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Patient and provider factors associated with receipt and delivery of brief interventions for unhealthy alcohol use in primary care

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Abstract

Background: Unhealthy alcohol use is a serious and costly public health problem. Alcohol screening and brief interventions are effective in reducing unhealthy alcohol consumption. However, rates of receipt and delivery of brief interventions vary significantly across healthcare settings, and relatively little is known about the associated patient and provider factors.

Methods: This study examines patient and provider factors associated with the receipt of brief interventions for unhealthy alcohol use in an integrated healthcare system, based on documented brief interventions in the electronic health record. We retrospectively analyzed 287,551 adult primary care patients (and their 2,952 providers) who screened positive for unhealthy drinking between 2014 and 2017 using multi-level logistic regression model.

Results: We found lower odds of receiving a brief intervention among those exceeding only daily or weekly drinking limits (vs. exceeding both limits), female gender, older age groups, higher medical complexity and those already diagnosed with alcohol use disorders. Patients with other unhealthy lifestyle activities (e.g., smoking, no/insufficient exercise) were more likely to receive a brief intervention. We also found that female providers and those with longer tenure in the health system were more likely to deliver brief interventions.

Conclusions: These findings point to characteristics that can be targeted to improve universal receipt of brief intervention.

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Keywords

receipt and delivery of brief interventions; alcohol screening; unhealthy alcohol use; patient and provider factors

Introduction

Unhealthy alcohol use is a significant public health problem associated with many common medical and mental health conditions (Sterling et al., 2020, Palzes et al., 2020b), and is often a precursor to alcohol use disorder and related medical problems (Mertens et al., 2003). A recent large-scale combined analysis found a positive and curvilinear association between the level of alcohol consumption and all-cause mortality, with the minimum mortality risk around or below 100 g per week (Wood et al., 2018). Unhealthy alcohol use, on a spectrum ranging from drinking above recommended guidelines to alcohol use disorder, is also costly, accounting annually for upwards of \$250 billion in U.S. health costs (Sacks et al., 2015).

Alcohol screening and brief intervention (SBI) is a public health approach to early intervention for unhealthy use that is supported by strong evidence of efficacy (Beich et al., 2003, Bertholet et al., 2005, Kaner et al., 2009, Whitlock et al., 2004), including findings of reductions of weekly alcohol consumption around 13-34% (–38 to –50g/week) at 6-12 months follow-up; and growing evidence of effectiveness in real-world settings. (Kaner et al., 2018) found an average reduction of weekly alcohol consumption of 20g after a year after receiving BI (a moderate effect size of about a standard-sized drink per week), although little impact was found on frequency of binge drinking days and number of drinking days. Research shows that individuals who receive a BI for unhealthy alcohol use reduced weekly consumption by about 8 drinks per week at one year later, while a control group only reduced by about 3 drinks per week, proportion of past-week heavy drinking days (Fleming et al., 1997). SBI is also cost-effective: In a review of 23 studies, (Angus et al., 2014, Barbosa et al., 2017) reviewed 7 studies of SBIs for alcohol in ED settings, and in six studies found a reduction in healthcare utilization or costs, while one found an increase, and cost reductions ranged from minor to substantial, depending on time frame, type of costs, and other factors. Although adoption and implementation of SBI in healthcare settings (Babor and Higgins-Biddle, 2000, Babor et al., 2007) has increased, rates of systematic implementation in primary care (including universal screening, secondary prevention, early intervention, and treatment for problematic alcohol use) have failed to reach most primary care populations (U.S. Department of Health and Human Services and Office of the Surgeon General, 2016). A recent analysis of national survey data found that while the majority of those surveyed with alcohol use disorders reported being asked about their alcohol use, only about 5% reported receiving a brief intervention from their physician (Mintz et al., 2021). Understanding patient and provider characteristics that facilitate or impede SBI implementation is critical for health systems to improve provider training and patient care, and to reduce avoidable patient suffering and health care costs.

A small but growing body of research has examined the relationship between patient characteristics (age, sex, race/ethnicity, and drinking severity) and receipt of BI. Findings

from limited research indicate existence of disparities in receipt of BI across patient subgroups, yet findings have yielded mixed results, and there are few large population studies other than those conducted in the Veteran's Health Administration (VA) and Kaiser Permanente Northern California (KPNC), another large health system. The large pragmatic trial conducted at KPNC found that middle-aged (45-59) patients, men, and those with medical or mental health comorbidities were more likely to receive a BI compared to patients 60 and over, women, and those without such conditions, respectively (Mertens et al., 2015). Bachhuber et al. (2017) studied SBI for unhealthy drinking for adult primary care patients Federally Qualified Health Center and found that older patients, women and those with chronic medical conditions were less likely to be screened; patients with higher AUDIT-C scores were more likely to receive a BI and non-English speaking patients were less likely to receive a BI (Bachhuber et al., 2017). Recent studies among adults from 13 states and the District of Columbia (McKnight-Eily et al., 2020) and veterans in the VA (Chen et al., 2020) found that women were significantly less likely to receive BI than men. Racial and ethnic differences in BI rates have been noted as well. In a VA study Williams et al. found higher rates of receiving brief advice among Black and Hispanic patients compared to White patients (Williams et al., 2012). Black, Hispanic and American Indian/Native American patients were more likely than White patients, men were more likely than women, and those with higher self-reported alcohol use severity, were more likely than those with lower scores, to receive advice about their alcohol use (Dobscha et al., 2009). These findings suggest that disparities for SBI exist and underscore the importance of examining trends within health systems to improve training materials and protocols with the goal of providing more equitable care.

Far fewer studies have examined the relationship between provider characteristics and delivery of BIs and the findings to date are inconclusive. A study by Mertens et al. (2015) found that primary care providers who were younger, White, or had a longer tenure in the healthcare system were more likely to deliver BIs than colleagues who were older, non-White, or had a shorter tenure. An older study by Kaner et al. (2001) found no association between provider demographics and likelihood of delivering BIs, but did find that providers with BI training in addition to written guidelines were more likely to provide BI than those receiving written guidelines alone. A study of primary care nurses also found no association between nurse demographic characteristics and delivery of BIs (Lock and Kaner, 2004). Thus, provider behavior is an important role in SBI delivery, however, more research is needed to understand how to best tailor training materials to improve BI rates.

This exploratory study makes a unique contribution to the growing literature examining factors associated with receiving BI by examining both provider and patient characteristics, while accounting for clustering of patients within providers. We examine rates of BI for unhealthy alcohol use in a systematic program of SBI in adult primary care clinics in KPNC, a large, not-for-profit integrated healthcare delivery system. We also examine characteristics of patients (socio-demographic and clinical) and providers (demographics, tenure in health system and specialization) and their associations with providing BIs to better understand which characteristics facilitate or impede widespread implementation of BIs in primary care. Understanding how patients and provider characteristics may be related to patterns of receipt and delivery of BIs will inform quality improvement efforts in clinician training

and intervention delivery, and also improve treatment outcomes. Increased awareness of disparities may help guide efforts to achieve equity in BI rates across patient characteristics.

Materials and Methods

Study Setting

KPNC is a non-profit integrated healthcare delivery system of four million members, representing about a third of all Northern Californians. The membership is socio-economically diverse and similar to the local and state-wide insured population, excluding those with very low income, although 12 percent are Medicaid patients. The members are 53% female, 21% Asian, 6% Black, and 22% Hispanic (Gordon, 2020). KPNC has 21 medical centers, 262 medical offices, and more than 2,900 adult primary care physicians and providers; most members have direct access to specialty care clinics, including psychiatry and addiction medicine. This study was approved by the KPNC Institutional Review Board.

Systematic Alcohol Screening and Brief Intervention in Adult Primary Care

The Alcohol as a Vital Sign (AVS) initiative is an SBIRT workflow in adult primary care at KPNC. Using National Institute on Alcohol Abuse and Alcoholism (NIAAA) evidence-based screening instruments embedded in the **electronic health record (EHR)**, medical assistants conduct screening by asking a modified single-item screening question ("How many times in the past three months have you had 5 or more drinks in a day" (for men aged 18-65), or "4 or more drinks" (for men aged 66 and women of all ages), followed by two questions on typical drinking days per week and typical number of drinks per drinking day (National Institute on Alcohol Abuse and Alcoholism, 2005, revised 2016). Questions are collected along with vital sign information, and patient answers are recorded in the EHR.

Drinking that exceeds the recommended age- and gender-specific daily and/or weekly limit (>7 drinks/week for women and men aged 66 and older, or >14 drinks/week for men aged 18-65), is considered a positive screening result for unhealthy alcohol use. Per protocol, patients who screen positive are administered a BI based on motivational interviewing principles (Miller and Rollnick, 2013), or a referral to outpatient addiction treatment, if needed, by their primary care provider. The EHR alerts medical assistants with a best practice reminder to screen patients annually, except for patients who had a prior positive alcohol screening, in which case the reminder is issued every six months until the patient has a negative screening.

Sample

We identified 446,299 adult primary care patients, ages 18-85 who had a positive screening result for unhealthy drinking in KPNC adult primary care (internal medicine, family practice, or urgent care) between January 1, 2014 and December 31, 2017. We defined the index date as the first date of a positive alcohol screen within the inception period. We excluded patients: 1) did not have continuous membership in the year prior to index (n=108,230); 2) were < 18 years old (n=13); 3) who had missing data for any of the patient-level covariates of interest (NDI index, BMI, exercise, smoking status or insurance, missing department, or missing AVS screening question(s), n=48,101); or 4) for whom the primary

care providers for the index screening visit had missing data for any of the provider-level covariates of interest (provider age or specialty, n=2,404). The final analytical sample was 287,551 patients among 2,952 providers (Figure 1).

Measures

1. Documented BI at the Index Screening—BI for unhealthy alcohol use on the index date was determined by using International Classification of Diseases (ICD)-9 (V65.42 and V65.49, for time period prior to October 2015) or ICD-10 diagnosis codes (Z71.41 and Z71.89, for time period after October 2015) for “Counseling, Alcohol Prevention”, Current Procedural Terminology codes (96160, 99420, 99408, and 99409) and Healthcare Common Procedure Coding System codes (G0396, G0397, G0443, and H0050) for alcohol use assessment and brief interventions.

2. Alcohol Consumption at the Index Screening—As mentioned above, patients were identified with unhealthy drinking if they reported drinking at levels exceeding either daily or weekly limits per NIAAA guidelines at their index screening visit. We further classified them into mutually exclusive groups as “exceeding only daily limit,” “exceeding only weekly limit,” or “exceeding both daily and weekly limits.” We also defined patients’ index year of screening based on the index screening date.

3. Patient and Provider Characteristics—From the EHR, we extracted patients’ sex, age, race/ethnicity, insurance type, physical activity level and smoking status at the time of alcohol screening. We used the most recent record of self-reported physical activity in the year prior to the index date and classified individuals into 3 physical activity groups: inactivity (0 min/week), insufficient activity (>0 but <149 min/week), and sufficient activity (>=150 min/week) (Golightly et al., 2017). Similarly, we used the most recent record of body mass index (BMI) in the year prior to the index date and created four groups: underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), and obese (>=30.0) (Centers for Disease Control and Prevention and Division of Nutrition, 2020). To adjust for patients’ medical comorbidities, we used the Charlson comorbidity score which estimates the one-year mortality risk based on a weighted score of 17 medical conditions (Charlson et al., 1987, Deyo et al., 1992). We also identified whether individuals had an alcohol use disorder diagnosis, drug use disorder diagnosis, mental health condition (Palzes et al., 2020a, Palzes et al., 2020b) (depression, bipolar disorder, schizophrenia, schizoaffective disorder, anxiety disorder, panic disorder, obsessive-compulsive disorder, pervasive developmental disorder, anorexia nervosa, and bulimia nervosa), or substance abuse-related medical condition (SAMC) (Weisner et al., 2001) in the year prior to index date, based on ICD-9 and ICD-10 codes. We used the neighborhood deprivation index (NDI) as a proxy for individual socioeconomic status (SES) and divided patients into quartiles based on the overall distribution (Messer et al., 2006). Neighborhood deprivation affects multiple health conditions, so an index may have more relevance than single-item measures of SES. In addition, we extracted and summarized patients’ service utilization in the year prior to the index screening. For the primary care providers of the index screening, we also extracted providers’ age, sex, race/ethnicity, specialty (Internal Medicine (MD),

Non-Internal Medicine (MD) and Non-MD) and years of service from the KPNC staff demographic and training administrative databases.

Statistical Analysis

We first examined the distributions of patient demographics, insurance type, health characteristics, and the prevalence of medical conditions, along with the distributions of provider characteristics. To determine the intraclass correlation coefficient (ICC), a two-level random intercept logistic model without predictors was conducted first (null model). Next, patient- and provider-level characteristics were added to the model to examine how they are associated with receipt of BI. To examine associations between patient- and provider-level characteristics and a BI, we conducted multi-level logistic regression analyses with random intercepts to account for the correlation between repeated patient measurements within each provider, while adjusting for medical facility as a fixed effect. We also adjusted for patients' service utilization in the year prior to and the year of the index screening. Significance was defined at $p < 0.05$ and all tests were two-tailed. Analyses were performed using SAS statistical software, version 9.4 (SAS Institute Inc.).

Results

Sample Characteristics

The final analytical sample of patients who screened positive for unhealthy alcohol use ($N=287,551$) was 40% female, 63% White (Table 1) and had a mean age of 43 years (standard deviation=10). More than two-thirds of the sample was either overweight (37%) or obese (32%). The majority of the sample did not smoke (85%) and had a Charlson comorbidity score of 0 (76%). Forty-six percent of the sample reported exercising 150 minutes or more per week. About 3% had an alcohol use disorder diagnosis, and 1.2% had a drug use disorder, in the year prior to the index positive screening. At the index visit, 60% reported exceeding only daily drinking limits, 26% reported exceeding only weekly drinking limits, and 13% reported drinking at levels exceeding both daily and weekly limits.

The primary care providers ($N=2,952$) whom the sample of patients visited at the index screening were primarily aged 35-49 (53%), Asian, Native Hawaiian, or Pacific Islander (49%), and female (58%) (Table 2). About half of the providers (47%) specialized in Internal Medicine, and 49% of providers had worked at KPNC at least for 6 years or more.

Patient Characteristics Associated with Documented BI

The null model, without predictors, revealed an ICC of 0.42, suggesting that approximately 42% of the variability in receipt of BI was accounted for by the providers, leaving 58% of the variability to be accounted for by the patients or other unknown factors. Of the full analytic sample of patients screening positive for unhealthy alcohol use, 134,311 (47%) received a BI. Results from the multi-level logistic regression model suggested that all patient-level characteristics examined were significantly associated with having a documented BI except BMI, insurance type, history of medical/mental health condition or drug use disorder (except alcohol use disorder) (Table 3).

Compared with the youngest age group (18-34 years), older patients were less likely to receive a BI, with the oldest age group (76+ years) having the lowest odds (aOR=0.84, 95% CI=0.78-0.91). Women had 27% lower odds of receiving a BI than men (aOR=0.73, 95% CI=0.72-0.75). Compared with White patients, Asian patients, including Native Hawaiians and Pacific Islanders, were more likely, while African American patients were less likely, to have a BI (aOR=1.05, 95% CI=1.02-1.08 and aOR=0.96, 95% CI=0.92-1, respectively). Patients in the highest NDI group (lowest SES) were 4% more likely to have a BI compared with those in the lowest NDI group (aOR=1.04, 95% CI=1.01-1.07). Smokers were more likely than non-smokers to receive one (aOR=1.28, 95% CI=1.25-1.31). Higher medical comorbidity based on the Charlson Comorbidity Index was associated with lower odds of receiving a BI (e.g., those with a score of 3 or higher had 14% lower odds of having a BI than patients with a score of zero (aOR=0.86, 95% CI=0.82-0.90). Lower levels of physical activity were associated with a higher likelihood of receiving a BI.

Compared with those reporting drinking exceeding both daily and weekly limits, those exceeding only daily or only weekly limits were less likely to receive a BI (aOR=0.65, 95% CI=0.64-0.67 and aOR=0.64, 95% CI=0.62-0.66, respectively). Patients with an alcohol use disorder diagnosis were less likely to have a BI than those without (aOR=0.86, 95% CI=0.81-0.91). Prior-year utilization of primary care, inpatient, and emergency department services were associated with lower odds of having a BI. We found an increasing trend of BIs being documented over time: compared with patients screened in the first year of SBIRT implementation (2014), patients screened in later years had higher odds of receiving a BI, with odds ratios increasing from 1.73 (95% CI=1.69-1.78) in the second year to 3.23 (95% CI=3.12-3.34) in the fourth year.

Provider Characteristics Associated with Documented BI

Younger provider age was associated with lower odds of delivering BIs (aOR=0.99, 95% CI=0.98-1). Female providers were more likely to deliver BIs than male providers (aOR= 1.21, 95% CI =1.08-1.35). African American providers had 32% lower odds (aOR=0.68, 95% CI=0.51-0.91) and Latino/Hispanic providers had about 26% lower odds (aOR=0.74, 95% CI=0.58-0.93) of delivering BIs than White providers. Compared with those having less than 1 year of service in KPNC, providers with 1-5 years (aOR=1.32, 95% CI=1.26-1.39) and 6 years or more of service (aOR=1.49, 95% CI=1.38-1.60) were more likely to deliver BIs.

Discussion

In this study we examined patient and provider predictors of EHR documented BIs for unhealthy alcohol use among a diverse sample of adult primary care patients (n=287,551) in an integrated health care delivery system, who reported unhealthy alcohol consumption. Understanding factors associated with delivery and receipt of BIs for unhealthy alcohol use can help health systems tailor alcohol screening and BI implementation approaches and clinician training to facilitate universal BIs. Our findings regarding the receipt of BIs and the relationship to patient and provider characteristics were consistent with another recent study in primary care which also found that female sex, older age, medical comorbidity and

higher severity of alcohol use were all associated with lower likelihood of receiving a BI. (Bachhuber et al., 2017).

Patient Characteristics

We found that the likelihood of receiving a BI decreased with patient age. Older patients may have more health conditions which require physicians' attention, leaving less time to discuss alcohol use. Physicians may rightly perceive young adults as more likely, in general, to drink in excess of guidelines (Grant et al., 2017, Saitz et al., 2019), but it is critical that providers and health systems systematically screen older adults for unhealthy alcohol consumption. The persistent and pernicious stigma associated with mental health and substance use problems may often contribute to older adults denying or minimizing the full scope of their substance use (Choi and DiNitto, 2013). Research also suggests that older adults may be particularly vulnerable to the health effects of unhealthy alcohol use (Mewton et al., 2020), including dangerous medication interactions (Holton et al., 2020), falls (Shakya et al., 2020), and exacerbation of chronic conditions (Moore et al., 2006, Zhou et al., 2016). In addition, studies show that older adults, especially the "baby boomer" generation, frequently drink above recommended limits and considerably more than previous older generations in the U.S., and have higher rates of comorbidities (Barry and Blow, 2016). Screening and BIs focused on limiting alcohol consumption to recommended guidelines can be tailored (Satre and Leibowitz, 2015) and should be part of the standard preventive conversations primary care physicians have with older patients. In the U.S., this could mean increasing emphasis on alcohol screening and intervention at required annual Medicare health assessments (Colburn and Nothelle, 2018).

Consistent with a recent study using Centers for Disease Control and Prevention's 2017 Behavioral Risk Factor Surveillance Survey data which found that compared to their male counterparts, women who reported binge drinking were less likely (13.6% vs. 25.9%) to receive advice to cut back (McKnight-Eily et al., 2020); we found that women were more than 25% less likely to receive a BI than men. Women may be less likely to report drinking behaviors at a level which physicians feel merit a BI (although we adjusted for self-reported drinking level), or there may be other competing clinical factors which take precedence during women's medical appointments. Women more often report stigma as a barrier to engage in clinical services for substance use compared to men (Stringer and Baker, 2018). Regardless of the reasons for receipt of BI, it is unfortunate that women were less likely to be screened given the well-documented "telescoping" phenomenon in which women progress more quickly than men from non-problematic use through unhealthy drinking to alcohol use disorders (Grant et al., 2017, Piazza et al., 1989). Women also enter addiction treatment with more severe substance, medical and mental health symptoms compared to men (Greenfield et al., 2007, Keyes et al., 2010). Robust delivery of BIs might help women avoid more severe alcohol use problems and increase clinician awareness and training about the importance of BIs for women with unhealthy alcohol use. Moreover, BIs could be incorporated into primary care routinely for women.

Interestingly, our findings in regard to race differ from those in the VA regarding Black patients being less likely to receive a BI in this private health system, as opposed to more

likely to receive BIs in the VA; disparities may differ across clinical settings, and racial/ethnic disparities may change over time in response to changes in membership, training or staffing.

Smokers, and people reporting less than the recommended amount of exercise per week, and individuals exceeding daily and weekly alcohol use limits, were more likely to receive a BI, perhaps because clinicians find it easier to integrate discussions of alcohol use into larger discussions of “lifestyle” factors than to broach alcohol use alone. Such an approach would be consistent with intervention strategies targeting multiple health risk behaviors (Prochaska and Prochaska, 2011). Conversely, people exceeding only daily or only weekly limits, and those with higher medical complexity, were less likely to receive a BI, perhaps due to less perceived problem severity, or competing clinical priorities, during medical appointments. The findings are consistent with recent research finding that people with HIV were less likely to receive a BI than a matched sample of HIV-negative patients (Silverberg et al., 2020). Likewise, people with more clinical encounters – visits at outpatient clinics or emergency departments, or hospitalizations – in the preceding year were less likely to receive a BI, perhaps for the same reason. Patients with alcohol use disorders were also less likely to receive a BI; physicians may reasonably assume that these patients’ problems are too severe to benefit from a BI and thus refer them directly to specialty addiction treatment, which is generally supported by the extant literature (Saitz, 2010).

Provider Characteristics.

Consistent with previous studies (Mertens et al., 2015, Roter et al., 2002), we found that female clinicians versus male, and those with longer tenure in the health system versus those with shorter, were more likely to deliver BIs, while Black and Latino clinicians versus White were less likely. Findings may reflect differences in gender or ethnic differences in communication styles, which may affect provider comfort level in screening for use and delivering BIs. In this regard, the potential contributions of systemic racism and implicit bias, also affecting physicians of color (Chandrashekar and Jain, 2020) needs to be considered as well. More research is needed to explore the causes of these differences, including institutional and systemic factors, that could help guide development of targeted clinician training and enhanced BI implementation tools, such as scripts and other clinical decision support tools.

Limitations

This study has several limitations. Similar to other EHR-based studies, data on BIs are limited to what is documented in the EHR. Data on other covariates such as alcohol consumption and exercise are based on self-report which is subject to social desirability bias. While the percentage of missing covariate data was within a similar range of other EHR-based studies (Hirschtritt et al., 2019, Lam et al., 2020), unfortunately, reasons for missing data in our study could not be determined. We have no data on important provider factors such as BI outcome expectancies, concerns about intrusiveness, beliefs that SBI is ineffective, negative attitudes about patients with alcohol problems, and self-efficacy; all have been identified as related to delivery of BI (Gargaritano et al., 2020). KPNC has a well-established EHR and has a membership that is racially diverse and reflects the U.S.

population with access to care, which allows us to study a large population-based sample of patients and providers; it is not known how well the study's findings generalize to other healthcare systems and populations. However, our findings generally are in alignment with other studies to date, suggesting that results can be useful for other health systems in making decisions for implementing SBI. Future studies are needed to confirm these exploratory findings. While some of the effect sizes were relatively small and their statistical significance influenced by our large sample size, others suggest clinically meaningful (and remediable) disparities. Finally, it is beyond the scope of this current study to examine the role of patient-provider concordance in the delivery of BIs; this is an important question deserving of future study.

Conclusion

This study identified several patient- and clinician-level characteristics associated with receipt or delivery of BIs for unhealthy alcohol use in the context of a systematic alcohol screening and BI program in a large health system with a diverse adult primary care population. Several patient sub-groups were less likely to receive a BI for unhealthy drinking, and certain clinicians were less likely than others to deliver BIs. Importantly, findings inform efforts to remediate disparities in delivering these important interventions, such as modifying clinician education tools and identifying critical patient sub-groups that would benefit from targeted interventions.

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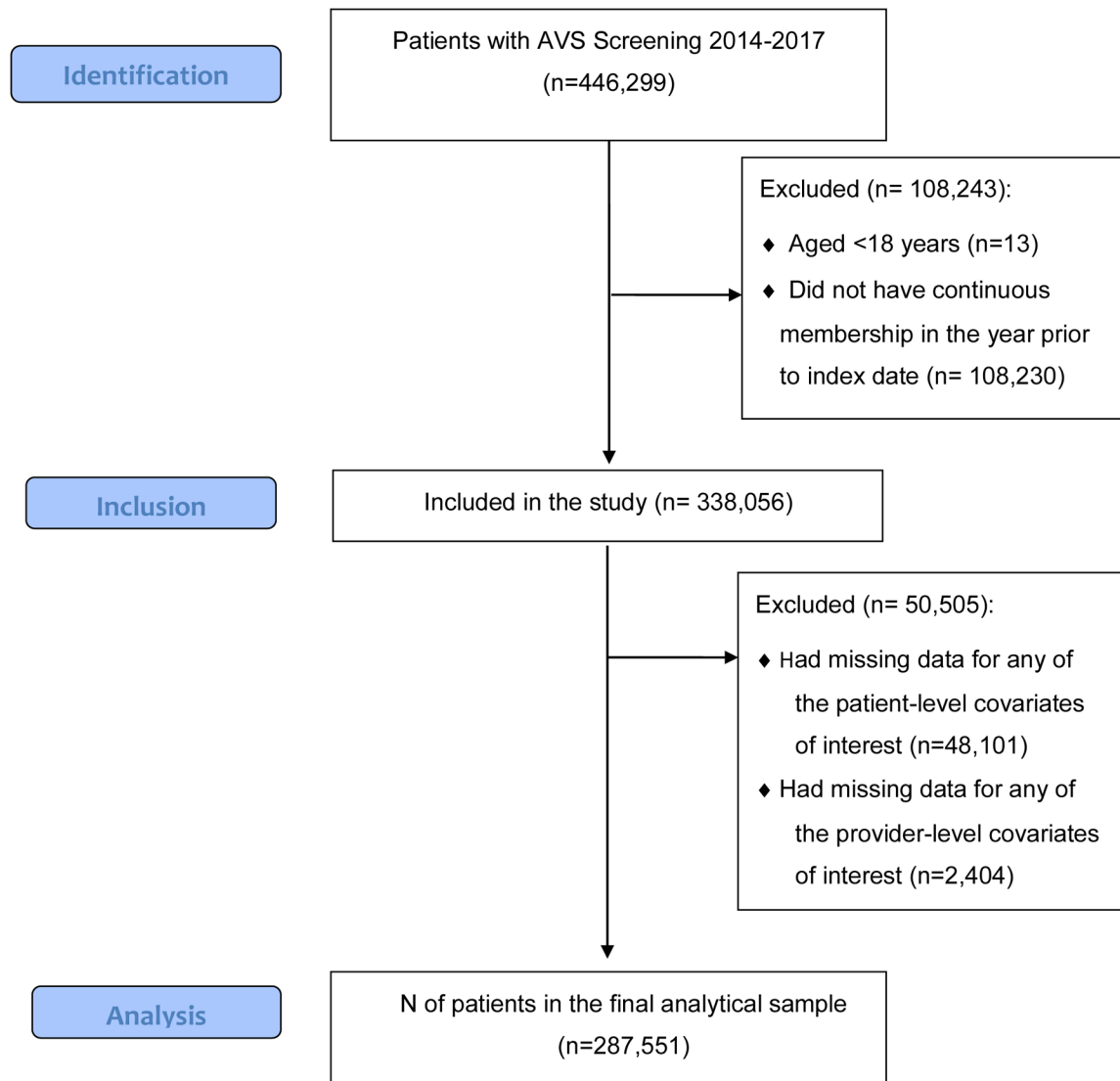


Figure 1.
STROBE Diagram of Sequential Inclusion/Exclusion Criteria

Table 1.

Patient Characteristics of KPNC Adult Primary Care Patients Screened Positive for Unhealthy Drinking between 2014 and 2017 (N=287,551)

Characteristics	N	%
Age, N (%)		
18-34 years	97,179	33.8
35-49 years	73,751	25.6
50-65 years	67,053	23.3
66-75 years	36,732	12.8
76+ years	12,836	4.5
Sex, N (%)		
Female	114,293	39.7
Male	173,258	60.3
Race/Ethnicity, N (%)		
Asian, Native Hawaiian, or Pacific Islander	29,147	10.2
Black/African American	16,761	5.8
Latino/Hispanic	51,496	17.9
Other	9,255	3.2
White	180,892	62.9
Insurance Type, N (%)		
Commercial	224,746	78.1
Medicaid/Other	8,267	2.9
Medicare	54,538	19.0
Patient NDI, N (%)		
1 st Quartile	71,159	25
2 nd Quartile	71,672	25
3 rd Quartile	72,319	25
4 th Quartile	72,401	25
Body Mass Index, N (%)		
Underweight	2,523	0.9
Normal Weight	85,925	29.9
Overweight	107,419	37.3
Obese	91,684	31.9
Smoking Status, N (%)		
Non-Smoker	243,245	84.6
Smoker	44,306	15.4
Charlson Comorbidity Score, N (%)		
0	219,264	76.3
1	43,198	15.0
2	12,983	4.5
3+	12,106	4.2
Physical Activity Level, N (%)		

Characteristics	N	%
Inactivity	83,771	29.1
Insufficient Activity	71,849	25.0
Sufficient Activity	131,931	45.9
Alcohol Consumption at Index, N (%)		
Exceeding Both Limits	38,176	13.3
Exceeding Daily Limits Only	173,701	60.4
Exceeding Weekly Limits Only	75,674	26.3
Medical Condition 1-Year Prior, N (%)		
Alcohol Use Disorder	90,50	3.2
Drug Use Disorder	3,459	1.2
Mental Health Condition	43,752	15.2
SAMC	148,038	51.5
Utilization 1-Year Prior, N (%)		
PC visits:		
0	200,407	69.7
1	58,732	20.4
2	18,253	6.3
3+	10,159	3.5
Hospitalizations:		
0	279,877	97.3
1	6,437	2.3
2	909	0.3
3+	328	0.1
ED visits:		
0	244,006	84.8
1	33,445	11.6
2	6,800	2.4
3+	3,300	1.2
Patient Screening Index Year, N (%)		
2014	106,499	37.0
2015	72,103	25.1
2016	57,825	20.1
2017	51,124	17.8

Abbreviations: NDI = Neighborhood Deprivation Index, SAMC= Substance Abuse-Related Medical Condition, PC = Primary Care, ED=Emergency Department

Table 2.

Provider Characteristics (N=2,952)

Characteristics	N	%
Age, N (%)		
18-34 years	631	21.4
35-49 years	1,554	52.6
50-64 years	686	23.2
65+ years	81	2.7
Sex, N (%)		
Female	1,460	57.9
Male	1,242	42.1
Race/Ethnicity, N (%)		
Asian, Native Hawaiian, or Pacific Islander	1,460	49.4
Black/African American	111	3.8
Latino/Hispanic	188	6.4
Other	122	4.1
White	1,071	36.3
Specialty, N (%)		
Non-Internal Medicine (MD)	1,395	47.2
Internal Medicine (MD)	1,396	47.3
Non-MD	161	5.5
Service Years in the Health Plan, N (%)		
Less than 1 year	1,042	35.3
1-5 years	469	15.9
6+ years	1,441	48.8

Abbreviations: MD=Medical Doctors

Table 3.

Multilevel Model Predicting Documented Brief Intervention (BI) Among Primary Care Patients Screening Positive for Unhealthy Alcohol Use (N = 287,551)

Characteristics	aOR	95%CI	P-value
<u>Patient:</u>			
Age, OR (95%CI)			<0.0001
18-34 years	1.00	--	
35-49 years	0.96	(0.93-0.98)	
50-65 years	0.99	(0.97-1.02)	
66-75 years	0.91	(0.86-0.97)	
76 + years	0.84	(0.78-0.91)	
Sex, OR (95%CI)			<0.0001
Male	1.00	--	
Female	0.73	(0.72- 0.75)	
Race/Ethnicity, OR (95%CI)			0.0034
Asian, Native Hawaiian, or Pacific Islander	1.05	(1.02-1.08)	
Black/African American	0.96	(0.92-1.00)	
Latino/Hispanic	1.00	(0.97-1.02)	
Other	1.01	(0.96-1.06)	
White	1.00	--	
Insurance Type, OR (95%CI)			0.1093
Commercial	1.00	--	
Medicaid/Other	0.95	(0.90-1.00)	
Medicare	1.03	(0.97-1.09)	
Patient NDI, OR (95%CI)			0.0783
1 st Quartile	1.00	--	
2 nd Quartile	1.01	(0.98-1.03)	
3 rd Quartile	1.02	(1.00-1.05)	
4 th Quartile	1.04	(1.01-1.07)	
Body Mass Index, OR (95%CI)			0.2965
Normal Weight	1.00	--	
Underweight	1.07	(0.97-1.18)	
Overweight	1.01	(0.98-1.03)	
Obese	1.02	(0.99-1.04)	
Smoking Status, OR (95%CI)			<0.0001
Non-Smoker	1.00	--	
Smoker	1.28	(1.25-1.31)	
Charlson Comorbidity Score, OR (95%CI)			
0	1.00	--	<0.0001
1	0.98	(0.95-1.00)	
2	0.89	(0.85-0.94)	
3+	0.86	(0.82-0.90)	

Characteristics	aOR	95%CI	P-value
Physical Activity Level, OR (95%CI)			0.0042
Inactivity	1.03	(1.00-1.05)	
Insufficient Activity	1.04	(1.01-1.06)	
Sufficient Activity	1.00	--	
Alcohol Consumption at Index, OR (95%CI)			<0.0001
Exceeding Both Limits	1.00	--	
Exceeding Daily Limits Only	0.65	(0.64-0.67)	
Exceeding Weekly Limits Only	0.64	(0.62-0.66)	
Diagnoses 1-Year Prior, OR (95%CI)			
Alcohol Use Disorders (AUD)	0.86	(0.81-0.91)	<0.0001
Drug Use Disorders (DUD)	0.98	(0.90-1.06)	0.5593
Mental Health Conditions	1.02	(0.99-1.05)	0.1515
SAMC Conditions	1.00	(0.98-1.03)	0.8412
Utilization 1-Year Prior, OR (95%CI)			
PC visits:	0.81	(0.79-0.82)	<0.0001
Hospitalization:	0.85	(0.80-0.90)	<0.0001
ED visits:	0.94	(0.91-0.96)	<0.0001
Patient Screening Index Year OR (95%CI)			<0.0001
2014	1.00	--	
2015	1.73	(1.69-1.78)	
2016	2.86	(2.77-2.94)	
2017	3.23	(3.12-3.34)	
<u>Health Provider:</u>			
Age, OR (95%CI)	0.99	(0.98-1.00)	0.0025
Sex, OR (95%CI)			0.0008
Male	1.00	--	
Female	1.21	(1.08-1.35)	
Race/Ethnicity, OR (95%CI)			0.0167
Asian, Native Hawaiian, or Pacific Islander	0.90	(0.80-1.02)	
Black/African American	0.68	(0.51-0.91)	
Latino/Hispanic	0.74	(0.58-0.93)	
Other	0.98	(0.74-1.31)	
White	1.00	--	
Specialty, OR (95%CI)			0.7430
Internal Medicine (MD)	1.00	--	
Non-Internal Medicine (MD)	0.97	(0.86-1.09)	
Non-MD	1.06	(0.79-1.43)	
KP Service Years, OR (95%CI)			<0.0001
Less than 1 year	1.00	--	
1-5 years	1.32	(1.26-1.39)	
6+ years	1.49	(1.38-1.60)	

Abbreviations: CI = Confidence Interval, NDI = Neighborhood Deprivation Index, SAMC= Substance Abuse-related Medical Conditions, PC=Primary Care, ED=Emergency Department, MD = Medical Doctors

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