HHS Public Access

Author manuscript

Drug Alcohol Depend. Author manuscript; available in PMC 2020 November 01.

Published in final edited form as:

Drug Alcohol Depend. 2019 November 01; 204: 107568. doi:10.1016/j.drugalcdep.2019.107568.

Sex differences in prescription opioid use patterns assessed through a community engagement program in Florida

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Abstract

Background—Morbidity and mortality attributed to prescription opioids are a crisis in the US and spreading globally. Sex differences related to these conditions have not been adequately assessed.

Methods—Through our community engagement program, data on demographics, health status, and substance use, including prescription opioids (e.g., Vicodin®, Oxycodone), were collected from community members in Florida (primarily North Central Florida) during a health needs assessment. Participants over 18 years of age were classified by opioid use: past 30-day, lifetime but not past 30-day, or no lifetime prescription opioid use. Descriptive statistics and chi-square tests were calculated, and multinomial logistic regression was used to calculate adjusted odds ratios (aOR; CI). Analyses were conducted for men and women separately to examine sex specific effects.

Results—Among 9,221 community members assessed, the mean age was 45 years, 60% were female, and 58% were black. Respondents who endorsed past 30-day use and lifetime use were more likely to be female. Prescription sedative use was the strongest risk factor for past 30-day (aOR= 3.96; 95% CI, 3.35–4.68) and lifetime (aOR= 2.67; 95% CI, 2.34–3.04) prescription opioid use, regardless of sex. Other factors including marijuana use and history of cancer were significantly associated with prescription opioid use; they varied by sex.

Conclusions—The risk factors identified in this community sample provide additional information not accounted for by national studies. Future examinations of the consequences of concomitant opioid and sedative use, especially among women, are needed.

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Contributors

Dr. Serdarevic wrote the first draft of the paper and worked with co-authors on subsequent drafts. All authors contributed to the manuscript and approved the submission.

Keywords

Prescription Opioids; Sex Differences; Community; Opioid Use

1. Background

Prescription opioids (e.g. Oxycodone, Vicodin® and Percocet®) are typically prescribed to treat either chronic or acute pain (Beaudoin et al., 2014; Caudill-Slosberg et al., 2004), though there is the potential for misuse and abuse which raises concerns about overprescribing (Kaye et al., 2017; Strand et al., 2018; White et al., 2009). While recently the overall national prescribing rate has decreased to the lowest it has been in the last decade, there are continuing concerns that people are getting prescription pain medication through other means, using non-medically (i.e., use of higher doses, use longer than prescribed, use for the experience or feeling caused or use of someone else's medication) (McCabe et al., 2013; Osborne et al., 2017) and the associated potential consequences of use, including overdose. The over-prescription of opioids has been implicated in overall overdose deaths (Centers for Disease Control and Prevention, 2018; Schatman and Ziegler, 2017). Over-prescription of opioids is also believed to be a risk factor for heroin use (Compton et al., 2016). Deaths due to heroin use have also risen sharply in recent years (Centers for Disease Control and Prevention, 2017; Rudd et al., 2014). Specifically, in Florida, emergency department (ED) visits and fatal overdose deaths related to opioids have increased substantially (Prekupec et al., 2017). Data from the Healthcare Cost and Utilization Project (HCUP) shows Florida had approximately 71 ED visits per 100,000 population in 2008 related to opioid use, whereas in 2016 there were 217 ED visits per 100,000 population (HCUP, 2018). More recently, data from the Florida Drug-Related Outcomes Surveillance and Tracking System (FROST) reported that there were 1,685 deaths that included a fentanyl analog in 2017 (FROST, 2018).

National studies can provide a useful high-level overview of prescription opioid use prevalence, but they do not provide granular data on variance in prevalence at the community level within specific geographic regions where higher overdose rates have been reported (Beheshti et al., 2015; Rudd et al., 2014). Most studies utilize opioid use data from treatment centers or the ED. They represent only those who were able to afford treatment or seek care. These studies often suffer from differential mortality due to selection bias. Opioid prescribing has decreased recently due to statewide legislation including the implementation of prescription drug monitoring programs (PDMPs) and the creation of new limits on prescriptions (Centers for Disease Control and Prevention, 2017; Florida Board of Medicine, 2018). In 2011, 83.5 opioid prescriptions per 100 persons were written in Florida whereas in 2017 there was a lower rate of 60.9 prescriptions per 100 persons (National Institute on Drug Abuse, 2019). Nonetheless, data examining patterns of prescription opioid use from a community where overdoses are high could inform efforts to reduce prescription opioid use and related morbidity and mortality (Centers for Disease Control and Prevention, 2016; FROST, 2018).

There are also limited epidemiologic data available to address sex differences for prescription opioid use in a community setting (Serdarevic et al., 2017a), though sex differences at the national level have been examined previously (Back et al., 2011; Han et al., 2017). Other studies have found men are more likely than women to overdose on drugs including opioids (Kaplovitch et al., 2015; Unick et al., 2013), but this gender gap is closing as opioid-related overdoses are increasing among women (Unick et al., 2013). This emphasizes the importance of examining prescription opioid use and risk factors for use among women and men separately in order to reduce health dipartites related to opioid use.

Among the many theoretical models that explain prescription opioid use behavior, the socio-ecological model includes four levels (individual, relationship, community, and society) which may influence behavior (McLeroy et al., 1988). This model postulates that people are not only influenced by their individual traits, but are also influenced by relationships with others, the community in which they reside, and the societies in which those communities grow in (Substance Abuse and Mental Health Services Administration, 2016). In this analysis, we aimed to characterize prescription opioid use by sex and examine risk factors at the individual, relationship, and community levels. Factors at the societal level were not examined.

2. Materials and Methods

2.1 Study Design

Community Health Workers (CHWs) from HealthStreet, a community engagement program at the University of Florida, assessed community members' health conditions and concerns using a cross-sectional study design and linked community members to health research opportunities and medical and social services. CHWs are trained and certified to directly engage community members in the community at parks, grocery stores, churches, laundromats, health fairs, and areas where community members recreate to meet people where they are and recruit them to participate in HealthStreet. This method of recruitment provides CHWs with the opportunity to engage with underrepresented populations within their own communities. Using this CHW model (Cottler et al., 2011), over 10,293 community members have been engaged in HealthStreet's catchment areas (Gainesville, Jacksonville, and Miami) since it began at the University of Florida.

After CHWs introduce themselves and explain the HealthStreet model, written consent is obtained and a health needs assessment is completed. The health needs assessment is a 25-minute, face-to-face interview, conducted by the CHWs to assess each new HealthStreet member's health conditions, health concerns, and history of substance use. The assessment has been tested and used in others studies regarding drug use and health (Cottler and Nagarajan, 2011; Serdarevic et al., 2017b; Liu et al., 2019). Responses to the health needs assessment are recorded on paper copies during outreach on location in the community. Once the participant has undergone the health needs assessment they become a member of the HealthStreet community cohort. HealthStreet members who self-identified as female or male, aged 18 years and older, and who enrolled between November 2011 and June 2018 were included in this analysis. This study was approved by the University of Florida Institutional Review Board.

2.2 Measurements

To assess prescription opioid use, CHWs asked: “Have you ever used prescription pain medications like Vicodin®, oxycodone, codeine, Demerol®, morphine, Percocet®, Darvon®, hydrocodone?” If community members indicated that they used a prescription opioid, they were asked subsequently if they used one of these prescription medications in the past 30 days. Based on answers to these questions, participants were classified into one of three categories of opioid use: (1) past 30-day use (reported use of prescription opioids in the past 30 days), (2) lifetime but not past 30-day use (reported using prescription opioids, but not in the past 30 days), and (3) no lifetime use (reported no use ever).

Risk factors at the individual level included age, race (white, black/African American, other), sex, educational attainment (more than high school or high school and less), health insurance (yes or no), doctor visit in the last 6 months (yes or no), frequent ED visits in the last 6 months (defined as >2 visits); a diagnosis of depression or anxiety from a health professional (yes or no), back pain (yes or no), cancer (yes or no), insomnia (yes or no), and substance use (lifetime cigarette smoking, past 30 day hazardous alcohol use, lifetime marijuana use, and/or lifetime prescription sedative use; yes or no). Past 30-day hazardous alcohol use was defined as [more than 4 for men, more than 3 for women] drinks like beer, wine, or liquor in a single day. Lifetime sedative use was assessed by asking: “Have you ever used prescription medications for anxiety or sleep like Valium®, Xanax®, or Ambien®?”

Data regarding several relationship-level risk factors were collected during the health needs assessment: marital status (never married; currently married; or separated, divorced, or widowed), number of children, employment (full time or part time), and use of social media (Twitter, Facebook, or Instagram; yes or no). The only community-level risk factor assessed was rurality (based on the participant’s address— urban/rural) from the health needs assessment. Specifically, zip codes for each participant were merged with US census tract data to designate each person as living in an urban or rural residence. Urban areas were based on the census designation of urbanized area greater than 50,000 people or urban cluster greater than 2,500 people (US Census Bureau, 2018).

2.3 Analysis

Participants less than 18 years of age (n=1,042), persons for whom prescription opioid use was missing due to it not being included in the health needs assessment yet (n=24) or who did not identify their biological sex (n=6) were excluded. Descriptive statistics were calculated to summarize patterns of prescription opioid use (past 30-day use, lifetime but not past 30-day use, and no reported lifetime use). The association between individual-, relationship-, and community-level variables and the outcome, prescription opioid use, was examined using chi-square tests for categorical variables. Age was categorized into two groups (18–49 years and 50+ years) and the number of children was categorized as yes (≥1) or no (0).

Based on the literature, age, sex, and pain were important variables to consider and, thus, were initially fitted in as interaction terms with prescription opioid use. The moderating effect of age (categorized as ≤49 years and 50 or more years) on the relationship between

sex and prescription opioid use was first assessed by including an age-sex interaction term in the logistic regression model and examining whether the association between age and prescription opioid use (past 30-day use, lifetime but not past 30-day use, and no reported lifetime use) differed significantly by sex. The moderating effect of sex between pain and prescription opioid use was also assessed. These interaction terms were not significantly associated with any outcomes. Further, when interaction terms were added to the multinomial model with all other covariates, there were no appreciable differences in odds ratios, hence they were omitted from the final model. Subsequently, analyses were conducted for men and women separately to examine sex-specific effects.

Multinomial logistic regression was used to calculate adjusted odds ratios (aORs) and 95% confidence intervals to examine risk factors for prescription opioid use (with those who reported no lifetime use of prescription opioids as the referent group). The first set of models examined sex as a risk factor for lifetime and past 30-day prescription opioid use. Variables at the individual level that were not significantly associated with opioid use were not included in the second model, which added relationship factors. The final model excluded non-significant variables from the individual, relationship, and community levels, stratifying by sex to build two specific models for men and women. Model fit was assessed using the likelihood ratio test comparing the null model to each of our models. The variance inflation factor (VIF) was assessed for severity of multicollinearity. All VIF values were under 10; thus, no variables were removed for this reason. All statistical analyses were conducted using SAS® 9.4 (SAS Institute Inc., 9.4, Cary, NC: SAS Institute Inc., 2011).

3. Results

A total of 12,986 community members had a “meaningful contact” (considered to be at least a 3 minute conversation) with a CHW, and 10,293 (79.2%) completed a health needs assessment (Figure 1). Of those, 9,221 (90%) comprised the sample here; 60% were female and 44% were 50 years or older. Overall, 37% (n=3,463) reported lifetime but not past 30-day use of prescription opioids, and 14% (n=1,286) reported past 30-day opioid use. Among 3,672 men, 1,961 (33%) reported lifetime but not past 30-day use, and 455 (12%) reported past 30-day use (Figure 1). Among 5,549 women, 2,267 (41%) reported lifetime but not past-30 day use, and 831 (15%) reported past 30-day prescription opioid use. Sample characteristics are displayed in Table 1. All factors examined were significantly associated with prescription opioid use overall with the exception of past 30-day hazardous alcohol use (Table 1).

After stratification (Table 2), factors on the individual level, relationship level, and community level remained significantly associated with prescription opioid use. Hazardous alcohol use was significantly associated with prescription opioid use for men (p=0.0025) but not for women (p=0.3789).

Table 3 provides all the significant risk factors on the individual, relationship, and community level in which depression, cigarette use, and rurality were eliminated. After adjustments for covariates, women were significantly more likely than men to report any use of prescription opioids. Women had a 36% increased odds of lifetime prescription opioid use

(aOR= 1.36; 95% CI, 1.22–1.51) compared to men and an 18% increased odds of past 30-day prescription opioid use compared to men (aOR= 1.18; 95% CI, 1.01–1.37).

After controlling for significant covariates, sex specific estimates were calculated among risk factors for past 30 and lifetime no past 30-day use of prescription opioids with never use of prescription opioids as the referent group (Table 4). The strongest risk factor for past 30-day and lifetime use of prescription opioids for women and men was prescription sedative use.

4. Discussion

Prescription opioids and consequences related to use continue to be a significant public health problem in the US. Though health problems attributed to prescription opioid use continue, recent studies have focused little on sex differences and prescription opioid use. The current analyses characterized opioid use by sex and examined risk factors for prescription opioid use at the individual, relationship, and community level. After adjustment for other covariates, we observed sex specific risk factors.

Overall, 37% of the entire sample reported lifetime but not past 30- day use and about 14% reported past 30-day use of prescription opioids. After stratifying by sex we found a higher proportion of women endorsed lifetime (40.9%) and past 30-day (14.9%) prescription opioid use than men (32.6%, 12.1%, respectively). The prevalence rate for past 30-day prescription opioid use we observed is higher than the national rate. The CDC reports 6.9% of the US adult population used prescription opioids in the past 30 days (Centers for Disease Control and Prevention, 2015), half of our rate. The CDC has also found women to be more likely to use prescription opioids in the past 30 days compared to men (7.2% vs 6.3%; Centers for Disease Control and Prevention, 2015), and we similarly found higher rates of past 30-day opioid use among women compared to men (14.9% vs 12.1%). Further examination, which allowed us to control for factors at different levels of the socio-ecological model, revealed women, compared to men, were more likely to endorse any use of prescription opioids. This may be partly due to higher prescribing rates and rates of use among women compared to men in the US (Manteuffel et al., 2014; Olfson et al., 2015; Simoni-Wastila, 2000). Another explanation could be due to the variation in pain sensitivity between men and women. Women have a higher incidence of chronic conditions that cause pain, report pain (Bartley and Fillingim, 2013; Darnall et al., 2012; Houghton et al., 2016), and seek healthcare more frequently than men (Pinkhasov et al., 2010) that subsequently may lead to opioid prescriptions for pain treatment which may also put women at greater risk for adverse events related to prescription opioid use.

Additionally we found risk factors and protective factors for prescription opioid use varied by sex at the individual level. We found overall cancer was a risk factor for prescription opioid use. This relationship may have been observed because chronic conditions such as cancer are associated with pain and may require opioids to treat pain (Boland and Pockley, 2018; Bruera and Kim, 2003). However, when we stratified by sex, we found history of cancer only remained a significant risk factor among women (lifetime prescription opioid use [aOR= 1.81; 95% CI, 1.44–2.30], past 30-day prescription opioid use [aOR= 2.16; 95%

CI, 1.63–2.88]) but not men (data not shown: lifetime prescription opioid use [aOR= 1.25; 95% CI, 0.89–1.76], past 30-day prescription opioid use [aOR= 1.42; 95% CI, 0.92–2.17]). Yet, males have a higher lifetime probability of developing cancer and have a higher cancer mortality rate compared to women (Dorak and Karpuzoglu, 2012; Siegel et al., 2015). Due to the association between cancer pain and prescription opioid use, we would expect to see an association not only among women but also men who have also reported a history of cancer in our sample. Other studies have also found that women were more likely to endorse prescription opioid use than men (Campbell et al., 2010; Fillingimn et al., 2009; Simoni-Wastila, 2000). Further research is needed to investigate this relationship, specifically the potential development of opioid use disorders among cancer patients.

We also found lifetime marijuana use was no longer a significant risk factor for past 30 day prescription opioid use among men (aOR= 1.23; 95% CI, 0.97–1.56), but remained a significant factor for past 30-day prescription opioid use among women (aOR= 1.42; 95% CI, 0.92–2.17) after stratifying by sex. Some studies have found individuals will substitute marijuana for opioids for pain management (Baron et al., 2018; Mercurio et al., 2019). Interestingly, marijuana use has also been associated with an increased risk of non-medical prescription opioid use (Olfson et al., 2018) which warrants further examination specifically among women who are being prescribed opioids.

At the relationship level, having a child was a risk factor for prescription opioid use (both lifetime and past 30-day use) among women but this was not observed among men. This may be due to biologic differences— opioids are commonly used to treat pain among women during and after labor and delivery (Shah et al., 2017). Use of prescription opioids among pregnant women specifically was not examined, though the additional risks of such use are important to highlight; infants of mothers who used opioids during their pregnancy can develop neonatal abstinence syndrome (NAS) (Jansson et al., 2009; Krans and Patrick, 2016). In Florida, prevalence of NAS has increased dramatically, with an increase from 1.6 to 25.2 per 1000 live births between 2000 and 2010 (Wang et al., 2017), indicating that opioids are being used among pregnant women in Florida and this use is increasing. Our analyses demonstrate that differences in prescription opioid use and patterns of use are present between sexes and may be important to explore further, while results from other studies suggest that use among pregnant women is a specific concern, given the consequences of such use.

Finally, we found that the strongest risk factor for both past 30-day and lifetime prescription opioid use was lifetime sedative use. We observed this not only overall but also after we stratified by sex. This finding is of importance as the combined use of prescription drugs such as opioids and sedatives can be lethal due to the effects these drugs produce when ingested together. Specifically, the pharmacodynamics of opioids and sedatives change when combined and work synergistically to reduce respiratory function (i.e., slowed or shallow breathing), which heightens the risk of overdose (Dowell et al., 2016; Sun et al., 2017). Both opioids and sedatives are central nervous system (CNS) depressants and when used simultaneously result in significant respiratory depression (Jann et al., 2014). In addition, the drug classes of both opioids and sedatives are associated with risks of withdrawal, tolerance and dependence. Unfortunately, the combination of prescribing opioids and sedatives is

common and subsequently overdose death due to concurrent use of these two prescription drugs though rare, has increased in the United States (Hwang et al., 2016; Paulozzi et al., 2011; Sun et al., 2017). One retrospective study found approximately 30% of fatal opioid overdoses involved sedatives between 2001 and 2013 among 315,428 patients enrolled in private health insurance (Sun et al., 2017). Another study examining overdose related to the use of both opioids and benzodiazepines found overdoses significantly increased between 2004 and 2011 from 11.0 to 34.2 per 100,000 population (Jones and McAninch, 2015). The negative and potentially fatal consequence outlined above due to simultaneous use of these two drugs signifies the continued prevention of such use in the community.

It should be noted that the cross-sectional data limits the ability to establish temporality between the risk factors examined and prescription opioid use. Participants were only asked about any prescription opioid use during two time frames (past 30 days and lifetime); information regarding dose, frequency, duration of opioid use, source of the opioids, and whether use was appropriate was not collected. However, since non-medical use of prescription opioids was not assessed, the potential for participant responses to be influenced by perceived desirability of their response by the interviewer to bias the findings was reduced. In addition, self-report drug use could be over- or under-reported, which may result in misclassification. Previous studies have found self-report data regarding chronic conditions (i.e., diabetes and hypertension), is often consistent with medical records (Johansson et al.,1999; Okura et al., 2004), and thus, the potential for misclassification is unlikely but still possible due to inaccurate recall and intentional misreporting. Additional self-report data regarding other covariates such as pain may also be under- or over-reported. This may be due to how the questions were asked and the participant's interpretation of the question. Information bias cannot be ruled out as a result, though care has been taken in the design of the questionnaire to aid understanding and CHWs are able to clarify the meaning of a question if required. Residual confounding by factors not measured in this study remains a possibility. We have attempted to include a sufficient number of factors in each model to account for confounding where possible.

CHWs try to ensure all community members they approach participate and visit locations within the community at different times and days during the week. The sampling technique may still be susceptible to selection bias if those who choose not to participate are systematically different than those who choose to participate. This is unlikely to be the case with respect to the outcome of prescription opioid use, given that members are not made aware of the questions on the health intake form before deciding to join HealthStreet. Overall, the relationships observed between the risk factors examined and prescription opioid use may be generalizable to communities with a similar population structure. It should be noted that the data collected regarding prescription opioid use covers a broad time period (November 2011-June 2018) and may not reflect current prescribing practices as they are changing quickly. Finally, we acknowledge that true sex differences may not be present where the confidence intervals for estimates of effect overlap for men and women. These sex-specific effect estimates still provide a useful indication of which factors at the individual, relationship and community level are important among men and women separately.

There are many strengths of this analysis, including use of a community-based sample from Florida which we could examine sex differences and prescription opioid use. The use of community-based samples facilitates bidirectional research which can reduce health disparities within the community. Further, this community sample has reinforced known information regarding prescription opioid use within this specific community-based population. This study provides data from a large sample that addressed risks for both lifetime and past 30-day use. In particular, the large sample size likely provides sufficient power to detect true effects, further reducing threats to internal validity. This community-based sample also provides variables at multiple levels of the socio-ecological model. In addition, this study was conducted in a diverse population and provides information on risk of prescription opioid use among individuals who are not traditionally represented in research. This is more likely to produce results which are generalizable to similar communities in the US, providing information on which to base intervention development for reducing prescription opioid use in these communities. The data collected includes a wide variety of medical and drug use information for each participant in addition to social and behavioral information, allowing adjustment for many different confounding factors which are often not available in other data sources. Finally, the non-anonymous design of the HealthStreet model affords the opportunity for follow up with community members in the future for further studies regarding prescription opioid use and possible intervention strategies.

5. Conclusions

Our data suggest women are more likely to use prescription opioids than men, and we found older age was a risk factor for prescription opioid use among women but the same was not observed among men, which warrants further examination among women specifically. We also found prescription sedative use was the strongest risk factor for prescription opioid use regardless of sex. Prescription opioid use prevention should be considered on the individual and relationship level within communities and targeting efforts should be considered for men and women separately. Risk factors identified from national studies may not be applicable to all communities, for which prevention strategies should account.

Acknowledgments

Author Disclosures

Role of Funding Source

This work was supported by the National Institutes of Health and National Clinical and Translational Science Award UF grant [UL1, TR000064].

Conflict of Interest

The authors report no conflict of interest with respect to the content of this manuscript. Dr. Cottler currently receives funding from the Opioids PMR Consortium, which consists of the following 12 companies: Allergan; Assertio Therapeutics, Inc.; BioDelivery Sciences, Inc.; Collegium Pharmaceutical, Inc.; Daiichi Sankyo, Inc.; Endo Pharmaceuticals, Inc.; Hikma Pharmaceuticals USA Inc.; Janssen Pharmaceuticals, Inc.; Mallinckrodt Inc.; Pernix Therapeutics Holdings, Inc.; Pfizer, Inc.; Purdue Pharma, LP.

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Highlights

- Sex differences related to prescription opioid use have not been adequately assessed.
- Women were significantly more likely than men to report any use of prescription opioids.
- Risk factors varied by sex and were significantly associated with prescription opioid use.
- Prescription opioid use prevention should be considered for men and women separately.

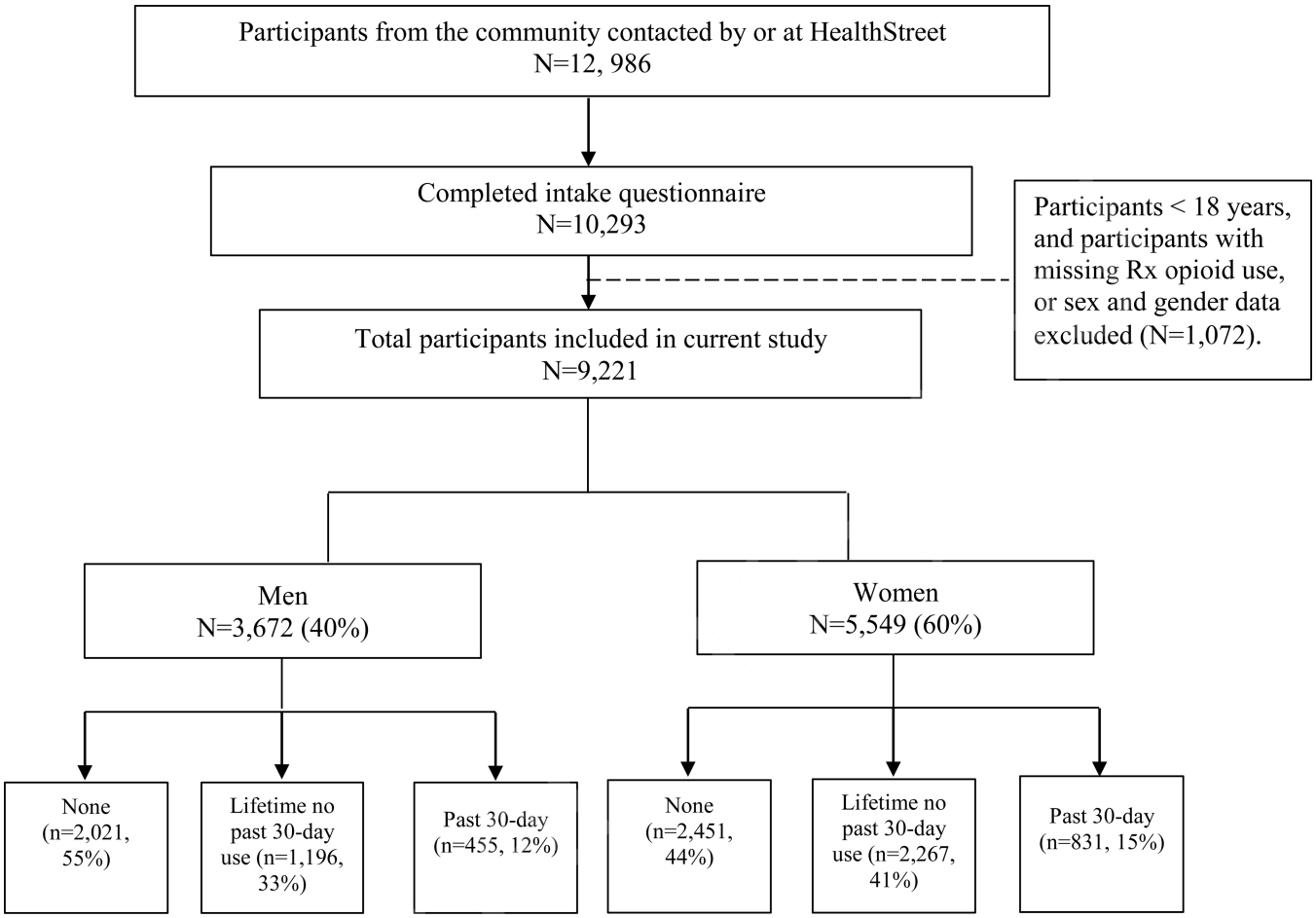

Figure 1.
Enrollment in HealthStreet and eligibility for current study, as of June 2018.

Table 1.

Association between individual-, relationship-, and community-level characteristics of prescription opioid use among HealthStreet members, 2011 – 2018, N=9,221.

Characteristic	Overall N=9,221 N (%)	No Rx opioid use N=4,472 N (%)	Lifetime, no past 30-day Rx opioid use N=3,463 N (%)	Past 30 day Rx opioid use N=1,286 N (%)	*P* value
INDIVIDUAL LEVEL FACTORS					
Sex					
Male	3672 (39.8)	2021 (45.2)	1196 (34.5)	455 (35.4)	<.0001
Female	5549 (60.2)	2451 (54.8)	2267 (65.5)	831 (64.6)	
Age					
18–49 years	5143 (55.8)	2781 (62.2)	1788 (51.6)	574 (44.6)	<.0001
50+ years	4078 (44.2)	1691 (37.8)	1675 (48.4)	712 (55.4)	
Race					
Black	5370 (58.2)	2981 (66.7)	1646 (47.5)	743 (57.8)	<.0001
Other	641 (7.0)	328 (7.3)	243 (7.0)	70 (5.4)	
White	3210 (34.8)	1163 (26.1)	1574 (45.5)	473 (6.8)	
Education					
HS or less	5246 (56.9)	2786 (62.3)	1690 (48.8)	770 (59.9)	<.0001
More than HS	3975 (43.1)	1686 (37.7)	1773 (51.2)	516 (40.1)	
Health insurance					
No	3401 (36.9)	1822 (40.7)	1208 (34.9)	371 (28.9)	<.0001
Yes	5820 (63.1)	2650 (59.3)	2255 (65.1)	915 (71.1)	
Doctor visits (past 6 months)					
No	2961 (31.0)	1845 (41.3)	882 (25.5)	134 (10.4)	<.0001
Yes	6360 (69.0)	2627 (58.7)	2581 (74.5)	1152 (89.6)	
ED visits (past 6 months)					
0–1	7849 (85.1)	4025 (90.0)	2945 (85.0)	879 (68.4)	<.0001
>2	1372 (14.9)	447 (10.0)	518 (15.0)	407 (31.6)	
Depression					
No	6499 (70.5)	3559 (79.6)	2228 (64.3)	712 (55.4)	<.0001
Yes	2722 (29.5)	913 (20.4)	1235 (35.7)	574 (44.6)	
Anxiety					
No	6881 (74.6)	3772 (84.4)	2331 (67.3)	778 (60.5)	<.0001
Yes	2340 (25.4)	700 (15.6)	1132 (32.7)	508 (39.5)	
Back pain					
No	5096 (55.3)	2992 (66.9)	1694 (48.9)	410 (31.9)	<.0001

Characteristic	Overall N=9,221 N (%)	No Rx opioid use N=4,472 N (%)	Lifetime, no past 30-day Rx opioid use N=3,463 N (%)	Past 30 day Rx opioid use N=1,286 N (%)	*P* value
Yes	4125 (44.7)	1480 (33.1)	1769 (51.1)	876 (68.1)	
Cancer					
No	8416 (91.3)	4266 (95.4)	3052 (88.1)	1098 (85.4)	<.0001
Yes	805 (8.7)	206 (4.6)	411 (11.9)	188 (14.6)	
Insomnia					
No	6823 (74.0)	3691 (82.5)	2338 (67.5)	794 (61.7)	<.0001
Yes	2398 (26.0)	781 (17.5)	1125 (32.5)	492 (38.3)	
Cigarette use (lifetime use)					
No	4449 (48.3)	2427 (54.3)	1506 (43.5)	516 (40.1)	<.0001
Yes	4772 (51.7)	2045 (45.7)	1957 (56.5)	770 (59.9)	
Hazardous alcohol use (past 30 days)					
No	7035 (76.3)	3439 (76.9)	2646 (76.4)	950 (73.9)	0.0779
Yes	2186 (23.7)	1033 (23.1)	817 (23.6)	336 (26.1)	
Marijuana use (lifetime)					
No	4565 (49.5)	2544 (56.9)	1425 (41.2)	596 (46.4)	<.0001
Yes	4656 (50.5)	1928 (43.1)	2038 (58.8)	690 (53.6)	
Rx sedative use (lifetime)					
No	6976 (75.7)	4003 (89.5)	2260 (65.3)	713 (55.4)	<.0001
Yes	2245 (24.3)	469 (10.5)	1203 (34.7)	573 (44.6)	
RELATIONSHIP LEVEL FACTORS					
Marital status					
Never married	4216 (45.7)	2442 (54.6)	1312 (37.9)	462 (35.9)	<.0001
Married	2013 (21.8)	863 (19.3)	860 (24.8)	290 (22.6)	
Separated, divorced, or widowed	2992 (32.5)	1167 (26.1)	1291 (37.3)	534 (41.5)	
Children					
No	2805 (30.4)	1606 (35.9)	934 (27.0)	265 (20.6)	<.0001
Yes	6416 (69.6)	2866 (64.1)	2529 (73.0)	1021 (79.4)	
Employment					
No	5905 (64.0)	2732 (61.1)	2167 (62.6)	1006 (78.2)	<.0001
Yes	3316 (36.0)	1740 (38.9)	1296 (37.4)	280 (21.8)	
Social media use					
No	5474 (59.4)	2852 (63.8)	1811 (52.3)	811 (63.1)	<.0001
Yes	3747 (40.6)	1620 (36.2)	1652 (47.7)	475 (36.9)	

Characteristic	Overall N=9,221 N (%)	No Rx opioid use N=4,472 N (%)	Lifetime, no past 30-day Rx opioid use N=3,463 N (%)	Past 30 day Rx opioid use N=1,286 N (%)	*P* value
COMMUNITY LEVEL FACTOR					
Rurality					
No	8894 (96.4)	4357 (97.4)	3311 (95.6)	1226 (95.3)	<.0001
Yes	327 (3.6)	115 (2.6)	152 (4.4)	60 (4.7)	

Table 2.

Association between individual-, relationship-, and community-level characteristics and prescription opioid use among HealthStreet members, stratified by sex, 2011 – 2018, N=9,221.

Characteristic	Males (n=3,672)				Females (n=5,549)			
	No Rx opioid use N=2,021 N (%)	Lifetime, no past 30-day Rx opioid use N=1,196 N (%)	Past 30-day Rx opioid use N=455 N (%)	*P* value	No Rx opioid use N=2,451 N (%)	Lifetime, no past 30-day Rx opioid use N=2,267 N (%)	Past 30-day Rx opioid use N=831 N (%)	*P* value
INDIVIDUAL LEVEL FACTORS								
Age				<.0001				<.0001
18–49 years	1221 (60.4)	589 (49.3)	197 (43.3)		1560 (63.7)	1199 (52.9)	377 (45.4)	
50+ years	800 (39.6)	607 (50.7)	258 (56.7)		891 (36.3)	1068 (47.1)	454 (54.6)	
Race								
Black	1394 (69.0)	549 (45.9)	260 (57.1)	<.0001	1587 (64.8)	1097 (48.4)	483 (58.1)	<.0001
Other	155 (7.7)	80 (6.7)	28 (6.2)		173 (7.1)	163 (7.2)	42 (5.1)	
White	472 (23.4)	567 (47.4)	167 (36.7)		691 (28.2)	1007 (44.4)	306 (36.8)	
Education								
HS or less	1340 (66.3)	636 (53.2)	296 (65.1)	<.0001	1446 (59.0)	1054 (46.5)	474 (57.0)	<.0001
More than HS	681 (33.7)	560 (46.8)	159 (34.9)		1005 (41.0)	1213 (53.5)	357 (44.0)	
Health insurance								
No	1003 (49.6)	545 (45.6)	175 (38.5)	<.0001	819 (33.4)	663 (29.3)	196 (23.6)	<.0001
Yes	1018 (50.4)	651 (54.4)	280 (61.5)		16632 (66.6)	1604 (70.7)	635 (76.4)	
Doctor visits (past 6 months)								
No	989 (48.9)	366 (30.6)	63 (13.9)	<.0001	856 (34.9)	516 (22.8)	71 (8.5)	<.0001
Yes	1032 (51.1)	830 (69.4)	392 (86.1)		1595 (65.1)	1751 (77.2)	760 (91.5)	
ED visits (past 6 months)								
0–1	1843 (91.2)	1028 (85.9)	316 (69.4)	<.0001	2182 (89.0)	1917 (84.6)	563 (67.8)	<.0001
>2	178 (8.8)	168 (14.1)	139 (30.6)		269 (11.0)	350 (15.4)	268 (32.2)	
Depression								
No	1666 (82.4)	815 (68.1)	277 (60.9)	<.0001	1893 (77.2)	1413 (62.3)	435 (52.4)	<.0001
Yes	355 (17.6)	381 (31.9)	178 (39.1)		558 (22.8)	854 (37.7)	396 (47.6)	
Anxiety								
No	1763 (87.2)	855 (71.5)	318 (69.9)	<.0001	2009 (82.0)	1476 (65.1)	460 (55.3)	<.0001
Yes	258 (12.8)	341 (28.5)	137 (30.1)		442 (18.0)	791 (34.9)	371 (44.7)	
Back pain				<.0001				<.0001

Characteristic	Males (n=3,672)				Females (n=5,549)			
	No Rx opioid use N=2,021 N (%)	Lifetime, no past 30-day Rx opioid use N=1,196 N (%)	Past 30-day Rx opioid use N=455 N (%)	*P* value	No Rx opioid use N=2,451 N (%)	Lifetime, no past 30-day Rx opioid use N=2,267 N (%)	Past 30-day Rx opioid use N=831 N (%)	*P* value
No	1365 (67.5)	629 (52.6)	149 (32.8)		1627 (66.4)	1065 (47.0)	261 (31.4)	
Yes	656 (32.5)	567 (47.4)	306 (67.2)		824 (33.6)	1202 (53.0)	570 (68.6)	
Cancer								
No	1946 (96.3)	1093 (91.4)	408 (89.7)	<.0001	2320 (94.7)	1959 (86.4)	690 (83.0)	<.0001
Yes	75 (3.7)	103 (8.6)	47 (10.3)		131 (5.3)	308 (13.6)	141 (17.0)	
Insomnia								
No	1693 (83.8)	831 (69.5)	308 (67.7)	<.0001	1998 (81.5)	1507 (66.5)	486 (58.5)	<.0001
Yes	328 (16.2)	365 (30.5)	147 (32.3)		453 (18.5)	760 (33.5)	345 (41.5)	
Cigarette use (lifetime use)				<.0001				<.0001
No	899 (44.5)	390 (32.6)	140 (30.8)		1528 (62.3)	1116 (49.2)	376 (44.2)	
Yes	1122 (55.5)	806 (67.4)	315 (69.2)		923 (37.7)	1151 (50.8)	455 (54.8)	
Hazardous alcohol use (past 30 days)				0.0025				0.3789
No	1441 (71.3)	829 (69.3)	287 (63.1)		1998 (81.5)	1817 (80.2)	663 (79.8)	
Yes	580 (28.7)	367 (30.7)	168 (36.9)		453 (18.5)	450 (19.8)	168 (20.2)	
Marijuana use (lifetime)				<.0001				<.0001
No	930 (46.0)	354 (29.6)	158 (34.7)		1614 (65.9)	1071 (47.2)	438 (52.7)	
Yes	1091 (54.0)	842 (70.4)	297 (65.3)		837 (34.1)	1196 (52.8)	398 (47.3)	
Rx sedative use (lifetime)				<.0001				<.0001
No	1841 (91.1)	826 (69.1)	276 (60.7)		2162 (88.2)	1434 (63.3)	437 (52.6)	
Yes	180 (8.9)	370 (30.9)	179 (39.3)		289 (11.8)	833 (36.7)	394 (47.4)	
RELATIONSHIP LEVEL FACTORS								
Marital status								
Never married	1187 (58.7)	509 (42.6)	178 (39.1)	<.0001	1255 (51.2)	803 (35.4)	284 (34.2)	<.0001
Married	360 (17.8)	268 (22.4)	109 (24.0)		503 (20.5)	592 (26.1)	181 (21.8)	
Separated, divorced, or widowed	474 (23.5)	419 (35.0)	179 (36.9)		693 (28.3)	872 (38.5)	366 (44.0)	
Children								
No	899 (44.5)	461 (38.6)	146 (32.1)	<.0001	707 (28.9)	473 (20.9)	119 (14.3)	<.0001
Yes	1122 (55.5)	735 (61.4)	309 (67.9)		1744 (71.1)	1794 (79.1)	712 (85.7)	

Characteristic	Males (n=3,672)				Females (n=5,549)			
	No Rx opioid use N=2,021 N (%)	Lifetime, no past 30-day Rx opioid use N=1,196 N (%)	Past 30-day Rx opioid use N=455 N (%)	*P* value	No Rx opioid use N=2,451 N (%)	Lifetime, no past 30-day Rx opioid use N=2,267 N (%)	Past 30-day Rx opioid use N=831 N (%)	*P* value
Employment								
No	1230 (60.9)	766 (64.1)	356 (78.2)	<.0001	1502 (61.3)	1401 (61.8)	650 (78.2)	<.0001
Yes	791 (39.1)	430 (35.9)	99 (21.8)		949 (38.7)	866 (38.2)	181 (21.8)	
Social media use								
No	1394 (69.0)	719 (60.1)	323 (71.0)	<.0001	1458 (59.5)	1092 (48.2)	488 (58.7)	<.0001
Yes	627 (31.0)	477 (39.9)	132 (29.0)		993 (40.5)	1175 (51.8)	343 (41.3)	
COMMUNITY LEVEL FACTOR								
Rurality								
No	1988 (98.4)	1161 (97.1)	437 (96.0)	0.0033	2369 (96.7)	2150 (94.8)	789 (95.0)	.0052
Yes	33 (1.6)	35 (2.9)	18 (4.0)		82 (3.3)	117 (5.2)	42 (5.0)	

Table 3.

Association between select risk factors and self-reported prescription opioid use pattern among HealthStreet members, 2011– 2018 (N = 9,221)

Characteristic	Lifetime, no past 30-day Rx opioid use N=3,463		Past 30-day Rx opioid use N=1,286	
	aOR	95% CI	aOR	95% CI
INDIVIDUAL LEVEL FACTORS				
Sex				
Male	Ref	-	Ref	-
Female	1.36	1.22–1.51	1.18	1.01–1.37
Age				
18–49 years	Ref	-	Ref	-
50+ years	1.09	0.98–1.23	1.17	0.99–1.37
Race				
White	Ref	-	Ref	-
Black	0.64	0.58–0.72	1.01	0.86–1.19
Other	0.69	0.56–0.84	0.69	0.51–0.94
Education				
More than HS	Ref	-	Ref	-
HS or less	0.72	0.65–0.80	0.94	0.81–1.09
Health insurance				
Yes	Ref	-	Ref	-
No	0.95	0.86–1.06	0.72	0.62–0.84
Doctor visits (past 6 months)				
No	Ref	-	Ref	-
Yes	1.45	1.30–1.62	3.32	2.71–4.07
ED visits (past 6 months)				
0–1	Ref	-	Ref	-
>2	1.24	1.06–1.44	2.57	2.16–3.05
Back pain				
No	Ref	-	Ref	-
Yes	1. 2	1.47–1.79	2.82	2.44–3.26
Cancer				
No	Ref	-	Ref	-
Yes	1.57	1.29–1.90	1.87	1.48–2.36
Insomnia				

Characteristic	Lifetime, no past 30-day Rx opioid use N=3,463		Past 30-day Rx opioid use N=1,286	
	aOR	95% CI	aOR	95% CI
No	Ref	-	Ref	-
Yes	1.26	1.11–1.42	1.27	1.08–1.49
Hazardous alcohol use (past 30 days)				
No	Ref	-	Ref	-
Yes	1.07	0.95–1.21	1.48	1.25–1.74
Marijuana use (lifetime)				
No	Ref	-	Ref	-
Yes	1.76	1.59–1.95	1.28	1.10–1.48
Rx sedative use (lifetime)				
No	Ref	-	Ref	-
Yes	2.67	2.34–3.04	3.96	3.35–4.68
RELATIONSHIP LEVEL FACTORS				
Marital status				
Married	Ref	-	Ref	-
Never married	0.72	0.63–0.83	0.78	0.63–0.95
Separated, divorced, or widowed	0.98	0.85–1.12	0.96	0.79–1.16
Children				
No	Ref	-	Ref	-
Yes	1.26	1.12–1.42	1.37	1.14–1.63
Employment				
Yes	Ref	-	Ref	-
No	0.90	0.81–1.00	1.47	1.24–1.73
Social media use				
No	Ref	-	Ref	-
Yes	1.32	1.19–1.46	0.92	0.79–1.07

aOR= adjusted Odds Ratio; CI= Confidence Interval; ref= reference group; N= sample size

Table 4.

Association between select risk factors and self-reported prescription opioid use pattern among HealthStreet members, by sex, 2011– 2018 (N = 9,221)

	Women (N=5,549)		Men (N=3,672)	
	Lifetime, no past 30-day Rx opioid use	Past 30-day Rx opioid use	Lifetime, no past 30-day Rx opioid use	Past 30-day Rx opioid use
Characteristic	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
INDIVIDUAL LEVEL FACTORS				
Age				
18–49 years	Ref	Ref	Ref	Ref
50+ years	1.11 (0.96–1.28)	1.31 (1.07–1.61)	1.07 (0.90–1.28)	1.08 (0.84–1.39)
Race				
White	Ref	Ref	Ref	Ref
Black	0.80 (0.69–0.92)	1.24 (1.01–1.52)	0.47 (0.39–0.55)	0.79 (0.61–1.01)
Other	0.89 (0.68–1.15)	0.82 (0.55–1.23)	0.48 (0.35–0.67)	0.61 (0.38–0.99)
Education				
More than HS	Ref	Ref	Ref	Ref
HS or less	0.69 (0.61–0.79)	0.87 (0.72–1.05)	0.70 (0.59–0.83)	0.99 (0.78–1.26)
Health insurance				
Yes	Ref	Ref	eliminated	.liminated
No	0.92 (0.80–1.05)	0.71 (0.58–0.87)		
Doctor visits (past 6 months)				
No	Ref	Ref	Ref	Ref
Yes	1.32 (1.14–1.53)	3.14 (2.39–4.14)	1.68 (1.42–2.00)	3.74 (2.76–5.05)
ED visits (past 6 months)				
0–1	Ref	Ref	Ref	Ref
>2	1.27 (1.05–1.53)	2.73 (2.19–3.39)	1.20 (0.93–1.53)	2.35 (1.77–3.11)
Back pain				
No	Ref	Ref	Ref	Ref
Yes	1.83 (1.61–2.08)	2.93 (2.44–3.52)	1.39 (1.18–1.63)	2.81 (2.22–3.56)
Cancer				
No	Ref	Ref	eliminated	eliminated
Yes	1.81 (1.44–2.30)	2.16 (1.63–2.88)		
Insomnia				
No	eliminated	eliminated	Ref	Ref
Yes			1.40 (1.16–1.70)	1.14 (0.88–1.49)

Characteristic	Women (N=5,549)		Men (N=3,672)	
	Lifetime, no past 30-day Rx opioid use	Past 30-day Rx opioid use	Lifetime, no past 30-day Rx opioid use	Past 30-day Rx opioid use
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Hazardous alcohol use (past 30 days)				
No	eliminated	eliminated	Ref	Ref
Yes			1.13 (0.95–1.35)	1.66 (1.31–2.11)
Marijuana use (lifetime)				
No	Ref	Ref	Ref	Ref
Yes	1.86 (1.63–2.11)	1.43 (1.19–1.71)	1.79 (1.52–2.12)	1.23 (0.97–1.56)
Rx sedative use (lifetime)				
No	Ref	Ref	Ref	Ref
Yes	2.83 (2.41–3.33)	4.27 (3.48–5.24)	2.71 (2.18–3.36)	4.02 (3.06–5.29)
RELATIONSHIP LEVEL FACTORS				
Marital status				
Married	Ref	Ref	Ref	Ref
Never married	0.74 (0.62–0.88)	0.92 (0.71–1.19)	0.63 (0.51–0.78)	0.52 (0.38–0.70)
Separated divorced, or Widowed	1.00 (0.84–1.18)	1.08 (0.85–1.36)	0.94 (0.75–1.18)	0.72 (0.53–0.98)
Children				
No	Ref	Ref	eliminated	eliminated
Yes	1.46 (1.25–1.72)	1.67 (1.31–2.14)		
Employment				
Yes	Ref	Ref	Ref	Ref
No	0.87 (0.76–0.99)	1.48 (1.20–1.81)	0.95 (0.80–1.13)	1.50 (1.14–1.97)
Social media use				
No	Ref	Ref	eliminated	eliminated
Yes	1.41 (1.24–1.60)	1.02 (0.85–1.22)		

aOR= adjusted Odds Ratio; CI= Confidence Interval; ref= reference group; N= sample size