ORIGINAL ARTICLE

Prevalence of Diagnosed Opioid Abuse and its Economic Burden in the Veterans Health Administration

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■ Abstract

Objective: Evaluate prevalence and risk-adjusted healthcare costs of diagnosed opioid abuse in the national Veterans Health Administration (VHA). Costs were compared between patients with and without diagnosed opioid abuse.

Design: Medical and pharmacy claims analysis of VHA data (10/01/2006 to 09/30/2010) were retrospectively analyzed. Prevalence was calculated as the percent of patients with diagnosed opioid abuse for the entire VHA membership and those with noncancer pain diagnoses, compared between patients prescribed opioids prior to abuse diagnosis and those not prescribed opioids through the VHA system. Healthcare utilization and costs were estimated using matching techniques and generalized linear models to control for clinical and demographic differences between patients with and without diagnosed opioid abuse. Separate comparisons were made (with diagnosed abuse vs. without) for each cohort: patients with/without opioid prescriptions.

Results: Five-year diagnosed opioid abuse was 1.11%. Among patients prescribed opioids, 5-year abuse prevalence was 3.04%. Pain patients prescribed opioids had the highest abuse rate at 3.26%. Adjusted annual healthcare costs for diagnosed opioid abuse patients were higher than for those without diagnosed abuse, (prescribed opioids overall healthcare costs: $28,882, with diagnosed abuse vs. $13,605 for those without; not prescribed opioids: $25,197 vs. $6350, *P*-value< 0.0001; opioid-specific healthcare costs for patients prescribed opioids: $8956 vs. $218; patients not prescribed opioids: $8733 vs. $20).

Conclusions: Diagnosed opioid abuse prevalence is almost 7-fold higher in the veteran's administration population than in commercial health plans and translates to a significant economic burden. Appropriate interventions should be considered to prevent and reduce opioid abuse. ■

Key Words: opioid abuse, opioid dependence, healthcare costs, economic burden, veterans

INTRODUCTION

Over the past decade, there has been an increase in opioid prescriptions to treat cancer-related and noncancer pain, and a parallel increase in opioid abuse.[1] In 2007, there were 12.7 million nonmedical opioid users in the United States.[2] When McAdam-Marx et al.[3] studied the relationship between diagnosed opioid abuse/dependence in Medicaid patients and economic outcomes from 2002 to 2003, the total adjusted cost of patients with diagnosed abuse/dependence significantly

exceeded the cost for matched controls ($23,556 vs. $8663; $P < 0.001$). Many recent studies on the cost burden of diagnosed opioid dependence and abuse disorders have limitations in sample size, data range, and data quality.[4,5] The Veterans Health Administration (VHA) is the largest integrated healthcare system in the United States, providing care to over 8.3 million veterans every year. A recent study demonstrated that the VHA population contains a large number of prescribed opioid users, of which 27,000 were diagnosed as opioid dependent in 2007.[6] However, the prevalence and economic burden of diagnosed opioid abuse, which is different than opioid dependence, in the VHA population have not been described. To our knowledge, no previous research has estimated the prevalence of diagnosed opioid abuse and economic outcomes including all-cause and opioid-related healthcare utilization and costs among VHA beneficiaries with and without diagnosed opioid abuse.

METHODS

This study used VHA administrative claims data from October 2005 to September 2010 using the VHA Medical SAS® datasets (SAS version 9.3 software, Cary, NC, USA). This dataset consists of national administrative data for VHA-provided healthcare utilized primarily by veterans and a small number of nonveterans (eg, employees, eligible family members, research participants) and includes inpatient, outpatient, laboratory, pharmacy, radiology, vital signs, enrollment, and vital status information. The frequency of diagnosed opioid abuse was determined during the study period of October 1, 2005 to September 30, 2010. Because only the first 3 quarters of the 2010 data were available, 2010 data were weighted to extend to the entire year. To compare healthcare utilization and costs, the identification period was from October 1, 2006 to September 30, 2009.

Study Sample

The prevalence of diagnosed opioid abuse in patients prescribed an opioid (prescription opioid receipt) and patients who did not receive an opioid prescription through the VHA system (no prescription opioid receipt) during the study period, and noncancer pain patients, was determined in subjects 12 years of age or older from October 1, 2005. Prescribed opioid users were required to have at least one pharmacy claim for opioids in the VA setting during the study period,

while study eligible opioid nonusers had no opioid pharmacy claims in the VHA setting during the study period. Noncancer pain patients must have received at least one medical claim for a noncancer pain diagnosis during the entire study period. Opioid abuse was defined using the following diagnoses: International Classification of Diseases 9th Revision Clinical Modification (ICD-9-CM) codes: 304.0x (opioid type dependence), 304.7x (combinations of opioid abuse with any other), 305.5x (opioid abuse), 965.00, 965.02, 965.09 (poisoning by opiates and related narcotics, not heroin). We used the same codes used by other authors in their analyses to enable better comparison between studies.[7,8]

To compare healthcare utilization and costs between diagnosed opioid abusers and those without diagnosed abuse, subjects with an opioid abuse diagnosis were required to have at least one medical claim for opioid abuse using the same sets of ICD-9-CM described above during the identification period (10/01/2006 to 09/30/2009). The date of the first such claim was designated as the index date. For patients without diagnosed opioid abuse claims, the index date was randomly assigned during the identification period to avoid selection bias. All patients were required to be 12 years or older on the index date. Minors under the age of 18 were considered in thus study due to previously published literature indicating the burden of opioid use in this age cohort, and their availability in the VHA dataset may be explained through coverage of TRICARE and CHAMPVA-eligible dependents.[4,9] All patients must also have continuous enrollment in a health plan with medical and pharmacy benefits 12 months pre-index date (baseline period) to 12 months postindex date (follow-up period).

Cohort Assignments (For Healthcare Costs and Comparisons Only)

Two cohorts were created to compare healthcare resource use and costs between those with and without diagnosed opioid abuse. The Diagnosed Opioid Abusers Cohort consisted of patients with at least one medical claim for the codes described above during the follow-up period. The Opioid nonabusers Cohort comprised of patients with no medical claims for the codes described above during the follow-up period. Outcomes for the two cohorts were further compared separately, by those who received or did not receive an opioid prescription.

Covariates and Outcome Variables

Covariate factors included gender, age, age group, region, race, marital status, pre-index Charlson Comorbidity Index (CCI) Score[10,11] pre-index Chronic Disease Score (CDS), nonpain-related and pain-related pre-index comorbid conditions, and overall and opioid-related healthcare utilizations and costs.

Nonpain-related pre-index comorbidity conditions included other substance abuse, nonopioid poisoning, psychiatric disorders, human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), endocarditis, skin infections/abscesses, gastrointestinal bleeding, cirrhosis/chronic or acute liver disease, hepatitis A, B, C, alcoholic hepatitis, other hepatitis, pancreatitis, sexually transmitted disease, herpes simplex, burns, trauma, and motor vehicle accidents. Pain-related pre-index comorbid conditions included cancer, low back pain, other back/neck disorders, arthritis, neuropathic pain, fibromyalgia, and headache/migraine. Each covariate was assessed during the 12-month baseline period.

Outcome Variables

Outcome variables included the prevalence of diagnosed opioid abuse, healthcare utilization and costs. Diagnosed opioid abuse prevalence was calculated for all patients, prescription opioid users and patients without prescription opioid receipt, and chronic noncancer pain patients. To calculate the prevalence rate, the number of patients with diagnosed opioid abuse during the study period was divided by the total number of patients in the population of interest.

Consumer Price Index (CPI)-adjusted postindex total healthcare costs were computed as the combined health plan and patient-paid amounts in the postindex period for all medical and pharmacy claims including all-cause and opioid-related total healthcare, inpatient, outpatient, office and emergency room (ER) visit, and pharmacy costs. Costs were adjusted to June 2010 U.S. dollars using the CPI medical care component. Opioid-related claims were defined as inpatient and outpatient claims with opioid diagnosis at any position, or pharmacy claims for an opioid prescription.

The number of all-cause and opioid-related inpatient admissions and outpatient, office, and ER visits was calculated for each patient. The number of hospitalization days was calculated during the postindex period.

Statistical Analysis

Descriptive analyses were performed for baseline and outcome variables. Percentages and standard deviations were calculated for dichotomous variables, and *P*-values were calculated using the chi-square test. Means and standard deviations were calculated for continuous variables, and *P*-values were calculated using the Student *t*-test.

The prevalence of diagnosed opioid abuse was calculated as the number of diagnosed opioid abusers divided by the total number of individuals for the study period of interest and was reported as a percentage and as cases per 1000 person population.

Multivariate analysis was performed using both propensity score matching (PSM) and generalized linear model (GLM) techniques. Propensity scores were estimated via unconditional logistic regression analysis. Potential predictors of an opioid abuse diagnosis were used as independent variables, and opioid abuse diagnosis was the outcome. Patients were matched if their propensity scores were within ± 0.01 units of one another.

Covariates in the logistic regression model included the following variables: age, gender, region, race, marital status, baseline CCI score, baseline CDS, baseline comorbid conditions (non-pain-related, pain-related), baseline healthcare utilization (all-cause, opioid-related), and baseline healthcare costs (all-cause, opioid-related). The dichotomous dependent variable was diagnosed opioid abuse vs. nonabuse. To estimate total costs, GLM with a gamma distribution and log link function was used. In these models, the dependent variables were total and opioid-related healthcare costs such as inpatient and outpatient ER, office visit, total and pharmacy costs. Independent variables were demographic and clinical factors used in PSM, and a group variable (diagnosed opioid abuse vs. no diagnosed abuse).

RESULTS

Overall Prevalence of Diagnosed Opioid Abuse

The overall 5-year prevalence of diagnosed opioid abuse among the VHA population was 1.11% (Table 1). Among patients prescribed an opioid, the overall prevalence of diagnosed opioid abuse was substantially higher at 3.04%. The prevalence of diagnosed opioid abuse was relatively low (0.29%) among patients who had not received an opioid prescription. For patients

Table 1. Five-Year Overall Prevalence of Prescribed Opioid Diagnosed Abuse in VHA Enrollees (Pain Patients, Prescribed Opioid Users and Non Users)

Totals	Population Sample Size	Opioid Abuser Sample Size	Prevalence (%)
VHA Enrollee	8,856,471	98,380	1.11
Prescription opioid user	2,631,511	80,066	3.04
Patients without prescription opioid receipt	6,224,960	18,314	0.29
Noncancer pain patient	4,337,072	86,052	1.98
Noncancer pain + prescription opioid user	2,304,181	75,069	3.26
Noncancer pain + patient without prescription opioid receipt	2,032,891	10,983	0.54
Patients without noncancer pain	4,519,399	12,328	0.27

VHA, veterans health administration.

with noncancer pain, the overall abuse rate was 1.98%, slightly higher than the overall rate of 1.11%. When pain patients were separated into prescription opioid users and patients without prescription opioid receipt, the rates of abuse were also slightly higher than overall prescription opioid users and those without prescription opioid receipt: 3.26% for opioid users and 0.54% for patients without prescription opioid receipt.

Over 5 years, the prevalence of diagnosed opioid abuse in noncancer pain patients (1.98%) was greater than in patients without noncancer pain (0.27%). The annual overall prevalence of diagnosed abuse in VHA enrollees consistently increased over the 5-year study period from 0.48% in 2006 to 0.73% in 2010 (Figure 1). For patients who had been prescribed an opioid, the annual prevalence increased from 1.67% to 2.10% before slightly decreasing in 2010 to 1.80%. In patients who had not received an opioid prescription, diagnosed opioid abuse remained fairly constant, ranging from 0.25% in 2006 to 0.27% in 2010.
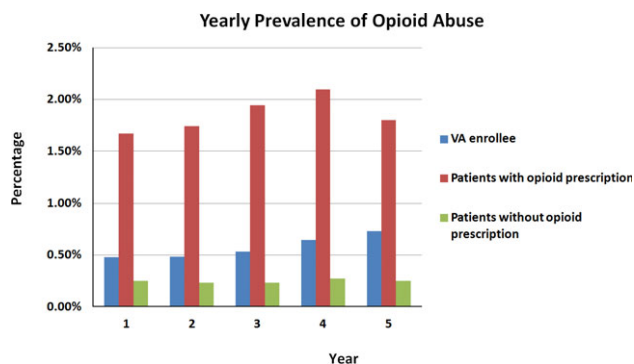

Figure 1. Annual prevalence of diagnosed opioid abuse, disaggregated by prescription opioid use status

In the first year (2006), diagnosed opioid abuse prevalence for the entire VHA population was the highest for patients 35 to 54 years of age (1.26%) and the lowest for patients age 65 and older (0.05%) (Figure 2). Diagnosed opioid abuse prevalence had the greatest increase over the study period from 2006 to 2010 for patients between the ages of 18 to 25 (0.38% to 1.09%) and 26 to 34 (0.45% to 1.18%). Patients 35 to 54 years of age maintained the highest percentage of diagnosed opioid abusers from 2006 to 2010. Among patients prescribed an opioid, the prevalence of diagnosed abuse was the highest among patients between age 35 and 54 years (3.39%) (Figure 3). However, by 2010, patients between ages 26 to 34 had the highest diagnosed abuse rate among opioid users at 3.90%. For patients who had not received an opioid prescription, the 35- to 54-year-old patient group also had the highest diagnosed abuse rate (0.70%) compared to the other age groups. Patients age 35 to 54 maintained the highest percentage of diagnosed opioid abusers in all 5 years of the study.

Patients prescribed an Opioid: Demographic/Clinical Characteristics

The following paragraphs summarize the demographic and clinical characteristics of patients who had been

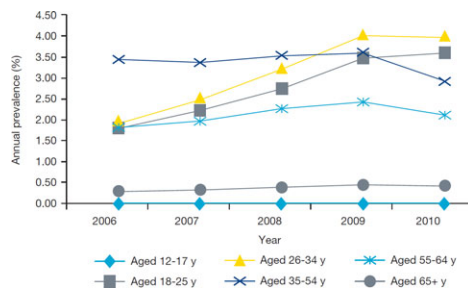**Figure 2.** Annual prevalence of diagnosed opioid abuse in overall population by age

Figure 3. Annual prevalence of diagnosed opioid abuse in prescription opioid users by age

prescribed an opioid and had diagnosed opioid abuse (N = 28,403) and patients prescribed an opioid without diagnosed abuse (N = 1,052,389).

The mean age of prescribed opioid users with diagnosed opioid abuse was lower than patients without diagnosed opioid abuse (52 vs. 61, P-value < 0.0001). Diagnosed opioid abusers were more likely to be male (93.31% vs. 92.67%, P-value < 0.0001) and had a higher probability of being divorced (37.66% vs. 25.91%, P-value < 0.0001) never married (21.65% vs. 14.32%, P-value < 0.0001) or separated (3.47% vs. 0.19%, P-value < 0.0001) than patients without diagnosed opioid abuse. A higher percentage of diagnosed opioid abusers were White (52.46% vs. 48.63%, P-value < 0.0001), Black/African American (18.42% vs. 12.30%, P-value < 0.0001), and American Indian patients (0.77% vs. 0.63%, P-value = 0.0034). The most prevalent comorbidities in the diagnosed abuser group were psychiatric problems (75.64%), other substance abuse (64.27%), arthritis (59.47%), and low back pain (55.20%). However, in terms of overall comorbidity measurements, patients without diagnosed opioid abuse had a higher CCI (1.34 vs. 1.10, P-value < 0.0001) and CDS score (6.46 vs. 5.98, P-value < 0.0001) than the diagnosed abuser cohort.

In terms of healthcare costs during the baseline period, total all-cause healthcare costs (inpatient, outpatient, pharmacy) were $14,157 for patients without diagnosed opioid abuse vs. $21,559 for diagnosed opioid abusers (P-value < 0.0001). The outpatient cost for diagnosed abusers ($11,192) and patients without diagnosed abuse ($8108) had the greatest impact on the total average healthcare expenses.

Differences in Healthcare Utilization

We first estimated the unadjusted baseline and follow-up differences and PSM-matched outcomes for opioid users. Unadjusted baseline results revealed a significantly higher percentage of diagnosed opioid abusers who visited inpatient (34.45% vs. 18.01%, P-value < 0.0001) and outpatient ER settings (34.69% vs. 20.14%, P-value < 0.0001) when compared to patients without diagnosed opioid abuse. While nearly every patient utilized outpatient pharmacy services, patients without diagnosed opioid abuse were more likely to visit the outpatient pharmacy than diagnosed opioid abusers (99.70% vs. 99.28%, P-value < 0.0001).

After PSM, 28,142 patients from each cohort were matched and GLM adjustments were made to compare follow-up healthcare utilization and costs between diagnosed opioid abusers (Figure 4) and patients without diagnosed abuse with only slight differences in magnitude from the unadjusted results. However, the sign and significance of the estimates do not change from the unadjusted to the final PSM and GLM adjusted results. Diagnosed abusers had higher healthcare resource utilization that was statistically significant. Patients with diagnosed abuse used follow-up care more often than patients without diagnosed abuse and had greater opioid-related follow-up healthcare utilization and costs as well.

Diagnosed opioid abusers had a higher percentage of inpatient and outpatient hospital visits than patients without diagnosed opioid abuse (53.39% vs. 17.06% for inpatient visits; 99.99% vs. 99.52% for outpatient visits; all P-values < 0.0001). Diagnosed abusers were also more likely to have outpatient ER visits compared to patients without diagnosed abuse (21.5% vs. 10.55%, P-value < 0.0001). Follow-up opioid-related healthcare utilization was also greater for diagnosed abusers compared to patients without diagnosed abuse (35.94% vs. 0.15% for inpatient care, P-value < 0.0001).

Differences in Direct Healthcare Costs

All adjusted follow-up healthcare costs (all-cause and diagnosed opioid abuse-specific) were significantly higher in the diagnosed opioid abuser cohort than in patients without diagnosed opioid abuse. In terms of the all-cause costs, the average direct healthcare costs for inpatient services nearly 4 times more expensive among patients with diagnosed opioid abuse than nonabusers ($12,837 vs. $3436, P-value < 0.0001, Figure 5 and
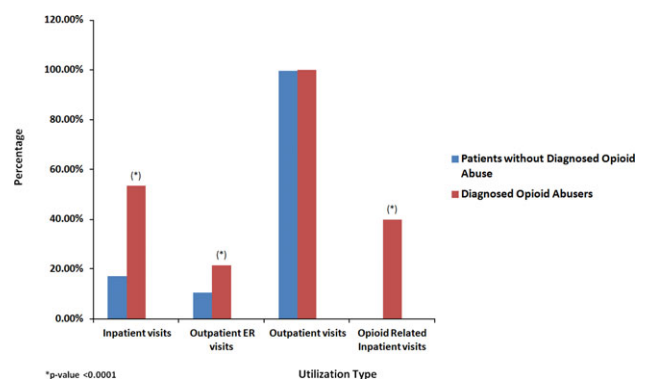

Figure 4. Follow-up healthcare utilization of diagnosed opioid abusers—generalized linear model (GLM) adjusted over propensity score matching (PSM)

Figure 5. Follow-up all-cause healthcare costs of prescribed opoid users—generalized linear model (GLM)-adjusted over propensity score matching (PSM)

Table 2). Outpatient pharmacy and nonpharmacy costs were also higher for diagnosed opioid abusers. The greatest difference in opioid abuse-specific costs between diagnosed opioid abusers and patients without diagnosed opioid abuse occurred with inpatient visits ($9603 vs. $5, P-value < 0.0001). When all costs were aggregated, total follow-up expenses for diagnosed abusers averaged $28,882 compared to $13,605 for patients without diagnosed opioid abuse. The average opioid-related follow-up expenditure was $8956 for a prescribed opioid abuser compared to $218 for a patient without diagnosed opioid abuse (all P-values < 0.0001).

Patients without an Opioid Prescription (NonUser): Clinical/Demographic Characteristics

The baseline demographic and clinical characteristics of patients without an opioid prescription (n = 3,607,371),

Table 2. Follow-up Healthcare Costs for Diagnosed Opioid Abusers-GLM adjusted over PSM

Follow-Up Healthcare Costs	Patients without Diagnosed Opioid Abuse (N = 28,142) Dollars ($)	Diagnosed Opioid Abusers (N = 28,142) Dollars ($)	P-value
Inpatient cost	3436	12,837	< 0.0001
Outpatient nonpharmacy cost	7801	13,062	< 0.0001
Outpatient pharmacy cost	1741	2209	<0.0001
Total follow-up costs	13,605	28,882	< 0.0001
Follow-up diagnosed opioid abuse-specific healthcare costs			
Inpatient cost	5	9603	< 0.0001
Outpatient nonpharmacy cost	2	2272	< 0.0001
Outpatient pharmacy cost	171	368	< 0.0001
Total follow-up costs	218	8956	< 0.0001

GLM, generalized linear model; PSM, propensity score matching.

including identified patients without diagnosed opioid abuse (99.47%; n = 3,588,203) and diagnosed opioid abusers (0.53%; n = 19,168), were similar to prescription opioid users. Diagnosed opioid abusers were younger than patients without diagnosed abuse (51 vs. 63, P < 0.0001). Nonusers with an opioid abuse diagnosis were more likely to be male (95.35% vs. 92.79%) and divorced (35.47% vs. 17.45%), never married (32.50% vs. 12.94%) or separated (3.76% vs. 0.10%, all P-values < 0.0001) compared to those without diagnosed abuse. A higher percentage of diagnosed opioid abusers were Black/African American (28.64% vs. 8.55%, P-value < 0.0001) and American Indian (0.55% vs. 0.38%, P-value < 0.0001). Diagnosed abusers had a greater number of studied comorbidities, with psychiatric (55.26% vs. 22.94%, P-value < 0.0001), other substance abuse problems (55.31% vs. 13.60%, P-value < 0.0001), and hepatitis A, B, or C (19.17% vs. 1.63%, P-value < 0.0001) being the most common. However, patients without diagnosed abuse had a higher frequency of cancer (7.25% vs. 2.30%, P-value < 0.0001) and higher overall comorbidity index scores, such as CCI (0.74 vs. 0.54, P-value < 0.0001) and CDS (3.73 vs. 2.77, P-value < 0.0001).

Baseline healthcare cost differences were also significant. The average total (inpatient, outpatient, pharmacy) costs for patients without diagnosed abuse were $3756 and $8209 ($P$-value < 0.0001) for diagnosed abusers.

Differences in Healthcare Utilization

To determine the differences in healthcare utilization, we first estimated the unadjusted baseline differences and PSM-matched outcomes for patients without an opioid prescription.

Similar to opioid user results, a significantly higher percentage of diagnosed opioid abusers in the no prescription receipt cohort visited outpatient ER (20.58% vs. 6.55%, P-value < 0.0001), and inpatient settings (16.39% vs. 2.93%, P-value < 0.0001) when compared to patients without diagnosed abuse. However, those without diagnosed abuse utilized outpatient services (office, other outpatient and outpatient pharmacy) more frequently when compared to diagnosed opioid abusers.

After PSM, 19,066 patients from each cohort were matched and GLM modeling was performed for the no prescription opioid receipt population. The final estimates for healthcare utilization and costs for

diagnosed opioid abusers and patients without diagnosed abuse are shown in Figure 6. There are slight differences in magnitude compared to the unadjusted tables. However, the significance of the estimates did not change between the unadjusted and the final PSM- and GLM adjusted results.

In both unadjusted and adjusted estimates, diagnosed opioid abusers had statistically significant higher healthcare resource utilizations. They used follow-up care more often than patients without diagnosed abuse and had greater opioid-related follow-up healthcare utilizations and costs.

Within the group without prescription opioid receipt, diagnosed abusers frequented hospital services more than patients without diagnosed abuse (47.47% vs. 10.69% for inpatient hospital visits, all *P*-values < 0.0001). Differences in the number of outpatient and ER visits were also statistically significant between the two groups. Diagnosed opioid abusers had more outpatient visits than patients without diagnosed abuse (99.97% vs. 97.13%, *P*-value < 0.0001) and were more likely to visit the ER (18.5% vs. 6.20%, *P*-value < 0.0001). Follow-up opioid-related healthcare utilization was also greater for diagnosed abusers compared to patients without diagnosed abuse (32.54% vs. 0.05% for inpatient care, *P*-value < 0.0001).

Differences in Direct Healthcare Costs

Upon examination of the differences in direct healthcare costs, the trend of healthcare received during the follow-up period for patients without prescription opioid receipt was parallel to the trend for those who received prescription opioids (Figure 7, Table 3). The average total follow-up healthcare cost was $6350 for patients without diagnosed

abuse, compared to $25,197 for diagnosed abusers (*P*-value < 0.0001). The average total cost for opioid-related follow-up healthcare was $8733 for diagnosed opioid abusers compared to $20 for patients without diagnosed opioid abuse (*P*-value < 0.0001).

DISCUSSION

This is the first study examining the prevalence and economic cost of diagnosed opioid abuse using VHA data. Two populations were studied as follows: patients with and without an opioid prescription. Within each group, we compared abuse prevalence, demographic characteristics, hospital utilization, and treatment costs for patients diagnosed with opioid abuse vs. patients without diagnosed opioid abuse. Over the 5-year study period, the overall prevalence of diagnosed opioid abuse increased, reaching its highest rate in 2010 at 0.73% for VHA enrollees. A similar study using MarketScan commercial employee population data estimated the
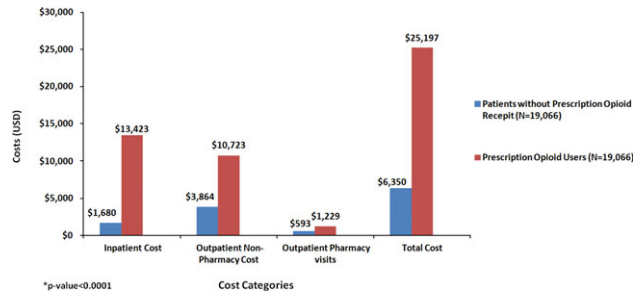
Figure 7. Follow-up healthcare costs of prescription opioid use—generalized linear model (GLM) Adjusted over propensity score matching (PSM)

Table 3. Follow-up Healthcare Costs for Prescription Opioid Use-GLM Adjusted Over PSM

Follow-Up Healthcare Costs	Patients without Prescription Opioid Receipt (N = 19,066) Dollars ($)	Prescription Opioid Users (N = 19,066) Dollars ($)	*P*-value
Inpatient cost	1680	13,423	< 0.0001
Outpatient nonpharmacy cost	3864	10,723	< 0.0001
Outpatient pharmacy cost	593	1229	< 0.0001
Total follow-up costs	6350	25,197	< 0.0001
Follow-up diagnosed opioid abuse-specific healthcare costs			
Inpatient cost	5	7089	< 0.0001
Outpatient nonpharmacy cost	2	2851	< 0.0001
Outpatient pharmacy cost	10	127	< 0.0001
Total follow-up costs	20	8733	< 0.0001

GLM, generalized linear model; PSM, propensity score matching.
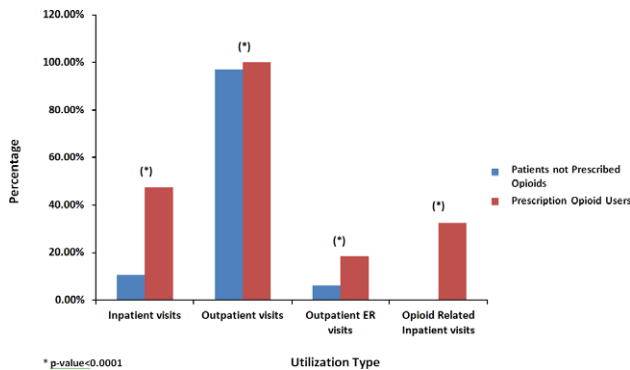
Figure 6. Follow-up healthcare utilization of prescription opioid use —generalized linear modelGLM-adjusted over propensity score matching (PSM).

overall prevalence of diagnosed opioid abuse at 0.12% from 2008 to 2009,[12] which is also consistent with the 0.11% prevalence rate from another commercial health plan in the United States. Diagnosed opioid abuse prevalence in the VHA population is almost 7 times higher than the estimates from commercial data.

Both prescribed opioid users and patients without prescription opioid receipt but with diagnosed opioid abuse had higher all-cause healthcare costs and diagnosed opioid abuse-specific healthcare utilization and costs, consistent with previous studies. A study by McAdam-Marx et al.[3] found that after matching diagnosed opioid abusers to nonabusers in the Medicaid patient population, the mean annual cost for diagnosed opioid abuse patients reached $23,556 vs. $8436 for controls (P-value < 0.001). While the total follow-up healthcare cost was higher in our study ($28,882 for diagnosed abusers compared to $13,605 for nonabusers; P-value < 0.001), the magnitude of difference in diagnosed abuse-related costs in the McAdam Marx et al. study ($15,120) was similar to the difference in total follow-up healthcare costs in this study ($15,277). In patients without prescription opioid receipt, the difference in total follow-up healthcare was $25,197 for diagnosed abusers vs. $6350 for patients without diagnosed abuse (P-value < 0.001). Our study also follows prior evidence that diagnosed opioid abuse generally decreases as age increases.[13] The average age of prescribed opioid users with diagnosed opioid abuse was significantly younger than patients without prescription opioid receipt (52 vs. 62 years, P < 0.0001), and the rate of increase among prescribed opioid patients was greater among age groups 18 to 25 and 26 to 35, than for those over age 35.

While some VHA results agree with other national studies using different datasets, it is important to consider the implications of opioid use in the veteran population alone. Previous research using VA regional data has shown that prior substance abuse and mental health disorders are two of the strongest predictors of future opioid abuse.[14] Investigating the specific costs associated with diagnosed opioid abuse (eg, multiple substance abuse, duration of drug abuse, and comorbidities) may reveal additional treatment patterns and risk factors that lead to a substance abuse diagnosis.

Our study has several advantages over previous research. We analyzed recent data from the VHA database, a population with a high prevalence of diagnosed opioid abuse. Both prescribed opioid users and patients without prescription opioid receipt were studied, and total healthcare costs as well as opioid-related healthcare costs were examined.

There are limitations to consider that could potentially affect the validity or interpretation of the results. Given that the VHA Medical SAS® datasets contain administrative information from multiple inpatient and outpatient sources, it is not specifically designed to capture a specific disorder for research purposes. As a result, under-reporting or misclassification of health outcomes of interest may occur. Although we used the same ICD-9-CM codes as previous studies, the diagnosed abuse codes are not specific to "prescribed" opioid users. Errors in the data could have resulted in an underreporting of patients with diagnosed opioid abuse and could have imparted a conservative bias. Errors in the electronic coding of complications can introduce bias as well. Opioids can potentially be obtained from a friend or relative (diversion) or through illegal activity, which may also result in diagnosed abuse. The rise in opioid prescriptions and diagnosed opioid abuse is further complicated by the lack of physician preparedness when diagnosing drug addiction or misuse. In the CASA national survey of primary care physicians and patients, it was revealed that less than one-third of doctors (30.2%) felt prepared to diagnose prescription drug abuse.[15] Because the incidence of diagnosed opioid abuse is often much lower than the incidence of prescription drug abuse, diagnosed drug abuse burden estimations are likely underestimating total abuse outcomes.[16] Finally, there is the potential for confounding variables. Although the models controlled for observable differences between cohorts, there is always the possibility that other variables (eg, socioeconomic status, treatment patterns, pain severity, prior abuse history, etc.) or factors such as disease management programs, media exposure, and risk evaluation and mitigation strategy (REMS) services could bias the study estimates.

CONCLUSIONS

Diagnosed opioid abuse is a significant problem in the VA population, and the annual prevalence rates of diagnosed opioid abuse are almost 7 times higher than other commercial health plans and still trending upward. From an economic perspective, this continuing increase is alarming because patients who abuse opioids incur greater cost burden than patients without diagnosed opioid abuse. To our knowledge, this is the first study to examine the healthcare burden and costs for diagnosed opioid abusers in the national VHA population. The study shows that patients with a diagnosis of

opioid abuse have more than 2 times higher healthcare costs than patients who do not have a diagnosis of opioid abuse, regardless of whether the patients were prescribed opioids or not.

The combination of recent data and new estimates of the frequency and cost of diagnosed opioid abuse makes these results relevant for future policy decisions. If greater resources and intervention programs are not devoted to addressing opioid abuse in the VA population, economic costs will continue to increase as more patients will require treatment for addiction and comorbidities linked to diagnosed opioid abuse.

ACKNOWLEDGMENTS

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