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Comorbid substance use disorders with other Axis I and II mental disorders among treatment-seeking Asian Americans, Native Hawaiians/Pacific Islanders, and mixed-race people

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ABSTRACT

Little is known about behavioral healthcare needs of Asian Americans (AAs), Native Hawaiians/Pacific Islanders (NHs/PIs), and mixed-race people (MRs)—the fastest growing segments of the U.S. population. We examined substance use disorder (SUD) prevalences and comorbidities among AAs, NHs/PIs, and MRs ($N = 4572$) in a behavioral health electronic health record database. DSM-IV diagnoses among patients aged 1–90 years who accessed behavioral healthcare from 11 sites were systematically captured: SUD, anxiety, mood, personality, adjustment, childhood-onset, cognitive/dementia, dissociative, eating, factitious, impulse-control, psychotic/schizophrenic, sleep, and somatoform diagnoses. Of all patients, 15.0% had a SUD. Mood (60%), anxiety (31.2%), adjustment (30.9%), and disruptive (attention deficit-hyperactivity, conduct, oppositional defiant, disruptive behavior diagnosis, 22.7%) diagnoses were more common than others (psychotic 14.2%, personality 13.3%, other childhood-onset 11.4%, impulse-control 6.6%, cognitive 2.8%, eating 2.2%, somatoform 2.1%). Less than 1% of children aged <12 years had SUD. Cannabis diagnosis was the primary SUD affecting adolescents aged 12–17. MRs aged 35–49 years had the highest prevalence of cocaine diagnosis. Controlling for age at first visit, sex, treatment setting, length of treatment, and number of comorbid diagnoses, NHs/PIs and MRs were about two times more likely than AAs to have ≥2 SUDs. Regardless of race/ethnicity, personality diagnosis was comorbid with SUD. NHs/PIs with a mood diagnosis had elevated odds of having SUD. Findings present the most comprehensive patterns of mental diagnoses available for treatment-seeking AAs, NHs/PIs, and MRs in the real-world medical setting. In-depth research is needed to elucidate intraracial and interracial differences in treatment needs.

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1. Introduction

Substance use disorders (SUDs; alcohol- or drug-related disorders) take a heavy toll on the affected individuals and their families. Substance abuse hampers educational attainment and productivity, leads to criminal activities, affects almost all major organs of users, and results in premature mortality (Brick, 2008; Clark et al., 2008; Wickizer, 2013). An estimated 11% of U.S. youth aged 13–18 years have SUD in their lifetime, which is close to rates for oppositional defiant disorder (ODD; 13%), attention deficit-hyperactivity disorder (ADHD; 9%), and conduct disorder (CD; 7%) and lower than any anxiety (32%) or mood (14%) disorder (Merikangas et al., 2010). Among U.S. individuals aged ≥12 years, approximately 8% have had a SUD in the past year (SAMHSA, 2012a). Persons with SUD often have comorbid mental conditions, which may include internalizing (depressive), externalizing (AHDH), or personality disorders (Najt et al., 2011; O'Neil et al., 2011; Wu et al., 2011a). Occurrences of comorbidities are related to multiple mechanisms (e.g., self-medication of substance use for relieving mental stress, substance-related neurotoxic effects on mental health, shared genetic or environmental factors), and severity generally elevates with an increased number of diagnoses (Glantz et al., 2009; Swendsen et al., 2010). Treatment-use data from a large electronic health record (EHR) database demonstrate that patients with comorbid SUD and mental disorders are among the most severe

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subset of patients: they received more clinical diagnoses, had a longer length of treatment, and used more costly inpatient and emergency care than patients without comorbid SUD (Wu et al., 2011a, 2013a).

Due to costs, stigma, and fragmentation of the healthcare system, individuals with SUD often received inadequate care for their condition (Pating et al., 2012; Wu et al., 2011b). Passage of the Affordable Care Act is expected to improve healthcare for all medical conditions, especially SUD, for members of nonwhite communities (Pating et al., 2012). To inform strategies for improving healthcare, one step is to understand the extent of SUD and comorbidities affecting people in the real-world settings. During the past decade, there were major shifts in the racial/ethnic composition of nonwhite populations, particularly Asian Americans [AAs] (14.7 million; 4.8% of the U.S. population), Native Hawaiians/Pacific Islanders [NHs/PIs] (0.5 million; 0.2%), and mixed-race (MR) individuals or people of more than one race (9.0 million; 2.9%). These populations grew three times faster than the total U.S. population (U.S. Census Bureau, 2011). However, little is known about the extent of SUD and comorbidities in these growing populations.

The rising numbers of AAs, NHs/PIs, and MRs require empirical data to inform behavioral healthcare. To improve health statistics for these overlooked groups, the U.S. Census Bureau began in 2000 to report AAs, NHs/PIs, and MRs (Srinivasan and Guillermo, 2000). However, because of relatively small samples of these groups participated in a typical study, AAs and NHs/PIs are either pooled as "other" or "Asian" or excluded from analysis; MRs are infrequently reported. The Monitoring the Future report has not provided substance use estimates for these groups (Johnston et al., 2012). The Treatment Episode Data Set (TEDS) reports findings of substance abuse treatment admissions for pooled AAs/NHs/PIs and does not have estimates for MRs (SAMHSA, 2012a). In TEDS, alcohol, marijuana, and stimulants were the primary substances of abuse for pooled AAs/NHs/PIs (SAMHSA, 2012a), and the majority (>50%) of AAs/NHs/PIs were either not employed or unemployed (SAMHSA, 2010). National data show that the majority of NHs/PIs and MRs live in lower-income families than whites and AAs, suggesting a greater need for support to address SUD care (Wu et al., 2013b,c).

Available substance use estimates for these groups rely mainly on adolescent data and lack information on SUD and comorbidity (Makimoto, 1998; Wallace et al., 2002). Prior data suggested prevalent rates of substance use among NHs/PIs or MRs (Edwards et al., 2010; Kim and McCarthy, 2006). Among 10th-graders, 52% of NHs used marijuana in their lifetime compared with 46% of whites (Wong et al., 2004). Among youths aged 16–23 years, MRs reported high prevalences of lifetime use of methamphetamine (MR: 11.4%, White: 6.1%, Black: 0.5%, Hispanic: 3.4%) and ecstasy (MR: 21.9%, White: 16.8%, Black: 4.2%, Hispanic: 8.9%) (Wu et al., 2006). Recent findings from people aged ≥12 years showed higher prevalences of alcohol, tobacco, and drug use among NHs/PIs and MRs than AAs (Wu et al., 2013b,c). MRs had a higher 12-month prevalence of any drug use (21.1%) than Whites (14.9%), NHs/PIs (16.4%), and AAs (7.5%) (Wu et al., 2013b). However, there is a dearth of SUD data for these populations. One study determined SUD prevalences among adolescents (aged 12–17) and found higher 12-month prevalences of drug use disorders among MRs (6.4%) than Whites (5.0%), Blacks (3.7%), Hispanics (4.4%), and AAs/NHs/PIs (2.0%) (Wu et al., 2011c). Among adolescents who used alcohol or drugs in the past year, a high proportion (25.2%) of MRs had SUD (Whites 22.9%, Blacks 15.5%, Native-Americans 31.5%, AAs/NHs/PIs 14.9%, Hispanics 21.0%) (Wu et al., 2011c). These findings support the need to disaggregate SUD estimates for AAs and NHs/PIs and to include MRs in research.

Even less is known about comorbidities. The 2002–2003 National Latino and Asian American Study (NLAAS) showed that 3.6% ($n = 71$) of AAs had a lifetime alcohol disorder (Chae et al., 2008), and that 17.3% had any lifetime disorder, including substance, depressive, and anxiety disorders (Takeuchi et al., 2007). The NLAAS findings have not provided data for individual drug use disorders and comorbid SUD for AAs. The 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) is presently the largest U.S. survey of comorbidities ($N = 43,093$) and includes 1332 non-Hispanic AAs/NHs/PIs (Huang et al., 2006). In NESARC, the 12-month prevalence of drug disorders (1.4%) and mood disorders (7.4%) in the pooled AA/NH/PI sample was similar to rates in Whites, Blacks, and Hispanics. In the pooled AA/NH/PI sample, lifetime alcohol disorder was associated with lifetime mood, anxiety, and personality disorders, and lifetime drug disorder was associated with lifetime mood disorder (Huang et al., 2006). There is no known finding on comorbidity among MRs from NESARC.

1.1. Study aims

The limitation of survey-based studies indicates the need for other sources to examine SUD and comorbidities. To address the issue of sample size, we utilized the largest behavioral health EHR database in the United States to determine patterns of SUDs and comorbidities among AAs, NHs/PIs, and MRs. The analysis sample included patients aged 1–90 years who accessed any behavioral healthcare at 1 of 11 sites in the community. The Institute of Medicine (IOM) highlights the need to use patients' personal medical records (EHRs) for research to learn about treatment needs and healthcare delivery in real-world settings (IOM, 2010). Using the EHR database allows us to examine SUDs and comorbidities in geographically diverse groups of AAs, NHs/PIs, and MRs in such settings. We (1) examined prevalences of DSM-IV mental diagnoses comprehensively captured in the EHR database, (2) determined SUD prevalences and correlates of having one or more SUDs, and (3) estimated associations of comorbid diagnoses with SUD.

2. Methods

2.1. Data source

Recognizing the need to increase the safety and quality of psychiatric care, the *MindLinc* EHR system was developed in 1998 by Kenneth R. Gersing, MD, a psychiatrist with expertise in medical information systems, to integrate clinical information systems with comprehensive assessments, medical evaluations, and evidence-based guidelines to provide real-time assistance to clinicians who treat persons with psychiatric conditions (Gersing and Krishnan, 2002, 2003). The *MindLinc* EHR system is a comprehensive electronic behavioral healthcare management system. It is among the first EHR systems to receive the federal government's meaningful use stamp of approval. In a single system, it seamlessly integrates clinical care at all levels (triage/crisis intervention, emergency department, outpatient, inpatient, adult child/adolescent psychiatry, substance abuse, case management), clinical and regulatory management, and research. The EHR system employs a clinical rules engine to guide clinical practices; it creates a clinical outcome data warehouse for retrospective clinical decision support. This single-source system simultaneously functions as a full electronic medical record (EMR) and an electronic data capture system (EDC). This dual functionality addresses inconsistencies in data capture between the source document and the case report form. The system supplies healthcare providers with a readily available means of monitoring patients' courses of treatment (Gersing et al., 2007; Wu et al., 2011a, 2013a). To ensure completeness of key patient data, the EHR system includes a quality check that requires the attending clinicians (e.g., psychiatrists, psychiatry residents) to complete

Table 1
Selected characteristics of Asian Americans, Native Hawaiians/Pacific Islanders, and mixed-race people ($N = 4572$).

	Total		Asian American		Native Hawaiian/Pacific Islander		Mixed-race		Chi^2 *P*-value
Sample size	$N = 4572$		$n = 1028$		$n = 1788$		$n = 1756$		
	N	%	%	95% CI	%	95% CI	%	95% CI	
Age in years									
1–11	839	18.4	10.2	8.4–12.1	14.6	13.0–16.2	26.9	24.9–29.0	df = 8
12–17	1018	22.3	11.6	9.6–13.5	30.6	28.5–32.7	20.0	18.2–21.9	<0.01
18–34	1237	27.1	38.9	35.9–41.9	25.8	23.8–27.8	21.4	19.5–23.3	
35–49	823	18.0	23.2	20.6–25.7	17.9	16.1–19.7	15.1	13.4–16.8	
50+	655	14.3	16.1	13.9–18.4	11.1	9.7–12.6	16.5	14.8–18.3	
Sex									
Male	2034	44.5	41.9	38.9–44.9	49.0	46.7–51.3	41.4	39.1–43.7	df = 2
Female	2538	55.5	58.1	55.1–61.1	51.0	48.7–53.3	58.6	56.3–60.9	<0.01
Setting									
Hospital	2698	59.0	82.3	80.0–84.6	99.2	98.8–99.6	4.4	3.5–5.4	df = 2
Mental health center	1874	41.0	17.7	15.4–20.0	0.8	0.4–1.2	95.6	94.6–96.5	<0.01
Age, mean	4572	36.6	32.7	31.7–33.8	26.9	26.1–27.6	28.4	27.5–29.4	<0.01[a]

CI: confidence interval. SE: standard error.
[a] *T*-test *P*-value for comparing Asian American vs. Native Hawaiian/Pacific Islander; *T*-test *P*-value for comparing Asian American vs. mixed-race.

required fields for a qualified clinical visit (diagnosis, clinician, services, medications, side effects, billing codes, allergies).

The *MindLinc* systematically captures data elements on every aspect of a patient's medical record to create a fully anonymized, longitudinal data repository. To comply with HIPAA requirements, all 18 identifiers specified by HIPAA guidelines are removed from the data repository. The *MindLinc* repository is the largest known psychiatry registry in the United States, presently containing about 260,000 individual patients from about 40 organizations across the country (2000 onwards). Since 1998, the Duke University Medical Center Department of Psychiatry has used the *MindLinc* EHR system in all its clinics and inpatient facilities to systematically capture each patient's medical records (Gersing and Krishnan, 2003). Recent findings from *MindLinc's* EHRs demonstrate the clinical value of using EHR data in elucidating mental diagnoses for understudied conditions and for population subgroups (Wu et al., 2011a, 2013a). To address the small sample sizes of AAs, NHs/PIs, and MRs that impede research, we used *MindLinc* EHR data (2000–2011) from behavioral healthcare units/clinics of four hospitals in three states (North Carolina, Colorado, New York) and EHR data from seven ambulatory community mental health centers in five states (North Carolina, Colorado, New York, Indiana, New Hampshire). These data represent 4.5% of unique patients ($N = 101,625$) in the analysis data of these sites (AAs 1.0%, NHs/PIs 1.8%, MRs 1.7%). The analysis sample included patients with valid clinical information (e.g., visit dates, one or more diagnoses based on Diagnostic and Statistical Manual of Mental Disorders, 4th Edition [DSM-IV], Clinical Global Impressions scores).

2.2. Diagnoses

Psychiatric diagnoses were based on treatment visits, assigned by the evaluating clinicians (e.g., psychiatrists, psychiatric residents, licensed PhD-level psychologists), and coded according to DSM-IV criteria (American Psychiatric Association, 2000). The entire DSM-IV is accessible within the EHR application to permit clinicians to evaluate patients' chief complaints, symptoms, mental and medical status examination findings, social/family history, and medical history data against the DSM-IV criteria. The EHR database captures detailed information on DSM-IV codes (when the diagnosis started, when it ended, if it is a primary disorder, if a diagnosis is ruled out, if symptoms are active or historical) and the level of baseline severity and improvement. For SUD, the EHR system includes a "Habit/Substance Use" domain that has multiple functionalities to allow the treating clinician to assess the patient's history of substance use, patterns of current use, American Society of Addiction Medicine dimensions, and SUD diagnoses.

We examined 16 major DSM-IV diagnoses: SUD (alcohol, tobacco, drugs); anxiety; adjustment; mood; ADHD/CD/ODD/DBD (attention deficit-hyperactivity disorder, conduct disorder, oppositional defiant disorder, disruptive behavior disorder); other childhood-onset diagnoses (e.g., mental retardation, learning, pervasive developmental); cognitive/dementia; dissociative; eating; factitious; impulse-control (e.g., gambling, intermittent-explosive); personality (mainly borderline, antisocial); psychotic (schizophrenic); sleep; somatoform; and mental disorders due to a general medical condition. Because it is critical to investigate the extent to which the EHR captures demographic and diagnostic patterns that are consistent with findings from other sources (Kessler et al., 2005; Wu et al., 2013a), we examined lifetime patterns for each patient logged in the EHRs (primary, secondary, current, remitted diagnoses). The same diagnosis for a patient was counted only one time in the analysis. The analysis of lifetime patterns allows comparisons of estimates with other data and specifies diagnoses of clinical concerns for informing priority areas.

2.3. Demographics and treatment

Demographics included age (1–90 years) at first behavioral healthcare visit logged in the database, sex, and race/ethnicity. Following the U.S. Census definitions of race/ethnicity, we used self-reported race and ethnicity information to identify mutually exclusive groups: AAs (e.g., Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese), NHs/PIs (Native Hawaiians, Pacific Islanders), and MRs (more than one race) (U.S. Census Bureau, 2011). Patients with a Hispanic status were excluded from these groups to provide an analogous comparison with other studies (Wu et al., 2011c, 2013a). Numbers of treatment days logged in the database and treatment setting (hospital vs. community mental health centers) were included as control variables.

2.4. Data analyses

We examined differences in demographics and treatment setting by race/ethnicity. We then determined prevalences of SUD and other diagnoses by treatment setting for each racial/ethnic group. SUD prevalences were generated by age to identify specific SUD affecting different age groups. Chi^2 tests determined between-group variations in prevalences of diagnoses; to aid interpretation, we conducted pairwise comparisons. The significant level for descriptive results was set conservatively for $P \leq 0.01$. We performed logistic regression analyses for each racial/ethnic group to determine associations of age at first visit, sex, race/ethnicity, treatment setting, length of treatment, and number of comorbid diagnoses with any SUD and with ≥2 SUDs. Finally, associations of each comorbid diagnosis with SUD were determined using logistic regression to control for age at first visit, sex, race/ethnicity, length of treatment, and number of comorbid diagnoses. All analyses were conducted using SAS 9.2 (SAS, 2010).

3. Results

3.1. Demographics by race/ethnicity (Table 1)

Compared with AAs (mean = 32.73 years), NHs/PIs (mean = 26.88 years) and MRs (mean = 28.45 years) were younger at age of first visit ($P < 0.01$). MRs had the highest proportion of children aged 1–11 years (26.9%). NHs/PIs included the highest proportion of adolescents aged 12–17 (30.6%). NHs/PIs included more males (49.0%) than AAs (41.9%) and MRs (41.4%).

3.2. Prevalences of diagnoses (Fig. 1)

Of all patients, 15.0% had SUD, which did not differ by treatment setting (online only eTable 1). Mood (60.0%), anxiety (31.2%), adjustment (30.9%), and ADHD/CD/ODD/DBD (22.7%) were more common than other diagnoses (schizophrenic/psychotic 14.2%, personality 13.3%, other childhood-onset diagnoses 11.4%, impulse-control 6.6%, cognitive 2.8%, eating 2.2%, somatoform 2.1%).

More NHs/PIs and MRs than AAs had mood, ADHD/CD/ODD/DBD, and SUD diagnoses. A high proportion of NHs/PIs had adjustment (43.5%) or impulse-control (12.2%) diagnoses, while a high proportion of MRs had anxiety (36.6%), personality (18.3%), or other childhood diagnoses (mental retardation, learning disabilities) (14.3%). AAs and NHs/PIs had the same high proportion of psychotic/schizophrenic diagnosis (15.8%).

3.3. SUD prevalences by age (Table 2)

3.3.1. Asian Americans

There were no cases of SUD among AAs aged <12 years. Overall, 11.3% of AAs aged ≥12 years had any SUD (3.7% had ≥2 SUDs). Adolescents aged 12–17 (10.1%) had a higher prevalence of cannabis diagnosis than adults aged 35–49 (10.1% vs. 2.1%, $P < 0.01$). Few adolescents and younger adults aged 18–49 had other drug diagnoses (≤2.3%).

3.3.2. Native Hawaiians/Pacific Islanders

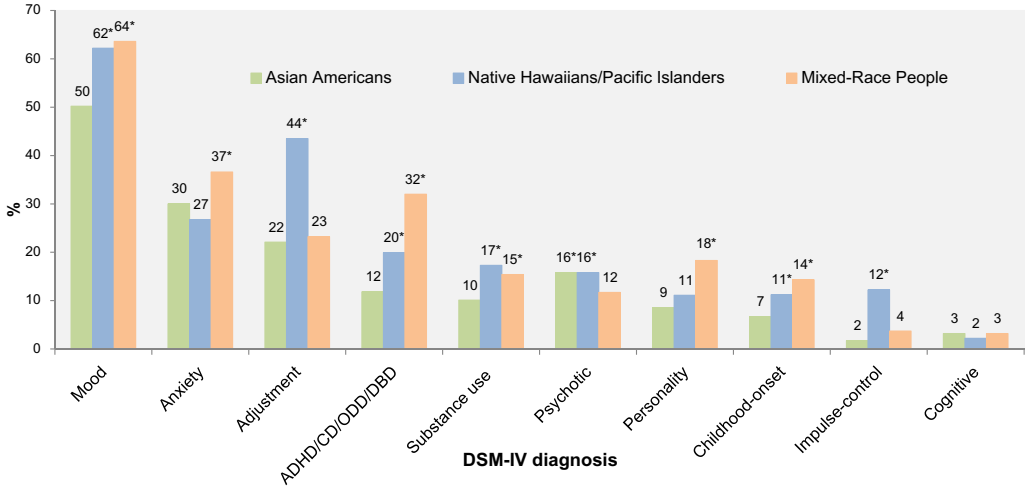
Few NHs/PIs aged <12 years had SUDs (alcohol 0.8%, amphetamine 0.4%, cannabis 0.4%, hallucinogens 0.4%). Overall, 20.1% of NHs/PIs aged ≥12 years had any SUD (6.5% had ≥2 SUDs). Adolescents aged 12–17 (4.2%) had a lower prevalence of alcohol diagnosis than adult groups (11.6–16.3%; $P < 0.01$). Adolescents aged 12–17 (7.7%) and young adults aged 18–34 (7.8%) had higher prevalences of cannabis diagnosis than NHs/PIs aged 35–49 (2.5%) or ≥50 years (1.0%). Other drug diagnoses (cocaine, cocaine, polysubstance) were more prevalent among adults than adolescents.

3.3.3. Mixed-race people

Few (0.2%) MRs aged <12 years had cannabis diagnosis. Overall, 20.9% of MRs aged ≥12 years had any SUD (8.3% had ≥2 SUDs). The two young-adult groups (18–34, 35–49) compared with adolescents had higher prevalences of alcohol (14.9%, 10.6%, respectively vs. 2.8%), cocaine (5.1%, 10.9%, respectively vs. 0.3%), and opioid (2.7%, 5.3%, respectively vs. 0.3%) diagnoses.

3.4. Length of treatment

On average, MRs had longer length of treatment logged in the EHR (mean = 738 days, 95% confidence interval [CI] 701.6–773.4)



ADHD/CD/ODD/DBD: Attention deficit hyperactivity disorder, conduct disorder, oppositional defiant disorder, and disruptive behavior disorder.
* $P<0.01$, the estimate differed by racial/ethnic status (was higher than other racial/ethnic groups).
Childhood-onset diagnoses include learning disabilities, mental retardation, and pervasive developmental diagnoses.
Diagnoses with prevalence less than 3% are not included in the figure: eating, somatoform, dissociative, disorder due to a general medical condition, sleep, and factitious diagnoses.

Fig. 1. DSM-IV mental diagnoses among Asian Americans, Native Hawaiians/Pacific Islanders, and mixed-race people ($N = 4572$).

Table 2
DSM-IV substance use disorder (SUD) diagnoses among patients aged 12 or older, by age group.

Prevalence, %	Asian American[a]					Native Hawaiian/Pacific Islander[b]					Mixed-race[c]				
Sample size, *n*	923	119	400	238	166	1527	547	461	320	199	1283	352	376	265	290
Age group in years	Total	12–17	18–34	35–49	50+	Total	12–17	18–34	35–49	50+	Total	12–17	18–34	35–49	50+
DSM-IV diagnosis	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Any SUD	11.3	14.3**	14.5	8.4	5.5	20.1	11.7**	16.7	25.3	19.6	20.9	11.1**	28.5	30.2	14.8
≥2 SUDs	3.7	6.7**	5.0	2.6	–	6.5	4.8	8.5	7.8	4.5	8.3	3.7**	15.4	9.4	3.8
Alcohol	7.0	6.7	9.3	5.0	4.8	10.3	4.2**	12.8	16.3	11.6	9.0	2.8**	14.9	10.6	7.2
Cannabis	4.0	10.1**	5.0	2.1	–	5.8	7.7**	7.8	2.5	1.0	9.7	8.8**	19.7	4.9	2.4
Amphetamine	0.7	1.7	1.0	0.4	–	0.1	–	0.2	–	–	0.5	0.3	1.1	0.4	0.3
Hallucinogen	0.3	1.7	0.3	–	–	0.1	–	–	0.3	–	0.2	–	0.5	–	0.3
Nicotine	0.8	0.8	1.3	0.4	–	0.1	0.2	–	0.3	–	2.2	1.7	2.4	3.4	1.4
Cocaine	0.7	–	1.0	0.8	–	0.3	0.4**	4.6	4.4	2.5	4.5	0.3**	5.1	10.9	3.1
Opioids	0.9	–	1.3	0.8	0.6	0.2	0.4**	1.5	4.1	3.0	2.1	0.3**	2.7	5.3	0.7
Sedatives/tranquilizers	0.2	0.8	0.3	–	–	0.1	–	0.2	1.9	1.0	1.0	0.3	1.1	2.6	0.3
Other drugs	1.4	0.8	2.3	1.3	–	4.5	2.7**	7.8	3.4	3.5	3.4	2.0	5.1	3.8	2.4
Polysubstance	0.8	0.8	1.3	0.4	–	2.5	2.0	2.8	3.4	1.5	2.7	–	3.2	4.2	3.8
Caffeine	0.2	–	0.3	0.4	–	–	–	–	–	–	0.7	–	–	0.4	–
Phencyclidine	–	–	–	–	–	0.2	–	0.4	–	0.5	–	–	–	–	–
Inhalant	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

**Chi^2 *P*-value < 0.01.
–: Zero cells.
[a] Prevalence of SUD diagnoses among Asian Americans aged <12 years (*n* = 105): 0%.
[b] Prevalence of SUD diagnoses among Native Hawaiians/Pacific Islanders aged <12 years (*n* = 261): alcohol 0.8%, amphetamine 0.4%, cannabis 0.4%, and hallucinogens 0.4%.
[c] Prevalence of SUD diagnoses among mixed-race people aged <12 years (*n* = 473): cannabis 0.2%.

than AAs (mean = 389 days, 95% CI 348.9–429.0) and NHs/PIs (mean = 285 days, 95% CI 259.3–310.2). When stratifying the analysis by any SUD (eTable 2), adolescents NHs/PIs aged 12–17 with SUD had longer length of treatment (mean = 414 days, 95% CI 269.3–558.2) than adolescents NHs/PIs without SUD (mean = 216 days, 95% CI 182.3–248.7).

3.5. Adjusted analyses of SUD (Table 3)

3.5.1. Racial differences in SUD

We conducted logistic regression analyses to determine racial/ethnic differences in having any SUD and ≥2 SUDs when controlling for patients' age at first visit, sex, treatment setting, length of treatment, and the number of other mental diagnoses. Due to a small proportion of children aged <12 years with SUD (<1.0%), adjusted analyses focused on patients aged ≥12 years.

NHs/PIs and MRs were about two times more likely than AAs to have any SUD or ≥2 SUDs. People aged 18–34 or 35–49 (relative to ≥50 years), male sex, and mental health setting were associated with increased odds of having any SUD or ≥2 SUDs.

3.5.2. Adjusted analyses of having any SUD

We then conducted separate logistic regression models for each racial/ethnic group to estimate associations of age at first visit, sex, treatment setting, length of treatment, and the number of mental diagnoses with having any SUD and ≥2 SUDs.

Among AAs, adolescents (12–17) and young adults (18–34) were about 2–3 times more likely than older adults (≥50 years) to have any SUD. Among NHs/PIs or MRs, adolescents had lower odds of having SUD than older adults. MR adults (18–49) were about 2 times more likely than older adults to have SUD. Regardless of race/ethnicity, males were more likely than females to have SUD.

3.5.3. Adjusted analyses of having ≥2 SUDs

Age among AAs was examined as a continuous variable due to very low SUD prevalences in older groups (12–17 years, 6.7%; 18–34, 5.0%; 35–49, 2.5%; ≥50 years, 0%). Among NHs/PIs, adolescents had lower odds of having ≥2 SUDs than older adults (≥50 years). MRs aged 18–49 had greater odds of having ≥2 SUDs than older MR adults (≥50 years). In all racial/ethnic groups, males were more likely than females to have ≥2 SUDs. Length of treatment was positively associated with having ≥2 SUDs among NHs/PIs.

3.6. Adjusted analyses of comorbidity with SUD (Table 4)

Logistic regression was used to identify diagnoses associated with having any SUD for each racial/ethnic group. Patients' age at first visit, sex, treatment setting, length of treatment, and the number of other mental diagnoses were controlled in each model. Prevalences of comorbid diagnoses are available online only (eTable 3).

In all three racial/ethnic groups, personality diagnosis was associated with elevated odds of having any SUD. Eating diagnosis was associated with elevated odds of having SUD among AAs. Among NHs/PIs, mood diagnosis was associated with increased odds of having SUD, while adjustment and other childhood-onset diagnoses were associated with decreased odds of having SUD. Among MRs, anxiety diagnosis was associated with decreased odds of having SUD (anxiety diagnosis: 21.5% among people with SUD vs. 26.9% among people without SUD).

4. Discussion

The growing population sizes of AAs, NHs/PIs, and MRs warrant research to inform their behavioral healthcare. Because of constraints by small samples of AAs, NHs/PIs, and MRs and a lack of data on mental disorders, research-based data provide limited information on SUD and comorbidity. Healthcare reform in the United States pushes for national adoption of an EHR system to improve the efficiency and quality of healthcare delivery (Silow-Carroll et al., 2012). Patients' EHR data are now recognized as valuable sources for research to inform health disparities and healthcare for minorities (IOM, 2009). Through use of EHR data, we present the most comprehensive patterns of comorbidities available for AAs, NHs/PIs, and MRs in the real-world medical settings. The same EHR system is used by all treatment sites; its data repository has systematically captured patients' medical records from every visit. Findings have implications for clinical care

Table 3
Adjusted odds ratios of substance use disorder (SUD) diagnoses among people aged 12 years or older.

Adjusted logistic regression	Total[a]		Asian American (AA)[a]		Native Hawaiian/Pacific Islander (MH/PI)[a]		Mixed-race (MR)[a]	
Sample size	$N = 3733$		$n = 923$		$n = 1527$		$n = 1283$	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Any SUD								
Race/ethnicity								
NH/PI vs. AA	**2.62**	**2.00–3.42**	–	–	–	–	–	–
MR vs. AA	**1.89**	**1.29–2.78**	–	–	–	–	–	–
Age in years								
12–17 vs. 50+	**0.64**	**0.47–0.88**	**2.48**	**1.03–5.96**	**0.49**	**0.31–0.49**	**0.55**	**0.33–0.91**
18–34 vs. 50+	**1.94**	**1.48–2.54**	**3.08**	**1.46–6.53**	1.40	0.93–1.40	**2.27**	**1.48–3.48**
35–49 vs. 50+	**1.78**	**1.34–2.36**	1.70	0.74–3.92	1.31	0.85–1.31	**2.47**	**1.61–3.80**
Sex								
Male vs. female	**2.70**	**2.26–3.22**	**4.78**	**2.98–7.69**	**2.26**	**1.74–2.26**	**2.76**	**2.05–3.71**
Treatment setting								
Hospital vs. mental health facility	**0.60**	**0.41–0.90**	**0.46**	**0.27–0.79**	1.15	0.24–1.15	0.61	0.28–1.33
Length of treatment	1.02	0.96–1.08	0.83	0.68–1.01	1.06	0.96–1.06	1.04	0.95–1.13
Number of other psychiatric disorders	1.01	0.93–1.09	0.80	0.63–1.02	1.03	0.92–1.03	1.05	0.93–1.19
2 or more SUDs								
Race/ethnicity								
NH/PI vs. AA	**2.41**	**1.55–3.76**	–	–	–	–	–	–
MR vs. AA	**1.83**	**1.02–3.29**	–	–	–	–	–	–
Age in years								
12–17 vs. 50+	1.37	0.79–2.39	**0.95**[b]	**0.92–0.98**	**0.99**	**0.45–0.99**	0.83	0.35–1.96
18–34 vs. 50+	**3.77**	**2.28–6.22**	–	–	1.90	0.90–1.90	**4.94**	**2.43–10.04**
35–49 vs. 50+	**2.46**	**1.45–4.16**	–	–	1.69	0.77–1.69	**2.71**	**1.29–5.69**
Sex								
Male vs. female	**2.60**	**1.97–3.42**	**6.09**	**2.47–15.03**	**1.88**	**1.24–1.88**	**2.91**	**1.91–4.44**
Treatment setting								
Hospital vs. mental health facility	**0.51**	**0.27–0.95**	0.47	0.21–1.04	**0.63**	**0.08–0.63**	0.45	0.13–1.53
Length of treatment	1.09	1.00–1.19	1.00	0.77–1.30	**1.17**	**1.02–1.17**	1.07	0.94–1.22
Number of other psychiatric disorders	0.99	0.88–1.12	0.78	0.53–1.15	1.09	0.92–1.09	0.93	0.77–1.12

AOR: adjusted odds ratio; CI: confidence interval. Boldface: $P < 0.05$.
[a] Each single adjusted logistic regression model included age at first treatment visit, sex, treatment setting, length of treatment, and number of other psychiatric diagnoses. Length of treatment and number of other psychiatric diagnoses were examined as continuous variables.
[b] Age was examined as a continuous variable due to small cell sizes; prevalence of substance use diagnosis among Asian Americans was 6.7%, 5.0%, 2.5%, and 0%, respectively, for the four age groups (12–17, 18–34, 35–49, and 50+ years).

and research. *First,* 15.0% of patients who received any behavioral healthcare had SUD. Mood (60%), anxiety (31.2%), adjustment (30.9%), and ADHD/CD/ODD/DBD (22.7%) were more common than other diagnoses. *Second,* while several diagnoses were more common among NHs/PIs (mood, ADHD/CD/ODD/DBD, SUD, adjustment, impulse-control) or MRs (mood, ADHD/CD/ODD/DBD, SUD anxiety, personality, other childhood diagnoses), NHs/PIs and AAs had a high proportion of psychotic/schizophrenic diagnosis (15.8%). *Third,* controlling for demographics, the number of co-morbid diagnoses, treatment setting, and treatment length, NHs/PIs and MRs were more likely than AAs to have any SUD or ≥2 SUDs. *Fourth,* personality diagnosis increased odds of having SUD in all three groups. Eating diagnosis increased odds of having SUD among AAs; mood diagnosis increased odds of having SUD among NHs/PIs. The positive association between length of treatment and ≥2 SUDs among NHs/PIs suggests a greater need for healthcare in that group.

4.1. What this study adds to our knowledge

The most salient, new findings concern the comprehensive patterns of mental diagnoses affecting AAs, NHs/PIs, and MRs. Because of cost constraints, surveys assess particular disorders (e.g., anxiety, mood, SUD) (Kessler et al., 2005). Other disorders are either infrequently included (e.g., personality disorder) or excluded from national surveys (Compton et al., 2007). Research-based clinical studies also require use of diagnostic inclusion and exclusion criteria to select study-specific participants; persons with severe conditions are likely to be excluded from research (O'Neil et al., 2011). EHRs include frequent and understudied diagnoses. Here, some key results are consistent with research-based findings indicating prevalent rates of mood, anxiety, SUD, and ADHD/CD/ODD/DBD diagnoses (Compton et al., 2007; Kessler et al., 2005; Merikangas et al., 2010). Regardless of race/ethnicity, treatment setting, and SUD status, mood disorder was the most prevalent diagnosis, demonstrating a high-burden condition. National survey data also show that "felt depressed" was the most commonly endorsed reason for using treatment in mental health settings (SAMHSA, 2012c). There are higher proportions of ADHD/CD/ODD/DBD diagnoses (mainly AHDA and ODD) among NHs/PIs (19.9%) and MRs (32.0%) than AAs (11.8%). However, little is known about prevalences and treatment outcomes of ADHD/CD/ODD/DBD for these populations because they are often underrepresented (Galanter et al., 2003). Findings demonstrate the need for research to elucidate risk factors, prevalences, diagnoses, and treatment courses for prevalent conditions for these groups.

Table 4
Adjusted odds ratios of having a comorbid SUD diagnosis in relation to other psychiatric diagnoses among people aged 12 years or older.

Adjusted logistic regression	Asian American[a]		Native Hawaiian/ Pacific Islander[a]		Mixed-race[a]	
Sample size	$n = 923$		$n = 1527$		$n = 1283$	
DSM-IV diagnosis	AOR	95% CI	AOR	95% CI	AOR	95% CI
ADHD/CD/ODD/DBD	0.91	0.40–2.05	1.50	0.92–2.43	1.27	0.75–2.17
Adjustment	0.56	0.31–1.03	**0.73**	**0.55–0.97**	0.66	0.44–1.00
Anxiety	0.99	0.57–1.71	0.74	0.52–1.05	**0.70**	**0.50–0.99**
Cognitive	2.19	0.46–1.50	0.43	0.16–1.15	0.84	0.38–1.85
Dissociative	–	–	1.26	0.31–5.12	1.60	0.52–4.92
Eating	**3.70**	**1.15–11.95**	0.95	0.32–2.87	0.67	0.26–1.72
Factitious	–	–	0.50	0.06–4.54	–	–
Disorder due to a general medical condition	–	–	0.51	0.14–1.80	0.97	0.25–3.83
Impulse-control	1.00	0.12–8.36	1.12	0.68–1.84	1.17	0.56–2.45
Mood	1.31	0.79–2.17	**1.90**	**1.38–2.61**	1.03	0.72–1.80
Other childhood-onset	1.80	0.20–1.38	**0.32**	**0.16–0.64**	0.70	0.37–1.34
Personality	**5.63**	**2.55–12.44**	**1.92**	**1.29–2.87**	**2.23**	**1.53–3.27**
Psychotic/schizophrenic	0.70	0.36–1.34	0.92	0.65–1.30	1.10	0.74–1.64
Sleep	–	–	0.84	0.08–8.82	0.90	0.17–4.83
Somatoform	1.72	0.20–14.74	0.37	0.08–1.66	0.72	0.34–1.53

ADHD/CD/ODD/DBD: attention deficit-hyperactivity disorder, conduct disorder, oppositional defiant disorder, and disruptive behavior disorder; CI: confidence intervals.
Boldface: $P < 0.05$.
–: Estimates not available due to a small sample size.
[a] Each adjusted logistic regression adjusted for age at first treatment visit, sex, treatment setting, length of treatment, and number of psychiatric diagnoses.

Additional noteworthy findings include high proportions of adjustment, psychotic/schizophrenic, personality, and childhood-onset (mental retardation, learning disabilities) diagnoses in all three groups. These conditions are not routinely assessed by community-based surveys. Patients' EHRs data help identify understudied conditions (Wu et al., 2011a, 2013a). A high proportion of NHs/PIs (43.5%), MRs (23.2%), and AAs (22.1%) received an adjustment diagnosis. By comparison, EHR data of behavioral healthcare patients aged 18–64 showed 7.3% of Whites and 7.0% of Blacks having an adjustment disorder (Wu et al., 2013a). Adjustment disorder is characterized by clinically significant symptoms of depressed mood, anxiety, or a combination of symptoms in response to stressors, which results in significant impairment in social or occupational functioning. Persons from disadvantaged life circumstances may experience multiple stressors that increase risk for adjustment disorder; persistent adjustment disorder could interact with existing mental conditions, resulting in disabling conditions (APA, 2000). While there is a dearth of research on adjustment disorder for AAs, NHs/PIs, and MRs, socioeconomic (e.g., financial) and cultural-related (e.g., adjustment to Western culture) stressors may trigger adjustment problems among minorities. For example, 58% of NHs/PIs and 60% of MRs nationally resided in a household with a family income less than $50,000/year, and they experienced more residential moves than whites (Wu et al., 2013b). However, the data do not permit analysis of family income to examine its association with mental diagnoses. To inform intervention efforts, research needs to discern risk and protective factors and to determine whether and why subgroups of socioeconomic disadvantaged minorities (e.g., NHs/PIs) may be at high risk for adjustment disorder.

Findings also demonstrate racial/ethnic differences in SUD and comorbidities. Survey data show higher illicit drug use prevalences among NHs/PIs and MRs than AAs (Wu et al., 2013c). This study adds clinical findings of higher odds of SUD among NHs/PIs and MRs than AAs. Alcohol and cannabis diagnoses were more prevalent among young AAs (ages 12–34) than older AAs, while SUDs (alcohol, cannabis, cocaine, opioids) affected adolescents and adults among NHs/PIs and MRs, even older adults aged ≥50 years. Age-related variations in drugs of abuse were also noted in the TEDS's treatment data (SAMHSA, 2012a), which found younger ages of substance abuse treatment admissions for marijuana abusers and older ages for cocaine/opioid abusers. Hence, EHR data support a problematic drug use pattern among NHs/PIs and MRs noted in survey data (Wu et al., 2013c) as treatment-seeking NHs/PIs and MRs experience more SUDs than AAs do and reinforce the need for research to guide substance abuse interventions. EHR data also reveal further diagnostic patterns: NHs/PIs and MRs have more mental diagnoses than AAs. This pattern may be related to the high prevalences of SUD as it may be a manifestation of underlying psychopathology among treatment-seeking NHs/PIs and MRs (Glantz et al., 2009; Swendsen et al., 2010). Studies on comorbidity demonstrate broad associations between SUD and mental disorders (Glantz et al., 2009; Najt et al., 2011; Wu et al., 2011c). Empirically, comorbidities measure a latent continuous trait, ranging from mild to severe as the number of comorbidities increases (Wu et al., 2011d). The continuous condition of comorbidity emphasizes screening and early prevention to avoid costly consequences (Wu et al., 2011d).

Further, adjusted analyses showed that personality diagnosis (mainly borderline, antisocial diagnoses) was associated with SUD in the three racial/ethnic groups. This is in line with population-based research showing that personality disorders are highly correlated with multiple mental disorders, and that borderline and antisocial personality disorders are especially likely to co-occur with SUD (Cohen et al., 2007; Grant et al., 2004, 2008). Patients with SUD should be assessed for personality diagnoses and treated as needed. To inform prevention and treatment management, longitudinal data will be needed to determine temporal relations of personality disorders and SUDs for AAs, NH/PIs, and MRs.

Finally, psychotic/schizophrenic diagnosis was the fourth common diagnosis (following mood, anxiety, adjustment) among AAs (sixth among NHs/PIs, eighth among MRs). It is unclear why AAs had more psychotic/schizophrenic diagnoses than other diagnoses. Because of cultural-related stigma and shame toward mental illness, AAs may not access behavioral healthcare in a timely manner and thus delay care until symptoms become unmanageable or legal involvement occurs (Ferran et al., 2002). Research will need to determine whether AAs in psychiatric care exhibit more severe symptoms than other racial/ethnic groups given the same diagnosis.

4.2. Limitations

Findings should be interpreted within the following limitations. Results are based on patients who accessed any behavioral healthcare at one of the included settings (psychiatric clinics of hospitals, ambulatory community mental health centers). Although the EHR captures data of geographically diverse patients from five states, results are not generalizable to patients in different regions and settings, or people with a psychiatric condition who had not used behavioral healthcare. Less than one-third of people with a mental disorder sought any behavioral health service in the past year, and treatment users were most likely to have severe problems (Wu et al., 1999). It is possible that these results reflect a subset of comparatively severe treatment-seeking AAs, NHs/PIs, and MRs in behavioral health settings. Additional data from individuals in the general medical care setting will help inform behavioral health profiles of these understudied groups. The Affordable Care Act and national adoption of the EHR system should stimulate research efforts to identify effective means to facilitate implementation of screening and intervention for SUD and other mental conditions in

primary care in order to increase detection and management of behavioral diagnoses (e.g., embedding a validated substance use screening tool in the EHR) (Tai et al., 2012). Additionally, patients included in the EHRs represent residents living in the neighboring areas of the medical settings (Wu et al., 2011a, 2013a). Findings describe diagnostic and treatment profiles of treatment-seeking AAs, NHs/PIs, and MRs in real-world behavioral health settings and in their communities. Research needs to determine how financial conditions, community-level resources for behavioral healthcare, cultural backgrounds, languages, and attitudes toward SUD or mental healthcare (e.g., stigma) affect diagnostic profiles, healthcare setting, and treatment engagement (Ferran et al., 2002; Fong and Tsuang, 2007). For example, we have identified substantially more MRs from a community mental health setting than from a hospital, which requires more research to understand factors contributing to this unique pattern.

Additionally, diagnoses in the EHRs are based on the actual treatment and non-standardized clinical evaluations of patients as part of usual care settings, using all the available information from medical evaluations and interactions among providers, patients, and family members. However, diagnoses can be influenced by clinicians' specialties and experience, insurance coverage (billable diagnoses), variations in clinical detection and practices, and patient demographics, culture, and treatment-seeking behaviors (Ferran et al., 2002; Garland et al., 2005; Snowden et al., 2009; Wu et al., 2011a). As such, these diagnoses may differ from research-based diagnoses, which often use predetermined survey questions and either self-administered or lay-interviewer-administered questions to derive self-reported mental disorders. The validity of research-based diagnoses also is influenced by sources of bias from assessments, the interviewing process, and self-reporting. Given the lack of SUD and comorbidity data from survey-based studies for AAs, NHs/PIs, and MRs, EHRs provide an important source for learning about SUDs and mental disorders experienced by these understudied populations (IOM, 2010).

Although EHRs include complete and potentially more accurate treatment-encounter data for research use than insurance claim data and abstracted medical record data (Silfen, 2006; Weiner et al., 2007), results from EHRs may underestimate the treatment needs of AAs, NHs/PIs, and MRs. In the usual care setting, it is not feasible to asses all possible diagnoses for each patient; diagnoses are influenced by patients' (or family members') presentations. Conditions that lack clinical urgency (not considered requiring immediate intervention) may not be captured in the EHRs. For example, the low rate of nicotine dependence indicates underdiagnoses (Wu et al., 2013a). Although these findings are conservative estimates of SUDs and comorbidities, they provide valuable data to inform research to further evaluate psychiatric conditions and care for these understudied populations. Because of diversity in the composition of AA, NH/PI, and MR populations (language, culture, immigration status), results are not fully applicable to a particular racial group. In-depth research is needed to disaggregate subgroup (intraracial, interracial) differences in SUDs and comorbidities.

4.3. Conclusions

This study presents new and comprehensive patterns of SUD and mental conditions for AAs, NHs/PIs, and MRs in real-world behavioral healthcare settings. While the EHRs are not perfect, some key findings on patterns of SUD and prevalent diagnoses, including younger ages of MRs than AAs and NHs/PIs, are consistent with national data (Wu et al., 2013b). These actual treatment data provide clinical patterns of SUDs and comorbidities that warrant research efforts to further evaluate specific prevalence, risk, treatment, and prognosis in different settings for AAs, NHs/PIs, and MRs.

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Contributors

Li-Tzy Wu originated research questions and wrote the drafts of the paper. Ken Gersing designed the electronic health record database system. Bruce Burchett managed the database and conducted statistical analyses. All authors contributed to critical revisions and interpretations of the findings to result in the final manuscript.

Conflicts of interest

Marvin S. Swartz has served as a consultant to Novartis Pharmaceuticals and has received research support from Eli Lilly and Co. Paolo Mannelli has received support from Alkermes, Inc., Forest Research Institute, Pfizer Inc., and Sunovion Pharmaceuticals. The other authors have no conflicts of interest to disclose.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jpsychires.2013.08.022.

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