Associations Between Psychiatric Disorders and Alcohol Consumption Levels in an Adult Primary Care Population

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Background: Unhealthy alcohol use frequently co-occurs with psychiatric disorders; however, little is known about the relationship between psychiatric disorders and alcohol consumption *levels*. Understanding varying levels of unhealthy alcohol use among individuals with a variety of psychiatric disorders in primary care would provide valuable insight for tailoring interventions.

Methods: We conducted a cross-sectional study of 2,720,231 adult primary care patients screened for unhealthy alcohol use between 2014 and 2017 at Kaiser Permanente Northern California, using electronic health record data. Alcohol consumption level was classified as no reported use, low-risk use, and unhealthy use, per National Institute on Alcohol Abuse and Alcoholism guidelines. Unhealthy use was further differentiated into mutually exclusive groups: exceeding only daily limits, exceeding only weekly limits, or exceeding both daily and weekly limits. Multivariable multinomial logistic regression models were fit to examine associations between 8 past-year psychiatric disorders (depression, bipolar disorder, anxiety disorder, obsessive–compulsive disorder, schizophrenia, schizoaffective disorder, anorexia nervosa, and bulimia nervosa) and alcohol consumption levels, adjusting for sociodemographic and health characteristics.

Results: In the full sample [53% female, 48% White, mean (SD) age = 46 (18) years], patients with psychiatric disorders (except eating disorders), compared to those without, had lower odds of reporting low-risk and unhealthy alcohol use relative to no use. Among patients who reported any alcohol use (*n* = 861,427), patients with depression and anxiety disorder, compared to those without, had higher odds of exceeding only weekly limits and both limits; patients with bulimia nervosa were also more likely to exceed both limits.

Conclusions: Findings suggest that patients with anxiety disorder, depression, and bulimia nervosa who drink alcohol are more likely to exceed recommended limits, increasing risk of developing more serious problems. Health systems and clinicians may wish to consider implementing more robust screening, assessment, and intervention approaches to support these vulnerable subgroups in limiting their drinking.

Key Words: Alcohol Consumption Levels, Alcohol Screening, Primary Care, Psychiatric Comorbidity.

UNHEALTHY ALCOHOL USE is a significant public health problem and is associated with considerable mortality and morbidity (Rehm et al., 2009). About 6.4% of

the population with unhealthy drinking has an alcohol use disorder (AUD) (U.S. Department of Health and Human Services, 2015), meaning there are many more people who exceed recommended drinking limits and do not have severe problems. Current U.S. guidelines disseminated by the National Institute of Alcoholism and Alcohol Abuse (NIAAA) recommend no more than 4 drinks on a single day and no more than 14 per week for men aged 18 to 64 years, and no more than 3 on a single day and no more than 7 per week for men aged ≥ 65 years and women of all ages (National Institute on Alcohol Abuse and Alcoholism, 2005). Approximately a quarter of U.S. adults (Centers for Disease Control and Prevention, 2014), and between 7 and 20% of adult primary care patients (Fleming et al., 1998; Mertens et al., 2005) exceed these recommendations. A recent study conducted at a large health system among primary care patients screened as part of an alcohol screening, brief intervention, and referral to treatment (SBIRT) implementation trial reported that about 10% screened positive for unhealthy drinking (Mertens et al., 2015).

There is a robust literature indicating that AUDs and psychiatric disorders frequently co-occur (Di Florio et al., 2014; Grant et al., 2015; Martins and Gorelick, 2011; Petersen et al., 2019; Regier et al., 1990; Udo and Grilo, 2019), which can impact the course of disease progression and severity, self-management, and treatment adherence and outcomes (Mäkelä et al., 2015; Oliveira et al., 2018; Ostacher, 2007; Sullivan et al., 2005). Prior studies of the general U.S. population suggest that individuals with mood disorders (including major depressive disorder and bipolar disorder) (Grant et al., 2015; Martins and Gorelick, 2011), anxiety disorders (Grant et al., 2015; Martins and Gorelick, 2011), and psychotic disorders (including schizophrenia and schizoaffective disorder) (Regier et al., 1990) are more likely to have lifetime AUD diagnoses compared to patients without psychiatric disorders. Additionally, U.S. adults with AUD had higher odds of eating disorders, including anorexia nervosa and bulimia nervosa (Udo and Grilo, 2019).

Fewer studies have evaluated alcohol consumption *levels* using recommended drinking guidelines (i.e., unhealthy alcohol use that exceeds daily and/or weekly limits), among individuals with psychiatric disorders. Moreover, studies have typically focused on specialized populations, such as psychiatric treatment, young adult, or largely male military populations. These studies have generally found that patients with depression, bipolar disorder, anxiety disorder, posttraumatic stress disorder, and psychotic disorders were more likely to report unhealthy alcohol use (Cetty et al., 2019; Hartz et al., 2014; Karpov et al., 2017; Smith et al., 2014; Subramaniam et al., 2017). Other studies evaluating the reverse association have found that patients with unhealthy alcohol use were more likely to have psychiatric disorders and poorer mental health (Mäkelä et al., 2015; Ordóñez et al., 2016). However, these studies have varied in their use of alcohol consumption measures and unhealthy alcohol use definitions, making it difficult to directly compare risks.

Prior research suggests that the health risks associated with exceeding only daily limits, exceeding only weekly limits, and exceeding both daily and weekly limits vary. The prevalence of AUDs increases nearly linearly with the frequency of exceeding daily drinking limits (Dawson et al., 2005). Exceeding daily drinking limits is also associated with increased risk of suicide attempts (Kittel et al., 2019). Additionally, exceeding weekly drinking limits is associated with increased risk of various chronic conditions such as certain cancers (Boffetta and Hashibe, 2006) and cardiovascular disease (Toma et al., 2017). Therefore, there is a need to examine varying levels of unhealthy alcohol use using standardized and well-validated measures (U.S. Preventive Services Task Force et al., 2018) in diverse, population-based samples, including subgroups with co-occurring psychiatric disorders. Intervening in primary care, when unhealthy alcohol use is often first identified, may help prevent more serious problems and distress from developing.

The aim of this study was to examine the association between a variety of psychiatric disorders and different alcohol consumption levels (no reported use, low-risk use, exceeding only daily limits, exceeding only weekly limits, or exceeding both daily and weekly limits, based on NIAAA drinking guidelines) in an outpatient primary care sample. In June 2013, Kaiser Permanente Northern California (KPNC), an integrated healthcare delivery system, incorporated population-based systematic alcohol screening into its adult primary care workflow. Since its implementation, over 12 million alcohol screenings have been conducted, with an 87% average screening rate in adult primary care across the health system; this study draws from this large, population-based sample. Findings will help identify subgroups of patients with psychiatric disorders and co-occurring unhealthy alcohol use, which will inform development of care management strategies in primary care settings for these particularly vulnerable patients.

MATERIALS AND METHODS

Study Setting

KPNC consists of 4.3 million members, representing about a third of the Northern California population. The membership is socioeconomically diverse and reflects the insured U.S. population (Gordon, 2015). KPNC provides care to a population insured through employer-based plans, Medicare, Medicaid, and health insurance exchanges. The membership is 53% female, 20% Asian, 7.5% Black, and 17% Hispanic. KPNC has 21 medical centers, 233 medical offices, and 2,147 adult primary care physicians and providers, and provides specialty psychiatry and addiction treatment as a covered benefit.

Systematic Alcohol Screening in Adult Primary Care

The Alcohol as a Vital Sign (AVS) initiative is an SBIRT workflow in adult primary care at KPNC. Using evidence-based screening instruments embedded in the EHR, medical assistants conduct screening by asking a modified version of the NIAAA single-item screening question to determine whether the individual had any heavy drinking days (National Institute on Alcohol Abuse and Alcoholism, 2005) ["How many times in the past 3 months have you had 5 or more drinks in a day" (for men aged 18 to 65), or "4 or more drinks" for men aged $\geq$ 66 and women of all ages)], and 2 questions used to calculate average alcoholic drinks consumed per week: "On average, how many days per week do you have an alcoholic drink?" and "On a typical drinking day, how many drinks do you have?"

Sample

We identified adult ($\geq$18 years) KPNC members who were screened for unhealthy alcohol use at primary care clinics between January 1, 2014, and December 31, 2017, using EHR-derived data. Patients with unknown geocoded household income ($n = 7,223$), smoking status ($n = 184,659$), or BMI ($n = 107,471$) were excluded from analyses, providing an analytical sample of 2,720,231 patients. The KPNC Institutional Review Board reviewed the study and granted a waiver of informed consent to examine EHR data.

Alcohol Use

Alcohol use was identified at the first screening during the study period. Per NIAAA daily and weekly drinking guidelines (National Institute on Alcohol Abuse and Alcoholism, 2005), individuals were

classified as: "no use" (reporting no heavy drinking days in the prior 3 months, and on average no drinking days per week and/or no drinks per drinking day), "low-risk" (exceeding neither daily nor weekly limits), and "unhealthy use" (exceeding either daily or weekly drinking limits). We further classified the "unhealthy use" group into mutually exclusive groups: ">daily" (exceeding only daily limits), ">weekly" (exceeding only weekly limits), or ">both" (exceeding both daily and weekly limits) to examine the relationship between psychiatric disorders and differences in risk profiles.

Psychiatric Disorders

We used *International Classification of Diseases and Related Health Problems, Ninth* (*ICD-9-CM*) and *Tenth Edition—Clinical Modification* (*ICD-10-CM*) codes (available upon request) extracted from the EHR to identify whether patients had a documented psychiatric disorder diagnosis at an encounter with the health system in the year prior to (and including) the date of their alcohol screening. We examined a list of 8 of the most common psychiatric disorders found in adult primary care populations (Bower and Gilbody, 2005), including depression (major depressive disorder and dysthymic disorder), bipolar disorder, anxiety disorder (including panic disorder), obsessive–compulsive disorder, schizophrenia, schizoaffective disorder, anorexia nervosa, and bulimia nervosa.

Patient Characteristics

From the EHR, we extracted patients' sex, age, race/ethnicity, and smoking status at the time of the alcohol screening. We used the most recent record of BMI in the year prior to the alcohol screening and created 4 groups: underweight (<18.5), normal weight (18.5 to 24.9), overweight (25.0 to 29.9), or obese (≥30.0) (Centers for Disease Control and Prevention, 2019). We included BMI because it has an inverse relationship with alcohol use (Kleiner et al., 2004), and is also part of *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* criteria for characterizing severity of eating disorders. We estimated household income from the U.S. Census 2010 median household income data by geocoding patients' residential addresses to census blocks using residential data from the year prior to screening (U.S. Census Bureau, 2020ensus Bureau, 2020), and created a categorical variable based on tertiles of the overall distribution (low: ≤$60,841; middle: $60,842-$87,461; and high: ≥$87,462). We included income as a proxy of socioeconomic status, which has been shown to be associated with both psychiatric disorders and unhealthy drinking (Sadler et al., 2017). To adjust for medical comorbidity burden, we used the Charlson comorbidity score, which estimates the 1-year mortality risk based on a weighted score of 17 medical conditions (Deyo et al., 1992).

Statistical Analysis

We examined the distributions of patient demographic and health characteristics and the prevalence of psychiatric disorders by alcohol consumption levels (no reported use, low-risk use, ">daily," ">weekly," and ">both"). We also examined the prevalence of comorbid psychiatric disorders. We fit multivariable multinomial logistic regression models, separately for each psychiatric disorder, to estimate associations between psychiatric disorders and alcohol consumption levels among the full sample (n = 2,720,231) and conditional associations among the subgroup who reported any alcohol use (n = 861,427). All models were adjusted for sex, age, household income, smoking status, BMI, and Charlson comorbidity score. In sensitivity analyses, we also adjusted for psychiatric disorders with high comorbidity in each model. Among the full sample, we estimated the odds of reporting low-risk use and unhealthy use, relative to no use, separately for each psychiatric disorder, comparing those with the psychiatric disorder to those without. In conditional analyses among patients who reported any alcohol use, we estimated the odds of ">daily," ">weekly," and ">both," relative to low-risk use, separately for each psychiatric disorder, comparing those with the psychiatric disorder to those without. We used Bonferroni correction to reduce the probability of committing a Type I error by lowering the p-value for determining statistical significance of 2-tailed tests [$p \leq (\alpha/n)$], where $\alpha = 0.05$, n is the number of comparisons (n = 40), and p ≤ 0.001] and calculated 99.9% confidence intervals (CIs), which is a conservative approach for adjusting for multiple comparisons (Dunn, 1961). All analyses were performed using SAS, version 9.4 (SAS Institute Inc.).

RESULTS

Sample Characteristics

The final analytical sample (n = 2,720,231) was 52.9% females and 48.1% Whites (Table 1); the mean age was 46 years (standard deviation = 18; data not shown). The majority of the sample (68.3%, n = 1,858,804) reported no alcohol use in the prior 3 months, 21.8% (n = 592,048) reported low-risk use, 6.1% (n = 165,581) reported ">daily," 2.3% (n = 62,349) reported ">weekly," and 1.5% (n = 41,449) reported ">both." The ">daily" group was more likely to be male and younger (18 to 34 years), and the ">weekly" group was more likely to be female and older (≥65 years). The group that reported no alcohol use consisted of a higher proportion of Asian, Native Hawaiian, or Pacific Islander patients and a lower proportion of White patients, relative to other consumption levels. While the no use and ">both" groups were more likely to have lower household incomes (≤$60,841), the low-risk, ">daily," and ">weekly" groups were more likely to have higher household incomes (≥$87,462). Overweight BMI was the most prevalent among all consumption level groups, except the no use group which was more likely to be obese. Prevalence of smoking was highest in the ">both" group relative to other consumption levels. Patients with a Charlson score ≥ 3 (indicating higher number of comorbidities) were more likely to report no alcohol use relative to other alcohol consumption levels; however, a greater proportion of patients who reported ">weekly" had a Charlson score ≥ 3 compared to those who reported ">daily."

Prevalence of Psychiatric Disorders by Alcohol Use Level Among the Full Sample

The most prevalent psychiatric disorders were depression (8.3%), anxiety disorder (7.5%), and bipolar disorder (0.8%); all others had a prevalence of 0.2% or less (Table 2). Depression and anxiety disorder were more prevalent among patients who reported ">weekly" (9.5% and 8.3%, respectively) and ">both" (8.8 and 8.9%, respectively). Bipolar disorder and schizoaffective disorder were more prevalent among patients who reported no use (0.9 and 0.2%, respectively) and ">both" (0.8 and 0.1%, respectively). Bulimia nervosa, obsessive–compulsive disorder, and schizophrenia

Table 1. Demographic Characteristics of Adult Primary Care Patients Screened for Unhealthy Alcohol Use Between 2014 and 2017 (n = 2,720,231) by Alcohol Consumption Level,[a] Kaiser Permanente Northern California

Characteristic	Overall, n (%[b])	Alcohol consumption level[a]				
		No Use, n (%[b])	Low-risk, n (%[b])	>Daily, n (%[b])	>Weekly, n (%[b])	>Both, n (%[b])
Overall	2,720,231	1,858,804 (68.3)	592,048 (21.8)	165,581 (6.1)	62,349 (2.3)	41,449 (1.5)
Sex						
Male	1,280,870 (47.1)	785,821 (42.3)	329,565 (55.7)	111,214 (67.2)	29,436 (47.2)	24,834 (59.9)
Female	1,439,361 (52.9)	1,072,983 (57.7)	262,483 (44.3)	54,367 (32.8)	32,913 (52.8)	16,615 (40.1)
Age group (years)						
18 to 34	883,276 (32.5)	593,012 (31.9)	178,422 (30.1)	87,297 (52.7)	10,868 (17.4)	13,677 (33.0)
35 to 49	705,906 (26.0)	474,246 (25.5)	161,571 (27.3)	46,697 (28.2)	12,299 (19.7)	11,093 (26.8)
50 to 64	680,832 (25.0)	462,168 (24.9)	164,939 (27.9)	26,035 (15.7)	17,425 (27.9)	10,265 (24.8)
≥65	450,217 (16.6)	329,378 (17.7)	87,116 (14.7)	5,552 (3.4)	21,757 (34.9)	6,414 (15.5)
Race/ethnicity						
White	1,308,659 (48.1)	772,508 (41.6)	370,413 (62.6)	91,151 (55.0)	46,880 (75.2)	27,707 (66.8)
Asian, Native Hawaiian, or Pacific Islander	531,947 (19.6)	434,051 (23.4)	70,745 (11.9)	21,209 (12.8)	3,211 (5.2)	2,731 (6.6)
African American	191,610 (7.0)	142,621 (7.7)	35,514 (6.0)	8,822 (5.3)	2,735 (4.4)	1,918 (4.6)
Latino/Hispanic	479,581 (17.6)	361,181 (19.4)	74,104 (12.5)	31,863 (19.2)	6,008 (9.6)	6,425 (15.5)
Native American	14,061 (0.5)	10,228 (0.6)	2,619 (0.4)	766 (0.5)	249 (0.4)	199 (0.5)
Multi or unknown	194,373 (7.1)	138,215 (7.4)	38,653 (6.5)	11,770 (7.1)	3,266 (5.2)	2,469 (6.0)
Household income						
Low (≤$60,841)	910,784 (33.5)	652,820 (35.1)	171,354 (28.9)	52,690 (31.8)	19,401 (31.1)	14,519 (35.0)
Middle ($60,842-$87,461)	907,754 (33.4)	624,570 (33.6)	193,785 (32.7)	55,468 (33.5)	20,234 (32.5)	13,697 (33.0)
High (≥$87,462)	901,693 (33.1)	581,414 (31.3)	226,909 (38.3)	57,423 (34.7)	22,714 (36.4)	13,233 (31.9)
Body mass index						
Underweight	42,799 (1.6)	34,039 (1.8)	6,213 (1.0)	1,398 (0.8)	768 (1.2)	381 (0.9)
Normal weight	883,471 (32.5)	594,660 (32.0)	203,838 (34.4)	51,340 (31.0)	21,260 (34.1)	12,373 (29.9)
Overweight	920,909 (33.9)	602,622 (32.4)	218,945 (37.0)	60,648 (36.6)	23,356 (37.5)	15,338 (37.0)
Obese	873,052 (32.1)	627,483 (33.8)	163,052 (27.5)	52,195 (31.5)	16,965 (27.2)	13,357 (32.2)
Smoking status						
Never or former	2,450,387 (90.1)	1,701,786 (91.6)	530,281 (89.6)	137,620 (83.1)	50,941 (81.7)	29,759 (71.8)
Current	269,844 (9.9)	157,018 (8.4)	61,767 (10.4)	27,961 (16.9)	11,408 (18.3)	11,690 (28.2)
Charlson comorbidity score						
0	2,270,837 (83.5)	1,506,158 (81.0)	522,699 (88.3)	153,416 (92.7)	51,848 (83.2)	36,716 (88.6)
1 to 2	330,604 (12.2)	252,258 (13.6)	55,720 (9.4)	10,834 (6.5)	7,921 (12.7)	3,871 (9.3)
≥3	118,790 (4.4)	100,388 (5.4)	13,629 (2.3)	1,331 (0.8)	2,580 (4.1)	862 (2.1)

[a]Patients were asked to estimate alcohol use in the past 3 months. Following the NIAAA drinking guidelines, we defined daily limits as> 4 drinks/day (for men aged 18 to 65) or> 3 drinks/day (for women of any age and men aged 66 or older), and weekly limits as> 14 drinks/wk (for men aged 18 to 65) or> 7 drinks/wk (for women of any age and men aged 66 or older). We classified patients as: "no use" (reporting no alcohol use), "low-risk" (exceeding neither daily nor weekly limits), and "unhealthy use" (exceeding either daily or weekly limit). We further classified the "unhealthy use" group into the following mutually exclusive groups: ">daily" (exceeding only daily limits), ">weekly" (exceeding only weekly limits), or ">both" (exceeding both daily and weekly limits).
[b]Column percentages are presented, which represent the proportion of patients within each demographic group in the overall sample and by alcohol consumption level. Percentages may not add up to 100% due to rounding error.

were more prevalent among patients who reported no use, but the prevalence was small (≤0.2%). The most common comorbid disorders were depression and anxiety, with high comorbidity among patients with anorexia nervosa, bulimia nervosa, and obsessive–compulsive disorder (Table S1). For example, 62.5% of patients with anorexia nervosa also had depression, and 55.1% also had an anxiety disorder.

Adjusted Associations Between Psychiatric Disorders and Alcohol Use Among the Full Sample

In the full sample (n = 2,720,231), we estimated the odds of low-risk and unhealthy use relative to no use for patients with a psychiatric disorder compared to those without. We fit separate models for each psychiatric disorder, so we used a Bonferroni-corrected α-level of 0.001 and calculated 99.9% CIs. Among all disorders examined

(except anorexia nervosa and bulimia nervosa), patients with a psychiatric disorder had 6% (anxiety disorder; OR = 0.94, CI = 0.92 to 0.96) to 80% (schizophrenia; OR = 0.20, CI = 0.14 to 0.28) lower odds of unhealthy use relative to no use, compared to those without (Table 3). Additionally, patients with a psychiatric disorder (except bulimia nervosa) had 14% (anxiety disorder; OR = 0.86, CI = 0.85 to 0.88) to 71% (schizoaffective disorder; OR = 0.29, CI = 0.24 to 0.36) lower odds of low-risk relative to no use, compared to those without. Patients with anorexia nervosa and bulimia nervosa were no more or less likely than those without to report unhealthy use relative to no use (OR = 0.62, CI = 0.37 to 1.01; and OR = 1.16, CI = 0.89 to 1.52, respectively), and patients with bulimia nervosa were also no more or less likely than those without to report low-risk use relative to no use (OR = 0.82, CI = 0.65 to 1.03).

Table 2. Unadjusted Prevalence of Psychiatric Disorders[a] by Alcohol Consumption Level[b], Kaiser Permanente Northern California, 2014 to 2017

Psychiatric disorder[a]	Overall (n = 2,720,231)	Alcohol consumption level[b], n (%)				
		No Use (n = 1,858,804)	Low-risk (n = 592,048)	>Daily (n = 165,581)	>Weekly (n = 62,349)	>Both (n = 41,449)
Anorexia nervosa	624 (<0.1)	487 (<0.1)	94 (<0.1)	27 (<0.1)	9 (<0.1)	7 (<0.1)
Anxiety disorder	203,242 (7.5)	143,045 (7.7)	40,037 (6.8)	11,267 (6.8)	5,191 (8.3)	3,702 (8.9)
Bipolar disorder	21,150 (0.8)	16,373 (0.9)	3,231 (0.5)	861 (0.5)	366 (0.6)	319 (0.8)
Bulimia nervosa	1,329 (<0.1)	933 (0.1)	236 (<0.1)	97 (0.1)	29 (<0.1)	34 (0.1)
Depression	225,185 (8.3)	164,236 (8.8)	41,540 (7.0)	9,851 (5.9)	5,917 (9.5)	3,641 (8.8)
Obsessive–compulsive disorder	4,980 (0.2)	3,783 (0.2)	795 (0.1)	271 (0.2)	69 (0.1)	62 (0.1)
Schizoaffective disorder	3,260 (0.1)	2,886 (0.2)	263 (<0.1)	59 (<0.1)	21 (<0.1)	31 (0.1)
Schizophrenia	2,660 (0.1)	2,330 (0.1)	239 (<0.1)	57 (<0.1)	19 (<0.1)	15 (<0.1)

[a]Psychiatric disorders were identified using *ICD-9-CM* and *ICD-10-CM* codes in the electronic health record in the year prior to (and including) the date of the alcohol screening visit.

[b]Patients were asked to estimate alcohol use in the past 3 months. Following the NIAAA drinking guidelines, we defined daily limits as> 4 drinks/d (for men aged 18 to 65) or> 3 drinks/d (for women of any age and men aged 66 or older), and weekly limits as> 14 drinks/week (for men aged 18 to 65) or> 7 drinks/wk (for women of any age and men aged 66 or older). We classified patients as: "no use" (reporting no alcohol use), "low-risk" (exceeding neither daily nor weekly limits), and "unhealthy use" (exceeding either daily or weekly limits). We further classified the "unhealthy use" group into the following mutually exclusive groups: ">daily" (exceeding only daily limits), ">weekly" (exceeding only weekly limits), or ">both" (exceeding both daily and weekly limits).

Adjusted Associations Between Psychiatric Disorders and Alcohol Use Level Among Patients Who Reported Any Alcohol Consumption

We conducted conditional analyses among patients who reported any alcohol use (n = 861,427) to estimate the odds of ">daily," ">weekly," and ">both" relative to low-risk use. Compared to patients without these disorders, those with anxiety disorder, bulimia nervosa, and depression were more likely to report unhealthy relative to low-risk use (Table 4). Specifically, patients with anxiety disorder (OR = 1.28, CI = 1.21 to 1.35), bulimia nervosa (OR = 2.07, CI = 1.16 to 3.68), and depression (OR = 1.22, CI = 1.15 to 1.29) had higher odds than those without of reporting ">both" relative to low-risk use. Additionally, patients with anxiety disorder (OR = 1.18, CI = 1.12 to 1.24) and depression (OR = 1.10, CI = 1.05 to 1.16) had higher odds than those without of reporting ">weekly" relative to low-risk use; however, they were no more or less likely than those without to report ">daily" relative to low-risk use (OR = 1.03, CI = 0.99 to 1.07; and OR = 1.02, CI = 0.99 to 1.06, respectively). In contrast, patients with schizoaffective disorder were less likely to report ">daily" relative to low-risk use compared to those without the condition (OR = 0.59, CI = 0.37 to 0.93), but they were no more or less likely than those without to report ">weekly" or ">both" relative to low-risk use (OR = 0.61, CI = 0.30 to 1.24; and OR = 0.99, CI = 0.54 to 1.80, respectively). Patients with anorexia nervosa, bipolar disorder, obsessive–compulsive disorder, and schizophrenia were no more or less likely to report ">daily," ">weekly," or ">both" relative to low-risk use.

Sensitivity Analyses

Since depression and anxiety disorder were highly comorbid with the other psychiatric disorders examined, we adjusted for them along with all other covariates in sensitivity analyses. All OR estimates became slightly weaker toward the null or generally remained the same (Tables S2 and S3).

DISCUSSION

Screening for unhealthy alcohol use in primary care can help clinicians address alcohol problems early on (Kaner et al., 2018). Understanding which patient characteristics and health conditions, including psychiatric disorders, are associated with exceeding various drinking limits is critical to ensuring that screening, assessment, and intervention approaches can address the entire patient's needs. Our findings from a large, population-based primary care sample suggest that the co-occurrence of psychiatric disorders and unhealthy alcohol use (based on NIAAA guidelines) is common, increasing risk of poorer prognoses and development of more serious problems, such as AUDs (Dawson et al., 2005) and certain chronic medical conditions (Boffetta and Hashibe, 2006; Toma et al., 2017). Health systems and clinicians may wish to consider tailoring SBIRT protocols and tools to support these vulnerable subgroups in limiting their drinking. For example, primary care clinicians could screen for psychiatric disorders after identifying unhealthy alcohol use, and vice versa, which could aid them with developing a comprehensive care management strategy to help them limit their drinking that is also relevant for treating their psychiatric disorder. A prior study suggests that workflows for depression screening in primary care are a specific area needing system-wide improvement (Hirschtritt et al., 2018). Our findings also support the need for systematic alcohol screening in specialty psychiatry settings.

In bivariate analyses, we examined distributions of patient demographic and health characteristics by alcohol consumption levels. Consistent with prior studies (Azagba et al., 2020;

Table 3. Adjusted[a] Associations of Psychiatric Disorders[b] With Reporting Low-Risk or Unhealthy Alcohol Use Relative to No Use,[c] Among the Full Sample (n = 2,720,231)

Psychiatric disorder[b]	OR (99.9% CI)[d]	
	Low-risk versus no use[c]	Unhealthy versus no use[c]
Anorexia nervosa		
No (reference)	-	-
Yes	0.61 (0.43, 0.87)	0.62 (0.37, 1.01)
Anxiety disorder		
No (reference)	-	-
Yes	0.86 (0.85, 0.88)	0.94 (0.92, 0.96)
Bipolar disorder		
No (reference)	-	-
Yes	0.57 (0.54, 0.61)	0.54 (0.50, 0.59)
Bulimia nervosa		
No (reference)	-	-
Yes	0.82 (0.65, 1.03)	1.16 (0.89, 1.52)
Depression		
No (reference)	-	-
Yes	0.82 (0.80, 0.83)	0.87 (0.85, 0.89)
Obsessive–compulsive disorder		
No (reference)	-	-
Yes	0.56 (0.49, 0.63)	0.58 (0.49, 0.68)
Schizoaffective disorder		
No (reference)	-	-
Yes	0.29 (0.24, 0.36)	0.22 (0.16, 0.30)
Schizophrenia		
No (reference)	-	-
Yes	0.31 (0.25, 0.38)	0.20 (0.14, 0.28)

CI, confidence interval; OR, odds ratio.

[a]Separate multivariable multinomial logistic regression models for each psychiatric condition were adjusted for sex, age, race/ethnicity, household income, BMI, smoking status, and Charlson comorbidity score.

[b]Psychiatric disorders were identified using *ICD-9-CM* and *ICD-10-CM* codes in the electronic health record in the year prior to (and including) the date of the alcohol screening visit.

[c]Low-risk alcohol use was defined as exceeding neither daily nor weekly limits, and unhealthy use as exceeding either limit.

[d]An OR < 1 indicates that patients with the psychiatric disorder had lower odds than those without the disorder of reporting low-risk or unhealthy use relative to no use (whereas an OR> 1 indicates higher odds), after adjusting for covariates. Confidence intervals have a Bonferroni-corrected α-level of 0.001.

Table 4. Adjusted[a] Associations of Psychiatric Disorders[b] With Reporting Unhealthy Relative to Low-Risk Alcohol Use,[c] Among Patients Who Reported Alcohol Use (n = 861,427)

Psychiatric condition[b]	OR (99.9% CI)[d]		
	>Daily limit versus low-risk[c]	>Weekly limit versus low-risk[c]	>Both limits versus low-risk[c]
Anorexia nervosa			
No (reference)	-	-	-
Yes	1.02 (0.51, 2.02)	0.95 (0.32, 2.85)	1.05 (0.31, 3.58)
Anxiety disorder			
No (reference)	-	-	-
Yes	1.03 (0.99, 1.07)	1.18 (1.12, 1.24)	1.28 (1.21, 1.35)
Bipolar disorder			
No (reference)	-	-	-
Yes	0.92 (0.81, 1.04)	0.95 (0.79, 1.13)	1.12 (0.93, 1.35)
Bulimia nervosa			
No (reference)	-	-	-
Yes	1.37 (0.94, 2.00)	1.37 (0.74, 2.53)	2.07 (1.16, 3.68)
Depression			
No (reference)	-	-	-
Yes	1.02 (0.99, 1.06)	1.10 (1.05, 1.16)	1.22 (1.15, 1.29)
Obsessive–compulsive disorder			
No (reference)	-	-	-
Yes	1.11 (0.88, 1.39)	0.85 (0.57, 1.26)	1.08 (0.72, 1.64)
Schizoaffective disorder			
No (reference)	-	-	-
Yes	0.59 (0.37, 0.93)	0.61 (0.30, 1.24)	0.99 (0.54, 1.80)
Schizophrenia			
No (reference)	-	-	-
Yes	0.63 (0.40, 1.02)	0.59 (0.28, 1.25)	0.53 (0.23, 1.21)

CI, confidence interval; OR, odds ratio.

[a]Separate multivariable multinomial logistic regression models for each psychiatric disorder were adjusted for sex, age, race/ethnicity, household income, BMI, smoking status, and Charlson comorbidity score.

[b]Psychiatric disorders were identified using *ICD-9-CM* and *ICD-10-CM* codes in the electronic health record in the year prior to (and including) the date of the alcohol screening visit.

[c]Low-risk alcohol use was defined as exceeding neither daily nor weekly limits, and unhealthy use as exceeding either limit. We further classified the "unhealthy use" group into the following mutually exclusive groups: ">daily" (exceeding only daily limits), ">weekly" (exceeding only weekly limits), or ">both" (exceeding both daily and weekly limits).

[d]An OR> 1 indicates that patients with the psychiatric disorder had higher odds than those without the disorder of reporting drinking that exceeded the daily and/or weekly limits relative to low-risk use (whereas an OR < 1 indicates lower odds), after adjusting for covariates. Confidence intervals have a Bonferroni-corrected α-level of 0.001.

Grant et al., 2017; McKee et al., 2007), higher proportions of men, younger patients (18 to 34 vs. ≥65 years), and patients who smoke exceeded only daily limits and both daily and weekly limits relative to the overall sample. We also found differences in risk profiles among patients with unhealthy alcohol use. For example, individuals exceeding only weekly limits were more likely to have medical comorbidities compared to those exceeding only daily limits, consistent with the literature indicating that exceeding weekly drinking limits increases risk of chronic medical conditions (Boffetta and Hashibe, 2006; Toma et al., 2017). These findings provide insight on key patient characteristics associated with exceeding different types of drinking limits, which can be used to tailor approaches for limiting alcohol consumption.

Informed by our bivariate analyses, we examined associations between psychiatric disorders and alcohol consumption levels, adjusting for patient characteristics. Contrary to

several prior studies of specialty psychiatric treatment (Cetty et al., 2019; Hartz et al., 2014; Karpov et al., 2017; Subramaniam et al., 2017) and military (Smith et al., 2014) populations, we found that, with a few exceptions, patients with psychiatric disorders were more likely than those without to report no alcohol use relative to low-risk or unhealthy use. Specifically, patients with schizophrenia and schizoaffective disorder were about 5 times as likely as those without to report no alcohol use, while patients with depression and

anxiety disorder were only slightly more likely than those without to report no alcohol use. These findings are more similar to our prior study showing that individuals with a range of chronic medical conditions were more likely to report no alcohol use (Sterling et al., 2020) and other studies revealing a U-shaped (or J-shaped) relationship between alcohol consumption and health status [including all-cause mortality (Shaper et al., 1988) and type 2 diabetes (Koppes et al., 2005)], suggesting that individuals in ill health may quit drinking. In the present study, patients with psychiatric disorders, particularly more serious ones, may find that alcohol exacerbates their symptoms (e.g., affective lability) or is contraindicated with medication they are taking, or they could have been advised to limit alcohol use by their care team, and thus chose not to drink.

Among patients who reported alcohol use, we found complex relationships between some psychiatric disorders and different types of unhealthy use. Specifically, patients with depression, anxiety disorder, and bulimia nervosa were more likely to report drinking that exceeded both daily and weekly limits relative to low-risk drinking. Patients with depression and anxiety disorder were also more likely to report drinking that exceeded only weekly limits. There were no significant differences between patients with depression, anxiety disorder, and bulimia nervosa, compared to those without, in reporting drinking that exceeded only daily limits relative to low-risk drinking, which could be because patients with these psychiatric disorders tended to drink more overall resulting in exceeding not only the daily limits. These findings are consistent with those of other studies suggesting that individuals with depression, anxiety disorder, and bulimia nervosa are at increased risk of drinking at unhealthy levels (Martins and Gorelick, 2011; Udo and Grilo, 2019). These subgroups may need support in limiting their alcohol consumption in order to prevent triggering or exacerbating mood and anxiety symptoms (Bahorik et al., 2016) and perceived stress (Strid et al., 2018), or developing more serious problems such as an AUD (Ordóñez et al., 2016) or chronic medical comorbidities that could complicate overall prognoses and healthcare expenses (i.e., complex needs patients) (Jolles et al., 2015). Thus, health systems and clinicians may wish to focus on these key patient subgroups when tailoring appropriate interventions.

Contrary to prior research (Di Florio et al., 2014; Grant et al., 2015; Hartz et al., 2014; Petersen et al., 2019; Regier et al., 1990; Udo and Grilo, 2019), we did not find associations between unhealthy alcohol use and anorexia nervosa, bipolar disorder, schizophrenia, and schizoaffective disorder in our study, which could be due to several reasons. First, the prevalence of these disorders was lower in our study. Second, source populations differed, so individuals with these psychiatric disorders from our primary care sample might not be as severe as other samples drawn from the general population (Grant et al.,

2017; Petersen et al., 2019; Regier et al., 1990; Udo and Grilo, 2019) or psychiatric treatment populations (Hartz et al., 2014). Third, we did not assess symptom severity or mood states, which have been shown to be associated with alcohol use (Meyer et al., 2012; Prisciandaro et al., 2012). Future studies should examine psychiatric symptoms and severity as possible moderators of the associations between psychiatric disorders and alcohol consumption levels.

Depression and anxiety disorder were highly comorbid with other psychiatric disorders in our sample; however, when we adjusted for them in sensitivity analyses, the results did not meaningfully change. Therefore, the associations we observed between psychiatric disorders and alcohol consumption levels do not appear to be biased due to confounding by depression and anxiety disorder.

Limitations

Our study has several limitations. We could not differentiate between patients who never used alcohol and those who reported no use at the screenings in our study. Consequently, the group who reported no use likely included individuals who had previously used alcohol but quit, possibly related to serious psychiatric disorders or recovery from AUD; however, our conditional analyses among patients who reported alcohol use provide valuable insight on the association between unhealthy drinking and psychiatric disorders. Like many other studies, our alcohol use measures are based on self-report, which could be affected by recall and social-desirability biases. A larger proportion of our sample reported no alcohol use compared to national survey populations (Substance Abuse and Mental Health Services Administration, 2017), which could be because this primary care sample is underreporting their drinking or that they are older and sicker. Lastly, while the amount of missing covariate data was low (<10%) (Bennett, 2001) and within a similar range of other EHR-based studies (Hirschtritt et al., 2019; Lam et al., 2020), reasons for missing data in our study could not be determined.

CONCLUSION

Patients with psychiatric disorders, compared to those without, were less likely to report alcohol use. However, among those who reported drinking alcohol, patients with depression, anxiety disorder, and bulimia nervosa were more likely than those without those conditions to exceed recommended drinking limits, increasing risk of worsening symptoms, poorer prognoses, and developing more serious problems. Our findings could aid clinicians and health systems in implementing more robust screening, assessment, and targeted-intervention approaches in limiting alcohol use for these particularly vulnerable subgroups in primary care settings.

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CONFLICTS OF INTEREST

All authors report no conflicts of interest, financial, or otherwise.

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SUPPORTING INFORMATION

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

Table S1. Frequency of psychiatric disorder comorbidities.

Table S2. Sensitivity analysis adjusting for comorbid depression and anxiety disorder along with all other covariates in models for each psychiatric disorder, among the full sample (n = 2,720,231).

Table S3. Sensitivity analysis adjusting for comorbid depression and anxiety disorder along with all other covariates in models for each psychiatric disorder, among patients who reported alcohol use (n = 861,427).