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Psychiatric comorbidity and access to multi-modal care among hospitalized patients with opioid use disorder: A cross-sectional study in a North American opioid crisis epicentre

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Psychiatric comorbidity and access to multi-modal care among hospitalized patients with opioid use disorder: A cross-sectional study in a North American opioid crisis epicentre.

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ABSTRACT:

Purpose: Concurrent disorders among people with opioid use disorder (OUD) are associated with overdose mortality. British Columbia is Canada's opioid crisis epicentre, yet psychiatric and addiction services remain largely non-integrated, and clinical complexity is under-explored. We estimated psychiatric comorbidity prevalence, patterns, and health needs among patients with OUD, and whether multi-modal care varied with comorbidity.

Methods: Cross-sectional structured interviews of 256 adults with OUD admitted to a Vancouver general hospital assessed self-reported health, addiction, and treatment history. Comorbidity was characterized using disorder count and latent class analysis. Multi-modal care was defined as psychiatric treatment uptake plus medication-based OUD treatment in the past 6 months. Logistic regressions adjusted for demographics, housing, overdose, and suicidality.

Results: Concurrent disorders were reported by 69.5% of participants (59.7% with ≥ 2) and associated with suicidal ideation and attempts ($p < 0.001$). Childhood trauma (97.0%), chronic pain (73.3%), and lifetime overdose history (81.6%) were common. Depression (51.8%) and anxiety (39.4%) were most prevalent and comorbid ($\varphi = 0.61$, $p < 0.0001$). Psychiatric treatment (72.7%) exceeded OUD treatment (50.4%), and multi-modal care (38.7%). Internalizing (58.3%) and Bipolar/psychosis (41.7%) classes emerged. Neither class membership nor disorder count was associated with multi-modal care uptake. Women had higher odds of multi-modal care (aOR = 2.48, 95% CI: 1.03-6.23, class model), but not other covariates.

Conclusions: Hospitalized patients with OUD had substantial psychiatric and health burdens, yet reported multi-modal care did not vary with comorbidity. Further concurrent disorders research should examine unmet needs, complexity measures, and implementation of integrated, trauma-targeted care.

Keywords: Concurrent mental illness psychiatric comorbidities, dual disorders, Fentanyl use, opioid use disorder, opioid overdose, concurrent disorders treatment

HIGHLIGHTS

- Most acute care patients with opioid use disorder had a mental illness.
- Childhood trauma, chronic pain, overdose, and suicidality were common.
- Multi-modal care was low and did not vary by comorbidity type or level.
- Women had higher odds of multi-modal care; overdose and suicide history did not.
- Findings inform research on integrated care and complexity in concurrent disorders.

INTRODUCTION

Concurrent disorders (CD or 'CCD'; i.e. presence of co-occurring psychiatric and substance use diagnoses) among people with substance use disorders (SUDs) have received increasing attention due to high prevalence, unmet needs, and shortened life expectancy (Fridell et al., 2019; Hakobyan et al., 2020; "Mental Illness and Addiction: Facts and Statistics | CAMH," n.d.; Plana-Ripoll et al., 2020; SAMHSA, 2024). This is especially pertinent amid the North American opioid crisis, where unprecedented overdose

mortality (Garnett et al., 2024; Public Health Agency of Canada, 2026) has coincided with a substantial burden of psychiatric conditions and general multimorbidity among people with opioid use disorder (PWOUD) (Goldner et al., 2014; Jones and McCance-Katz, 2019; Kelly and Daley, 2013; Ross and Peselow, 2012; Russolillo et al., 2025a), and has been associated with high hospitalization rates (Morin et al., 2020). However, most available studies have examined CDs in general SUD contexts.

British Columbia (BC) has been the epicentre of this crisis since the public health emergency was declared in 2016, with the highest opioid toxicity death rates among Canadian provinces (BC Coroners Service, 2026; Ciccarone, 2017; Office of the Provincial Health Officer., 2016), a 7% increase in prevalence of CDs from 2013 to 2021 (Russolillo et al., 2025b), and markedly elevated overdose risk among those with CDs (Keen et al., 2022).

Suicidality is closely related to mental illness and opioid use (Kuppusamy et al., 2024), accounting for up to 20% of deaths among PWOUD(Bohnert and Ilgen, 2019; Colledge-Frisby et al., 2023) and 15-30% of non-fatal opioid overdoses involving suicidal intent (Connery et al., 2022; Pergolizzi et al., 2021).

Collectively, co-occurring mental health and substance use (MHSU) challenges involve a complex biopsychosocial interplay of risk factors and health needs (Beaulieu, 2022; Gardiner and Lawson, 2023; Montiel Ishino et al., 2020), such as genetic predisposition, Adverse Childhood Experiences (ACE), , socioeconomic status, and early substance exposure shaping shared neurobiological (e.g., reward circuitry, hippocampal volume) and socio-cognitive (e.g., impulsivity) pathways to psychiatric disorders, addiction, and suicidality,(Gobbi et al., 2019; Gong et al., 2024; Gorgellino et al., 2025; Hatoum et al., 2023; Parakh and Basu, 2013)
Treatment for co-occurring OUD and mental illness remains poorly integrated despite a decade of fentanyl adulteration in the unregulated drug supply (Krausz et al., 2021; Sisco et al., 2026). Providers may not feel equipped to provide OAT (Kestler et al., 2021; Narayan et al., 2023), and specialized psychiatric care within OAT programs is limited (Morin et al., 2020). In a Canadian study, 35% to 50% of individuals with CDs received no formal psychiatric treatment (Wiktorowicz et al., 2019); nearly 20% of BC residents report unmet MHSU needs due to limited service availability (Keen et al., 2022). Similarly, only 12.4% of adults in the US with CDs receive treatment for both OUD and psychiatric conditions (SAMHSA, 2024).

Addiction treatment in general has historically been siloed from psychiatric services (Szerman et al., 2019); Szerman et al., 2019). Despite the classification of SUD as a mental disorder, and its shared psychopathological and neurobiological mechanisms, SUD continues to be conceptualized and treated distinctly from other psychiatric conditions (Drake et al., 2001; Schütz et al., 2025), underscoring the need for transdiagnostic approaches to studying and treating CDs.

There is a paucity of tools or measures of complexity in psychiatric comorbidities (Kapustianyk et al., 2024), and guidance on addressing it in SUD treatment remains limited (Hakobyan et al., 2020). Recent research used clustering to examine multimorbidity patterns among PWOUD but was primarily physical health-focused (Rodrigues et al., 2025). Conventional measures, including diagnostic counts and summary indices, may not capture severity, progression, interactions, or psychosocial dimensions (Meghani et al., 2013).

Given their complexity, concurrent disorders often require multi-modal MHSU interventions that also address social determinants of health such as housing, employment, and family support (Hammervold et al., 2024; Haverfield et al., 2019). Integrated approaches are increasingly recognized as essential to continuity across providers and service delivery levels (Karapareddy, 2019; Wiktorowicz et al., 2019), reducing substance use and improving health outcomes. Yet community-based systems often lack the capacity, infrastructure, and trained personnel to manage complex psychiatric needs (Endale et al., 2020).

These challenges are particularly evident in Vancouver, which has the highest per capita concentration of unhoused individuals among Canadian cities, where psychiatric morbidity and systemic inequities intersect with gaps in community-based MHSU care, including loss of continuity of care after the 2012 closure of a psychiatric hospital (City of Vancouver, 2019; Krausz et al., 2013; Read, Alison, 2009). This closure reflects broader North American deinstitutionalization since the 1980s , impacting those with severe mental health needs.

Mental health care overall in Canada and the US is largely crisis-driven, i.e., treating patients once they reach their highest need (Moroz et al., 2020; Saunders et al., 2018; SAMHSA, 2014), often resulting in individuals primarily engaging with the health system at the acute care level (Kendall et al., 2017; Morin et al., 2020), and facing structural barriers to long-term treatment retention (Krawczyk et al., 2021; Piske et al., 2020). For people with CDs, multimorbid physical health needs further contribute to hospital admission, such as injuries , necrotic wounds from opioid adulterants (Zagorski et al., 2023)Iacopetta et al., 2025), and chronic pain complications (Hser et al., 2017; Kim et al., 2025). This population therefore navigates challenges that restrict longitudinal observation.

Within this context, we conducted a Vancouver-based, cross-sectional study of acute care patients with OUD to examine the prevalence and health-related needs of CDs, exploratory measures of comorbidity and complexity, and access to multi-modal care in a high-burden region.

METHODS

Recruitment and study design

The Fentanyl Cohort Study was a cross-sectional, interviewer-administered survey of adults receiving inpatient services for any clinical complaint at Vancouver General Hospital (VGH), a major acute care hospital in BC, Canada. Eligible participants were 18 years or older, provided informed consent, had an OUD diagnosis, and reported fentanyl as their primary substance used in the previous six months. Convenience sampling was facilitated by consulting physicians from the Complex Pain and Addiction Services (CPAS) who identified potentially eligible patients across clinical departments. Structured 30-45 minute interviews were conducted March 2023 to May 2024 using Qualtrics software on tablet devices; participants could withdraw at any time. Interviewers received standardized training and entered responses directly, including fixed responses, open-text elaborations, and integrated assessment tools. Developed through expert consensus, the survey assessed sociodemographics, physical health, substance use, overdose history, treatment utilization, and risk-management strategies using self-report and

validated instruments, including the Adverse Childhood Experiences (ACE) questionnaire (Felitti et al., 1998) and the numeric pain rating scale (NPRS) (Hawker et al., 2011). A clinician regularly monitored data collection and survey validity. The target sample size (N = 200-300) and study design reflected feasibility and anticipated patient volume.

CD characterization

The cohort's prevalence of concurrent disorders was estimated using self-reported questions related to mental health conditions (item Q48, Appendix A), asking whether participants had ever received a diagnosis of a mental health condition, other than substance use disorder, from a health professional and allowed selection of depression, anxiety disorder, bipolar disorder, psychosis/schizophrenia, borderline personality disorder (BPD), post-traumatic stress disorder (PTSD), and "other mental illness". Exploratory analyses described the distribution of individual disorders, disorder count, and pairwise comorbidity correlations. Pairwise associations were assessed using chi-squared tests and visualized in a comorbidity network using phi (φ) coefficients; with Benjamini–Hochberg-adjusted *p*-values for multiple comparisons (Appendix D).

Treatment and outcome definitions

Disorder-specific treatment uptake was assessed as well (item Q43; Appendix A), asking whether each condition had been treated by a health professional with medication, psychotherapy, or other treatment in the past six months. Treatment method types were binarized, and their distributions and co-occurrence were summarized descriptively.

The primary outcome, multi-modal care uptake, was operationalized as the combination of reported MHSU treatments. This was a proxy of integrated care, since psychiatric and OUD services are often delivered separately in both the regional and broader health systems (Cheung et al., 2026; Nosyk et al., 2022), and structured integration or coordinated delivery could not be confirmed. Disorder-specific treatment modalities were grouped into three categories: any (1) psychiatric care (medication and/or psychotherapy), (2) OUD treatment, and (3) multi-modal care (both psychiatric and OUD treatment). Medication and psychotherapy were combined to account for any patient-level variation and psychiatric treatment approaches across conditions. OUD treatment was defined as reported receipt of prescribed medications for OUD (MOUD) in the past six months (Bell and Strang, 2020), identified from opioid agonist therapy (OAT) medications and current substance use treatment (Q7.3, Q7.9; Appendix A). Although OUD is itself a psychiatric condition, we categorized its treatment separately from psychiatric care to reflect how these services are typically delivered.

Statistical analysis

Analyses were performed in R (version 2026.01.1), with statistical significance set at $p < 0.05$. Data were preprocessed according to each analysis by excluding missing or ambiguous responses (e.g., "Rather not answer", "Not applicable", and "Not sure"), applying listwise deletion for test-specific variables (Appendix H), and re-coding variables as binary or categorical where appropriate. Exploratory distributional and normality assessments informed test selection.

To characterize factors associated with CDs and compare with literature, the cohort was stratified by CD status and compared across sociodemographic variables (age, gender, ethnicity, high school completion, housing, and employment), and clinical factors, including childhood trauma/ACE, opioid overdose history (lifetime and 6-month), suicidal ideation (last 6 months), suicide attempt (lifetime), and 6-month history of chronic pain and substance use patterns. Age was compared using independent-samples t-tests, with Mann-Whitney U tests as sensitivity analyses; categorical variables were compared using chi-square or Fisher's exact tests. Effect sizes were calculated using Cohen's d (Cohen, 1998) for continuous variables and Cramér's V for categorical variables. Supplementary multivariable logistic regressions examined associations between CD status or disorder count with outcome-relevant variables significant in bivariate analyses, adjusting for age, gender, ethnicity, and housing status.

Given the overlap of multiple disorders in exploratory analyses, latent class analysis (LCA) was used to identify probability-based comorbidity classes, consistent with prior research (Essau and de la Torre-Luque, 2019). Four candidate models, incorporating all seven disorder options, were compared using fit indices (Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample size- adjusted BIC (saBIC), entropy, posterior probability, and class sizes) (Morgan, 2015) and clinical interpretability, informed by clinician input and the literature. Class-probability tables and plots informed selection between the two best-fitting models. Sensitivity analyses excluded "other mental illness" as a disorder option. The disorder count was also calculated to represent individual-level comorbidity burden. Comorbidity class and disorder count were exploratively employed as complementary measures of CD complexity (Villalobos-Gallegos et al., 2017; Weich et al., 2011).

MHSU treatment categories (psychiatric, OUD treatment, and multi-modal) were compared bivariately using chi-squared or Fisher's exact tests. Two multivariable logistic regression models estimated the odds of receiving multi-modal care, using comorbidity class and disorder count as respective primary predictors. Both models were adjusted for age, gender, ethnicity, and housing status as potential access-to-care factors (Andersen, 1995; Piske et al., 2020), and 6-month overdose history and suicidal ideation as proxy indicators of clinical severity (Bogdanowicz et al., 2016; Caudarella et al., 2016).

RESULTS

Cohort descriptives & biopsychosocial factors

This cohort of 256 PWOUD had a mean age of 44.39 years (SD = 11.49), with 65.1% identifying as male and 59.0% as White (Table 1). Among the participants who completed mental health-related questions (analytic N = 200), 69.5% (subgroup N = 139) reported at least one concurrent mental disorder. Among participants with CD, 56.8% were male, 55.8% were White, and 27.5% were Indigenous, with no significant differences by CD status ($p > 0.05$).

Several biopsychosocial characteristics were highly prevalent in the overall cohort as similarly found in other subgroup analyses (M. J. Song et al., 2026), including lifetime and 6-month opioid overdose, ACE

exposure, and 6-month fentanyl-involved polysubstance use and chronic pain history (73.3% - 92.0%); none differed significantly by CD status (Table 1).

Participants with CD (subgroup N = 139) were significantly younger than those without ($p < 0.01$; Table 2), a difference supported by non-parametric testing (Mann-Whitney U = 3251.0, $p < 0.01$). Suicidal ideation in the past 6 months was significantly more prevalent in the CD group than the non-CD group (43.3% vs. 14.6%; $p < 0.001$), as was a lifetime history of suicide attempt (47.0% vs. 17.9%; $p < 0.001$) (Table 2). In adjusted supplementary analyses (Table 3), CD presence was associated with higher odds of 6-month suicidal ideation (aOR = 4.23, 95% CI: 1.90-10.49) and lifetime suicide attempt (aOR = 3.64, 95% CI: 1.71-8.33). Each additional disorder was associated with higher odds of both outcomes (suicidal ideation: aOR = 1.63, 95% CI: 1.27-2.14; suicide attempt: aOR = 1.61, 95% CI: 1.26-2.10).

Table 1. Cohort characteristics and concurrent disorder (CD) status. Data are presented as mean (SD) for continuous variables and n (%) for categorical variables, with p values corresponding to each bivariate, unadjusted correlation test comparing a variable with CD status.

Category (Total n[a])	**Value**	**Overall Cohort[b]**	**Has CD (n = 139)**	**No CD (n = 61)**	***p***
Age, years (n =252)	Mean (SD)	44.39 (11.49)	42.53 (10.45)	47.67 (13.02)	0.008
Gender (n = 252)	Man	164 (65.08%)	79 (56.83%)	44 (73.33%)	0.063
	Non-Binary	4 (1.59%)	4 (2.88%)	0 (0.00%)	
	Woman	84 (33.33%)	56 (40.29%)	16 (26.67%)	
Ethnicity[c] (n = 251)	Indigenous	62 (24.70%)	38 (27.54%)	17 (28.33%)	0.661
	Other	41 (16.33%)	23 (16.67%)	7 (11.67%)	
	White	148 (58.96%)	77 (55.80%)	36 (60.00%)	
High School Completion (n = 256)	Yes	149 (58.20%)	82 (58.99%)	33 (54.10%)	0.625
Housing Status (n = 250)	Stable	94 (37.60%)	52 (37.41%)	24 (40.00%)	0.852
	Unstable	156 (62.40%)	87 (62.59%)	36 (60.00%)	
Employment Status (n = 256)	No	200 (78.12%)	109 (78.42%)	49 (80.33%)	0.907
	Yes	56 (21.88%)	30 (21.58%)	12 (19.67%)	
Adverse Childhood Experiences (ACE) (n = 226)	Yes	208 (92.04%)	129 (96.99%)	55 (94.83%)	0.436
Overdose History (lifetime) (n = 238)	Yes	193 (81.09%)	111 (81.62%)	48 (81.36%)	1

Recent Overdose (last 6 mo) (n = 191)	Yes	95 (49.74%)	57 (52.29%)	24 (50.00%)	0.927
Suicidal ideation (last 6 mo) (n = 212)	Yes	70 (33.02%)	58 (43.28%)	8 (14.55%)	<0.001*
Suicide Attempt (lifetime history) (n = 213)	Yes	78 (36.62%)	63 (47.37%)	11 (19.30%)	<0.001*
Polysubstance Use (last 6 mo) (n = 231)	Yes	193 (83.55%)	112 (86.15%)	45 (78.95%)	0.308
Chronic Pain (last 6m) (n = 221)	Yes	162 (73.30%)	99 (73.33%)	40 (66.67%)	0.436

Note. CD = concurrent disorder; SD = standard deviation. 'Last 6 mo' or 'lifetime' indicate the timeframe of history. Percentages represent proportions within each respective column.
[a]Total n' indicates participants with observed data for each variable after accounting for missing data.
[b] 'Overall Cohort' column reflects the total cohort (Overall N = 256), while the analytic sample (Analytic N = 200) reflects participants with complete CD data ('Has CD').
[c]'Other' is a combined category representing Black, Latinx, Middle Eastern, or East, South, or Southeast Asian due to small cell counts. The most common ethnic backgrounds were reported.

Table 2. Sociodemographic and clinical characteristics that differed significantly between participants with and without a concurrent disorder (CD).

Characteristic Variable	Has CD (n = 139)	No CD (n = 61)	Test Statistic	p	Effect Size
Age (years), Mean (SD)	42.53 (10.45)	47.67 (13.02)	t(198) = -2.68	0.008	d = -0.46
Suicidal ideation (past 6 months)	58 (43.28%)	8 (14.55%)	$\chi^2(1) = 12.56$	0.0004	Cramér's V = 0.26
Lifetime suicide attempt	63 (47.37%)	11 (19.30%)	$\chi^2(1) = 12.90$	0.0003	Cramér's V = 0.26

Note. CD = concurrent disorder; SD = standard deviation. Age was compared using independent-samples t-tests (effect size: Cohen's d), and categorical variables using chi-square tests (effect size: Cramér's V). Suicidal ideation refers to the past 6 months, and suicide attempt refers to lifetime history.

Table 3. Adjusted odds of past 6-month suicidal ideation and lifetime suicide attempt by CD status and disorder counts per-individual.

Outcome Variable	Predictor	aOR	95% CI	*p*

Suicidal ideation (past 6 months)	CD presence (vs. absent)	4.23	(1.90, 10.49)	< .001
	Disorder count (per 1-unit increase)	1.63	(1.27, 2.14)	< .0001
Lifetime suicide attempt	CD presence (vs. absent)	3.64	(1.71, 8.33)	0.001
	Disorder count (per 1-unit increase)	1.61	(1.26, 2.10)	< .0001

Note. aOR = adjusted odds ratio; CI = confidence interval; CD = concurrent disorder. Estimates are from multivariable logistic regression models adjusted for age, gender, ethnicity, and housing status. Odds ratios for disorder counts are per 1-unit increase.

Comorbidities & latent classes

Depression (51.8%) and anxiety (39.4%) were the most prevalently reported psychiatric diagnosis among those with CDs, non-mutually exclusively. This was followed by psychosis and schizophrenia (29.9%), bipolar disorder (25.6%), PTSD (20.9%), and BPD (13.1%) (Table C.1). An additional 19.7% (n = 27) reported other unlisted disorders, such as ADHD, other personality disorders (e.g. anti-social, multiple personality disorder), fetal alcohol syndrome (FASD), oppositional defiant disorder, and obsessive-compulsive disorder (OCD). Besides ADHD, which was the most named by almost half that reported 'other' (n=11); each other unlisted diagnosis had 1-3 reported occurrences.

Among participants with CDs, over half (n = 83, 59.7%) reported multiple diagnoses in addition to OUD, with the majority having either two or three (Figure 1; Table C.2). Exploratory pairwise tests identified positive correlations among several disorders, most notably anxiety and depression (φ = 0.61, $p_{adj} <$ 0.001) (Figure 2; Appendix D).

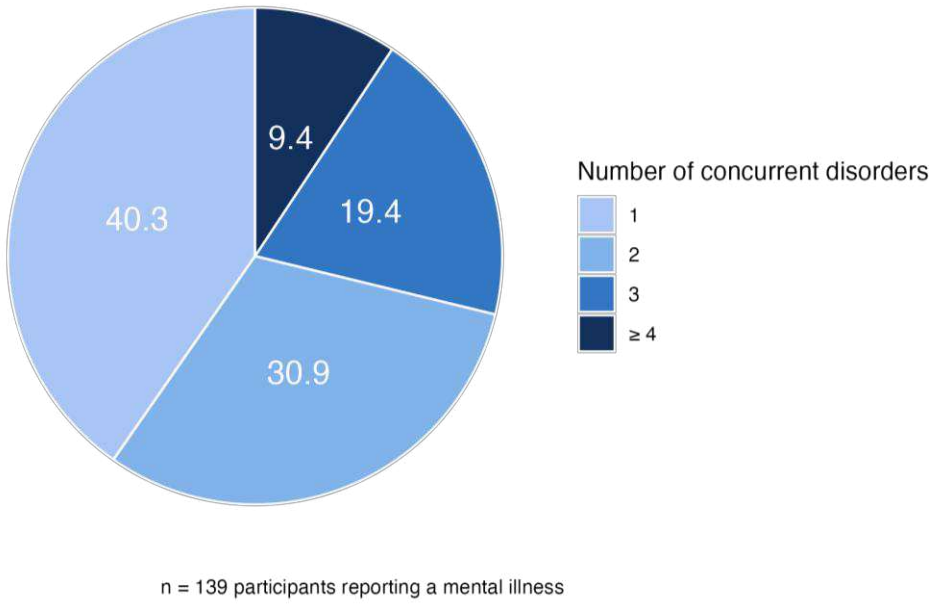


Figure 1. Distribution of the number of concurrent disorders among individuals with CDs (Subgroup N = 139). Combining the disorder count groups, 59.7% (n = 83) of people with CDs had ≥ 2 disorders besides OUD.

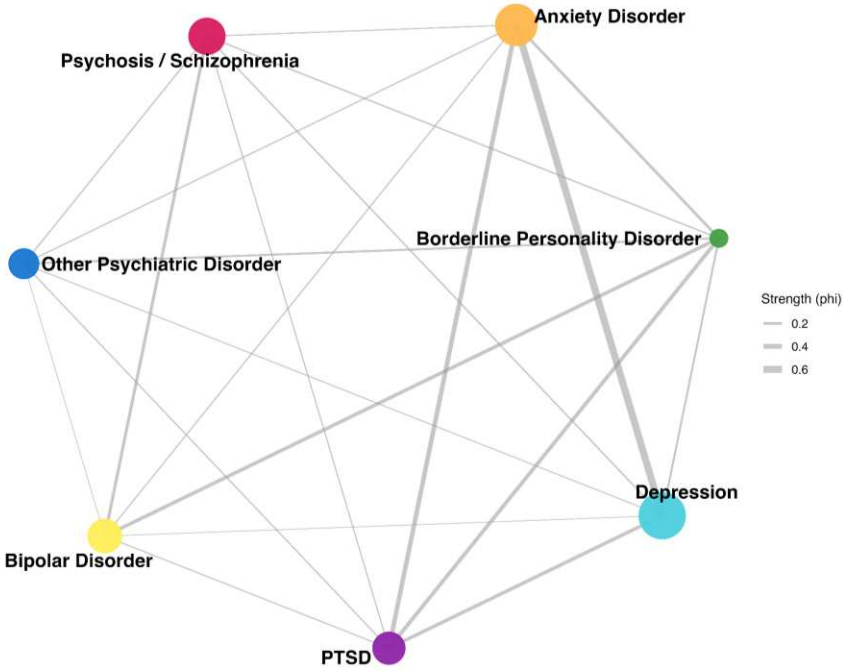


Figure 2. Comorbidity network representing prevalence of overlapping diagnoses from exploratory pairwise analyses (Subgroup N = 139). Circle sizes indicate prevalence, and weight of network lines indicate strength of association (Phi coefficient), values found in Appendix D.

The two-class model was selected for its lowest BIC, adequate classification quality (entropy = 0.754), and absence of small classes (minimum class size 41.7% versus 7.2% and 5.0% for three- and four-class models; Table E1). Class 1 ('Internalizing'; n = 81, 58.3%) had higher probabilities of depression (82.4%), anxiety (67.7%), and PTSD (32.8%); Class 2 ('Bipolar/psychosis-predominant'; n = 58, 41.7%) had higher probabilities of psychosis/schizophrenia (49.4%) and bipolar disorder (41.8%) (Figure 3; Tables E2-E3). BPD was not predominant in either class. Sensitivity analysis excluding 'Other mental illness' yielded similar class structure and assignments (95% agreement; Cohen's $\kappa = 0.895$; Table E4).

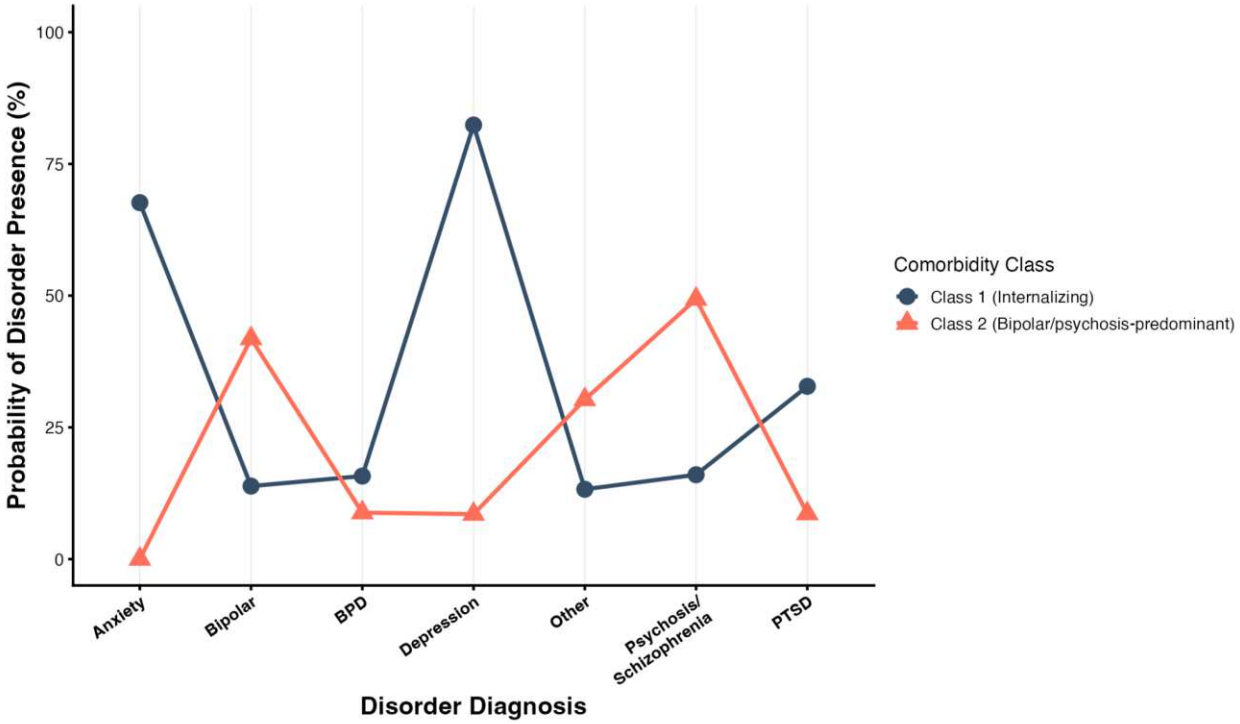


Figure 3. Comorbidity class profiles using a two-class solution/model) from latent class analysis among individuals with CD (Subgroup N = 139). Probability of endorsing each psychiatric diagnosis, by class (Class 1 'Internalizing', n = 81, 58.3%; Class 2 'Bipolar/psychosis-predominant', n = 58, 41.7%).

MHSU Treatment uptake

The majority (82.7%, n = 115) of participants with CD reported receiving any type of MHSU treatment within the past 6 months (psychiatric medication/pharmacotherapy, psychotherapy, OAT/OUD treatment, Other). Noting that respondents were able to report more than one type, among reported MHSU treatment-receiving participants, psychiatric medication was the most common intervention (83.5%, n = 96), with less reporting OUD treatment (60.0%, n = 69) or psychotherapy (40.9%, n = 47).

Descriptively, psychiatric medication was most common among those with psychosis/schizophrenia (75.6%) and bipolar disorder (74.3%), psychotherapy uptake was highest for bipolar disorder (40%) and BPD (38.9%). across disorders (22.2-40%), and OUD treatment was lowest for psychosis/schizophrenia (39.0%). All counts and proportions of treatment types and disorders are provided in Appendix F.

Transforming MHSU treatment categories for main outcome analyses, 72.7% (n = 101) of participants with CD received psychiatric interventions (medication and/or psychotherapy), 50.4% (n = 69) OUD treatment, and 38.7% (n = 53) multi-modal methods (psychiatric and OUD treatments). In bivariate analysis of MHSU treatment category distributions (Figure 4), while Class 1 (Internalizing) descriptively showed a higher proportion receiving OUD and multi-modal treatments than Class 2 (Bipolar/psychosis), but treatment category distributions did not differ significantly between classes ($p > 0.05$).

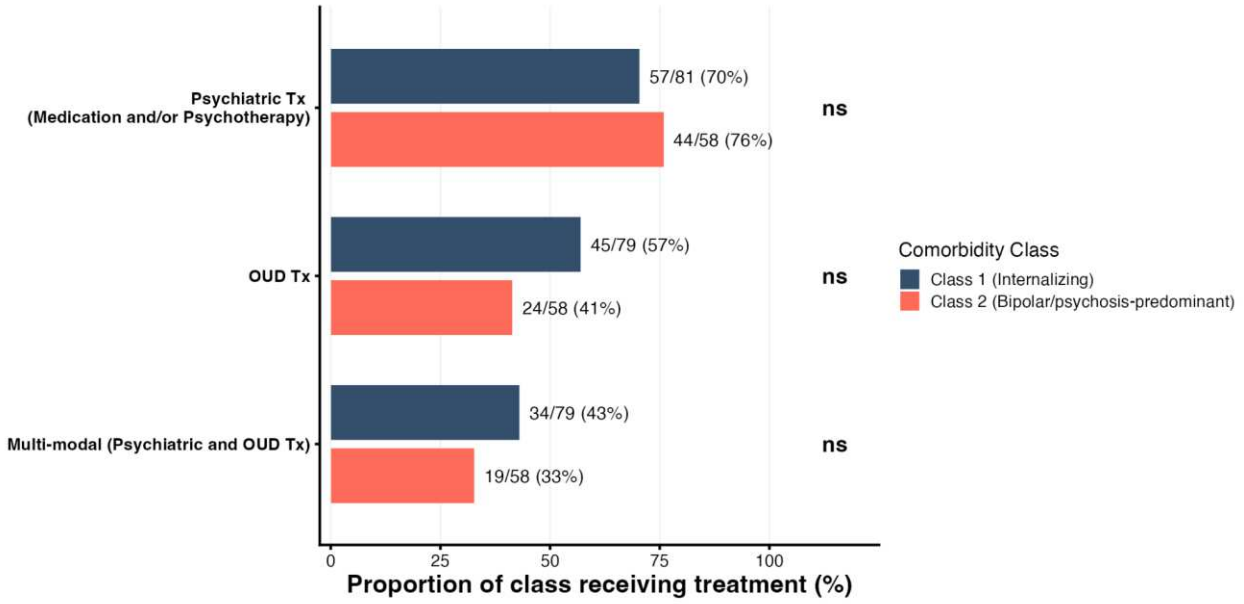


Figure 4. Reported uptake and comorbidity class comparison of recent MHSU treatment (Tx) methods (past 6 months) among individuals with CD (Subgroup N = 139): Psychiatric Tx (medication and/or psychotherapy), OUD Tx (i.e. OAT), and multi-modal care (psychiatric and OUD Tx). Disorder-specific psychiatric treatments organized by comorbidity class prior to MHSU Tx categorizations can be found in Figure F2. * p < .05, ** p < .01, *** p < .001, ns = not significant (chi-square or Fisher's exact, class 1 vs class 2).

Multi-modal care uptake regressions

In the first multivariable regression model, with comorbidity class as the primary predictor (Figure 5; Table G.1), class membership (Class 1 vs. Class 2) was not significantly associated with multi-modal care uptake (aOR = 0.79, 95% CI: 0.32 - 1.88, p = 0.60, Ref = Class 1 'Internalizing'). Women had significantly higher odds of engagement than men (aOR = 2.48, 95% CI: 1.03-6.23, p = 0.046), whereas age, ethnicity, housing stability, and 6-month histories of opioid overdose and suicidal ideation were not significantly associated with the outcome.

In the second model, which included disorder count per-individual as the primary comorbidity-related predictor (Figure 5; Table G.2), the same included covariates in the previous model were not significantly associated with odds of multi-modal care uptake ($p > 0.05$). Findings were consistent in weighted sensitivity analyses excluding 'Other mental illness' (Table G.3).

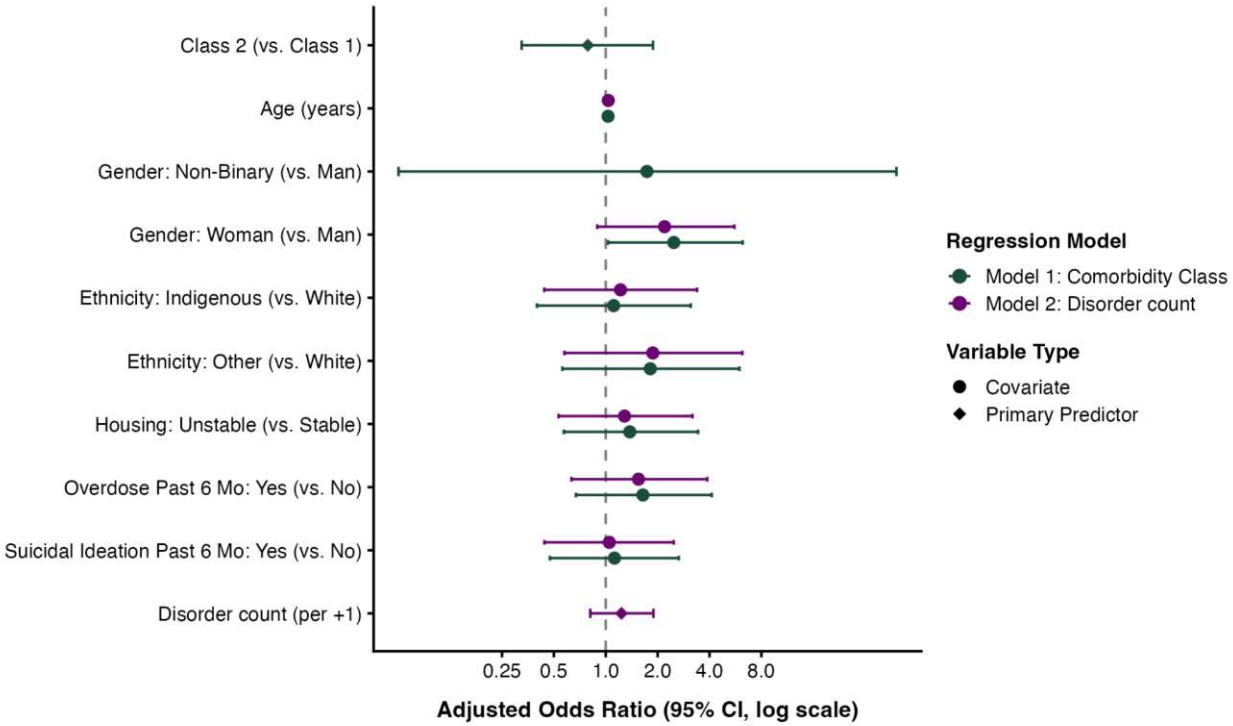


Fig 3. Adjusted associations between psychiatric comorbidity (main predictor), covariates, and receipt of integrated treatment (outcome).

Figure 5. Adjusted associations between psychiatric comorbidity predictors (comorbidity class or disorder count), covariates, and receipt of multi-modal care (outcome) among individuals with CD. Analytic sample size was n = 104 after listwise deletion of missing values across variables.

DISCUSSION

Principal findings

We examined psychiatric comorbidity and reported receipt of psychiatric and OUD treatment among acute-care patients with OUD in a major general hospital in Vancouver, BC. Consistent with previous opioid use research (Jones and McCance-Katz, 2019; Keen et al., 2022; Russolillo et al., 2025a; Santo Jr et al., 2024; Santo et al., 2022), most participants reported a concurrent disorder, alongside substantial burdens of childhood trauma, chronic pain, overdose, and suicidality. Despite these complex needs, only 38.7% of participants with CDs reported receiving both psychiatric and OUD-specific treatment. Neither comorbidity class, disorder count, recent overdose, nor suicidal ideation was significantly associated with multimodal treatment uptake, although clinical severity and need are difficult to estimate from the self-reported number and type of diagnoses alone.

Biopsychosocial needs

Disease models of addiction recognize biopsychosocial mechanisms underlying substance use, including its use to cope with trauma, distress, psychiatric symptoms, or other health needs (Keen et al., 2022; Rizk et al., 2021; Van Draanen et al., 2022). However, in practice, treatment models may insufficiently address these functionalities or underlying broad-spectrum needs in standardized assessments and care (Degenhardt et al., 2019).

The high burden of self-reported CDs is clinically relevant because participants were hospitalized for diverse medical complaints non-exclusive to MHSU conditions, corroborating with high acute care utilization and complications among PWOUD (Rostam-Abadi et al., 2025; Singh and Cleveland, 2020). Earlier subgroup analyses of this cohort identified self-medicative opioid use for chronic pain (Kim et al., 2025), and relationships among suicidality, polysubstance use, and overdose (Minhas et al., 2026). Together with our findings, these patterns underscore the need to assess psychiatric and psychosocial needs in acute-care settings and consider their interplay with opioid-related harms (Haverfield et al., 2019; Prince and Wald, 2018; Scott and Gorey, 2025).

Given the lack of standardized measures of clinical complexity in addiction psychiatry, we conceptualized 'complexity' as the relative degree of co-existing conditions (Valderas et al., 2009; Vila-Rodriguez et al., 2013). Over half of participants with CDs reported multiple concurrent diagnoses, similar to other substance use cohorts (Andersson et al., 2023; Kingston et al., 2017; Vila-Rodriguez et al., 2013), supporting the exploratory use of comorbidity profiles and disorder count as complementary indicators of complexity.

Comorbidities

Internalizing conditions, particularly depression and anxiety, were prevalent and frequently co-occurred in pairwise and LCA, consistent with their overrepresentation among people who use opioids (PWUO) (Langdon et al., 2019). These associations may be bidirectional: mood and anxiety symptoms may contribute to opioid use as a coping strategy, while opioid dependence may worsen psychiatric symptoms (Langdon et al., 2019; Rosoff et al., 2021). PTSD co-occurred in the internalizing class more frequently than the other latent class, potentially reflecting shared distress-related coping mechanisms involved in SUD (Bryant, 2022; Pietrzak et al., 2011). Given the associations of internalizing disorders with childhood trauma, which was highly prevalent in our cohort and other OUD populations (Carliner et al., 2016; Lake et al., 2015; Taplin et al., 2014), trauma-focused assessment and treatment warrant clinical consideration. Notably, reported psychotherapy uptake for internalizing conditions was relatively low compared to psychiatric medication and OUD treatment, despite evidence supporting integrated psychotherapeutic approaches, including CBT (Banerjee and Spry, 2017; McHugh et al., 2024)(and trauma-focused therapies such as EMDR (Carletto et al., 2018; Markus and Hornsveld, 2017; Perez-Dandieu and Tapia, 2014) where individually-relevant.

Psychosis/schizophrenia, bipolar disorder, and BPD were less prevalent than internalizing disorders, as in the broader population and aligning with a meta-analysis of OUD populations (Santo et al., 2022), but still substantial in burden. Psychosis/schizophrenia and bipolar disorder also co-occurred in pairwise analysis and formed a latent class, consistent with their high prevalence with OUD, although the cited study did not examine their co-occurrence (Russolillo et al., 2025a). Often categorized as severe mental

illnesses (SMIs), these disorders carry substantial impairment and mortality burdens that opioid use can compound through reward system dysregulation, thought and reality disruption, and other cognitive deficits (Hunt et al., 2018; Vila-Rodriguez et al., 2013; Walker et al., 2015). BPD did not predominate in either class, possibly because of its multidimensional psychopathology spanning both internalizing and psychotic phenotypes (Bailey and Finn, 2020). Its shared vulnerability in impulsivity and self-harm with OUD also highlights limits of conventional disorder-specific treatment pathways (Trull et al., 2018). Overall, these may warrant individualized assessment and specialized or coordinated addiction psychiatry care, particularly given their higher susceptibility to polysubstance use and amid rising opioid-stimulant co-use (Ciccarone, 2021) and substance-induced psychosis (McKetin et al., 2013; Murrie et al., 2020).

Treatment uptake & access to multi-modal care

A core component of specialized care for CDs is whether psychiatric and SUD services are coordinated to address patients' overlapping needs (Karapareddy, 2019; Wiktorowicz et al., 2019). The higher overall uptake of psychiatric treatment (72.7%) than OUD treatment (50.4%) or both (38.7%) suggests that engagement with mental health services may not translate into comparable access to addiction treatment, possibly reflecting differences in service availability or persistent fragmentation between psychiatric and addiction care (Jones and McCance-Katz, 2019; Priester et al., 2016). Receiving both modalities also did not necessarily indicate that services were structurally integrated or coordinated, a limitation in operationalizing integrated care.

OAT is the first-line, evidence-based treatment for OUD, with reduction in all-cause mortality and retention associated with long-term recovery and reduced overdose risk (Hser et al., 2017; Stahler and Mennis, 2020), but it does not alone stabilize co-occurring psychiatric illness (Brooner et al., 2013; Zhu et al., 2021). Conversely, standalone psychiatric treatment may leave withdrawal, relapse, and overdose risk insufficiently addressed. There is thus a pronounced need to examine how service pathways can enable access to concurrent delivery.

Type of MHSU treatment uptake did not significantly differ by comorbidity class, although the internalizing class exhibited relatively higher reported uptake of OUD and multimodal treatment than the bipolar/psychosis class. Although this could suggest that depression and anxiety may be more readily addressed in concurrent SUD contexts than the multi-faceted needs of SMIs, research with more nuanced data on care access is required to assess whether treatment practices accommodate presentations beyond internalizing conditions.

Treatment services for MHSU may often be delivered sequentially or by providers with expertise in only one domain (Priester et al., 2016; Wiktorowicz et al., 2019)(Restrictive eligibility criteria impedes access when psychiatric symptoms limit entry to SUD treatment or ongoing substance use may be an exclusionary criteria for psychiatric services (NICE 2016; Priester et al., 2016), which is particularly difficult given high prevalence rats of acquired brain injury post-overdose, magnifying psychiatric, neurocognitive, and functional needs (Winstanley et al., 2021; Xavier et al., 2023). Coordinated, cross-disciplinary assessment, hence, is recommended to address these comorbidities alongside integrated care.

Neither comorbidity class nor degree of comorbidity was significantly associated with reported multi-modal MHSU treatment uptake after adjustment, nor were recent overdose and suicidal ideation, despite their clinical relevance and the association of suicidal ideation and attempt with CDs (and higher degree of comorbidity). This may contrast with a machine learning-based study highlighting the need for integrated treatment to reduce overdose risk, beyond fentanyl use, in people with CDs (M. Song et al., 2026). Unstable housing, a common barrier for PWUO (Gaeta Gazzola et al., 2023)(Gaeta et al., 2023), was also not associated with multi modal care despite its high prevalence. These findings do not necessarily establish that clinical needs were unmet; rather, reported multimodal uptake did not vary by the measured indicators of complexity and severity in this sample. Given rising discussions on 'mandatory' or 'compassionate' care in severe MHSU contexts (Kisely et al., 2024; Wilson et al., 2025), future studies should examine whether service infrastructure, such as supportive housing and residential treatment, can modify care engagement (Komaromy et al., 2023; McLaughlin et al., 2021).

The limited predictive capacity of our exploratory measures may reflect this gap in assessing complexity (Meghani et al., 2013). Targeted research on psychiatric comorbidity and complexity could support measurement-based care; where needs-relevant assessment tools can advance precision medicine in SUD and CD treatment (Samokhvalov et al., 2024).

Although gender was not significantly correlated with CD presence, women had significantly higher odds of multi-modal care than men in the class-based model, which may reflect gender differences in MHSU treatment engagement or help-seeking (Chen et al., 2013), and warrants investigation of phenotype-specific needs, referral pathways and service access. At the bivariate level, younger age was correlated with having a CD, suggesting implications for assessing psychiatric needs and substance use patterns among younger adults with OUD.

System implications

While integrated care models exist (ASAM, 2026), they are not broadly implemented. As one example of limited applied models, Redfish Healing Centre is a tertiary-level inpatient program in BC for complex MHSU needs (Hakobyan et al., 2020). The centre's interdisciplinary, trauma- and culturally responsive approach has reported significant reductions in psychopathology and substance use (Schütz et al., 2013, 2025). However, access to such programs is limited relative to the broader population with CDs (Cheung et al., 2026; Nosyk et al., 2022), supporting the need to evaluate scalable approaches that improve coordination across acute care, community mental health, and addiction services.

LIMITATIONS

This study's sample enabled a focus on concurrent disorders in hospitalized patients within an opioid-use context, capturing individuals who may be underrepresented in addiction treatment studies due to lower long-term treatment retention or prior negative healthcare experiences (Chan Carusone et al., 2019; Galarneau et al., 2023). However, physician-identified convenience sampling at a single site limits generalizability to PWOUD in broader, non-acute-care populations.

As such, mental health conditions and treatment receipt were self-reported, which has has demonstrated reliability in substance use research (Napper et al., 2010; Secades-Villa and Fernández-Hermida, 2003), and the observed prevalence and comorbidity patterns were broadly consistent with previous OUD studies. Responses, however, may be affected by recall and reporting biases.

Medication types and psychotherapeutic methods were not collected to minimize recall bias, limiting treatment-specific interpretation. Moreover, the 17.3% of participants with CDs who reported no MHSU treatment were not characterized separately, as the survey did not directly assess barriers or preferences. While MHSU treatment uptake, overdose, and suicidality were captured within the same 6-month periods, the cross-sectional design limits temporal specificity.

These limitations preclude causal inference but provide a basis for further investigation across community, outpatient, and tertiary-care settings. Longitudinal, chart-review, or administrative-data studies could clarify diagnostic-specific needs, service-level barriers, and outcome trajectories to assess how coordination and continuity of care can support people with complex MHSU needs.

CONCLUSION

OUD is interconnected with concurrent mental health conditions and mortality-related outcomes such as overdose and suicide, yet current applied models of care do not sufficiently reflect this across settings. The complex MHSU needs of this acute care population highlight a needed paradigm shift from crisis stabilization to care focused on both survival and long-term recovery, addressing the cycles in overdose, suicide risk, marginalization, and premature death.

Changing these trajectories requires moving beyond siloed mental health and addiction services to prevention and an integrated, recovery-oriented response whenever MHSU challenges present at any care level. Cross-disciplinary training, guidelines, and assessment protocols can improve individualization to both clinical and psychosocial needs of people with CDs. Emerging integrated care models and targeted clinical research can improve service coordination across the care continuum, including through trauma care, suicide prevention, adjunctive pain management, and clinically supported housing.

Despite resource limitations, building capacity for integrated care remains a critical priority in BC and other regions affected by the opioid epidemic and accompanying morbidity and drug supply adulteration. If concurrent disorders are not an exception among PWOUD , access to care that addresses both should not remain uncommon.

Author Contributions

AWK: Writing – original draft, Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – review & editing. MSh: Writing — review & editing, Investigation, Writing – original draft. EC, GM: Writing – review & editing. MSo: Conceptualization, Methodology, Writing – review & editing. BM: Validation, Formal analysis, Visualization. AL: Writing – review & editing, Conceptualization. AS: Writing – review & editing, Validation, Visualization. FC:

Conceptualization, Methodology, Writing – review & editing. VT: Funding acquisition, Writing – review & editing. RS: Supervision, Writing – review & editing. MJI: Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing. RMK: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing.

Author Disclosures
All authors of this manuscript have no competing interests to declare.

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Data Statement
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Statement
This study was conducted in accordance with the ethical standards set by the World Medical Association Declaration of Helsinki and followed the International Committee of Medical Journal Editors (ICMJE) recommendations. The study protocol was reviewed and approved by the University of British Columbia's Clinical Research Ethics Board (CREB), with approval granted on January 16 2023 under reference number H22-00879. All participants were fully informed of the study's purpose and procedures, and written informed consent was obtained from each participant prior to their involvement. The privacy rights of the participants were rigorously protected throughout the study.

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This study took place on the traditional and unceded territories of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), and sel̓il̓wi- tulh (Tsleil-waututh) Nations. The authors thank the clinical staff at VGH and research volunteers for their support, including Stella Argentopoulos, Rishika Daswani, and Raha Masoudi for their valuable contributions during earlier stages of the project. Finally, the research team extends its gratitude to all study participants for sharing their lived experiences.

APPENDICES

Appendix A. Multi-select survey questions asking about receiving substance use disorder treatment, and any psychiatric diagnoses and treatments received in the past 6 months.

Volunteer: Thank you for answering those questions. I would like to ask some more questions about the types of treatment you have been in over the past 6 months for substance use specifically:

Q7.3 Are you currently in any kind of substance use disorder treatment? (YES/NO). If 'yes', what treatment?
Yes _____

No
Prefer not to say
Other _____

Q7.9 Have you participated in an opiate agonist treatment, such as Suboxone, Kadian, Methadone? (YES/NO) What was the medication? [Multi-select]

- ❑ Suboxone
- ❑ Kadian
- ❑ Methadone
- ❑ Sublocade
- ❑ iOAT/injectable OAT (heroin/diacetylmorphine/hydromorphone/dilaudid)
- ❑ Other _____
- ❑ None of the above

Q48. Have you ever been diagnosed with a mental illness by a health professional? If "Yes" , please specify the mental illness(es). [Multi-select]

- ❑ "Depression: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)
- ❑ "Anxiety disorder: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)
- ❑ "Bipolar disorder: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other: Please specify" (Select/Text input)
- ❑ "Psychosis/Schizophrenia: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)
- ❑ "Borderline personality disorder: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)

- ❑ "Post-traumatic stress disorder: Over the past 6 months, have you been treated for it with medication and/or psychotherapy by a health professional?" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)
- ❑ "Other mental illness: Please specify" (Select)
    - o "Medication" (Select)
    - o "Psychotherapy" (Select)
    - o "Other:" (Select/Text input)
- ❑ "No"
- ❑ "Rather not answer"

Appendix B. Supplementary multivariate regressions of concurrent disorder status and comorbidity burden with suicide-related outcomes.

Outcome	Predictor	Model	Term	OR	CI (lower)	CI (upper)	OR (95% CI)	*p*-value
Suicidal ideation in past 6 months	Has a concurrent disorder	Adjusted	Has CD: Yes vs. No	4.229	1.897	10.493	4.23 (1.90–10.49)	0.001
Suicidal ideation in past 6 months	Number of concurrent disorders	Adjusted	Per additional CD	1.634	1.274	2.141	1.63 (1.27–2.14)	0.000
Lifetime suicide attempt	Has a concurrent disorder	Adjusted	Has CD: Yes vs. No	3.636	1.712	8.335	3.64 (1.71–8.33)	0.001
Lifetime suicide attempt	Number of concurrent disorders	Adjusted	Per additional CD	1.610	1.259	2.098	1.61 (1.26–2.10)	0.000

Appendix C. Summary distribution tables of concurrent disorders and counts.

Table C.1. Distribution (count, %) of reported diagnoses among participants with concurrent disorders (in addition to OUD) (Subgroup N =139).

Diagnosis	Count (n)	% of People with CD
Depression	71	51.82
Anxiety Disorder	54	39.42

Bipolar Disorder	35	25.55
Psychosis/Schizophrenia	41	29.93
Borderline Personality Disorder	18	13.14
Post-Traumatic Stress Disorder	32	23.36
Other Mental Illness	27	19.71

Table C.2. Distribution of number of concurrent diagnoses among participants with concurrent disorders (in addition to OUD) (Subgroup N = 139). Combining disorder count groups, 59.7% (n = 83) of people with CD's had ≥ 2 disorders.

Disorder count	Count (n)	% of People with CD
1	56	40.29
2	43	30.942
3	27	19.42
4	7	5.041
5	4	2.88
6	2	1.44

Appendix D. Phi (φ) coefficients and Benjamini-Hochberg-adjusted *p*-values for pairwise associations between psychiatric disorders. * $p < .05$, ** $p < .01$, *** $p < .001$.

Disorder 1	**Disorder 2**	**phi**	**Adjusted p-value**
Depression	Anxiety Disorder	0.614	0.000**
Depression	PTSD	0.264	0.001**
Depression	Psychosis / Schizophrenia	-0.076	0.575
Depression	Borderline Personality Disorder	0.124	0.183
Depression	Other Psychiatric Disorder	-0.037	0.669
Depression	Bipolar Disorder	0.006	0.957
Anxiety Disorder	PTSD	0.366	0.000***
Anxiety Disorder	Borderline Personality Disorder	0.193	0.019*
Anxiety Disorder	Other Psychiatric Disorder	-0.059	0.605
Anxiety Disorder	Bipolar Disorder	-0.053	0.607

Anxiety Disorder	Psychosis / Schizophrenia	-0.041	0.658
Bipolar Disorder	Borderline Personality Disorder	0.269	0.001**
Bipolar Disorder	Psychosis / Schizophrenia	0.222	0.006***
Bipolar Disorder	PTSD	0.050	0.607
Bipolar Disorder	Other Psychiatric Disorder	0.004	0.957
Psychosis / Schizophrenia	Borderline Personality Disorder	-0.073	0.575
Psychosis / Schizophrenia	Other Psychiatric Disorder	-0.062	0.605
Psychosis / Schizophrenia	PTSD	0.049	0.607
PTSD	Other Psychiatric Disorder	0.060	0.605
Borderline Personality Disorder	PTSD	0.292	0.000***
Borderline Personality Disorder	Other Psychiatric Disorder	0.125	0.183

Appendix E. Latent class analysis (LCA) results.

Table E.1. Fit statistics for latent class models with 1 to 4 classes (primary analysis, all eight disorders). Sensitivity analyses excluding the "other" disorder option were run for the two candidate solutions (2- and 3-class models).

Analysis	Model	Classes	N	Parameters	LogLik	AIC	BIC	aBIC	Gsq	Entropy	Minimum Class N	Minimum Class %
Primary: including Other	Primary 1 Class	1	139	7	-551.03	1116.06	1136.60	1114.45	218.39		139	100
Primary: including Other	Primary 2 Class	2	139	15	-512.62	1055.24	1099.26	1051.80	141.57	0.754	58	41.72661871
Primary: including Other	Primary 3 Class	3	139	23	-497.75	1041.49	1108.99	1036.22	111.83	0.839	10	7.194244604
Primary: including Other	Primary 4 Class	4	139	31	-485.41	1032.82	1123.79	1025.71	87.15	0.812	7	5.035971223
Sensitivity	Sensitivi	2	139	13	-	915.	953.	912.	73.8	0.741	51	36.69064

: excluding Other	ty 2 Class				444.82	63	78	65	5			748
Sensitivity : excluding Other	Sensitivity 3 Class	3	139	20	-430.88	901.75	960.44	897.17	45.96	0.826	7	5.035971223

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = sample-size-adjusted BIC; G^2 = likelihood-ratio chi-square; Entropy = classification certainty (0 to 1; higher is better). Lower AIC, BIC, aBIC, and G^2 indicate better fit. Minimum Class = size of the smallest class.

Table E.2. Item-response probabilities by class for the selected 2-class model, in the primary and sensitivity analyses, with absolute disorder.

Disorder	**Class**	**Primary**	**Sensitivity**	**Absolute Difference**
Depression	Class 1	0.824	0.796	0.028
Depression	Class 2	0.085	0.069	0.016
Anxiety	Class 1	0.676	0.642	0.034
Anxiety	Class 2	0.000	0.000	0.000
Bipolar	Class 1	0.139	0.138	0.001
Bipolar	Class 2	0.418	0.444	0.026
Psychosis/Schizophrenia	Class 1	0.160	0.154	0.006
Psychosis/Schizophrenia	Class 2	0.494	0.531	0.037
BPD	Class 1	0.158	0.154	0.004
BPD	Class 2	0.088	0.088	0.000
PTSD	Class 1	0.328	0.330	0.002
PTSD	Class 2	0.086	0.062	0.024

Table E.3. Class membership for 2-class model, showing proportion of participants assigned to each latent class. Ave PP = Average posterior probability of class membership.

Model	Class	N	Percentage	Model Estimated Percentage	AvePP
2-Class (Primary)	Class 1	81	58.3	59.6	0.952
2-Class (Primary)	Class 2	58	41.7	40.4	0.903
2-Class (Sensitivity)	Class 1	88	63.3	62.7	0.941
2-Class (Sensitivity)	Class 2	51	36.7	37.3	0.914

Table E.4. Agreement in class assignment between the primary and sensitivity 2-class models (Subgroup N = 139).

	Sensitivity model		
Primary model	Class 1	Class 2	Total
Class 1	81	0	81
Class 2	7	51	58
Total	89	51	139

Note. Cells show the number of participants assigned to each combination of classes. Bolded cells on the diagonal are participants assigned to the same class in both models. Percent agreement = 95%; Cohen's κ = 0.895, indicating high agreement. The two participants who differed were assigned to Class 2 in the primary model and Class 1 in the sensitivity model.

Appendix F. Disorder-specific treatments prior to MHSU categorizations.

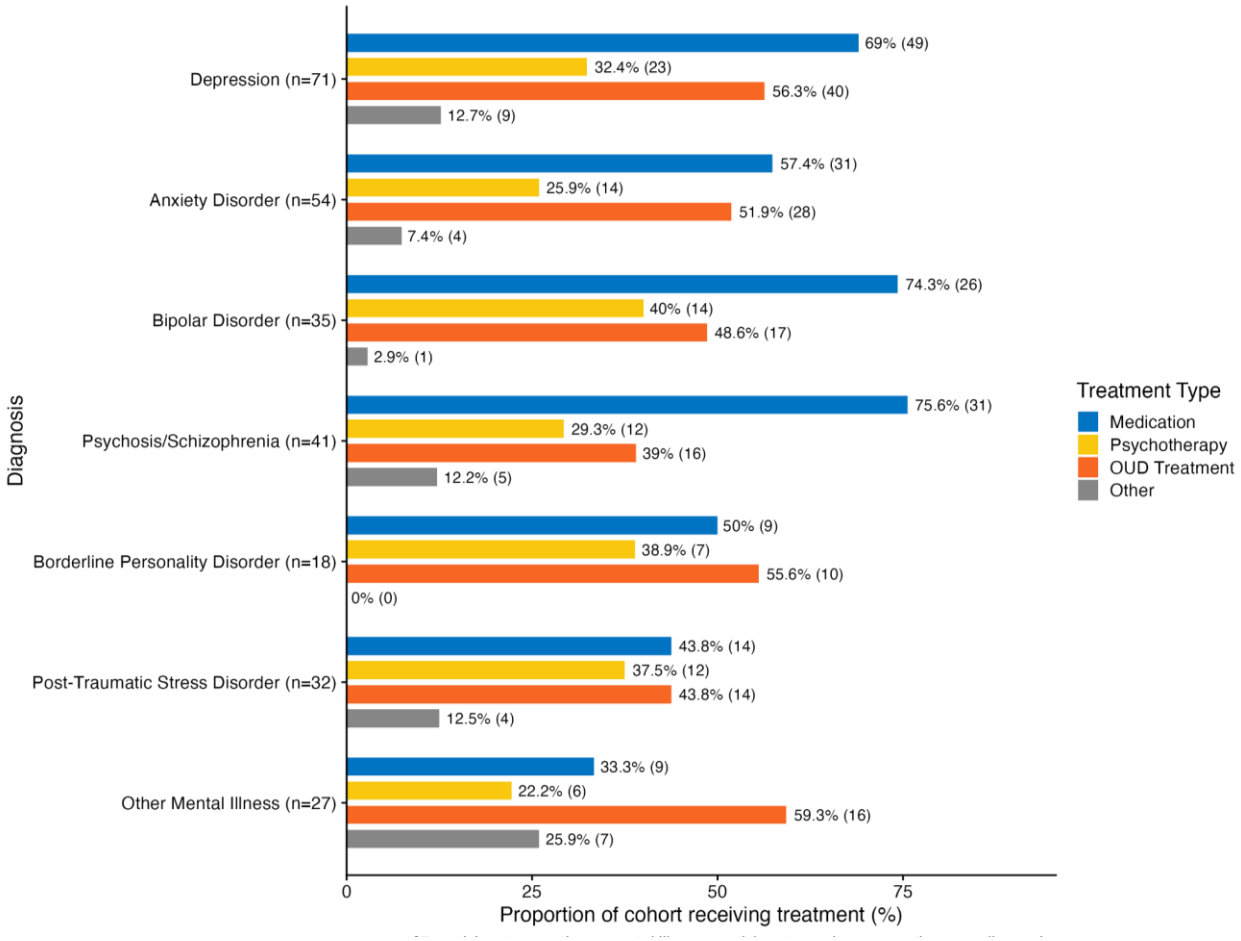


Figure F.1. Proportion of CD cohort receiving treatments by diagnosis (n = 115), demonstrating reported medication, psychotherapy, and OUD treatment uptake per diagnosis. N = 139 (analytic subgroup) reported a mental illness; participants can have more than one diagnosis.

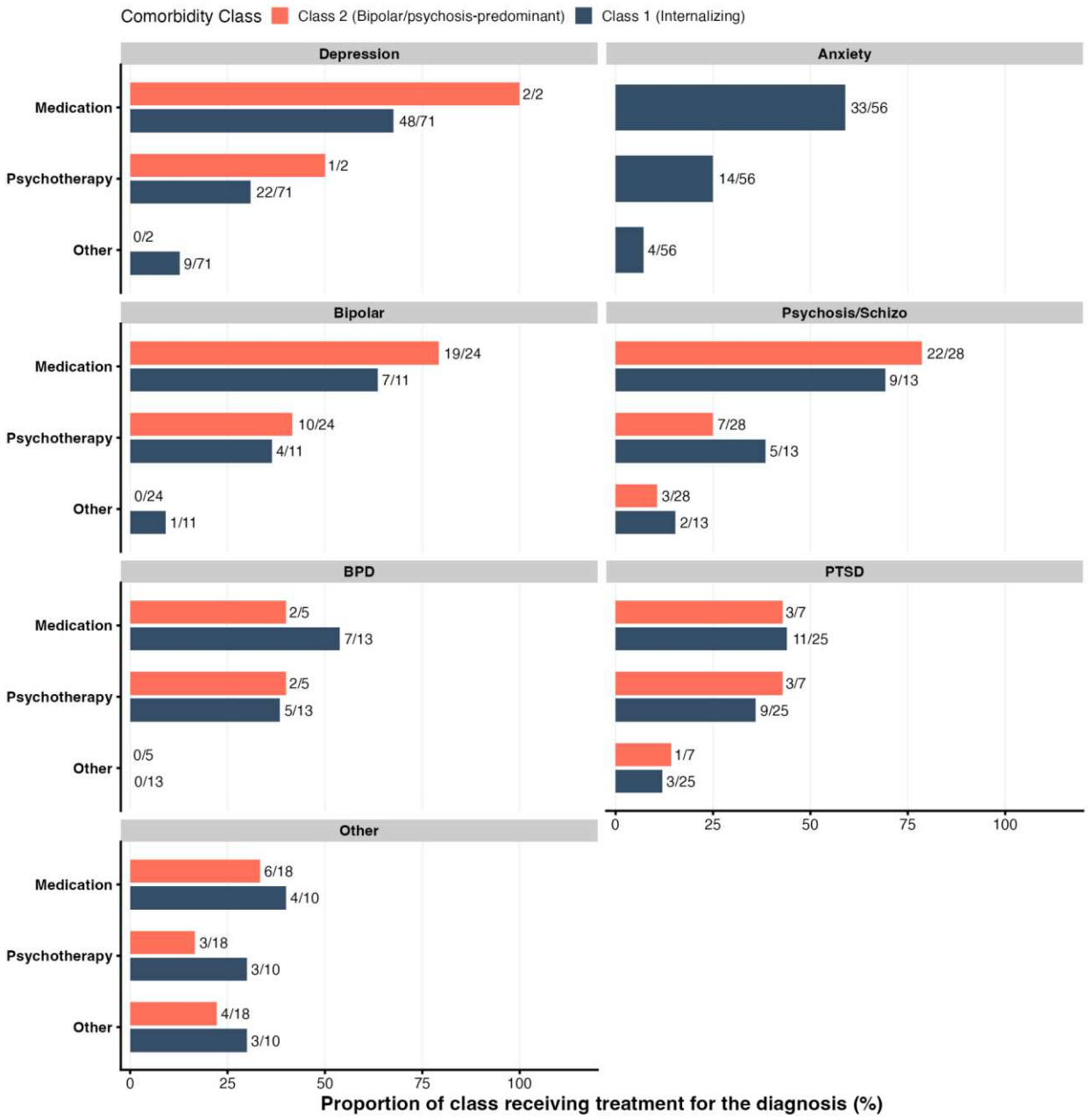


Fig S2. Treatment uptake by diagnosis and comorbidity class, among participants who endorsed each diagnosis (n/N shown).

Figure F.2. Psychiatric treatment category stratification by diagnosis among participants who endorsed each diagnosis (n/N show).

Appendix G. Multivariable logistic regression tables of multi-modal care access.

Table G.1. Multivariable logistic regression model assessing the odds of multi-modal care uptake with 'Comorbidity Class' as the main predictor (Model 1). Multi-modal care ~ comorbidity class + covariates.

Characteristic	**OR**	**95% CI**	***p*-value**
Comorbidity Class			
1	—	—	
2	0.79	0.32, 1.88	0.6
Age	1.03	0.99, 1.08	0.2
Gender			
Man	—	—	
Non-Binary	1.73	0.06, 48.6	0.7
Woman	2.48	1.03, 6.23	0.046
Ethnicity			
White	—	—	
Indigenous	1.11	0.40, 3.11	0.8
Other	1.81	0.56, 5.97	0.3
Housing Stability			
Stable	—	—	
Unstable	1.38	0.57, 3.43	0.5

Overdose (Past 6 months)			
No	—	—	
Yes	1.64	0.67, 4.12	0.3
Suicidal Ideation (Past 6 months)			
No	—	—	
Yes	1.12	0.47, 2.65	0.8

Abbreviations: CI = Confidence Interval, OR = Odds Ratio

Table G.2. Multivariable logistic regression model assessing the odds of multi-modal care uptake, with 'disorder count' per individual as the main predictor (Model 2). Multi-modal Tx ~ disorder count + covariates.

Characteristic	**OR**	**95% CI**	***p*-value**
Disorder count	1.23	0.81, 1.89	0.3
Age	1.04	0.99, 1.08	0.12
Gender			
Man	—	—	
Woman	2.19	0.89, 5.58	0.091
Ethnicity			

White	—	—	
Indigenous	1.22	0.44, 3.39	0.7
Other	1.88	0.58, 6.20	0.3
Housing Stability			
Stable	—	—	
Unstable	1.29	0.53, 3.18	0.6
Overdose (Past 6 months)			
No	—	—	
Yes	1.55	0.63, 3.88	0.3
Suicidal Ideation (Past 6 months)			
No	—	—	
Yes	1.05	0.44, 2.48	>0.9

Abbreviations: CI = Confidence Interval, OR = Odds Ratio

Table G.3. Weighted sensitivity checks for multivariable logistic regression models ofmulti-modal care, with primary and sensitivity analysis results.

Model	**N**	**Term**	**OR**	**CI (low)**	**CI (high)**	***p*-value**
Primary: GLM, modal class (lca_2)	104	class2	0.787	0.325	1.88	0.5898
Primary: GLM, modal class (lca_2)	104	Q2_age	1.032	0.989	1.078	0.1532

Primary: GLM, modal class (lca_2)	104	Q3_genderNon-Binary	1.734	0.063	48.636	0.711
Primary: GLM, modal class (lca_2)	104	Q3_genderWoman	2.484	1.032	6.235	0.046
Primary: GLM, modal class (lca_2)	104	Q4_ethnicityIndigenous	1.112	0.399	3.112	0.8389
Primary: GLM, modal class (lca_2)	104	Q4_ethnicityOther	1.814	0.56	5.966	0.3182
Primary: GLM, modal class (lca_2)	104	Q79_housing_binaryUnstable	1.379	0.571	3.433	0.4799
Primary: GLM, modal class (lca_2)	104	Q19_last_overdose_6m_ppYes	1.642	0.671	4.119	0.2806
Primary: GLM, modal class (lca_2)	104	Q67_suicidal_thoughts_6mYes	1.124	0.474	2.653	0.7894
Sensitivity A: posterior-weighted (svyglm)	104	class2	0.796	0.334	1.897	0.6037
Sensitivity A: posterior-weighted (svyglm)	104	Q2_age	1.03	0.985	1.078	0.1902
Sensitivity A: posterior-weighted (svyglm)	104	Q3_genderNon-Binary	1.811	0.151	21.776	0.6365
Sensitivity A: posterior-weighted (svyglm)	104	Q3_genderWoman	2.323	0.883	6.116	0.0871
Sensitivity A: posterior-weighted (svyglm)	104	Q4_ethnicityIndigenous	1.096	0.4	3.005	0.8568
Sensitivity A: posterior-weighted (svyglm)	104	Q4_ethnicityOther	1.746	0.543	5.609	0.3456
Sensitivity A: posterior-weighted (svyglm)	104	Q79_housing_binaryUnstable	1.336	0.504	3.544	0.5569
Sensitivity A: posterior-weighted (svyglm)	104	Q19_last_overdose_6m_ppYes	1.551	0.629	3.826	0.337
Sensitivity A: posterior-weighted (svyglm)	104	Q67_suicidal_thoughts_6mYes	1.214	0.511	2.887	0.6573

Sensitivity B: classes from LCA excluding Other	104	class2	0.74	0.29	1.842	0.5189
Sensitivity B: classes from LCA excluding Other	104	Q2_age	1.031	0.988	1.077	0.1675
Sensitivity B: classes from LCA excluding Other	104	Q3_genderNon-Binary	1.773	0.064	50.142	0.7007
Sensitivity B: classes from LCA excluding Other	104	Q3_genderWoman	2.438	1.011	6.121	0.0509
Sensitivity B: classes from LCA excluding Other	104	Q4_ethnicityIndigenous	1.108	0.399	3.089	0.8426
Sensitivity B: classes from LCA excluding Other	104	Q4_ethnicityOther	1.84	0.567	6.069	0.3079
Sensitivity B: classes from LCA excluding Other	104	Q79_housing_binaryUnstable	1.389	0.575	3.462	0.4704
Sensitivity B: classes from LCA excluding Other	104	Q19_last_overdose_6m_ppYes	1.604	0.652	4.042	0.3067
Sensitivity B: classes from LCA excluding Other	104	Q67_suicidal_thoughts_6mYes	1.136	0.481	2.674	0.7694
Comparison: number of disorders (GLM)	102	num_disorders	1.224	0.809	1.871	0.3418
Comparison: number of disorders (GLM)	102	Q2_age	1.033	0.991	1.079	0.1274
Comparison: number of disorders (GLM)	102	Q3_genderWoman	2.155	0.892	5.379	0.092
Comparison: number of disorders (GLM)	102	Q79_housing_binaryUnstable	1.317	0.551	3.24	0.5401
Comparison: number of disorders (GLM)	102	Q19_last_overdose_6m_ppYes	1.418	0.6	3.407	0.4277
Comparison: number of disorders (GLM)	102	Q67_suicidal_thoughts_6mYes	1.074	0.454	2.529	0.8703

Appendix H. Missing data summary by analysis. Analyses used complete cases. Prevalence of concurrent disorders was calculated among 200 of 256 participants with observed mental illness data. Latent class analysis included all 139 participants with at least one concurrent disorder. Both regression models included 104 of 139 participants (25.2% excluded) with complete outcome and covariate data.

Analysis/Sample	Eligible participants (n)	Included participants with observed data (N)	Missing, n (%)	Count (n/N)
Prevalence of CD's	256	200	56 (21.9)	139/200
Latent class analysis	139	139	0	-
Regression model 1: comorbidity class and multimodal care	139	104	35 (25.2)	104/139
Regression model 2: disorder count and multimodal care	139	104	35 (25.2)	104/139

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