Associations Between Medical Conditions and Alcohol Consumption Levels in an Adult Primary Care Population

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Abstract

IMPORTANCE Excessive alcohol consumption is associated with increased incidence of several medical conditions, but few nonveteran, population-based studies have assessed levels of alcohol use across medical conditions.

OBJECTIVE To examine associations between medical conditions and alcohol consumption levels in a population-based sample of primary care patients using electronic health record data.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional study used separate multinomial logistic regression models to estimate adjusted associations between 26 medical conditions and alcohol consumption levels in a sample of 2720231 adult primary care patients screened for unhealthy drinking between January 1, 2014, and December 31, 2017, then only among those reporting alcohol use. The study was conducted at Kaiser Permanente Northern California, a large, integrated health care delivery system that incorporated alcohol screening into its adult primary care workflow. Data were analyzed from June 29, 2018, to February 7, 2020.

MAIN OUTCOMES AND MEASURES The main outcome was level of alcohol use, classified as no reported use, low-risk use, exceeding daily limits only, exceeding weekly limits only, or exceeding daily and weekly limits, per National Institute on Alcohol Abuse and Alcoholism guidelines. Other measures included sociodemographic, body mass index, smoking, inpatient and emergency department use, and a dichotomous indicator for the presence of 26 medical conditions in the year prior to the alcohol screening identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM diagnosis codes.

RESULTS Among the 2720231 included patients, 1439361 (52.9%) were female, 1308659 (48.1%) were white, and 883 276 (32.5%) were aged 18 to 34 years. Patients with any of the conditions (except injury or poisoning) had lower odds of drinking at low-risk and unhealthy levels relative to no reported use compared with those without the condition. Among 861427 patients reporting alcohol use, patients with diabetes (odds ratio [OR], 1.11; 95% CI, 1.08-1.15), hypertension (OR, 1.11; 95% CI, 1.09-1.13), chronic obstructive pulmonary disease (COPD; OR, 1.16; 95% CI, 1.10-1.22), or injury or poisoning (OR, 1.06; 95% CI, 1.04-1.07) had higher odds of exceeding daily limits only; those with atrial fibrillation (OR, 1.12; 95% CI, 1.06-1.18), cancer (OR, 1.06; 95% CI, 1.03-1.10), COPD (OR, 1.15; 95% CI, 1.09-1.20), or hypertension (OR, 1.37; 95% CI, 1.34-1.40) had higher odds of exceeding weekly limits only; and those with COPD (OR, 1.15; 95% CI, 1.07-1.23), chronic liver disease (OR, 1.42; 95% CI, 1.32-1.53), or hypertension (OR, 1.48; 95% CI, 1.44-1.52) had higher odds of exceeding both daily and weekly limits.

CONCLUSIONS AND RELEVANCE Findings suggest that patients with certain medical conditions are more likely to have elevated levels of alcohol use. Health systems and clinicians may want to

Key Points

Question What are the associations between medical conditions and alcohol drinking levels in primary care patients?

Findings In this cross-sectional study of more than 2.7 million adult primary care patients screened for unhealthy alcohol use, 269 379 patients (9.9%) reported unhealthy drinking habits, and patients with medical conditions were less likely to drink compared with those without. However, among those reporting alcohol use, patients with diabetes, hypertension, chronic obstructive pulmonary disease, atrial fibrillation, cancer, chronic liver disease, or injury or poisoning were more likely to report drinking above recommended guidelines.

Meaning Health systems and clinicians should take a more targeted approach to help patients with certain medical conditions reduce unhealthy alcohol consumption and health risks.

Invited Commentary

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consider approaches to help targeted patient subgroups limit unhealthy alcohol use and reduce health risks.

Introduction
Excessive alcohol use is a serious and growing public health problem.1 Annually, approximately 65,000 US deaths and approximately 4% of deaths and 5% of disease and injuries globally are attributable to alcohol use.2 The population of excessive drinkers includes those with severe problems3 and those who exceed drinking guidelines but do not reach the severity of a disorder. US guidelines specify no more than 4 drinks per day or 14 per week for men aged 18 to 64 years and no more than 3 per day or 7 per week for women and men older than 65 years. In the US, at least 25% of adults4 and between 7% and 20% of adult primary care patients5,6 exceed guidelines. Excessive drinking is associated with increased incidence of numerous medical conditions, including certain cancers,7-12 cardiovascular disease,13-15 cirrhosis and pancreatitis,16-18 and gastrointestinal disorders.20 In older, predominantly male, white Veterans Health Administration samples, excessive drinking has been found to be associated with increased risk of gastrointestinal-related hospitalizations,20,21 postoperative complications,22 and poorer self-management of chronic diseases, such as diabetes24 and hypertension.24 A 2018 meta-analysis25 found that, even at moderate levels, alcohol use increases all-cause mortality and risk of death from several cardiovascular diseases and reduces life expectancy. Another study found that alcohol use uniformly increases blood pressure and stroke risk; even moderate drinking (2 drinks per day or less) increased the risk of stroke by about 15%.25 But research has rarely assessed levels of alcohol consumption across medical conditions among primary care patients.
Kaiser Permanente Northern California (KPNC), a large, integrated health care delivery system, incorporated alcohol screening into its adult primary care workflow. Since implementation, more than 12 million alcohol screenings have been conducted in more than 150 clinics, with an 87% average screening rate. Using electronic health record (EHR) data collected during clinical care, we build on the growing literature on the health effects of alcohol use and examine alcohol consumption levels in a population-based sample of primary care patients with common chronic medical conditions. The findings help us better identify the associations between medical conditions and levels of alcohol use and may aid primary care clinicians in specific disease management strategies targeted at particularly vulnerable patients.

Methods
Setting
Kaiser Permanente Northern California’s 4.3 million members constitute about one-third of northern California’s population. They are insured through employer-based plans, Medicare, Medicaid, and health insurance exchanges and are representative of the US population with insurance: 53% women and 20% Asian persons, 7.5% black persons, and 17% Hispanic persons. The KPNC Institutional Review Board reviewed the study and granted a waiver of informed consent to examine EHR data. This report follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies.

Systematic Alcohol Screening in Adult Primary Care
The KPNC alcohol screening, brief intervention, and referral to treatment (SBIRT) initiative was implemented in adult primary care in June 2013. Medical assistants screened all patients while
collecting vital sign measurements using EHR-embedded screening questions from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guide for primary care clinicians. A modified single-item screening question, automatically tailored to patient age and sex, was used: “How many times in the past three months have you had 5 or more drinks in a day” for men aged 18 to 65 years or “4 or more drinks in a day” for women and men 66 years and older. This was followed by, “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?” These were used to calculate average drinks per week.

Study Sample
The study sample included 3013643 adult KPNC members 18 years and older screened between January 1, 2014, and December 31, 2017. The final analytical sample included 2720231 patients with complete data.

Alcohol Use
Individual alcohol consumption was identified at the first screening of the study period. Per NIAAA daily and weekly drinking guidelines, individuals were classified as having no use (reporting no alcohol use in the prior 90 days), low-risk use (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: exceeding daily limits (exceeding only daily limits), exceeding weekly limits (exceeding only weekly limits), or exceeding both limits (exceeding both daily and weekly limits).

Medical Conditions
The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM diagnosis codes in the year prior to the patient’s alcohol screening were extracted from the EHR. We examined 20 common medical conditions, some of which are among the most costly to treat in the US, including asthma, atherosclerosis, atrial fibrillation, chronic kidney disease, chronic liver disease, chronic obstructive pulmonary disease (COPD), coronary disease, diabetes, dementia, epilepsy, gastroesophageal reflux, heart failure, hyperlipidemia, hypertension, migraine, osteoarthritis, osteoporosis/osteopenia, Parkinson disease/syndrome, peptic ulcer, and rheumatoid arthritis. We also examined conditions associated with alcohol problems, including arthritis, cerebrovascular disease, chronic pain, HIV, and injury or poisoning. The KPNC cancer registry was used to identify patients with cancer.

Patient Characteristics
From the EHR, we extracted patients’ sex, age, race/ethnicity, smoking status at screening, and the most recent body mass index (BMI) in the year prior to screening. To estimate socioeconomic status, which is associated with health status, we used median household income by geocoding residential addresses to 2010 census blocks. We created a 3-group categorical variable for income based on tertiles of the overall distribution in the sample (low [<$60,841 or less], middle [$60,842 to <$87,461], and high [$87,462 or more]). To control for medical acuity, we counted inpatient and emergency department (ED) visits in the year prior to screening and created 3 categories (0, 1 to 2, or 3 or more visits). Patients with unknown household income (n = 7223), smoking status (n = 184,659), and BMI (n = 107,471) were excluded, providing a final analytical sample of 2720131 patients.

Statistical Analysis
We examined differences in alcohol consumption levels by medical conditions with \( \chi^2 \) tests. We used multivariable multinomial logistic regression to estimate associations between conditions and levels of consumption, adjusting for sex, age, income, smoking status, BMI, and the number of inpatient and ED visits in the year prior. We fit separate multivariable models for each condition and conducted
the analyses in 2 steps. First, we estimated the odds of reporting low-risk use and unhealthy use relative to no use for those with the condition compared with those without the condition among the full sample (n = 2,720,231). Second, among patients reporting alcohol use (n = 861,427), we estimated the odds of exceeding daily limits, weekly limits, and both limits relative to low-risk use for those with the condition compared with those without. In bivariate analyses, statistical significance was defined at a 2-tailed P value less than .05. In multivariable analyses, we used Bonferroni correction to lower the type I error rate for 2-tailed tests to a P value of .0004 or less (P ≤ α/n, where α = .05 and n is number of comparisons [n = 130]). All analyses were performed using SAS version 9.4 (SAS Institute).

Results

Sample Characteristics

Among the 2,720,231 patients in the final analytical sample, 1,439,361 (52.9%) were female, 1,308,659 (48.1%) were white, and 883,276 (32.5%) were aged 18 to 34 years (Table 1). Among the full sample, 1,858,804 (68.3%) reported no alcohol use in the prior 90 days, 592,048 (21.8%) reported low-risk use, 165,581 (6.1%) reported use that exceeded daily limits, 62,349 (2.3%) reported use that exceeded weekly limits, and 41,449 (1.5%) reported use that exceeded both limits. A greater proportion of patients with 3 or more inpatient and ED visits and Asian, Native Hawaiian, or Pacific Islander patients reported no use relative to other consumption levels. Patients reporting use that exceeded daily limits were more likely to be male and younger (aged 18 to 34 years), while patients reporting use that exceeded weekly limits were more likely to be female and older (65 years and older). A greater proportion of patients who smoked reported exceeding both limits relative to other consumption levels.

Prevalence of Alcohol Use by Medical Condition

The most prevalent conditions in the full sample of 2,720,231 patients were hypertension (626,153 patients [23.0%]), hyperlipidemia (601,782 patients [22.1%]), and injury or poisoning (427,398 patients [15.7%]) (Table 2). Patients with medical conditions were more likely to report no use, followed by low-risk use and unhealthy use. Among patients reporting unhealthy use, use exceeding daily limits was most prevalent among those with asthma, chronic liver disease, chronic pain, diabetes, epilepsy, gastroesophageal reflux, HIV, injury or poisoning, migraine, and peptic ulcer; use exceeding weekly limits was most prevalent among those with arthritis, atherosclerosis, atrial fibrillation, cancer, cerebrovascular disease, chronic kidney disease, COPD, coronary disease, dementia, heart failure, hypertension, osteoarthritis, osteoporosis/osteopenia, Parkinson disease/syndrome, and rheumatoid arthritis. Patients with hyperlipidemia had similar prevalence of exceeding daily and weekly limits, which were higher than exceeding both limits.

Adjusted Associations Between Medical Conditions and Alcohol Use Among the Full Sample

In the full sample of 2,720,231 patients, using multivariable multinomial logistic regression, we estimated the odds of reporting low-risk and unhealthy use relative to no use for patients with a medical condition compared with those without the condition. Among all conditions examined, except for hypertension and injuries or poisonings, patients with a medical condition had lower odds than those without the medical condition of low-risk and unhealthy use relative to no use (Table 3). For example, patients with Parkinson disease/syndrome were less likely compared with those without to report low-risk use (odds ratio [OR], 0.58; 95% CI, 0.53-0.63) and unhealthy use (OR, 0.38; 95% CI, 0.33-0.44) relative to no use. Compared with patients without those with hypertension were less likely to report low-risk use (OR, 0.80; 95% CI, 0.79-0.80) but not unhealthy use (OR, 1.00; 95% CI, 0.99-1.02) relative to no use. In contrast, patients with an injury or poisoning...
were more likely than those without to report low-risk use (OR, 1.02; 95% CI, 1.01-1.03) and unhealthy use (OR, 1.06; 95% CI, 1.05-1.07) relative to no use.

### Adjusted Associations Between Medical Conditions and Alcohol Use Among Patients Who Reported Drinking

Associations between medical conditions and unhealthy use relative to low-risk use were examined among 861,427 patients who reported drinking. Compared with patients without these conditions, those with chronic liver disease, COPD, hypertension, and injury or poisoning were more likely to

#### Table 1. Demographic Characteristics of Adult Primary Care Patients Screened for Unhealthy Alcohol Use at Kaiser Permanente Northern California Between 2014 and 2017 by Alcohol Consumption Level

| Characteristic                  | Overall | No use (%) | Low-risk use (%) | Exceeds daily limits (%) | Exceeds weekly limits (%) | Exceeds both limits (%) | P value<sup>c</sup> |
|--------------------------------|---------|------------|------------------|-------------------------|--------------------------|-------------------------|---------------------|
| **Sex**                        |         |            |                  |                         |                          |                         |                     |
| Male                           | 2720231 | 1858804 (68.3) | 592 048 (21.8) | 165 581 (6.1)           | 62 349 (2.3)            | 41 449 (1.5)           | NA                  |
| Female                         | 1439361 | 1072983 (75.7) | 262 483 (44.3) | 54 367 (32.8)           | 32 913 (52.8)           | 16 615 (40.1)          | <.001               |
| **Age group, y**               |         |            |                  |                         |                          |                         |                     |
| 18-34                          | 883276  | 593012 (31.9) | 178 422 (30.1) | 87 297 (25.7)           | 10 868 (17.4)           | 13 677 (33.0)          | <.001               |
| 35-49                          | 705906  | 474246 (25.5) | 161 571 (27.3) | 46 697 (28.2)           | 12 299 (19.7)           | 11 093 (26.8)          |                     |
| 50-64                          | 680832  | 462168 (24.9) | 164 939 (27.9) | 26 035 (15.7)           | 17 425 (27.9)           | 10 265 (24.8)          |                     |
| ≥65                            | 450217  | 329378 (17.7) | 87 116 (14.7)  | 55 523 (3.4)            | 21 757 (34.9)           | 6414 (15.5)            |                     |
| **Race/ethnicity**             |         |            |                  |                         |                          |                         |                     |
| White                          | 1308659 | 772508 (59.6) | 370 413 (26.6) | 91 151 (55.0)           | 46 880 (25.7)           | 27 707 (66.8)          | <.001               |
| Asian, Native Hawaiian, or Pacific Islander | 531947 | 434051 (23.4) | 20 745 (9.5)  | 31 120 (12.8)           | 21 260 (75.2)           | 12 373 (15.5)          |                     |
| African American               | 191610  | 142621 (7.4)  | 37 412 (19.2)  | 21 120 (7.8)            | 31 260 (52.8)           | 21 260 (34.1)          |                     |
| Latino/Hispanic                | 479581  | 361181 (19.4) | 74 104 (12.5)  | 31 863 (19.2)           | 60 008 (9.6)            | 6425 (15.5)            |                     |
| Native American                | 14061   | 10228 (0.6)   | 26 193 (15.2)  | 76 6 (0.5)              | 249 (0.4)               | 199 (0.5)              |                     |
| Multiracial or unknown         | 194373  | 138215 (7.3)  | 38 653 (6.5)   | 11 770 (7.1)            | 3266 (5.2)              | 2469 (6.0)             |                     |
| **Household income**           |         |            |                  |                         |                          |                         |                     |
| Low (≤$60,481)                 | 910784  | 652820 (35.1) | 171 354 (28.9) | 52 690 (31.8)           | 19 401 (31.1)           | 14 519 (35.0)          | <.001               |
| Middle ($60,482-$87,461)       | 907754  | 624570 (33.6) | 193 785 (32.7) | 55 468 (33.5)           | 20 234 (32.5)           | 13 697 (33.0)          |                     |
| High (≥$87,462)                | 901693  | 581414 (31.3) | 226 909 (38.3) | 57 423 (34.7)           | 22 714 (36.4)           | 13 233 (31.9)          |                     |
| **BMI**                        |         |            |                  |                         |                          |                         |                     |
| Underweight                    | 42799   | 34039 (1.8)  | 6213 (1.0)      | 1398 (0.8)              | 768 (1.2)               | 381 (0.9)              | <.001               |
| Normal weight                  | 883471  | 594660 (32.0) | 203 838 (34.4) | 51 340 (31.0)           | 21 260 (34.1)           | 12 373 (29.9)          |                     |
| Overweight                     | 920909  | 602622 (32.4) | 218 945 (37.0) | 60 648 (36.6)           | 23 356 (37.5)           | 15 338 (37.0)          |                     |
| Obese                          | 873052  | 627483 (33.8) | 163 052 (27.5) | 52 195 (31.5)           | 16 965 (27.2)           | 13 357 (32.2)          |                     |
| **Smoking status**             |         |            |                  |                         |                          |                         |                     |
| Never or former                | 2450387 | 1701786 (91.6) | 530 281 (89.6) | 137 620 (83.1)          | 50 941 (81.7)           | 29 759 (71.8)          | <.001               |
| Current                        | 269844  | 157018 (8.4)  | 61 767 (10.4)  | 27 961 (16.9)           | 11 408 (18.3)           | 11 690 (28.2)          |                     |
| **No. of inpatient and ED visits** |         |            |                  |                         |                          |                         |                     |
| 0                              | 2277944 | 1522084 (81.9) | 520 274 (87.9) | 146 127 (88.3)          | 53 839 (86.4)           | 35 620 (85.9)          | <.001               |
| 1-2                            | 388030  | 290267 (15.6) | 66 456 (11.2)  | 18 147 (11.0)           | 7837 (12.6)             | 5323 (12.8)            |                     |
| ≥3                             | 54257   | 46453 (2.5)   | 5318 (0.9)     | 1307 (0.8)              | 673 (1.1)               | 506 (1.2)              |                     |

Abbreviations: BMI, body mass index; ED, emergency department; NA, not applicable.

<sup>a</sup> 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.

<sup>b</sup> Patients were asked to estimate alcohol use in the past 3 months. Following the National Institute on Alcohol Abuse and Alcoholism drinking guidelines, we defined daily limits as more than 4 drinks per day for men aged 18 to 65 years or more than 3 drinks per day for women of any age and men 66 years or older and weekly limits as more than 14 drinks per week for men aged 18 to 65 years or more than 7 drinks per week for women of any age and men 66 years or older. We classified patients as having no use (reporting no alcohol use), low-risk use (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: exceeding daily limits, exceeding weekly limits, or exceeding both limits.

<sup>c</sup> χ<sup>2</sup> tests were used to test for associations between demographic characteristics and alcohol consumption levels.
Table 2. Unadjusted Prevalence of Alcohol Consumption Levels by Medical Conditions Among Patients Screened at Kaiser Permanente Northern California From 2014 to 2017

| Condition | Totalb | Alcohol consumption levelc,d | No reported use | Low-risk use | Exceeding daily limits | Exceeding weekly limits | Exceeding both limits | P valuee |
|-----------|--------|------------------------------|----------------|-------------|------------------------|------------------------|-----------------------|----------|
| Arthritis | 35883 (1.3) | 26836 (74.8) | 6598 (18.4) | 902 (2.5) | 1132 (3.2) | 415 (1.2) | <.001 |
| No        | 26843 (98.7) | 1831968 (68.2) | 585450 (21.8) | 164679 (6.1) | 61217 (2.3) | 41034 (1.5) | |
| Asthma    | 256681 (9.4) | 186479 (72.7) | 48691 (19.0) | 12933 (5.0) | 5269 (2.1) | 3309 (1.3) | <.001 |
| No        | 2463550 (90.6) | 1672325 (67.9) | 543357 (22.1) | 152648 (6.2) | 57080 (2.3) | 38140 (1.5) | |
| Atherosclerosis | 210702 (7.7) | 164968 (78.3) | 33235 (15.8) | 2988 (1.4) | 162593 (6.5) | 55260 (2.2) | <.001 |
| No        | 2509529 (92.3) | 1693836 (67.5) | 558813 (22.3) | 165455 (6.1) | 62118 (2.3) | 40812 (1.5) | |
| Atrialfibrillation | 48873 (1.8) | 36990 (75.7) | 8611 (17.6) | 750 (1.5) | 1885 (3.9) | 637 (1.3) | <.001 |
| No        | 2671358 (98.2) | 1821814 (68.2) | 583437 (21.8) | 164831 (6.2) | 60646 (2.3) | 39027 (1.6) | |
| Cancer    | 125655 (4.6) | 90068 (71.7) | 26094 (20.8) | 2866 (2.3) | 4975 (4.0) | 1652 (1.3) | <.001 |
| No        | 2594576 (95.4) | 1768736 (68.2) | 565954 (21.8) | 162715 (6.3) | 57374 (2.2) | 39797 (1.5) | |
| Cerebrovascular disease | 9732 (0.4) | 8053 (82.7) | 1239 (12.7) | 126 (1.3) | 231 (2.4) | 83 (0.9) | <.001 |
| No        | 2710499 (99.6) | 1850751 (68.3) | 590809 (21.8) | 165455 (6.1) | 62118 (2.3) | 41366 (1.5) | |
| Chronic kidney disease | 131355 (4.8) | 108504 (82.6) | 17176 (13.1) | 1674 (1.3) | 3084 (2.3) | 917 (0.7) | <.001 |
| No        | 2588876 (95.2) | 1750300 (66.8) | 574872 (22.3) | 163907 (6.3) | 59265 (2.3) | 40532 (1.6) | |
| Chronic liver disease | 62170 (2.3) | 50543 (81.3) | 7892 (12.7) | 1888 (3.0) | 1042 (1.7) | 825 (1.3) | <.001 |
| No        | 2658061 (97.7) | 1808261 (68.0) | 584156 (22.0) | 163715 (6.3) | 61307 (2.3) | 40624 (1.5) | |
| COPD      | 69159 (2.5) | 53021 (76.7) | 10744 (15.5) | 1828 (2.6) | 2499 (3.6) | 1067 (1.5) | <.001 |
| No        | 2651072 (97.5) | 1805783 (68.1) | 581304 (21.9) | 163765 (6.2) | 59850 (2.3) | 40556 (1.5) | |
| Chronic pain | 150977 (5.6) | 115136 (76.3) | 25556 (16.9) | 5479 (3.6) | 3136 (2.1) | 1670 (1.1) | <.001 |
| No        | 2569254 (94.4) | 1743668 (67.9) | 564692 (22.0) | 160102 (6.2) | 59213 (2.3) | 39779 (1.5) | |
| coronary disease | 88732 (3.3) | 68735 (77.5) | 14681 (16.5) | 1481 (1.7) | 2874 (3.2) | 961 (1.1) | <.001 |
| No        | 2631499 (96.7) | 1790669 (68.0) | 577367 (21.9) | 164100 (6.2) | 59475 (2.3) | 40488 (1.5) | |
| Dementia  | 8890 (0.3) | 8102 (91.1) | 643 (7.2) | 22 (0.2) | 103 (1.2) | 20 (0.2) | <.001 |
| No        | 2711341 (99.7) | 1850783 (68.2) | 581405 (21.8) | 165559 (6.1) | 62246 (2.3) | 41429 (1.5) | |
| Diabetes  | 262715 (9.7) | 217042 (82.6) | 32694 (12.4) | 6513 (2.5) | 4161 (1.6) | 2305 (0.9) | <.001 |
| No        | 2457516 (90.3) | 1641762 (66.8) | 553534 (22.8) | 159068 (6.5) | 58188 (2.4) | 39144 (1.6) | |
| Epilepsy  | 17415 (0.6) | 14160 (81.3) | 2250 (12.9) | 530 (3.0) | 295 (1.7) | 180 (1.0) | <.001 |
| No        | 2702816 (99.4) | 1844644 (68.2) | 589798 (21.8) | 165051 (6.1) | 62054 (2.3) | 41269 (1.5) | |
| Gastroesophageal reflux | 301844 (11.1) | 225862 (74.8) | 53827 (17.8) | 10290 (3.4) | 8060 (2.7) | 3805 (1.3) | <.001 |
| No        | 2418387 (88.9) | 1632942 (67.5) | 538221 (22.3) | 155291 (6.4) | 54289 (2.2) | 37644 (1.6) | |
| Heart failure | 34721 (1.3) | 29492 (84.9) | 3856 (11.1) | 375 (1.1) | 745 (2.1) | 253 (0.7) | <.001 |
| No        | 2685510 (98.7) | 1829312 (68.1) | 588192 (21.9) | 165206 (6.2) | 61604 (2.3) | 41196 (1.5) | |
report unhealthy relative to low-risk use (Table 4). Patients with hypertension and COPD were more likely than those without to report use exceeding daily limits (hypertension: OR, 1.11; 95% CI, 1.09-1.13; COPD: OR, 1.16; 95% CI, 1.10-1.22), weekly limits (hypertension: OR, 1.37; 95% CI, 1.34-1.40; COPD: OR, 1.15; 95% CI, 1.09-1.20), and both limits (hypertension: OR, 1.48; 95% CI, 1.44-1.52; COPD: OR, 1.15; 95% CI, 1.07-1.23) relative to low-risk use. Patients with an injury or poisoning were more likely than those without to report use exceeding daily limits relative to low-risk use (OR, 1.06; 95% CI, 1.02-1.10). Percentages represent the proportions of patients who reported drinking at each level by whether they have a medical condition. Percentages by row may not add up to 100% due to rounding error.

Abbreviation: COPD, chronic obstructive pulmonary disease.

### Table 2. Unadjusted Prevalence of Alcohol Consumption Levels by Medical Conditions Among Patients Screened at Kaiser Permanente Northern California From 2014 to 2017 (continued)

| Condition | Totala | No reported use | Low-risk use | Exceeding daily limits | Exceeding weekly limits | Exceeding both limits | P valuea |
|-----------|--------|----------------|--------------|------------------------|------------------------|----------------------|----------|
| HIV       |        |                |              |                        |                        |                      |          |
| Yes       | 6530 (0.2) | 4217 (64.6) | 1728 (26.5) | 409 (6.3) | 116 (1.8) | 60 (0.9) | <.001    |
| No        | 2 713 701 (99.8) | 1 854 587 (68.3) | 590 320 (21.8) | 165 172 (6.1) | 62 233 (2.3) | 41 389 (1.5) |          |
| Hyperlipidemia | 601 782 (22.1) | 439 213 (73.0) | 117 419 (19.5) | 18 542 (3.1) | 18 512 (3.1) | 8096 (1.3) | <.001    |
| Yes       | 2 118 449 (77.9) | 1 419 591 (67.0) | 474 629 (22.4) | 147 039 (6.9) | 43 837 (2.1) | 33 353 (1.6) |          |
| No        | 626 153 (23.0) | 461 131 (73.6) | 114 291 (18.3) | 19 370 (3.1) | 21 159 (3.4) | 10 202 (1.6) | <.001    |
| Hypertension | Yes | 626 153 (23.0) | 461 131 (73.6) | 114 291 (18.3) | 19 370 (3.1) | 21 159 (3.4) | 10 202 (1.6) | <.001    |
| No        | 2 094 078 (77.0) | 1 397 673 (66.7) | 477 757 (22.8) | 146 211 (7.0) | 41 190 (2.0) | 32 147 (1.5) |          |
| Injury or poisoning | Yes | 427 398 (15.7) | 298 499 (69.8) | 87 754 (20.5) | 24 647 (5.8) | 10 109 (2.4) | 6389 (1.5) | <.001    |
| No        | 2 292 833 (84.3) | 1 560 305 (68.1) | 504 294 (22.0) | 140 934 (6.1) | 52 240 (2.3) | 35 060 (1.5) |          |
| Migraine | Yes | 112 353 (4.1) | 85 560 (76.2) | 20 028 (17.8) | 4198 (3.7) | 1710 (1.5) | 857 (0.8) | <.001    |
| No        | 2 607 878 (95.9) | 1 773 244 (68.0) | 572 020 (21.9) | 161 383 (6.2) | 60 639 (2.3) | 40 592 (1.6) |          |
| Osteoarthritis | Yes | 279 772 (10.3) | 205 306 (73.4) | 54 738 (19.6) | 7469 (2.7) | 8797 (3.1) | 3642 (1.2) | <.001    |
| No        | 2 440 459 (89.7) | 1 653 498 (67.8) | 537 310 (22.0) | 158 112 (6.5) | 53 552 (2.2) | 37 987 (1.6) |          |
| Osteoporosis/osteopenia | Yes | 118 948 (4.4) | 92 759 (78.0) | 20 651 (17.4) | 1259 (1.1) | 3530 (3.0) | 749 (0.6) | <.001    |
| No        | 2 601 283 (95.6) | 1 766 045 (67.9) | 571 397 (22.0) | 164 322 (6.3) | 58 819 (2.3) | 40 700 (1.6) |          |
| Parkinson disease/syndrome | Yes | 5170 (0.2) | 4247 (82.1) | 745 (14.4) | 31 (0.6) | 120 (2.3) | 27 (0.5) | <.001    |
| No        | 2 715 061 (99.8) | 1 854 557 (68.3) | 591 303 (21.8) | 165 550 (6.1) | 62 229 (2.3) | 41 422 (1.5) |          |
| Peptic ulcer | Yes | 8612 (0.3) | 6867 (79.7) | 1226 (14.2) | 229 (2.7) | 194 (2.3) | 96 (1.1) | <.001    |
| No        | 2 711 619 (99.7) | 1 851 937 (68.3) | 590 822 (21.8) | 165 352 (6.1) | 62 155 (2.3) | 41 353 (1.5) |          |
| Rheumatoid arthritis | Yes | 16 933 (0.6) | 13 455 (79.5) | 2592 (15.3) | 355 (2.1) | 395 (2.3) | 136 (0.8) | <.001    |
| No        | 2 702 298 (99.4) | 1 845 349 (68.3) | 589 456 (21.8) | 165 226 (6.1) | 61 954 (2.3) | 41 313 (1.5) |          |

Abbreviation: COPD, chronic obstructive pulmonary disease.

a Medical conditions were identified using International Classification of Diseases, Ninth Revision, Clinical Modification and International Statistical Classification of Diseases, Tenth Revision, Clinical Modification codes in the electronic health record in the year prior to and including the date of the alcohol screening visit.

b Percentages represent the proportions of patients with and without the medical condition in the overall sample. Percentages by column may not add up to 100% due to rounding error.

c Patients were asked to estimate alcohol use in the past 3 months. Following the National Institute on Alcohol Abuse and Alcoholism drinking guidelines, we defined daily limits as more than 4 drinks per day (for men aged 18 to 65 years) or more than 3 drinks per day (for women of any age and men 66 years or older) and weekly limits as more than 14 drinks per week (for men aged 18 to 65 years) or more than 7 drinks per week (for women of any age and men 66 years or older). We classified patients as having no use (reporting no alcohol use), low-risk use (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: exceeding daily limits, exceeding weekly limits, or exceeding both limits.

d Percentages represent the proportions of patients who reported drinking at each level by whether they have a medical condition. Percentages by row may not add up to 100% due to rounding error.

e χ² tests were used to test for associations between demographic characteristics and alcohol consumption levels.
Patients with chronic liver disease were more likely than those without to report use exceeding both limits, relative to low-risk use (OR, 1.42; 95% CI, 1.32-1.53).

In contrast, compared with those without the condition, patients with asthma, atherosclerosis, chronic kidney disease, chronic pain, coronary disease, dementia, HIV, migraine, osteoarthritis, osteoporosis/osteopenia, and Parkinson disease/syndrome were less likely to report unhealthy use relative to low-risk use. Patients with migraine and osteoporosis/osteopenia were less likely than patients without to report use exceeding daily limits (migraine: OR, 0.88; 95% CI, 0.85-0.91; osteoporosis/osteopenia: OR, 0.75; 95% CI, 0.70-0.79). Weekly limits (migraine: OR, 0.72; 95% CI, 0.69-0.76; osteoporosis/osteopenia: OR, 0.64; 95% CI, 0.62-0.67), and both limits (migraine: OR, 0.63; 95% CI, 0.59-0.67; osteoporosis/osteopenia: OR, 0.50; 95% CI, 0.46-0.54) relative to low-risk use. Patients with coronary disease were less likely than those without to report use exceeding daily limits (OR, 0.86; 95% CI, 0.82-0.91) and both limits (OR, 0.85; 95% CI, 0.80-0.92) relative to low-risk use. Patients with the following conditions were less likely than those without to report use exceeding weekly limits and both limits relative to low-risk use: chronic kidney disease (weekly: OR, 0.93; 95% CI, 0.90-0.96; both: OR, 0.89; 95% CI, 0.86-0.93), chronic pain (weekly: OR, 0.90; 95% CI, 0.86-0.93; both: OR, 0.89; 95% CI, 0.84-0.91), and osteoarthritis (weekly: OR, 0.94; 95% CI, 0.93-0.96; both: OR, 0.89; 95% CI, 0.84-0.91). Patients with atherosclerosis (OR, 0.87; 95% CI, 0.81-0.93) and Parkinson disease/syndrome (OR, 0.44; 95% CI, 0.31-0.64) were less likely than those without to report use exceeding daily limits relative to low-risk use. Patients with asthma (OR, 0.93; 95% CI, 0.90-0.96) and dementia (OR, 0.67; 95% CI, 0.59-0.74) were less likely than those without to report use exceeding weekly limits relative to low-risk use. Patients with HIV were less likely than those without to report use exceeding both limits relative to low-risk use (OR, 0.86; 95% CI, 0.83-0.90).

Table 3. Adjusted Associations of Medical Conditions With Reporting Low-Risk or Unhealthy Drinking Among the Full Sample of 2,720,231 Patients

| Condition | OR (95% CI) | Low-risk use vs no use | Unhealthy use vs no use |
|-----------|------------|------------------------|------------------------|
| Arthritis | 0.91 (0.89-0.94) | 0.90 (0.86-0.94) |
| Asthma    | 0.91 (0.90-0.92) | 0.89 (0.88-0.91) |
| Atherosclerosis | 0.70 (0.69-0.71) | 0.67 (0.66-0.69) |
| Atrial fibrillation | 0.82 (0.80-0.84) | 0.81 (0.78-0.84) |
| Cancer    | 0.94 (0.93-0.96) | 0.93 (0.91-0.95) |
| Cerebrovascular disease | 0.74 (0.69-0.79) | 0.69 (0.62-0.76) |
| Chronic kidney disease | 0.57 (0.56-0.58) | 0.48 (0.47-0.49) |
| Chronic liver disease | 0.58 (0.57-0.60) | 0.67 (0.65-0.70) |
| COPD      | 0.71 (0.70-0.72) | 0.83 (0.81-0.86) |
| Chronic pain | 0.71 (0.70-0.72) | 0.66 (0.64-0.67) |
| Coronary disease | 0.71 (0.69-0.72) | 0.64 (0.62-0.66) |
| Dementia  | 0.32 (0.30-0.35) | 0.20 (0.17-0.24) |
| Diabetes  | 0.52 (0.51-0.53) | 0.51 (0.50-0.52) |
| Epilepsy  | 0.50 (0.48-0.53) | 0.49 (0.46-0.52) |
| Gastroesophageal reflux | 0.83 (0.82-0.84) | 0.83 (0.82-0.84) |
| Heart failure | 0.54 (0.52-0.56) | 0.49 (0.46-0.52) |
| HIV       | 0.88 (0.83-0.93) | 0.67 (0.61-0.73) |
| Hyperlipidemia | 0.84 (0.83-0.84) | 0.84 (0.83-0.85) |
| Hypertension | 0.80 (0.79-0.80) | 1.00 (0.99-1.02) |
| Injury or poisoning | 1.02 (1.01-1.03) | 1.06 (1.05-1.07) |
| Migraine  | 0.82 (0.81-0.83) | 0.64 (0.63-0.66) |
| Osteoarthritis | 0.92 (0.91-0.93) | 0.87 (0.85-0.88) |
| Osteoporosis/osteopenia | 0.94 (0.93-0.96) | 0.72 (0.70-0.74) |
| Parkinson disease/syndrome | 0.58 (0.53-0.63) | 0.38 (0.33-0.44) |
| Peptic ulcer | 0.73 (0.68-0.78) | 0.76 (0.70-0.84) |
| Rheumatoid arthritis | 0.72 (0.69-0.76) | 0.66 (0.62-0.71) |

Abbreviations: COPD, chronic obstructive pulmonary disease; OR, odds ratio.

* Separate multinomial logistic regression models for each medical condition were adjusted for sex, age, race/ethnicity, household income, body mass index, smoking status, and number of inpatient and emergency department visits in the year prior to the alcohol screening.

b Medical conditions were identified using International Classification of Diseases, Ninth Revision, Clinical Modification and International Statistical Classification of Diseases, Tenth Revision, Clinical Modification 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, according to the National Institute on Alcohol Abuse and Alcoholism drinking guidelines.

d An OR less than 1 indicates that patients with the medical condition had lower odds than those without the condition of reporting low-risk or unhealthy use relative to no use (whereas an OR greater than 1 indicates higher odds), after controlling for covariates.

* Bonferroni-corrected P < .0004.
likely than those without to report use exceeding both limits relative to low-risk use (OR, 0.45; 95% CI, 0.34-0.58).

Compared with patients without the condition, those with atrial fibrillation (OR, 0.80; 95% CI, 0.74-0.87) and cancer (OR, 0.91; 95% CI, 0.87-0.95) were less likely to report use exceeding daily limits but more likely to report use exceeding weekly limits relative to low-risk use (atrial fibrillation: OR, 1.12; 95% CI, 1.06-1.18; cancer: OR, 1.06; 95% CI, 1.03-1.10). In contrast, relative to low-risk use, patients with diabetes were more likely to report use exceeding daily limits (OR, 1.11; 95% CI, 1.08-1.15) but less likely to report use exceeding weekly limits (OR, 0.90; 95% CI, 0.86-0.93) compared with those without. There were no associations between cerebrovascular disease, epilepsy, gastroesophageal reflux, heart failure, hyperlipidemia, peptic ulcer, and rheumatoid arthritis and unhealthy alcohol use relative to low-risk use among patients reporting drinking.

Discussion

Using data collected in a systematic alcohol screening program, we examined associations between a variety of medical conditions and alcohol consumption levels among 2720231 adult primary care patients. With the exception of those with injury or poisoning diagnoses, often associated with acute alcohol intoxication in the literature,37,38 people with medical conditions were more likely to report no use compared with people without. This is consistent with previous studies that found no alcohol use was associated with poorer health, perhaps because people in ill health choose to quit drinking owing to the effects on their condition’s symptoms or progression or medication contraindications—

Table 4. Adjusted Associations of Prevalent Medical Conditions With Reporting Unhealthy Alcohol Use Among 861 427 Patients Who Reported Alcohol Usea

| Conditionb | OR (95% CI)c,d Exceeding daily limits vs low-risk use | Exceeding weekly limits vs low-risk use | Exceeding both limits vs low-risk use |
|------------|-----------------------------------------------------|----------------------------------------|--------------------------------------|
| Arthritis  | 1.02 (0.95-1.09)                                      | 0.98 (0.92-1.05)                         | 0.89 (0.80-0.98)                      |
| Asthma     | 1.03 (1.00-1.05)                                      | 0.93 (0.90-0.96)*                        | 0.97 (0.93-1.00)                      |
| Atherosclerosis | 0.87 (0.84-0.91)*                              | 1.12 (1.06-1.18)*                        | 1.00 (0.92-1.09)                      |
| Atrial fibrillation | 0.91 (0.87-0.95)*       | 1.06 (1.03-1.10)*                        | 0.92 (0.87-0.97)                      |
| Cancer     | 0.81 (0.67-0.97)                                      | 0.97 (0.84-1.12)                         | 0.88 (0.70-1.10)                      |
| Chronic kidney disease | 0.91 (0.87-0.96)     | 0.87 (0.83-0.90)*                        | 0.71 (0.66-0.76)*                     |
| Chronic liver disease | 1.07 (1.01-1.12)       | 1.09 (1.02-1.17)                         | 1.42 (1.32-1.53)*                     |
| COPD       | 1.16 (1.10-1.22)*                                    | 1.15 (1.09-1.20)*                        | 1.15 (1.07-1.23)*                     |
| Chronic pain | 0.96 (0.94-0.99)*                               | 0.90 (0.86-0.93)*                        | 0.84 (0.80-0.88)*                     |
| Coronary disease | 0.86 (0.82-0.91)*        | 1.07 (1.03-1.12)                         | 0.85 (0.80-0.92)*                     |
| Dementia   | 0.49 (0.32-0.76)                                      | 0.67 (0.54-0.83)*                        | 0.45 (0.29-0.70)                      |
| Diabetes   | 1.11 (1.08-1.15)*                                    | 0.90 (0.86-0.93)*                        | 0.96 (0.92-1.00)                      |
| Epilepsy   | 0.94 (0.85-1.04)                                      | 1.05 (0.93-1.19)                         | 1.03 (0.89-1.21)                      |
| Gastroesophageal reflux | 0.99 (0.97-1.01)      | 0.99 (0.97-1.02)                         | 0.97 (0.94-1.01)                      |
| Heart failure | 0.85 (0.76-0.95)                                  | 0.99 (0.91-1.07)                         | 0.84 (0.73-0.95)                      |
| HIV        | 0.83 (0.74-0.93)                                      | 0.72 (0.60-0.87)                         | 0.45 (0.34-0.58)*                     |
| Hyperlipidemia | 1.02 (1.00-1.04)                               | 1.01 (0.99-1.03)                         | 0.99 (0.97-1.02)                      |
| Hypertension | 1.11 (1.09-1.13)*                                | 1.37 (1.34-1.40)*                        | 1.48 (1.44-1.52)*                     |
| Injury or poisoning | 1.06 (1.04-1.07)*     | 0.99 (0.97-1.02)                         | 0.98 (0.95-1.01)                      |
| Migraine   | 0.88 (0.85-0.91)*                                    | 0.72 (0.69-0.76)*                        | 0.63 (0.59-0.67)*                     |
| Osteoarthritis | 0.96 (0.93-0.98)                               | 0.94 (0.92-0.97)*                        | 0.88 (0.84-0.91)*                     |
| Osteoporosis/osteopenia | 0.75 (0.70-0.79)*   | 0.64 (0.62-0.67)*                        | 0.50 (0.46-0.54)*                     |
| Parkinson disease/syndrome | 0.44 (0.31-0.64)*     | 0.83 (0.69-1.01)                         | 0.54 (0.37-0.80)                      |
| Peptic ulcer | 1.10 (0.95-1.27)                                 | 0.98 (0.84-1.14)                         | 1.03 (0.83-1.27)                      |
| Rheumatoid arthritis | 0.94 (0.84-1.06)   | 0.92 (0.82-1.02)                         | 0.77 (0.64-0.91)                      |

Abbreviations: COPD, chronic obstructive pulmonary disease; OR, odds ratio.

* Separate multinomial logistic regression models for each medical condition were adjusted for sex, age, race/ethnicity, household income, body mass index, smoking status, and number of inpatient and emergency department visits in the year prior to the alcohol screening.

b Medical conditions were identified using International Classification of Diseases, Ninth Revision, Clinical Modification and International Statistical Classification of Diseases, Tenth Revision, Clinical Modification 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, according to the National Institute on Alcohol Abuse and Alcoholism drinking guidelines. We further classified the unhealthy use group into the following mutually exclusive groups: exceeding daily limits, exceeding weekly limits, or exceeding both limits.

d An OR less than 1 indicates that patients with the medical condition had lower odds than those without the condition of reporting unhealthy use (exceeding daily, weekly, or both limits) relative to low-risk use (whereas an OR greater than 1 indicates higher odds), after controlling for covariates.

* Bonferroni-corrected P < .0004.
so-called sick quitters—or because they were formerly heavy drinkers whose drinking may have been related to their poor health.39-42

However, among those reporting drinking, we found more complex associations. People with migraine or osteoporosis/osteopenia, for example, were less likely than those without to report unhealthy drinking than they were to drink within guidelines. Alcohol may exacerbate symptoms or they may use medications contraindicated with alcohol use. People with atrial fibrillation and cancer were less likely to exceed daily limits but more likely to exceed weekly limits compared with people without these conditions. These patients may be less able to tolerate the intoxicating effects of drinking 4 or more drinks at one time.

A few conditions, including COPD, hypertension, and chronic liver disease, were associated with unhealthy as opposed to low-risk drinking; patients with COPD and hypertension were more likely to exceed daily, weekly, and both limits, and those with chronic liver disease were more likely to exceed both daily and weekly limits. Patients with diabetes were more likely to report exceeding only daily limits but less likely to report exceeding only weekly limits than they were to report low-risk use. Our findings echo other studies demonstrating an association between these conditions and heavy drinking. While some studies have found light to moderate drinking to be associated with lower risk of type II diabetes,43-44 a 2015 meta-analysis45 of data from almost 2 million individuals found this protective relationship only among women and only related to standard volume over time, not to a heavy episodic drinking pattern, such as the exceeding daily limits level we examined. There is also evidence on the association between excessive drinking and hypertension46-49 and on the benefits of reducing consumption. A 2017 meta-analysis50 of data from 36 randomized clinical trials found that among people drinking 2 or more drinks per day, a reduction in alcohol consumption resulted in significant reductions in blood pressure. While several studies found an association between drinking and COPD and many patients with COPD have been or are heavy drinkers, smoking was often a confounder, and research is rarer on the independent association between excessive alcohol use and COPD controlling for smoking. A 2019 study of 44 000 Swedish men51 found that while light drinking was protective, the incidence of COPD increased significantly beginning at 14 or more drinks per week. Studies also found an association between unhealthy drinking and liver disease52 and liver disease outcomes,53 especially for women.54

All 4 conditions associated with higher rates of unhealthy drinking relative to low-risk drinking—COPD, hypertension, chronic liver disease, and diabetes—are common, costly, and prevalent among primary care populations. In all cases, heavy drinking can exacerbate symptoms, complicate treatment, and increase the risk of adverse outcomes, and reducing consumption may have beneficial effects.55,56 These findings underscore the clinical importance of linking unhealthy alcohol use to specific medical conditions. The mounting evidence of alcohol’s adverse health effects have led to increased efforts to address harmful use in primary care settings.57 Studies have documented the efficacy of approaches such as systematic alcohol SBIRT in reducing use.58-63 While many studies have focused on alcohol use outcomes, emerging research is examining how these interventions may affect health outcomes, such as blood pressure. Chi et al64 found that a brief alcohol intervention delivered by a primary care physician was associated with reductions in blood pressure and improvements in blood pressure control among patients with hypertension. The physician SBIRT training in this system emphasized discussing alcohol consumption in the context of managing patients’ presenting health concerns. We need further research on ways to identify and reduce excessive alcohol use among these higher-risk patients.

Limitations
Our study has several limitations. We cannot establish temporality of the associations observed between medical conditions and alcohol consumption levels, since patients were asked about consumption over the past 3 months at the screening, and the presence of medical conditions was determined for the year prior to (and including) the screening date. Future studies should aim to establish temporality to infer causality. We did not have lifetime drinking data for our sample and
could not differentiate between lifetime and current abstainers or determine if use levels reported at screenings represented lifetime use; the no use group likely included individuals who drank previously but quit, possibly related to serious medical conditions or to recovery from an alcohol use disorder. We found a high rate of no reported use, much higher than those in national surveys.\textsuperscript{65} This primary care population may be older and sicker than those in community surveys or may be underreporting their drinking. We are also unable to determine clinically meaningful thresholds for the strength of associations we found. We used a conservative approach for adjusting for multiple comparisons, which could have dampened the significance of some associations we observed. Finally, while unadjusted ORs could potentially inform clinicians about drinking patterns among particularly vulnerable populations, we chose a more conservative approach, which adjusted for important sociodemographic, health, and utilization characteristics, to provide clinicians with information about medical conditions and drinking patterns independent of case-mix differences.

Conclusions

Patients with most medical conditions, compared with those without, were more likely to report no alcohol use than to drink at low-risk or high-risk levels. However, people with diabetes, hypertension, COPD, and chronic liver disease who reported drinking were more likely than those without to drink at unhealthy levels, potentially exacerbating their conditions and jeopardizing treatment regimens. Further research should identify how clinicians can tailor screening and interventions to help patients with certain chronic medical conditions to curtail excessive alcohol use and minimize health risks.
Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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