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Understanding health disparities affecting utilization of tobacco treatment in low-income patients in an urban health center in Southern California

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ABSTRACT

Tobacco use disproportionately affects low-income communities. Prevalence among patients in Federally Qualified Health Centers (FQHCs) is higher (29.3%) than the general population (20%). Little is known about the rates of referrals to cessation services and cessation pharmacotherapy practices in FQHCs. This study will examine referral and prescribing patterns based on patient characteristics at a large FQHC in Southern California. We conducted a retrospective analysis of EHR data from 2019. Patients who were ≥ 18 years old and had "tobacco use" as an active problem were included in analyses. We characterized the proportion of 1) those who were referred to California Smokers' Helpline (CSH), 2) referred to smoking cessation counseling (SCC) at the FQHC clinic, or 3) received pharmacotherapy. Associations of demographic characteristics and comorbidities with referral types and uptake of services were evaluated using mixed-effects multinomial and logistic regressions. Of the 20,119 tobacco users identified, 87% had some cessation intervention: 66% were advised to quit and given information to contact CSH, while 21% were referred to SCC. Patients were least likely to get referred to cessation services if they had more medical, psychiatric, or substance use comorbidities, were in the lowest income group, were uninsured or were Hispanic. Although EHR systems have enhanced the ease of screening, most patients do not receive more than brief advice to quit during a PCP visit. Most (70%) low-income smokers see their PCPs at least once a year, making FQHCs excellent settings to promote smoking cessation initiatives in low-income populations.

1. Introduction

Tobacco use adversely affects low-income, underserved, and minority communities. Despite persistent tobacco control efforts, the prevalence of smoking among low-income smokers has not declined in step with other smokers (Cornelius et al., 2020). In the US, more than 28 million – one in three low-income Americans (living below 200% of the federal poverty level) – receive their medical care at an FQHC (Health Center Patient Survey Dashboard, 2014). Studies show that the median prevalence of tobacco use in FQHC patient populations is 29.3% (Flocke et al., 2017), compared to 20.8% in the general population (Cornelius et al., 2020). Thus, FQHCs represent a potentially important setting in which to promote smoking cessation services among low-income smokers.

In California, where the Tobacco Control Program (Roeseler and Burns, 2010) has driven rates of smoking down to 10.1% (Zhang and Vuong, 2019), more than 20% of men and 10% of women who are low-income continue to smoke cigarettes, accounting for close to 2 million people. In 2018, the 33% of Californians who were low-income were 1.8 times more likely to be current smokers, yet were 21% less likely to quit successfully than other smokers (Zhang and Vuong, 2019). Reduced rates of quitting success cannot be attributed to a lack of motivation to quit or lack of interest in cessation treatment, as efforts to quit among low-income smokers (58%±3%) mirror the general population of smokers (55%±2%) (California Health Interview Survey, 2018). Furthermore, recent studies show that 83% of the FQHC patient population who are cigarette smokers desire to quit smoking (Lebrun-Harris et al., 2015).

It has been suggested that the reduced rates of quitting success among low-income smokers may be due, at least in part, to low rates of referral to smoking cessation services. Data from the 2014 Health Center Patient Survey indicates that 76.5% of adult community health center tobacco users were recommended to quit tobacco products within the past year, the rates lower at 62.5% (95% CI = 46.8%, 76.0%) amongst Hispanic patients (Health Center Patient Survey Dashboard, 2014). The odds of receiving counseling was higher if the patient had multiple chronic conditions (AOR = 2.05; 95% CI = 1.11, 3.78) and lower if the patient was Hispanic (AOR = 0.57; 95% CI = 0.34, 0.96) (Lebrun-Harris et al., 2015).

Evidence also suggests that concurrent multiple modalities to assist with cessation is predictive of higher success (Lebrun-Harris et al., 2015). However, little is known about rates of concurrent referrals to 1) quitlines, 2) clinic-based health education programs, and 3) pharmacologic therapy, including nicotine replacement therapy, particularly in the FQHC setting. To address this gap in understanding, we examined the demographic characteristics, referral patterns to cessation services, pharmacologic therapy, and factors that influence these patterns at a large FQHC system in Southern California.

2. Methods

2.1. Study design

We conducted a retrospective analysis of Electronic Health Record (EHR) data on tobacco user characteristics, referrals to cessation services, pharmacotherapy, and patient engagement in services at Family Health Centers of San Diego (FHCSD). The study was approved by the institutional review board of the University of California, San Diego (IRB# 201170).

2.2. Data source

Family Health Centers of San Diego is one of the ten largest FQHCs in the nation and provides healthcare for more than 140,000 low-income patients annually, at its 23 medical clinics. FHCSD uses a custom-built EHR system developed by its own information technology (IT) department. Data were extracted from the EHR on adult patients ≥ 18 years of age who received care between January 1 and December 31, 2019, and had "tobacco use" as an active problem. Demographic characteristics were gathered when a patient first registered to receive healthcare services at FHCSD and updated yearly, this information is stored in the EHR. The current clinical process at FHCSD primary care clinics generates two opportunities where smoking cessation can be addressed and data are collected (Fig. 1): one by the medical assistant (MA), and one by the physician, physician assistant, or nurse practitioner primary care provider (PCP). Smoking status, pack years, referral to services and cessation related pharmacotherapy are captured in the EHR through data entry or orders by the MA or PCP. Quit history, counseling by PCP, when discussed, were captured in the Subjective, Objective, Assessment and Plan (SOAP) note in free text.

2.3. Measures

Demographic characteristics included age, race, ethnicity, sex, gender identity, preferred gender, sexual orientation, monthly income, insurance status. Current tobacco use status, duration, and quantity consumed were used to calculate pack year data. 1) Passive referrals to the California Smokers Helpline (CSH) and 2) active referrals to FHCSD smoking cessation class (SCC) counts, as well as 3) pharmacotherapy data are aggregated from EHR encounters.

Passive referrals were handouts with advice to quit and the CSH phone number provided to the patient at the PCP visit. Engagement in passive referral to CSH is currently not measurable. Active referrals were defined as a trackable referral processed by the referrals department to FHCSD SCC. Engagement was measured by successfully completed SCC visits documented in the EHR. Pharmacotherapy (nicotine replacement products or cessation aid medications including varenicline or bupropion), referral and prescribing provider, and major medical and mental health co-morbidities were also extracted. Referrals and prescriptions were linked back to the day of the visit the order was placed, ordering provider, and clinic location on the day of the visit. Adherence to nicotine replacement or medication is by self-report, and optionally recorded in the SOAP note at subsequent PCP visits. Successful quit attempts were optionally documented in the SOAP note or under the history tab in the EHR at subsequent PCP visits.

2.3.1. Substance use diagnoses

International Classification of Diseases-10 (ICD-10) codes for alcohol, cannabis, cocaine, methamphetamine, opioid, sedative, hallucinogen, or inhalant use disorders were summed and categorized as
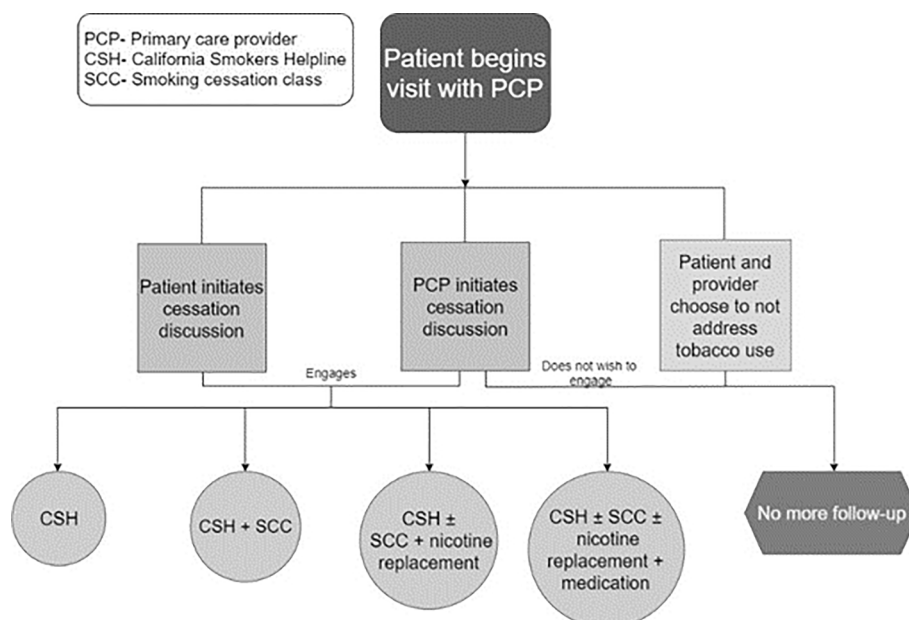

Fig. 1. Tobacco Cessation Services and Referrals in the Primary care Setting, San Diego, 2019.

none, one, or multiple substance use diagnoses.

2.3.2. Psychiatric diagnoses

The inclusion of a current ICD-10 diagnosis of any anxiety, depression, bipolar, post-traumatic stress, eating, or psychotic disorders were summed and categorized into none, one, or multiple psychiatric diagnoses.

2.3.3. Cardiac, respiratory, and diabetes diagnoses

The inclusion of a current ICD-10 diagnosis of any cardiac, respiratory, or diabetes disorder were summed and categorized into none, one, or multiple medical diagnoses.

2.3.4. Obesity diagnoses

Obesity was defined as body mass index (BMI) ≥30 and categorized as no obesity or obesity.

2.4. Analyses

Among the cohort of tobacco users who were seen at FHCSD medical clinics between January 1 and December 31, 2019 (n = 20,119), we examined the data on those with no referrals to those with referrals to CSH and FHCSD SCC. Among those who received passive referral to CSH and active referral to FHCSD SCC, we examined what proportion of patients engaged in cessation services, with either FHCSD SCC, or were prescribed pharmacotherapy, or both, within the FHCSD clinic system. Associations between CSH or FHCSD SCC and engagement in FHCSD SCC or pharmacotherapy with age, sex, race-ethnic categories, insurance type, poverty status, and comorbidities were examined in mixed-effects multinomial and logistic regressions, respectively. Clustering of tobacco users within clinics was adjusted using a random effect term. Odds Ratios (OR) and 95% confidence intervals were computed to quantify the strength of these relationships. All analyses were preformed using R 4.1 (R Core Team. R, 2019) using the mclogit (Mclogit, 2020) and lme4 (Bates et al., 2015) packages.

3. Results

The overall tobacco use prevalence is 14.4% at FHCSD. Among the 20,119 tobacco users, the patients were from a broad age range, with 41.1% between 35 and 54 years old (Table 1). Racial-ethnic representation reflected a diverse sample with 39% White, 33% Hispanic, 15% Black, and 13% of other groups (see Table 1). In this sample, 95% had incomes that were below 200% of the federal poverty line and 25% were uninsured. Substance use diagnoses (16%), psychiatric diagnoses (20%) and cardiac or respiratory diagnoses (40%) were reported in the sample.

3.1. Referral for tobacco cessation

Among all active patients with tobacco use in 2019, 87% (n = 17,521) were recorded as having some intervention for tobacco cessation, 66% (n = 13,277) were provided advice to quit and given information to contact the CSH and 21% (n = 4,244) were referred to FHCSD SCC cessation services.

3.1.1. Characteristics of patients who did not receive standard passive referral to California Smokers' Helpline

Table 2 presents results from multinomial logistic model associating patient characteristics with the odds of no referral or referral to FHCSD SCC relative to receiving standard passive referral to CSH.

Tobacco users who did not receive a referral to CSH or FHCSD SCC were younger. Those 18–34 years had higher odds (p's < 0.01) of no recorded referral for smoking cessation than patients from each of the older age groups. Patients with income < 200% federal poverty level (OR = 1.28, 95%CI = 1.03–1.58) and those who were uninsured (OR = 1.91, 95%CI = 1.34–2.72) had a higher odds of no cessation referral

Table 1
Demographic characteristics of tobacco users, San Diego, CA, 2019.

Variable	n (N = 20,119)	Percent
Age		
18–34	5296	26.3%
35–54	8259	41.1%
55–60	3215	16.0%
61–64	1738	8.6%
65+	1611	8.0%
Sex		
Male	11,112	55.3%
Female	8807	43.8%
Other	186	0.9%
Race-Ethnicity		
Non-Hispanic White	7882	39.2%
American Indian or Alaska Native	159	0.8%
Asian	622	3.1%
Black	3082	15.3%
Hispanic	6603	32.8%
Hawaiian or Asian Pacific Islander	240	1.2%
Middle Eastern or Arabic	580	2.9%
Multi-Racial	321	1.6%
Other	630	3.1%
Percent Federal Poverty		
≥200%	1028	5.1%
<200%	19,019	94.9%
Insurance		
Private	448	2.2%
MediCal (Medicaid)	12,349	61.6%
Medicare	2353	11.7%
Uninsured/Self-pay	4906	24.5%
Substance Use Diagnoses		
None	16,883	83.9%
One	2633	13.1%
Multiple	603	3.0%
Psychiatric Diagnoses		
None	16,027	79.7%
One	3031	15.1%
Multiple	1061	5.3%
Cardiac or Respiratory Diagnosis		
None	12,109	60.2%
One	6292	31.3%
Multiple	1718	8.5%

than those with incomes >200+% of federal poverty or those with private insurance, respectively. Tobacco users with one (OR = 1.2, 95% CI = 1.06–1.36) or more than one (OR = 1.57, 95%CI = 1.31–1.89) psychiatric diagnosis had higher odds of no referral for cessation services. Having no substance use diagnosis (OR = 1.31, 95%CI = 1.14–1.50) compared to one substance use diagnosis or no medical diagnoses compared to one (OR = 1.31, 95%CI = 1.18–1.47) or multiple medical diagnoses (OR = 1.52, 95%CI = 1.25–1.87) was related to higher odds of no referral for smoking cessation.

3.1.2. Characteristics of patients who received referral to FHCSD cessation clinics rather than standard passive referral to California smokers Helpline

When compared to those aged 18–34, tobacco users in each older age group had higher odds of having been referred to FHCSD SCC rather than passive referral to CSH (see Fig. 2). Tobacco users reporting Hispanic ethnicity had significantly lower odds (OR = 0.79, 95%CI = 0.72–0.87) of referral to FHCSD SCC than those with White racial-ethnic affiliation (see Table 2). Lower odds of referral to FHCSD SCC relative to passive referral to CSH also were observed for tobacco users who were uninsured (OR = 0.62, 95%CI = 0.49–0.79). Having one (OR = 0.64, 95%CI = 0.58–0.72) or multiple (OR = 0.54, 95%CI = 0.45–0.65) psychiatric, one (OR = 0.61, 95%CI = 0.54–0.69) or multiple (OR = 0.67, 95%CI = 0.45–0.65) substance use (p < 0.01), and medical diagnoses (p < 0.01) each were associated with a lower odds of referral to FHCSD SCC rather than CSH.

Table 2

Multinomial mixed-effects model of odds of referral outcomes for tobacco users, San Diego, CA, 2019 (N = 20,119)

Variable	No Referral vs Passive Referral to CSH				Equation for Referral to FHCSD Cessation Services vs Passive Referral to CSH			
	Estimate	Std. Error	Pr(>|z|)	OR (95% CI)	Estimate	Std. Error	Pr(>|z|)	OR (95% CI)
(Intercept)	−2.14	0.28	< 0.01	–	−0.88	0.17	< 0.01	–
Age Group								
Age 18–24	–	–	–	–	–	–	–	–
Age 35–54	−0.26	0.06	< 0.01	0.77 (0.69–0.86)	0.48	0.05	< 0.01	1.61 (1.46–1.78)
Age 55–60	−0.34	0.08	< 0.01	0.71 (0.61–0.83)	0.78	0.06	< 0.01	2.18 (1.93–2.45)
Age 61–64	−0.22	0.10	0.03	0.81 (0.52–0.99)	0.83	0.07	< 0.01	2.29 (1.98–2.64)
Age 65+	−0.29	0.12	0.02	0.75 (0.52–0.99)	0.78	0.09	< 0.01	2.17 (1.82–2.59)
Sex								
Male	–	–	–	–	–	–	–	–
Female	0.04	0.05	0.44	1.04 (0.52–0.99)	0.02	0.04	0.61	1.02 (0.95–1.10)
Other	−1.35	0.32	< 0.01	0.26 (0.52–0.99)	0.08	0.21	0.68	1.09 (0.73–1.63)
Race-Ethnicity								
White	–	–	–	–	–	–	–	–
American Indian/ Alaska Native	−0.49	0.30	0.11	0.62 (0.52–0.99)	−0.13	0.21	0.53	0.88 (0.58–1.32)
Asian	−0.08	0.15	0.59	0.92 (0.52–0.99)	−0.10	0.11	0.35	0.91 (0.73–1.12)
Black	0.06	0.07	0.44	1.06 (0.52–0.99)	−0.01	0.05	0.81	0.99 (0.89–1.10)
Hispanic	−0.02	0.06	0.71	0.98 (0.52–0.99)	−0.23	0.05	< 0.01	0.79 (0.72–0.87)
Hawaiian/ Asian Pacific Islander	−0.35	0.24	0.15	0.71 (0.52–0.99)	−0.23	0.17	0.19	0.80 (0.57–1.12)
Middle Eastern/Arabic	−0.34	0.16	0.04	0.72 (0.52–0.99)	0.08	0.11	0.47	1.08 (0.87–1.34)
Multi-Racial	−0.06	0.19	0.76	0.94 (0.65–1.37)	0.02	0.15	0.92	1.02 (0.76–1.35)
Other Race	−0.01	0.14	0.96	0.99 (0.75–1.31)	−0.09	0.12	0.45	0.92 (0.73–1.15)
Poverty Status								
Income 200+% Federal Poverty	–	–	–	–	–	–	–	–
Income < 200% Federal- Poverty	0.24	0.11	0.03	1.28 (1.03–1.58)	−0.03	0.08	0.75	0.97 (0.83–1.15)
Insurance Type								
Private	–	–	–	–	–	–	–	–
MediCal	−0.04	0.18	0.83	0.96 (0.68–1.37)	−0.17	0.12	0.15	0.84 (0.67–1.06)
Medicare	0.12	0.20	0.55	1.12 (0.76–1.66)	−0.15	0.13	0.24	0.86 (0.66–1.11)
Uninsured/Self-pay	0.65	0.18	< 0.01	1.91 (0.79–1.30)	−0.48	0.12	< 0.01	0.62 (0.49–0.79)
Substance Use Diagnoses								
None	–	–	–	–	–	–	–	–
One	−0.27	0.07	< 0.01	0.76 (0.79–1.30)	−0.50	0.06	< 0.01	0.61 (0.54–0.69)
Multiple	0.02	0.13	0.89	1.02 (0.79–1.30)	−0.40	0.12	< 0.01	0.67 (0.53–0.85)
Psychiatric Diagnoses								
None	–	–	–	–	–	–	–	–
One	0.18	0.06	< 0.01	1.20 (1.06–1.36)	−0.44	0.06	< 0.01	0.64 (0.58–0.72)
Multiple	0.45	0.09	< 0.01	1.57 (1.31–1.89)	−0.62	0.10	< 0.01	0.54 (0.45–0.65)
Medical Problems								
None	–	–	–	–	–	–	–	–
One	−0.27	0.06	< 0.01	0.76 (0.68–0.85)	−0.76	0.04	< 0.01	0.47 (0.43–0.51)
Multiple	−0.42	0.10	< 0.01	0.66 (0.54–0.80)	−0.64	0.07	< 0.01	0.53 (0.46–0.60)

3.1.3. Engagement in cessation treatments

Among the 4,344 who received cessation-related referral to SCC or pharmacotherapy at FHCSD, 37.7% (n = 1598) engaged in some way. Some received SCC alone (n = 274), pharmacotherapy alone (n = 1,048), or both SCC and pharmacotherapy (n = 276). Tobacco users referred to FHCSD clinics had higher odds of engaging in treatment if they were older (range of OR = 1.42–1.46, p's < 0.01). However, when compared to young tobacco users aged 18–34, those aged 65 + had similar odds of engagement (OR = 1.13, 95%CI = 0.81–1.58, p = 0.46). Compared to males, females (OR = 1.25, 95%CI = 1.09–1.44) and other sex tobacco users (OR = 3.16, 95%CI = 1.47–6.80) had higher odds of engagement than males. When compared to those reporting White racial-ethnic affiliation, tobacco users who reported Hispanic ethnicity were significantly less likely to engage FHCSD services (OR = 0.81, 95% CI = 0.68–0.95). Engagement was not significantly different when comparing other examined racial-ethnic affiliations to White tobacco users (p's greater than 0.21). Poverty status was not related to engagement (OR = 1.08, 95%CI = 0.79–1.49). Having insurance coverage by MediCal (Medicaid) (OR = 1.71, 95%CI = 1.10–2.67) or Medicare (OR = 1.72, 95%CI = 1.05–2.80) was associated with greater engagement. Those with multiple psychiatric and substance use diagnoses were more likely to receive no referral to services, and less likely to receive a referral to the SCC or prescribed medication (Fig. 3). Increasing co-morbidity with substance use disorders, psychiatric disorders, and medical disorders each were independently associated with higher odds of engagement (OR range 1.42 – 3.11) when compared to tobacco users without comorbid conditions. Fig. 4 shows increased probability of engagement across increasing numbers of substance use and psychiatric conditions.

4. Discussion

Addressing smoking cessation in FQHCs presents its own set of challenges as patients in this setting often face a greater number of medical and mental health co-morbidities, as well as social, racial, and economic barriers. Our study found that patients with the highest burden of disease and health disparities, including those with the lowest income, who are uninsured, Hispanic, and with more psychiatric diagnoses, were least likely to be referred to the range of cessation services. Engagement in cessation services were also lower in this FQHC patient population at 37% compared to other populations at 42–76% (Nash et al., 2015; Paz Castro et al., 2017; Mg et al., 2012). A possible explanation is that when a patient has many co-morbidities, the clinical encounters are generally busy with more pressing needs to address other
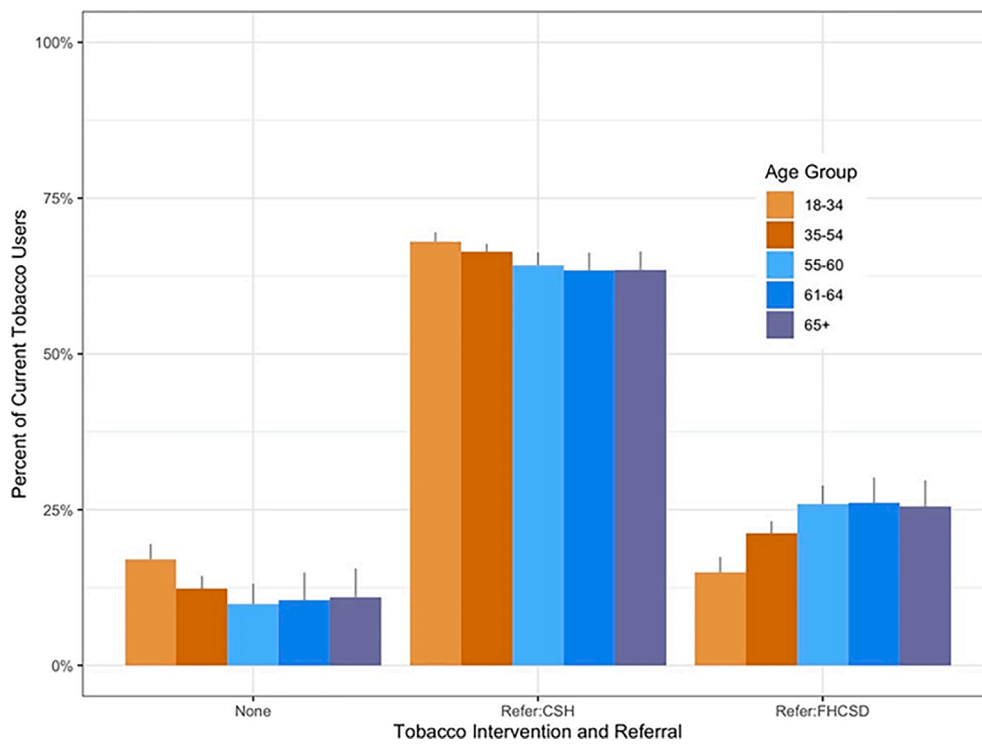
Fig. 2. Percentage of cessation referral outcomes in each age group, San Diego, CA, 2019 (N = 20,119).
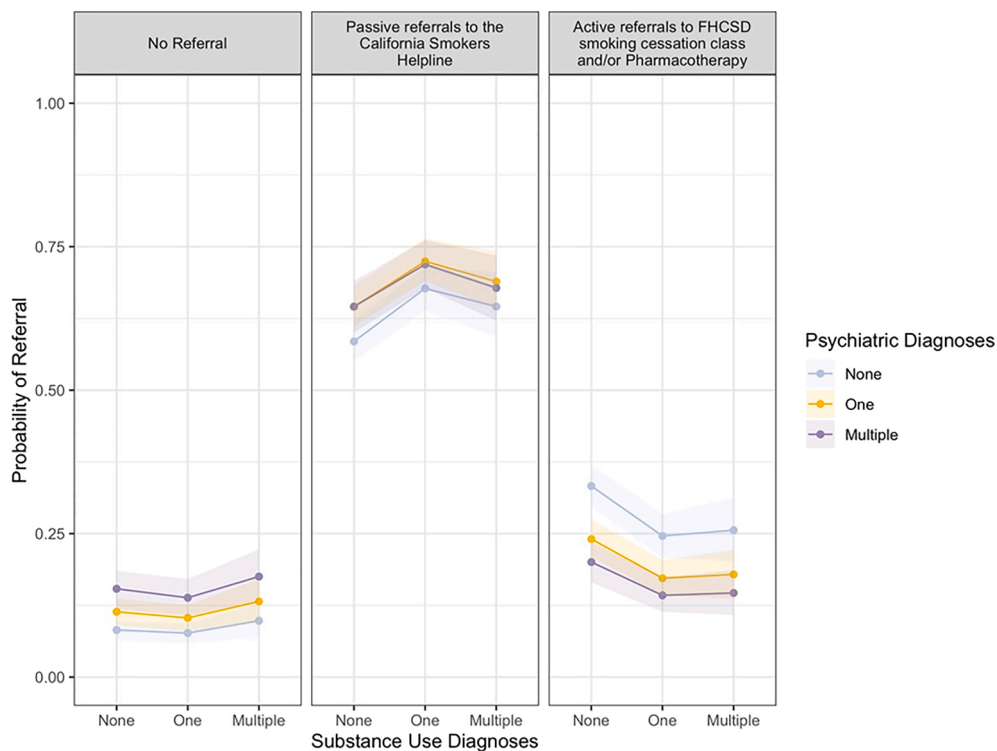

Fig. 3. Association between substance use and psychiatric diagnoses with referral to smoking cessation counseling within FHCSD compared to California Smokers Helpline, San Diego, CA, 2019.

co-morbid conditions. Thus, there may be little to no time to address tobacco cession referrals. Once referred, patients with high numbers of co-morbidities are more likely to engage. A reminder that conversations on tobacco cessation should not be forgotten despite the complexity of patient encounters in those with multiple co-morbid psychiatric or

substance use conditions. Yet, it is worth noting that 87% of tobacco users received some cessation intervention at FHCSD, which is not trivial in a challenging FQHC setting. Passive referrals, however, pose many challenges as the burden of follow-through is placed on the patient. This may partially explain the disparity in cessation service engagement at
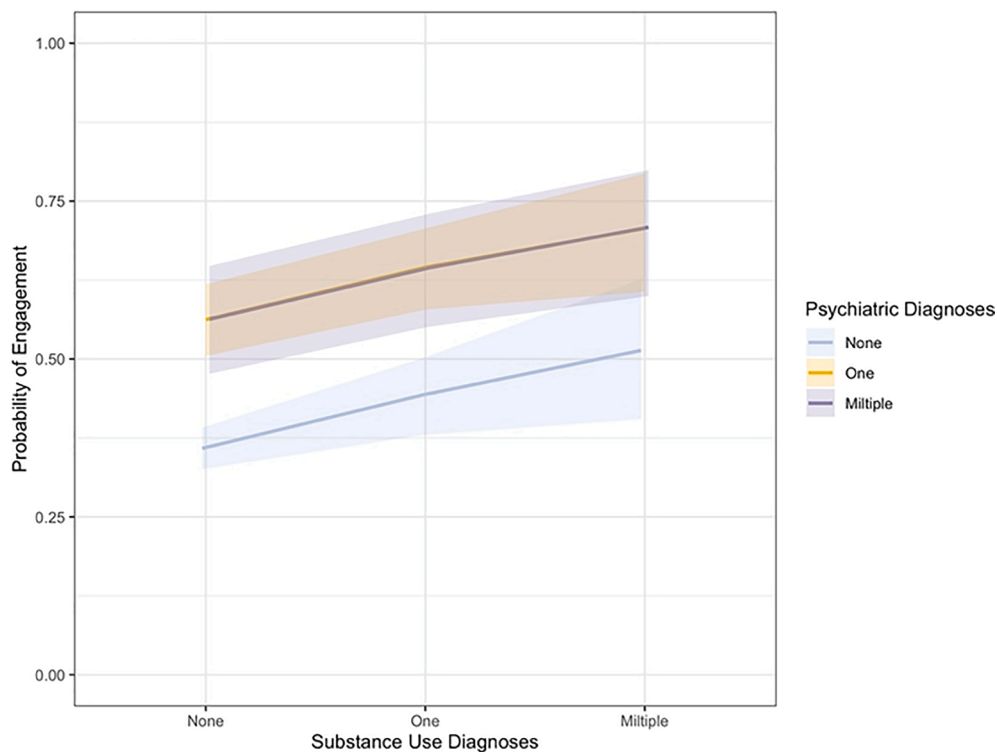
Fig. 4. Probability of engagement in smoking cessation counseling and/or pharmacotherapy among patients with comorbid substance and psychiatric conditions, San Diego, CA, 2019.

this FQHC. Additionally, when quitlines are not connected to the EHR of the health system, engagement is difficult to measure and under-reporting is possible.

These data reveal areas in need of improvement. Lower referral rates and lower engagement among Hispanic patients reveal findings consistent with previous data from the CDC, showing that this group of patients is less likely to display high interest in smoking cessation (Cox et al., 2011; Babb et al., 2020). There are many Spanish speaking PCPs, as well as phone interpretation services available to non-Spanish speaking PCPs at FHCSD. Thus, the inherent reason for less engagement in the Hispanic patient population may go beyond a language barrier, as more than half of Hispanic patients are not monolingual Spanish speakers at FHCSD. In the sub-population of patients with psychiatric co-morbidities, a greater number of psychiatric diagnoses lead to greater engagement, though it is unclear the reason that may have led to this phenomenon.

With 70% (Tobacco Cessation in Primary Care, 2020) of low-income smokers visiting a PCP each year and a national movement to integrate tobacco control strategies, FQHC primary care clinics are a natural setting to identify and promote cessation among low-income smokers. However, although the use of EHR systems has led to improvements in screening (Boyle and Solberg, 2004; Marcy et al., 2003) and adherence to practice guidelines (Boyle et al., 2010), our findings are in alignment with other studies that suggest few smokers leave PCP visits with more than brief advice to quit (Boyle and Solberg, 2004; American Cancer Society, 2005). Often, a patient may choose to decline an offered referral to SCC type counseling, due to time requirements of attending a group class, transportation issues, or personal preference. Though evidence shows that counseling plus pharmacotherapy yields higher cessation success, when more than one intervention is offered, a review of encounters revealed, that patients often decline to accept all of them, citing a specific preference for one form of intervention. Though adherence to NRTs or pharmacotherapy are by self-report and optionally added to the SOAP note by the PCPs, the future potential of an electronic referral system to the CSH that automatically feeds data back to the FHCSD EHR

will allow for more systematic and objective feedback to the PCP on cessation counseling and quit status on patients who engage in care, thus allowing for better measurement of outcomes. There are small interventions in the clinical flow process that can improve data capture of patient engagement, such as streamlining data collection during the MA rooming process, displaying updated tobacco use information prominently on the EHR dashboard to alert the PCPs, and the availability of smart phrases and order sets that can guide PCPs on engaging patients in conversation as well as referrals to counseling plus prescription of pharmacotherapy.

Recognition of the difficulty of delivering comprehensive cessation services in primary care has led to development of innovative fax, web, and electronic referral systems that link to evidence-based behavioral treatment within state-funded quitlines (Gordon et al., 2007; Bentz et al., 2007; Linder et al., 2009). Electronic and web referral programs now make up a majority of proactive referrals to CSH (Reports and March, 2020). Referral to structured behavioral cessation services like CSH by a trusted clinician may have specific appeal. Harmonization of cessation services between FQHC and CSH hold the promise of closing the gap between the current 15.5% smoking rate among low-income Californians and the general population rate of 10% (Zhang and Vuong, 2019). With the estimated healthcare and lost productivity costs of $4,603 per smoker in California (Max et al., 2016), closing this gap would result in substantial economic savings and could reduce tobacco related health disparities among low-income Californians. In the FQHC setting, low-income patients often consider their clinic a trusted medical home. At FHCSD, the average patient visits 6 times a year to engage in services for physical health, mental health, health education and dental health. Future research should evaluate the effectiveness of leveraging a highly credible primary care physician as well as the rest of the health care team advocating cessation to increase utilization of an electronic referral to CSH.

This study has important strengths, including the use of robust EHR data among a population of low-income patients in a large, urban FQHC system. Additionally, the use of SOAP note data allowed for the

examination of a range of indicators of engagement. We acknowledge the limitation of our EHR data on passive referrals to the CSH only allowed us to examine whether a referral was made, as the EHR currently does not track patient engagement in CSH services. Electronic linkage between the two systems would improve understanding of CSH uptake. We also acknowledge that there may be factors that influence referral rates that were not measured and included in multivariable models.

In conclusion, although electronic or fax quitline referrals are available in approximately 50% of FQHCs serving low-income smokers, 62% of providers report significant barriers to offering combined cessation treatments that could be addressed through harmonized coverage of cessation assistance (Flocke et al., 2019). The linkage between an FQHC system and the CSH should take into consideration existing knowledge on barriers in harmonization. Our findings revealed that the type of tobacco product used is not well-collected in EHR, yet, determining how this data can be best collected may help target future interventions. Increased and improved surveillance of quitting in this underserved population is needed for the efficient delivery of specialized interventions.

Disclosure statement

CRediT authorship contribution statement

Jie Liu: Conceptualization, Methodology, Validation, Writing – original draft, Writing - review & editing, Visualization, Supervision, Project administration, Funding acquisition. **Elizabeth Brighton:** Writing – original draft, Investigation. **Aaron Tam:** Investigation, Data curation, Writing – original draft, Visualization, Writing - review & editing. **Job Godino:** Resources, Writing - review & editing. **Kimberly C. Brouwer:** Investigation, Writing - review & editing. **Charles Bart Smoot:** Resources. **Eva Matthews:** Supervision. **Paloma Mohn:** Investigation, Data curation, Writing - review & editing. **Carrie Kirby:** Resources. **Shu-Hong Zhu:** Resources. **David Strong:** Conceptualization, Methodology, Formal analysis, Validation, Writing – original draft, Writing - review & editing, Visualization, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101541.

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