).

Summary of model agreement: across all four estimators and both outcomes, the direction and significance of the three behavioral predictors were stable (Table 3, Figure 4 and Figure 5). Psychological distress was the strongest and most consistent correlate of both outcomes; prescription misuse was consistently associated with both, and binge drinking was associated only with the co-occurring outcome, not with MI alone. The convergence of the design-based, complete-case, multiply-imputed, and Firth-penalized estimates is the clearest evidence that the findings are robust to how missing data and small-sample bias are handled rather than being artifacts of any single modelling choice.

Multicollinearity

Multicollinearity was assessed using GVIF, which appropriately handle multi-category predictors. All values were well below conventional thresholds (maximum GVIF^(1/(2·df)) = 1.26, below the $\sqrt{2} \approx 1.41$ threshold), confirming that the predictors contributed independent information and that the OR are not distorted by overlap among them.

Limitations

Limitations to the analysis include the cross-sectional design, which supports associations rather than causal or utilization claims; no causality can be inferred or is claimed from any aspect of this analysis. First, the analysis relies on self-reported behaviors and symptoms, which are subject to recall and social-desirability bias that may understate stigmatized behaviors such as prescription misuse. Second, although the design-based primary model and the multiply-imputed model retain the full analytic sample, the complete-case specifications reduce the sample from 5,060 to 4,882 older adults because the multiply-imputed and complete-case estimates were substantively identical, the missing values appear unlikely to bias the reported associations, but selection on unobserved characteristics cannot be excluded. Third, the primary distress measure is the full validated six-item K6; a three-item variant is retained only as a sensitivity analysis and reproduces the full-scale result. Fourth, the co-occurring outcome is rare (90 events), which limits the precision of its adjusted estimates despite the use of Firth penalization. Fifth, NSDUH top-codes age at 65 and older, which prevents examination of the steep within-group gradients (for example, adults aged 75 and older or 85 and older).

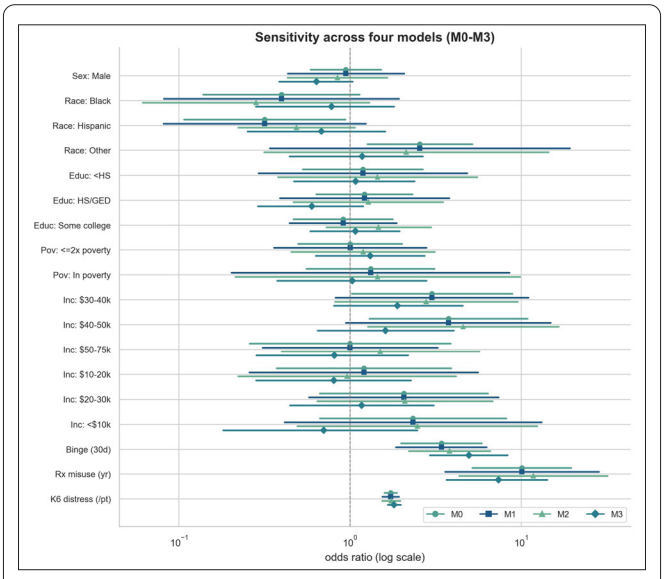


Figure 4: ORs for each predictor across all four models (M0 - M3), primary AMIPY outcome, using the full six-item K6 distress scale.

Discussion

This study adds important empirical support to a growing body of literature highlighting the complex, intertwined burdens of MI, substance misuse, and psychological distress among older adults in the United States. Using recent, nationally representative NSDUH data, the analysis identifies psychological distress as a strong and consistent correlate of any MI and prescription misuse as a more modest correlate, while binge drinking was not associated with MI alone (AMI) among adults aged 65 and older (Figure 5). The findings are notable for several reasons. First, alongside a common overall prevalence of AMI (11.68%), binge drinking was relatively frequent (12.04%) and prescription misuse, though less prevalent (2.79%), emerged as the more consequential substance-use correlate, suggesting that problematic substance use is both present and underrecognized within this age group. This pattern reinforces the emerging consensus that substance use in older adults is not only increasing in prevalence but is also shifting from alcohol misuse alone to include a broader spectrum of prescription drug misuse, often involving opioids and sedatives. From a life course perspective, these elevated rates are consistent with the substance use trajectories that the baby boomer cohort has carried into late life, underscoring the importance of understanding behavioral health risk as a cumulative, longitudinal phenomenon rather than one that emerges solely in older age.

Additionally, this study emphasizes the independent and compounded association of psychological distress with MI. The K6-based distress index demonstrated strong predictive value, with each one-SD increase associated with roughly 5.6 times the odds of MI (per-SD OR = 5.65; equivalently

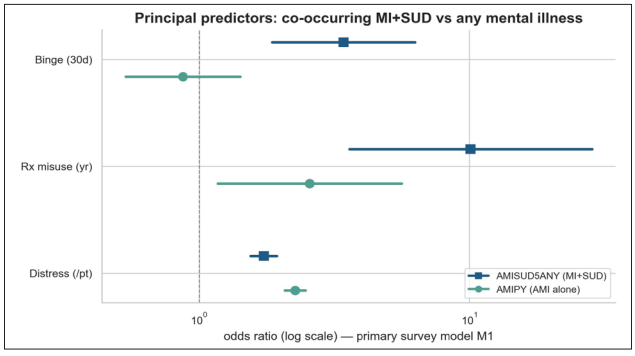


Figure 5: Principal predictor OR under the co-occurring MI + SUD outcome vs any MI alone (primary survey model M1), using the full six-item K6 distress scale.

OR = 1.68 per point on the six-item scale), the strongest and most stable association across all four models. These findings are consistent with the stress-vulnerability model, in which accumulating psychological stressors are associated with increased psychiatric vulnerability in individuals with underlying biological predispositions. Framed within this model, the six-item distress index can be read as a marker of accumulated stress load that, interacting with age-related biological vulnerability such as reduced physiologic reserve, polypharmacy, and comorbidity, tracks with a higher probability of manifest MI. The life course perspective adds a temporal layer: the elevated prescription-misuse association is consistent with substance-use trajectories carried forward by the baby-boom cohort rather than arising de novo in later life, framing the observed correlates as endpoints of cumulative exposure rather than isolated late-life events.

It is important to note, however, that the cross-sectional design of this study precludes causal inference. The observed associations indicate that prescription misuse and distress are associated with AMI in this population, but the directionality and mechanisms underlying these relationships cannot be determined from the present data. Prescription misuse was associated with roughly 2.4 times the odds of MI and reached significance in the complete-case, multiply-imputed, and Firth-penalized models, though it fell just short of significance in the design-based primary model (OR = 2.37, 95% CI 0.95 to 5.95, p = 0.065), indicating a consistent but less precisely estimated association than that of distress. Binge drinking, by contrast, showed no association once the outcome was restricted to MI alone, even though it was robustly associated with the co-occurring outcome (OR = 3.25 to 4.73 across models); its apparent relevance in the co-occurring analysis was therefore carried by the SUD component rather than by MI itself. Several factors may explain the null association with MI alone. The conventional binge threshold (five or more drinks for men, four or more for women) is not calibrated to the reduced volume of distribution and heightened sensitivity of older adults, and so may misclassification risk in this group; the low frequency of the MI outcome limits statistical power to detect a modest binge effect and, as a past-30-day measure, binge drinking may not capture the longer-term drinking trajectories most relevant to psychiatric burden. The contrast with prescription misuse suggests that, in later life, the pharmacological and iatrogenic pathways of prescription drug misuse may be more proximally linked to MI than episodic heavy drinking.

The primary contribution of this work is one of population focus and design-based rigor rather than of newly discovered mechanisms: although the associations among substance use, distress, and MI are established in general adult samples, they have rarely been examined jointly in a nationally representative sample of adults aged 65 and older using a design-based analytic approach, and prior older-adult work has been largely descriptive or limited in scope.

Furthermore, this study contributes to equity-focused aging research by analyzing socioeconomic modifiers. While poverty status was not a significant predictor in the adjusted regression, income was the covariate most consistently associated with the outcome: relative to the highest-income band, several lower-income categories carried elevated odds of any MI, with adjusted OR ranging from roughly 2.2 to 3.4 and most reaching statistical significance. The pattern was elevated but non-monotonic rather than a smooth income gradient, and the lowest band did not reach significance, so it should be read as broadly consistent with an inverse socioeconomic association rather than a precise dose-response relationship. This finding, combined with prior literature on insurance disparities and access gaps, suggests that low-income older adults remain at disproportionate risk, a trend that warrants deeper exploration using datasets with more detailed SES variables.

Overall, the implications of this work are both clinically and policy-relevant. The associations observed between substance misuse, psychological distress, and AMI suggest that screening for these factors in both primary care and community settings may assist in the earlier identification of older adults at elevated psychiatric risk. Because MI in older adults is consequential, earlier identification and intervention are clinically valuable. Age-adapted treatment protocols for SUD, integrated behavioral health services, and coordinated medication management represent plausible targets for system-level intervention, though longitudinal studies are needed to establish whether such approaches reduce AMI incidence in this population.

Conclusion

This study underscores the significant associations between substance misuse, psychological distress, and MI in older adults. While the overall prevalence of AMI was relatively moderate, high levels of binge drinking and prescription misuse alongside elevated distress scores indicate a substantial, and largely underrecognized, behavioral health burden in this population. Although the cross-sectional design limits causal interpretation, the magnitude of the observed associations, particularly for psychological distress, highlights the clinical relevance of screening for co-occurring substance use and distress as potential indicators of psychiatric risk in older adult populations.

The work affirms that mental and behavioral health needs are a significant and growing concern among older adults. Consistent with the life course perspective, the baby boomer cohort is entering older adulthood with higher baseline rates of substance use than prior generations, suggesting that the prevalence of co-occurring MI and substance misuse in this age group is likely to increase in the coming decades. These patterns underscore the importance of age-adapted behavioral health surveillance and intervention strategies that are proactive rather than crisis-driven.

The authors recommend the following ideas for future research:

- Longitudinal studies tracking substance use, MI onset, and treatment utilization over time in older cohorts to better understand causal pathways.
- Integration of claims data or linked electronic health record datasets with survey data (e.g., NSDUH) to establish patient-level connections between risk behaviors

and healthcare use.

- Evaluation of interventions targeting co-occurring mental health and SUD in older adults, including age-adapted screening tools and treatment protocols.
- More detailed analyses of socioeconomic and racial/ethnic disparities, including Medicaid-specific outcomes and access to outpatient behavioral health services.
- Examination of protective factors, such as social engagement, resilience traits, or healthcare continuity, that may mitigate risk in distressed or substance-using older adults.

Given the aging of the population and the increasing prevalence of substance use in later life, public health and clinical systems must adapt to better identify and address psychiatric and substance-related needs among older adults. The findings of this study suggest that earlier identification of at-risk individuals, supported by routine screening for substance misuse and psychological distress, may represent an important step toward reducing the burden of MI in this population.

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Conflict of Interest

None.

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