

Prescription Opioid Use in the U.S. in 2012: Characterizing Sustained vs. Infrequent Use Using the Medical Expenditure Panel Survey

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ABSTRACT

BACKGROUND/OBJECTIVES: Opioid has been declared an epidemic as trends of use, abuse, addiction and overdose related deaths have increased. This study provides a detailed portrait of opioid exposure in the United States and characterizes subpopulations with varying levels of exposure.

METHODS: A secondary analysis of the nationally representative Medical Expenditure Panel Survey examines self-reported prescription opioid exposure in US adults 18 years and older in 2012. Opioid users are divided into categories based on use duration and drug DEA Schedule: infrequent (< 30 day supply or one prescription), sustained (Narcotic Analgesics (Schedule II, 30-89 days and Non-Schedule II, >30 days), Narcotic Analgesic Combinations (Schedule II and Non-Schedule II, >30 day)), and intensive (Narcotic Analgesics (Schedule II, 90-day supply or more)). Socio-demographic factors such as sex, age, race, census region, family income, insurance coverage, education, and BMI were investigated.

RESULTS: According to our estimates, 14.5% of the US adult population reported opioid prescriptions in 2012, or about 21.5% of the US adult population with any medication. Among opioid users, 62.8% were infrequent users, 30.6% sustained users, and 6.5% intensive users. The mean total day supply was 8 days (Standard Error 0.2) among infrequent users, 176 days (SE 9) among sustained users, and 353 days (SE 13) among intensive users. Adults 65-85 years old (Odds Ratio 6.7, 95% CI 3.7-12.0, p-value < 0.0001), those at less than 100% of the Federal Poverty Level (OR 2.6, 95% CI 1.9-3.7, p-value < 0.0001), and those with public insurance coverage (OR 1.5, 95% CI 1.2-1.9, p-value = 0.0013) were more likely to be in a higher use group.

CONCLUSIONS: A significant proportion of individuals who reported an opioid prescription in 2012 received a supply of 30 days or less and have the lowest risk of dependency. The subgroup of individuals who received a supply of 90 days or more of high risk opioids needs to be better understood in order to avoid adverse outcomes in this risk group.

INTRODUCTION

In recent years, increased attention has been paid to opioid analgesic prescriptions and consumer characteristics as agencies such as the Department of Health and Human Services (DHHS), the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) have declared opioid use an epidemic and called for policy reform.^{1,2} Most recently, the President's 2016 budget included \$133 million in new funding for efforts that will seek to reduce opioid misuse and abuse.³ Additionally, Attorney General Eric Holder stated that opioid abuse is a growing public health crisis.⁴ In general, trends of opioid use, abuse, and addiction have continued to increase.⁵ The CDC reports that from 2003-2012 opioid analgesic overdoses accounted for more deaths than heroin and cocaine combined.¹ More recently in 2013, 71.3% (16,235) of deaths associated with pharmaceutical overdose involved opioid analgesics.⁶ Prescribing patterns of opioids have also increased over the past 20 years.⁷ According to the IMS Institute for Healthcare Informatics^a, from 2008 to 2012 pain was second among the therapeutic classes in most dispensed prescriptions in the United States.⁸ More specifically, the narcotic analgesic combination drug hydrocodone/acetaminophen (Brand names: Lortab, Vicodin) was the most dispensed medication across all medications.^{9b} Opioid use not only affects mortality but also morbidity. For every one opioid-related death, nine people are admitted for opioid substance abuse treatment, 161 report opioid drug abuse or dependence, and 461 report nonmedical uses of opioid analgesics.¹

The opium plant has been used by pharmacotherapy for analgesic pain relief since 3500 B.C.⁷ Many opium derivatives have since been created including natural, semisynthetic, and synthetic medications.^{7,10} Prescription opioids come in many different variations defined by class (agonist, antagonist, mixed), dosage, naturally occurring, synthetic, semisynthetic, and type (short acting (SA), long acting (LA)).¹¹ Selection of opioid therapy is dependent on several factors including pain severity and a person's physical characteristics.⁷ Little is known regarding the efficacy of different variations of opioid treatments especially long-term use for chronic pain.⁵

Opioid analgesics can present serious side effects including sedation, respiratory depression, constipation, nausea, cognitive impairment, edema, and hypogonadism.¹² While some side effects can be intermittent and others managed, opioids can have a significant risk of tolerance which leads to increased doses over time, physical dependence, addiction and ultimately withdrawal.^{12,13} Research has identified a need to identify patients who are

^aIMS Health is a company that provides information, services, and technology for the healthcare industry. www.imshealth.com

^bExcludes over the counter medications; prescription counts are not adjusted for length of therapy. 90-day and 30-day prescriptions are both counted as one prescription.

potentially at higher risk for developing these adverse outcomes. Opioid usage for more than three months has been associated with tolerance and dependence development and led to higher prescribed dosages.¹⁴ When studying opioid use disorder (OUD) it has been shown that length of therapy predicts addiction and the effects are compounded when high daily opioid doses are present.¹⁵ Opioid abuse is a progressive disease and often begins with a prescription.⁴ There is a great need to identify populations who use prescription opioids of high doses, long-term who have an increased risk of dependency and overdose.

For some individuals, pain becomes a disability. 90-95% of long-term opioid therapy is prescribed for non-cancer pain conditions (NCPC).¹⁶ Some of the most common pain areas are back, head, and joints.¹⁶ A large portion of patients who report chronic pain said they were unable to work full-time because of the pain.¹⁶ Physicians feel they must use all available resources even though efficacy of opioids is still debated.¹³ Increased knowledge of conditions that are most commonly prescribed prescription opioids could help to avoid adverse outcomes.

PRINCIPAL AIMS AND HYPOTHESES

The purpose of this study is to provide a detailed portrait of opioid exposure for adults 18 years and older in the United States in 2012. The primary objective of this study is to describe the extent of population opioid prescription exposure and characterize subpopulations with varying levels of exposure. The specific aims are to investigate prescription opioid characteristics at the population, prescription, and person level. This study assess differences in opioid exposure by opioid type, medical condition, and demographic variables. As identified from the literature, opioid abuse is considered to be a significant public health concern and it is hypothesized that opioid prescriptions continue to be dispensed in large amounts.¹⁷ In addition, as patients become tolerant to opioids they are prescribed higher doses long-term. Research has shown that high dose opioid use long-term leads to an increased risk for dependency and addiction. There is also evidence that documents opioid exposure differences by demographic variables such as type of health insurance type and geographic region that should be further investigated.¹³ One particular novel hypothesis is that opioid prescription exposure varies by the medical conditions they are prescribed for. Associations in this area could potentially help alter opioid prescribing patterns and fuel research for alternative forms of pain treatment.

METHODS

This study is a secondary data analysis to determine and characterize the extent of population prescription opioid exposure in the United States among adults 18 years and older in 2012. This study uses nationally representative cross-sectional survey data that has been de-identified and is publicly available and exempt from institutional board review by the George Washington University.

SURVEY

Data for this study comes from the Medical Expenditure Panel Survey (MEPS). MEPS is a nationally representative survey conducted by the Agency for Healthcare Research and Quality (AHRQ) that collects information about the health of the U.S. civilian non-institutionalized population.¹⁸ The MEPS uses a panel design that has five rounds of interviews and covers two full calendar years.¹⁸ The MEPS began in 1996 and selects a new panel of households each year.¹⁸ The set of households selected by the MEPS for each panel is a subsample of households participating in the previous year's National Health Interview Survey (NHIS) conducted by the National Center for Health Statistics (NCHS).¹⁸ The NHIS sampling frame is also nationally representative of the U.S. civilian non-institutionalized population and oversamples blacks, Hispanics, and Asians.¹⁸ Each year the MEPS has a sample size of about 15,000 households and the data are weighted to produce national estimates.¹⁸ The MEPS is designed to collect information from individuals, families and selected population subgroups and uses computer assisted personal interviewing (CAPI) technology to administer the survey.¹⁸

One of the MEPS major components is the Household Component that collects data from individuals on demographic variables, health conditions, health status, use of medical care services, charges and payments, access to care, satisfaction with care, health insurance coverage, income, and employment. The respondents' data are supplemented with data from their medical providers.¹⁸

This study uses the MEPS 2012 Full Year Consolidated Data File and Prescribed Medicines File. The Full Year Consolidated Data File has 38,974 observations, each observation representing one person, and contains information about demographic variables. The Prescribed Medicines Data File has 324,744 observations, each observation represents one reported prescribed medicine that was purchased by a person in the household during the calendar year. The Prescribed Medicines file contains data on prescription drugs that were collected during household interviews and a pharmacy data collection/verification component.¹⁸ During each round of the MEPS, participants are asked to supply the name of any prescribed medicine they or their family members purchased or obtained during that round.¹⁸ The Prescribed Medicines File does not distinguish between the original purchase and refills and considers both to be a unique prescribed medicine event.¹⁸

SAMPLE

The MEPS utilizes a complex weighting mechanism that allows national estimates to be calculated. Participants who were a member of a selected NHIS household, civilian and non-institutionalized for at least one day during 2012, and responded for the full period in which they were eligible, were assigned positive person-level

weights to enable national estimates from the MEPS.¹⁸ This analysis was restricted to US adults 18 years and older with positive person-level weights. Individuals who did not have an age recorded were excluded from analysis. This accounted for less than 1% of the total population. The Full Year Consolidated Data File and Prescribed Medicines Data File were merged to associate person-level, demographic information with each prescribed medicine observation in 2012. The MEPS 2012 Full Year Consolidated File represents a national estimate of 313.5 million U.S. residents of all ages. Of those persons having at least one prescribed medicine purchase, the average annual utilization estimate is 3.2 billion prescriptions.¹⁸

IDENTIFICATION OF PRESCRIPTION OPIOIDS

Opioid analgesic prescriptions in the 2012 Prescribed Medicines file were identified using two classification methods; Multum Lexicon Drug Classes and National Drug Codes (NDC). Multum Lexicon Drug Classes are from Cerner Multum, Inc. and group together NDC codes to indicate therapeutic and chemical drug categories.¹⁸ National Drug Codes (NDC) are a requirement by the Food and Drug Administration (FDA) for all commercially distributed drugs and serve as a universal drug identifier. The Multum classes used in this study for opioid identification were 60 “Narcotic Analgesics”, 63 “Analgesic Combinations”, and 191 “Narcotic Analgesic Combinations”. Multum variables and NDCs were used to create separate opioid subsets from the 2012 Prescribed Medications file and then cross referenced to verify that all opioid prescriptions within the MEPS data were accurately captured. This analysis was restricted to prescription observations that had an NDC.^c

Multum classes were used to distinguish two categories of opioids: Narcotic Analgesics and Narcotic Analgesic Combinations. Six unique NDCs (19 prescription observations) were present in the Prescribed Medicines file and associated with Multum classes 60 or 191 but were not identified in any other source and therefore not included in the analysis. 195 prescription observations in the Prescribed Medicines Data File were missing a NDC and a drug name and were also excluded from analysis. One drug, Zonisamide (15 prescription observations), was identified using the Multum class 191 “Narcotic Analgesic Combinations” however it is an antiseizure medication and was not included in the analysis. All forms of prescription opioid analgesics including tablet, capsule, lozenge/troche, patch, solution, and spray were included

OPIOID STRATIFICATION

Drug Enforcement Agency (DEA) Drug Schedule information was associated with each prescription opioid using NDCs. Schedules I – V describe medical use and drug abuse or dependency potential. Schedule I drugs are considered to be the most dangerous with a high potential for abuse and physical dependence. Schedule II drugs also have a high potential for abuse and can lead to severe psychological or physical dependence. Schedules III-V drugs have moderate to low potential for abuse and physical dependence.¹⁹

Four classifications were identified in the MEPS opioid subset, Long-Acting Schedule II, Long-Acting Non-Schedule II, Short-Acting Schedule II, Short-Acting Non-Schedule II. Non-Schedule II drugs can be drugs that are Schedules III – V. Only ten observations in the opioid subset were identified as Long-Acting Non-Schedule II so Long-Acting Non-Schedule II and Short-Acting Non-Schedule II were combined into Non-Schedule II. In 2014, Hydrocodone Narcotic Combinations were rescheduled by the DEA to be Schedule II so in this analysis Hydrocodone Narcotic Combinations are Schedule II.²⁰

DURATION

Prescription opioid use duration was identified for each person using the following variables: total number of opioid prescriptions, total day supply, and earliest year a person began purchasing an opioid prescription. A reported day supply of 0 days was recoded as missing and year 2013 recoded as 2012. The total number of prescriptions and total day supply per person was computed and then broken further into categories. Based on the distribution in the data, the prescription count categories are 1, 2-4, 5-7, 8-10, 11-13, and more than 13 prescriptions, and the total day supply categories are 30 days or less, 31 – 180 days, 181 – 360 days, and more than 360 days. The earliest year a person began an opioid prescription was determined using the years associated with each unique prescription per person.

USE CATEGORIES

An infrequent user is defined as someone with of 30 day supply or less, or (if the day supply information was missing) just one prescription in the 12 month survey period. A sustained user is defined as someone with a total day supply of more than 30 days, or (if the day supply information was missing) more than one prescription in the survey period. Individuals identified as sustained users were separated into two groups of intensive and non-intensive users. An intensive user is defined as someone with prescriptions for Narcotic Analgesics, Short and Long Acting Schedule II with a 90 day supply or more. A non-intensive user are individuals with Narcotic Analgesics, Short and Long Acting

^c A prescription observation identified using an NDC that was missing a Multum class was identified as a Narcotic Analgesic Combination using the prescription name Acetaminophen/Hydrocodone and the Multum code recoded as ‘191’. This method was only used for one observation.

Schedule II with more than 30 day supply, but less than a 90 day supply as well as all Narcotic Analgesic Combinations with a day supply over 30 days.

MEDICATION CONDITIONS

Medical diagnoses are associated with opioid prescriptions in the 2012 Prescribed Medicines File. These diagnoses were self-reported by the survey respondents and then coded using both ICD-9 chapter code headings and AHRQ Clinical Classification Codes (CCC) for confidentiality.²¹ Differences in medical diagnoses between infrequent, sustained, and intensive opioid users were investigated. These diagnoses findings should be interpreted with caution as the accuracy condition linkage to opioid prescriptions cannot be assumed. These findings should be used as the basis for more exploratory analyses.

DEMOGRAPHIC VARIABLES

Demographic information was associated with each prescribed medication event using a unique person identifier. The demographic variables assessed in this analysis were sex, age, race/ethnicity, census region, income, insurance coverage, education, and BMI. All of these variables are common confounders or have been previously identified as having an association with opioid analgesic use.

STATISTICAL ANALYSIS

Descriptive statistics (e.g., percentages) were provided for prescription and person level opioid characteristics. The SAS® Survey Procedures (surveyfreq, surveymeans, and surveylogistic) were used to obtain nationally weighted estimates using the 2012 MEPS person weight, sampling strata and primary sampling units (PSU). We used Chi-square tests to assess whether demographic variables differed significantly between populations. We performed Logistic regression analyses for the following outcome variables: any opioid use, sustained use, and intensive use. We used Ordinal logistic regression to compare all three levels of opioid use. The predictors considered were sex, age, race/ethnicity, census region, family income, insurance coverage, education level, and BMI. All tests were assessed at a 0.05 significance level and we performed our analyses using SAS (Version 9.4; SAS Institute Inc., Cary, NC).

RESULTS

POPULATION PERCENTAGE

Population exposure is shown in Table 2. In 2012, an estimated 34,366,368 adults 18 years and older reported 138,923,145 opioid prescriptions during the household interview. This is approximately 14.5% of the general US adult population, or 21.58% of the U.S. adult population who reported any medication in 2012.

SAMPLE DEMOGRAPHICS AND COMPARISON

A comparison between the opioid and non-opioid population among adults with any medication is shown in Table 4 and Table 4a. The opioid sample population was mostly female (59.0%) aged 45 – 64 (41.4%), white (81.8%), from the south (39.3%), of more than 400% of the federal poverty level (33.6%), on private insurance (62.66%) and obese (BMI >30) (40.1%). This composition is similar to the composition of the general adult population with any prescribed medication in 2012. Comparing the opioid population to non-opioid population among adults with any medication, there was found to be an association ($p < 0.05$) between opioid use, age, race, census region, family income, education, BMI, and insurance coverage. Opioid exposure rates were highest among individuals aged 45-64 (Odds Ratio 1.4, 95% CI 1.1-1.8, $p = 0.0014$), living in the West (OR 1.3, 95% CI 1.1-1.5, $p = 0.0015$), 100% of the federal poverty level or less (OR 1.6, 95% CI 1.4-2.0, $p < 0.0001$), and with public insurance coverage (OR 1.5, 95% CI 1.3-1.7, $p < 0.0001$). Opioid exposure was lower among Asians (OR 0.38 95% CI 0.3-0.5, $p < 0.0001$).

PRESCRIPTION SUMMARY

A summary of the prescription opioid characteristics is shown in Table 6. Of the 138,923,145 reported opioid prescriptions in 2012, there were more Narcotic Analgesic Combinations (59.7%) than Narcotic Analgesics (40.3%) and more Short Acting Schedule II (62.9%) than Long Acting Schedule II or Long and Shorting Acting Non-Schedule II. Among Narcotic Analgesics, 41.4% were Long or Short Acting Non-Schedule II drugs and among Narcotic Analgesic Combinations, 90% were Short Acting Schedule II drugs. 53.9% of prescriptions were reported to have begun between 2000 and 2011, and 40.9% in 2012. The average day supply across all prescriptions (Table 3) was approximately 19 days (SE 0.54). 39.7% of all prescriptions had a day supply of 1-10 days and 40.3% had a day supply of exactly 30 days.

POPULATION SUMMARY

A summary of the person-level characteristics is found in Table 7. The mean total prescriptions per person during the one-year study period (Table 3) was 4 prescriptions (SE 0.14) and the mean total day supply per person was 75.8 days (4.17). Of the 34,366,368 people who reported at least one opioid prescription in 2012, 47.05% of these people had a total of one prescription during this time. Another 26.2% had a total of 2-4 prescriptions. 65.9% of opioid users had a total day supply of 30 days or less, 21.0% had a total day supply of 31 to 180 days, and only 4.72% had a total day supply of more than 360 days. Among people with prescriptions for Short Acting Schedule II

drugs, 50.0% only had 1 prescription, 34.5% had 3 or more prescriptions, and 69.8% had a total day supply of 30 days or less. Among people with Long Acting Schedule II prescriptions, 66.7% had 3 or more prescriptions and 74.9% had a total day supply of more than 30 days. Among people with Long and Short Acting Non-Schedule II drugs, 53.3% had only 1 prescription, 35.4% had 3 or more prescriptions, and 66.9% had a total day supply of 30 days or less. 63.1% of opioid users first began taking opioids in 2012 and 33.4% first began taking opioids between 2000-2011.

USE GROUPS

A summary of opioid user groups is found in Table 2. Among opioid users, 62.8% were infrequent users, 30.6% sustained users, and 6.5% intensive users. The mean total day supply in the infrequent user group was 8.88 days (SE 0.23), 176.35 days (SE 9.25) in the sustained user group, and 353.84 days (SE 13.38) in the intensive user group. Comparing all three user groups, opioid use was predicted by age, race, family income, and insurance coverage. Individuals with the following characteristics were more likely to be in a higher use category (either sustained or intensive), adults aged 25-44 (OR 2.8 95% CI 1.5-5.1, p-value 0.0006), aged 45-64 (OR 5.9 95% CI 3.2-10.6, p-value <.0001) aged 65-85 (OR 6.7, 95% CI 3.7-12.0, p-value <.0001), 100% of the federal poverty level or less (OR 2.6, 95% CI 1.8-3.7, p-value <.0001), between 100%-125% of the federal poverty level (OR 1.8 95% CI 1.3-2.7, p-value 0.0012), between 125%-200% of the federal poverty level (OR 1.4 95% CI 1.0-2.0, p-value 0.0457), between 200%-400% of the federal poverty level (OR 1.5 95% CI 1.1-2.0, p-value 0.0087), and on public insurance (OR 1.5, 95% CI 1.2-1.9, p-value = 0.0013). Individuals who identified themselves as Black (OR 0.8 95% CI 0.6-0.9, p-value 0.0174) or Asian (OR 0.5 95% CI 0.3-0.9, p-value 0.0248) were less likely to be in a higher use category.

DIAGNOSES

Common diagnoses among opioid users are shown in Tables 8. Among all opioid users the most common diagnoses were spondylosis, intervertebral disc disorder, other back problems (17.3%), joint disorders (16.6%), and connective tissue disease (8.5%). These conditions continued to be the most reported conditions associated with prescription opioids in the sustained and intensive user groups. Among intensive users the most common diagnosis was spondylosis, intervertebral disc disorders, other back problems (40.6%). Other reported conditions included osteoarthritis (11.2%), nervous system disorders (11.0%), and rheumatoid arthritis (9.1%).

DISCUSSION

Since the 1980s, the use of opioids for treatment of chronic pain has been increasing and in turn the prevalence of abuse, addiction, and mortality as well.²² Opioid use has since been declared an epidemic therefore predictive factors need to be identified. In this study we report the extent of population opioid prescription exposure in 2012 and characterize subpopulations with varying levels of exposure using prescription information and socio-demographic variables. Our study found approximately 21.5% of the adult US population with any medication purchased had at least one opioid prescription in 2012. We compared adults with opioid exposure to the general adult population with any prescribed medication in 2012. Our rationale for making this comparison was that we assumed adults had some pharmacy benefits and access to medications. The results of this analysis showed that the opioid-using population and the population with any medication are similar. Differences were observed and identified age, race, census region, family income, and insurance coverage as significantly associated with opioid use. Our findings agree with previous study findings.^{5, 13} Not only did this study investigate population level characteristics, we also looked within opioid users and found three distinct user groups: infrequent users (a group that receives a very small amount of opioids), intensive users (a group that receives a large amount), and sustained users (a group in between). The average day supply in each group showed a steep increase when moving to higher use categories. Other research has shown that individuals who continue taking opioid medications past 90 days are at a higher risk for dependency and abuse.¹⁵ The results of our analysis showed significant differences in age, race, family income, and insurance coverage between intensive, sustained, and infrequent users. The likelihood of being in a more frequent user group increased with age and decreased as family income decreased. In addition, individuals who were on private insurance were also more likely to be in a higher use category. Further research needs to be done to better understand this population using other predictive variables. In addition, as reported in other research, disorders of the back and joint are the most common conditions that are being prescribed opioid medications. Our analysis found no distinguishing disease characteristics among persons with sustained opioid exposure.

STRENGTHS/LIMITATIONS

The MEPS survey is useful for studying prescriptions because self-reported exposure is supplemented and confirmed with pharmacy prescription data. In addition, the sampling method enables national estimates to be calculated to provide a snapshot of the U.S. population, and the data are very complete with very small percentages missing. However, the MEPS data are observational and based on self-reports so there is a potential for recall bias. In addition, National Drug Codes are a challenge because they can be coded wrong, are hard to find, and can

change or go out of use. It is likely that the MEPS data is underestimating opioid exposure because the data are self-reported prescriptions and are only assessing licit drug use which excludes illicit and non-medical use.^d

These findings in addition to other studies show a need for more effective policies. Policy makers need to not only focus on illicit and nonmedical use but also medical use as a significant proportion of medical users are at high risk for abuse and adverse outcomes.¹⁷ State-level policy changes need to be made that will reduce population exposure and protect high risk individuals who are in need of pain treatment.²³

TABLES AND FIGURES

Table 1. Sample Size

| Dataset | Level | N | Weighted N |
|--|--------------|---------|---------------|
| 2012 Household Component | Person | 37,182 | 313,489,853 |
| 2012 Full Year Consolidated File (H155) | Person | 38,974 | 313,489,853 |
| 2012 Prescribed Medicines File (H152A) | Prescription | 324,744 | 3,214,685,627 |
| Adults 18+ in 2012 | Person | 27,820 | 237,113,917 |
| Adults 18+ with a medication in 2012 | Person | 15,987 | 159,282,020 |
| Adults 18+ with opioid prescriptions in 2012 | Person | 3,488 | 34,366,368 |
| Opioid Prescriptions in 2012 (Adults 18+) | Prescription | 14,076 | 138,923,145 |

Table 2. Opioid Population (Adults 18+)

| | N | Weighted N | % |
|--|--------|-------------|--------|
| General Adult Population | | | |
| Any Use (At least 1 opioid prescription in 2012) | 3,488 | 34,366,368 | 14.49 |
| No Use (0 opioid prescriptions in 2012) | 24,332 | 202,747,548 | 85.51 |
| Total | 27,820 | 237,113,917 | 100.00 |
| <i>Adult Population With Any Prescribed Medication</i> | | | |
| Any Use (At least 1 opioid prescription in 2012) | 3,488 | 34,366,368 | 21.58 |
| No Use (0 opioid prescriptions in 2012) | 12,499 | 124,915,652 | 78.42 |
| Total | 15,987 | 159,282,020 | 100.00 |
| <i>Any Use Opioid Population</i> | | | |
| Sustained Use (More than 30 day supply or more than 1 total prescription) | 1,279 | 12,766,830 | 37.15 |
| Infrequent Use (30 day supply or less or 1 total prescription) | 2,209 | 21,599,539 | 62.85 |
| Total (Any Use) | 3,488 | 34,366,368 | 100.00 |
| <i>Sustained Use Opioid Population</i> | | | |
| Intensive Use Narcotic Analgesics (Short and Long Acting Schedule II, 90 day supply or more) | 200 | 2,248,798 | 17.61 |
| Non-Intensive Use Narcotic Analgesics (Short and Long Acting Schedule II, < 90 day supply Non-Schedule II) Narcotic Analgesic Combinations (Schedule II and Non-Schedule II) | 1,079 | 10,518,032 | 82.39 |
| Total (Sustained Use) | 1,279 | 12,766,830 | 100.00 |
| <i>Any Use Opioid Population</i> | | | |
| Infrequent Use (30 day supply or less or 1 total prescription) | 2,209 | 21,599,539 | 62.85 |
| Sustained Use | 1,079 | 10,518,032 | 30.61 |

^d Our estimates of opioid exposure are lower than other reports that are derived from other methods.

| | | | |
|--|-------|------------|--------|
| Narcotic Analgesics (Short and Long Acting Schedule II, 30-89 day Non-Schedule II, >30 day) Narcotic Analgesic Combinations (Schedule II and Non-Schedule II, >30 day) | | | |
| Intensive Use Narcotic Analgesics (Short and Long Acting Schedule II, 90 day supply or more) | 200 | 2,248,798 | 6.54 |
| Total (Any Use) | 3,488 | 34,366,368 | 100.00 |

Table 3. Total Day Supply among Opioid Population

| Total Day Supply | Weighted Mean (SE) | Weighted Median (IQR) |
|--|--------------------|-----------------------|
| <i>Any Use Opioid Population</i> | | |
| Sustained Use | 205.25 (8.95) | 142.70 (270.0-66.1) |
| Infrequent Use | 8.88 (0.23) | 5.10 (10.6-2.7) |
| <i>Sustained Use Opioid Population</i> | | |
| Intensive Use | 353.84 (13.38) | 299.76 (441.4-175.6) |
| Non-Intensive Use | 176.35 (9.25) | 118.65 (235.1-59.9) |
| <i>Any Use Opioid Population</i> | | |
| Infrequent Use | 8.88 (0.23) | 5.10 (10.6-2.7) |
| Sustained Use | 176.35 (9.25) | 118.65 (235.1-59.9) |
| Intensive Use | 353.84 (13.38) | 299.76 (441.4-175.6) |
| Prescription – Day Supply | 19.28 (0.54) | 19.35 (29.4-4.9) |
| Person - Total Prescriptions | 4.04 (0.14) | 1.20 (4.4-1.0) |
| Person - Total Day Supply | 75.85 (4.17) | 11.21 (71.4-4.0) |

**Table 4. Population Characteristics:
Opioid Users and Non-Opioid Users in Adult Population With Any Prescribed Medication (Adults 18+)**

| | Opioid Population N = 3,488 Weighted N / % | | Non-Opioid Population N = 12,499 Weighted N / % | | p-value ⁺ | OR ^{**} | 95% CI of OR | p-value ⁺⁺ |
|---|--|-------|---|-------|----------------------|------------------|--------------|-----------------------|
| Sex | | | | | 0.1078 | | | |
| Male | 14,076,155 | 40.96 | 53,427,854 | 42.77 | | Ref | | |
| Female | 20,290,213 | 59.04 | 71,487,798 | 57.23 | | 1.035 | 0.942, 1.138 | 0.4730 |
| Age | | | | | 0.0004 | | | |
| 18 – 24 | 2,607,054 | 7.59 | 11,087,319 | 8.87 | | Ref | | |
| 25 – 44 | 9,934,334 | 28.91 | 34,436,650 | 27.57 | | 1.342* | 1.060, 1.698 | 0.0143 |
| 45 – 64 | 14,243,097 | 41.44 | 46,806,457 | 37.47 | | 1.459* | 1.157, 1.840 | 0.0014 |
| 65 – 85 | 7,581,882 | 22.06 | 32,585,226 | 26.09 | | 0.948 | 0.749, 1.200 | 0.6579 |
| Race | | | | | <.0001 | | | |
| White | 28,128,374 | 81.85 | 103,362,513 | 82.75 | | Ref | | |
| Black | 4,456,567 | 12.97 | 13,007,390 | 10.41 | | 1.077 | 0.949, 1.223 | 0.2514 |
| Asian | 601,250 | 1.75 | 5,624,657 | 4.50 | | 0.381* | 0.294, 0.493 | <.0001 |
| Native Hawaiian Pacific Islander American Indian Alaska Native | 501,191 | 1.45 | 1,149,444 | 0.92 | | 1.450 | 0.994, 2.116 | 0.0540 |
| Other (includes multiple races) | 678,987 | 1.98 | 1,771,648 | 1.42 | | 1.309 | 0.941, 1.819 | 0.1095 |
| Census Region | | | | | 0.0043 | | | |
| Northeast | 5,342,526 | 15.55 | 23,939,337 | 19.16 | | Ref | | |
| Midwest | 8,054,150 | 23.44 | 28,413,571 | 22.75 | | 1.296* | 1.096, 1.534 | 0.0025 |
| South | 13,500,452 | 39.28 | 45,993,548 | 36.82 | | 1.297* | 1.106, 1.522 | 0.0014 |
| West | 7,469,240 | 21.73 | 26,569,195 | 21.27 | | 1.304* | 1.107, 1.536 | 0.0015 |
| Family Income | | | | | <.0001 | | | |
| Poor/Negative | 5,776,949 | 16.81 | 13,328,309 | 10.67 | | 1.652* | 1.388, 1.966 | <.0001 |

| | | | | | | | | |
|------------------------------------|------------|-------|------------|-------|--------|--------|--------------|--------|
| (< 100% FPL) | | | | | | | | |
| Near Poor (100% - 125% FPL) | 1,977,711 | 5.75 | 5,686,100 | 4.55 | | 1.387* | 1.091, 1.765 | 0.0077 |
| Low Income (125% - 200% FPL) | 5,075,733 | 14.77 | 15,834,718 | 12.68 | | 1.376* | 1.178, 1.606 | <.0001 |
| Middle Income (200% - 400% FPL) | 9,976,406 | 29.03 | 37,183,408 | 29.77 | | 1.188* | 1.035, 1.363 | 0.0140 |
| High Income (> 400% FPL) | 11,559,570 | 33.64 | 52,883,117 | 42.33 | | Ref | | |
| | | | | | | | | |
| Insurance Coverage | | | | | <.0001 | | | |
| Any Private | 21,533,609 | 62.66 | 88,845,022 | 71.12 | | Ref | | |
| Public Only | 9,579,944 | 27.87 | 25,234,499 | 20.20 | | 1.489* | 1.300, 1.705 | <.0001 |
| Uninsured | 3,252,815 | 9.47 | 10,836,130 | 8.68 | | 0.977 | 0.825, 1.158 | 0.7884 |

+ p-value from Chi-square test

**p-value from multiple logistic regression

* p < 0.05

** From multiple logistic regression

Table 4a. Other Associated Variables

| | Opioid Population N = 3,488 Weighted N / % | | Non-Opioid Population N = 12,499 Weighted N / % | | p-value ⁺ |
|-----------------------------------|--|-------|---|-------|----------------------|
| Education* | | | | | <.0001 |
| < High School Diploma | 3,533,612 | 20.27 | 10,145,898 | 15.96 | |
| GED or High School Diploma | 4,594,809 | 26.36 | 14,446,464 | 22.72 | |
| Some College - No Degree | 3,401,298 | 19.51 | 11,136,697 | 17.52 | |
| Associate Degree | 2,304,176 | 13.22 | 8,025,067 | 12.62 | |
| Bachelor's Degree | 2,255,276 | 12.94 | 11,703,903 | 18.41 | |
| Master's Degree | 912,986 | 5.24 | 6,022,658 | 9.47 | |
| Professional School | 199,348 | 1.14 | 739,966 | 1.16 | |
| Doctorate | 229,875 | 1.32 | 1,356,346 | 2.13 | |
| | | | | | |
| BMI* | | | | | <.0001 |
| Underweight (Less than 18.5) | 581,792 | 1.73 | 1,863,783 | 1.53 | |
| Normal/healthy weight (18.5 – 24) | 9,048,187 | 26.89 | 40,517,941 | 33.12 | |
| Overweight (25 – 29) | 10,509,721 | 31.24 | 41,268,592 | 33.73 | |
| Obese (30-40) | 13,503,210 | 40.14 | 38,684,935 | 31.62 | |

+ p-value from Chi-square test

*Percentages do not include missing values.

Table 5. Use Groups Comparison (Adults 18+)

| | Intensive User N = 200 Weighted N / % | | Sustained User N = 1,079 Weighted N / % | | Infrequent User N = 2,209 Weighted N / % | | p-value ⁺ | OR** | 95% CI of OR | p-value** |
|--|---|-------|---|-------|--|-------|----------------------|--------|---------------|-----------|
| Sex | | | | | | | 0.9257 | | | |
| Male | 933,658 | 41.52 | 4,239,042 | 40.30 | 8,903,455 | 41.22 | | Ref | | |
| Female | 1,315,140 | 58.48 | 6,278,989 | 59.70 | 12,696,083 | 58.78 | | 0.969 | 0.811, 1.157 | 0.7265 |
| | | | | | | | | | | |
| Age | | | | | | | <.0001 | | | |
| 18 - 24 | 48,556 | 2.15 | 287,911 | 2.74 | 2,270,587 | 10.51 | | Ref | | |
| 25 - 44 | 615,406 | 27.37 | 2,015,075 | 19.15 | 7,303,853 | 33.82 | | 2.812* | 1.556, 5.083 | 0.0006 |
| 45 - 64 | 1,090,374 | 48.49 | 4,955,760 | 47.12 | 8,196,963 | 37.95 | | 5.892* | 3.256, 10.664 | <.0001 |
| 65 - 85 | 494,462 | 21.99 | 3,259,286 | 30.99 | 3,828,135 | 17.72 | | 6.746* | 3.775, 12.054 | <.0001 |
| | | | | | | | | | | |
| Race | | | | | | | 0.0266 | | | |
| White | 1,932,415 | 85.93 | 8,552,591 | 81.31 | 17,643,368 | 81.68 | | Ref | | |
| Black | 183,634 | 8.16 | 1,433,347 | 13.63 | 2,839,586 | 13.15 | | 0.791* | 0.652, 0.960 | 0.0174 |
| Asian | 13,240 | 0.59 | 110,653 | 1.05 | 477,357 | 2.21 | | 0.498* | 0.271, 0.915 | 0.0248 |
| American Indian/Alaska Native/Native Hawaiian/Pacific Islander | 39,743 | 1.77 | 181,029 | 1.72 | 280,419 | 1.30 | | 0.955 | 0.516, 1.768 | 0.8832 |

| | | | | | | | | | | |
|---------------------------------|-----------|-------|-----------|-------|------------|-------|--------|--------|--------------|--------|
| Other (includes multiple races) | 79,767 | 3.55 | 240,412 | 2.29 | 358,808 | 1.66 | | 1.610 | 0.952, 2.723 | 0.0755 |
| Census Region | | | | | | | 0.3098 | | | |
| Northeast | 323,298 | 14.38 | 1,501,336 | 14.27 | 3,517,892 | 16.29 | | | | |
| Midwest | 377,873 | 16.80 | 2,428,876 | 23.10 | 5,247,401 | 24.29 | | | | |
| South | 1,001,188 | 44.52 | 4,439,614 | 42.21 | 8,059,650 | 37.31 | | | | |
| West | 546,440 | 24.30 | 2,148,205 | 20.42 | 4,774,595 | 22.11 | | | | |
| Family Income | | | | | | | <.0001 | | | |
| Poor/Negative (< 100% FPL) | 713,321 | 31.72 | 2,052,734 | 19.52 | 3,010,893 | 13.94 | | 2.630* | 1.867, 3.705 | <.0001 |
| Near Poor (100% - 125% FPL) | 128,657 | 5.72 | 832,590 | 7.91 | 1,016,463 | 4.71 | | 1.883* | 1.284, 2.760 | 0.0012 |
| Low Income (125% - 200% FPL) | 257,397 | 11.45 | 1,610,522 | 15.31 | 3,207,813 | 14.85 | | 1.439* | 1.007, 2.055 | 0.0457 |
| Middle Income (200% - 400% FPL) | 589,932 | 26.23 | 3,152,196 | 29.97 | 6,234,279 | 28.86 | | 1.471* | 1.102, 1.964 | 0.0087 |
| High Income (> 400% FPL) | 559,491 | 24.88 | 2,869,989 | 27.29 | 8,130,090 | 37.64 | | Ref | | |
| Insurance Coverage | | | | | | | <.0001 | | | |
| Any Private | 1,293,244 | 57.51 | 5,633,560 | 53.56 | 14,606,805 | 67.63 | | Ref | | |
| Public Only | 773,703 | 34.40 | 4,236,971 | 40.28 | 4,569,271 | 21.15 | | 1.488* | 1.167, 1.896 | 0.0013 |
| Uninsured | 181,851 | 8.09 | 647,501 | 6.16 | 2,423,463 | 11.22 | | 0.648* | 0.444, 0.946 | 0.0247 |

* p-value from Chi-square test

**p-value from ordinal logistic regression

* p < 0.05

** From ordinal logistic regression

Table 5a. Other Associated Variables

| | Intensive User N = 200 Weighted N / % | | Sustained User N = 1,079 Weighted N / % | | Infrequent User N = 2,209 Weighted N / % | | p-value* |
|-----------------------------------|---|-------|---|-------|--|-------|----------|
| | Weighted Frequency | % | Weighted Frequency | % | Weighted Frequency | % | |
| Education* | | | | | | | 0.0166 |
| < High School Diploma | 250,261 | 22.98 | 1,454,186 | 27.07 | 1,829,165 | 16.67 | |
| GED or High School Diploma | 358,923 | 32.95 | 1,396,530 | 26.00 | 2,839,356 | 25.88 | |
| Some College - No Degree | 241,673 | 22.19 | 1,022,909 | 19.04 | 2,136,715 | 19.48 | |
| Associate Degree | 101,770 | 9.34 | 563,657 | 10.49 | 1,638,750 | 14.94 | |
| Bachelor's Degree | 73,169 | 6.72 | 629,780 | 11.72 | 1,552,327 | 14.15 | |
| Master's Degree | 24,931 | 2.29 | 170,526 | 3.17 | 717,529 | 6.54 | |
| Professional School | 23,374 | 2.15 | 73,848 | 1.37 | 102,126 | 0.93 | |
| Doctorate | 15,067 | 1.38 | 61,157 | 1.14 | 153,651 | 1.41 | |
| BMI* | | | | | | | 0.0007 |
| Underweight (Less than 18.5) | 38,363 | 1.78 | 163,496 | 1.59 | 379,933 | 1.79 | |
| Normal/healthy weight (18.5 – 24) | 545,732 | 25.38 | 2,193,523 | 21.34 | 6,308,932 | 29.74 | |
| Overweight (25 – 29) | 789,548 | 36.71 | 3,104,074 | 30.19 | 6,616,099 | 31.19 | |
| Obese (30-40) | 776,880 | 36.13 | 4,819,368 | 46.88 | 7,906,963 | 37.28 | |

* p-value from Chi-square test

*Percentages do not include missing values.

Table 6. Opioid Prescription Summary (Adults 18+)

| | N | Weighted N | % |
|---|--------|-------------|---|
| Total Self-Reported Opioid Prescriptions in 2012 | 14,076 | 138,923,145 | |
| Multum Catagories | | | |

| | | | |
|---|-------|------------|-------|
| Narcotic Analgesics | 5,535 | 56,048,210 | 40.34 |
| Narcotic Analgesic Combinations | 8,541 | 82,874,935 | 59.66 |
| | | | |
| DEA Schedule | | | |
| Short acting, Schedule II | 8,758 | 87,410,039 | 62.92 |
| Long acting, Schedule II | 1,943 | 20,058,625 | 14.44 |
| Long and short acting, Non-Schedule II | 3,375 | 31,454,482 | 22.64 |
| | | | |
| Multum Catagories - DEA Schedule | | | |
| Narcotic Analgesics* | | | |
| Short acting, Schedule II | 1,213 | 12,794,867 | 22.83 |
| Long acting, Schedule II | 1,943 | 20,058,625 | 35.79 |
| Long and short acting, Non-Schedule II | 2,379 | 23,194,718 | 41.38 |
| Narcotic Analgesic Combinations* | | | |
| Short acting, Schedule II | 7,545 | 74,615,172 | 90.03 |
| Long and short acting, Non-Schedule II | 996 | 8,259,763 | 9.97 |
| | | | |
| Year* | | | |
| 1971 - 1999 | 599 | 6,320,385 | 5.21 |
| 2000 - 2011 | 6,799 | 65,334,549 | 53.90 |
| 2012 | 4,790 | 49,573,422 | 40.89 |
| | | | |
| Day Supply* | | | |
| 1-10 days | 3,928 | 37,573,692 | 39.73 |
| 11 – 20 days | 1,225 | 11,461,206 | 12.12 |
| 21 – 29 days | 476 | 4,558,353 | 4.82 |
| 30 days | 3,990 | 38,167,989 | 40.35 |
| More than 30 days | 230 | 2,821,438 | 2.98 |

*Percentages do not include missing values.

Table 7. Opioid Population Summary (Adults 18+)

| | N | Weighted N | % |
|---|-------|------------|-------|
| People With At Least One Opioid Prescription in 2012 | 3,488 | 34,366,368 | |
| | | | |
| Total Prescriptions | | | |
| 1 prescription | 1,667 | 16,170,144 | 47.05 |
| 2 – 4 prescriptions | 903 | 9,004,120 | 26.20 |
| 5 – 7 prescriptions | 339 | 3,380,337 | 9.84 |
| 8 – 10 prescriptions | 206 | 2,199,629 | 6.40 |
| 11 – 13 prescriptions | 219 | 1,997,760 | 5.81 |
| More than 13 prescriptions | 154 | 1,614,378 | 4.70 |
| | | | |
| DEA Schedule – Total prescriptions* | | | |
| Short acting, Schedule II | | | |
| 1 prescription | 1,298 | 12,998,787 | 50.00 |
| 2 prescriptions | 355 | 4,025,751 | 15.48 |
| 3 or more prescriptions | 887 | 8,974,738 | 34.52 |
| | | | |
| Long acting, Schedule II | | | |
| 1 prescription | 70 | 764,777 | 28.04 |
| 2 prescriptions | 16 | 143,415 | 5.26 |
| 3 or more prescriptions | 154 | 1,818,771 | 66.70 |
| | | | |
| Long and short acting, Non-Schedule II | | | |
| 1 prescription | 598 | 5,515,048 | 53.31 |
| 2 prescriptions | 134 | 1,166,090 | 11.27 |
| 3 or more prescriptions | 405 | 3,664,471 | 35.42 |
| | | | |
| Total Day Supply* | | | |
| 30 days or less | 1,642 | 15,841,944 | 65.90 |
| 31 – 180 days | 527 | 5,047,559 | 21.00 |
| 181 – 360 days | 219 | 2,016,078 | 8.38 |

| | | | |
|---|-------|------------|-------|
| More than 360 days | 101 | 1,133,764 | 4.72 |
| DEA Schedule – Total Day Supply* | | | |
| Short acting, Schedule II | | | |
| 30 days or less | 1,213 | 12,107,186 | 69.83 |
| More than 30 days | 527 | 5,229,909 | 30.17 |
| Long acting, Schedule II | | | |
| 30 days or less | 40 | 450,979 | 25.07 |
| More than 30 days | 117 | 1,348,002 | 74.93 |
| Long and short acting, Non-Schedule II | | | |
| 30 days or less | 567 | 5,127,126 | 66.98 |
| More than 30 days | 280 | 2,527,315 | 33.02 |
| Earliest Year* | | | |
| 1971 - 1999 | 106 | 1,073,269 | 3.42 |
| 2000 - 2011 | 1,086 | 10,523,211 | 33.45 |
| 2012 | 1,995 | 19,860,063 | 63.13 |

*Percentages do not include missing values.

Table 8. Common Diagnoses Among Intensive Use Opioid Population (Adults 18+)

| | N | Weighted N | % |
|---|-----|------------|-------|
| Most Common Diagnoses among Intensive Opioid Population* | 200 | 2,248,798 | |
| Spondylosis; intervertebral disc disorders; other back problems | 78 | 914,345 | 40.66 |
| Other non-traumatic joint disorders | 56 | 570,798 | 25.38 |
| Residual codes; unclassified | 37 | 453,687 | 20.17 |
| Other connective tissue disease | 33 | 395,380 | 17.58 |
| Osteoarthritis | 28 | 252,328 | 11.22 |
| Other nervous system disorders | 18 | 246,971 | 10.98 |
| Rheumatoid arthritis and related disease | 19 | 204,938 | 9.11 |
| Other injuries and conditions due to external causes | 15 | 154,481 | 6.87 |
| Administrative/social admission | 10 | 147,923 | 6.58 |

*Using Agency for Healthcare Research & Quality Clinical Classification Codes (AHRQ – CCC)

REFERENCES

- Centers for Disease Control and Prevention. CDC grand rounds: prescription drug overdoses – a U.S. epidemic. MMWR Morb Mortal Wkly Rep. 2012;61:10-13.
- Office of National Drug Control Policy, Executive Office of the President of the United States. Washington, DC, 2011. Epidemic: Responding to America's Prescription Drug Abuse Crisis. 2011. http://www.whitehouse.gov/sites/default/files/ondcp/policy-and-research/rx_abuse_plan.pdf
- Fact Sheet: Administration Proposes Critical Investments to Tackle Prescription Drug Abuse, Heroin Use, and Overdose Deaths. Office of the National Drug Control Policy, The White House. February 5, 2015. <http://www.whitehouse.gov/ondcp/news-releases/2016-budget-opioid-resources>
- 2013 Drug Overdose Mortality Data Announced. Centers for Disease Control and Prevention. January 12, 2015. <http://www.cdc.gov/media/releases/2015/p0114-drug-overdose.html>
- Sites BD, Beach ML, David MA. Increases in the Use of Prescription Opioid Analgesics and the Lack of Improvement in Disability Metrics Among Users. Reg Anesth Pain Med. 2014;39:6-12.
- Centers for Disease Control and Prevention. Prescription Drug Overdose in the United States: Fact Sheet. 2014. <http://www.cdc.gov/homeandrecreationalsafety/overdose/facts.html>
- Cortazzo MH, Copenhaver D, Fishman SM. Major Opioids and Chronic Opioid Therapy. Practical Management of Pain. 5th Edition. 2014.
- IMS Institute for Healthcare Informatics. Top Therapeutic Classes by Dispensed Prescriptions (U.S.) http://www.imshealth.com/deployedfiles/imshealth/Global/Content/Corporate/Press%20Room/2012_U.S/Top_Therapeutic_Classes_Dispensed_Prescriptions_2012.pdf
- IMS Institute for Healthcare Informatics. Top 25 Medicines by Dispensed Prescriptions (U.S.). http://www.imshealth.com/deployedfiles/imshealth/Global/Content/Corporate/Press%20Room/2012_U.S/Top_25_Medicines_Dispensed_Prescriptions_U.S..pdf
- Fukuda K. Opioid Analgesics. Miller's Anesthesia. Chapter 31, 864-914.e12. 2015.
- Brenner GM. Opioid Analgesics and antagonists. Pharmacology. Fourth Edition. 2013. 238-248.
- Bartleson JD. Evidence For and Against the Use of Opioid Analgesics for Chronic Nonmalignant Low Back Pain: A Review. Pain Medicine. 2002;3(3).

13. Luo X, Pietrobon R, Hey L. Patterns and Trends in Opioid Use among Individuals with Back Pain in the United States. *SPINE*. 2004;29(8):884-891.
14. Calculating Daily Morphine Milligram Equivalents. Technical Assistance Guide No. 01-13. Prescription Drug Monitoring Program Training and Technical Assistance Center. [BJA_performance_measure_aid_MME_conversion.pdf](#)
15. Edlund MJ, Martin BC, Russo JE, DeVries A, Braden JB, Sullivan MD. The Role of Opioid Prescription in Incident Opioid Abuse and Dependence Among Individuals With Chronic Noncancer Pain. *Clin J Pain*. 2014;30:557-564.
16. Sullivan MD, Edlund MJ, Fan MY, DeVries A, Braden JB, Martin BC. Trends in use of opioids for non-cancer pain conditions: 2000-2005 in Commercial and Medicaid insurance plans: The TROUP study. *Pain*. 2008;138:440-449.
17. Kolodny et al. The Prescription Opioid and Heroin Crisis: A Public Health Approach to an Epidemic of Addiction. *Annu. Rev. Public Health*. 2015; 36:559-74.
18. MEPS Survey documentation. Accessed at <http://meps.ahrq.gov/mepsweb/>.
19. Drug Scheduling. United States Drug Enforcement Administration. Accessed on March 16, 2015. <http://www.dea.gov/druginfo/ds.shtml>
20. DEA to Publish Final Rule Rescheduling Hydrocodone Combination Products. United States Drug Enforcement Administration. Accessed on May 4, 2015. <http://www.dea.gov/divisions/hq/2014/hq082114.shtml>
21. Clinical Classifications Software (CCS) for ICD-9-CM. <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>
22. Nelson LS, Perrone J. Curbing the Opioid Epidemic in the United States. *JAMA*. 2012; 308:5.
23. Franklin et al. A Comprehensive Approach to Address the Prescription Opioid Epidemic in Washington State: Milestones and Lessons Learned. *American Journal of Public Health*. 2015; 105(3).

8. Supplemental Tables

Table 9. Comparing Sustained Users to Infrequent Users (Adults 18+)

| | Sustained User N = 1,279 Weighted N / % | | Infrequent User N = 2,209 Weighted N / % | | p-value ⁺ | OR ^{**} | 95% CI of OR |
|---|---|-------|--|-------|----------------------|------------------|---------------|
| Sex | | | | | 0.7481 | | |
| Male | 5,172,700 | 40.52 | 8,903,455 | 41.22 | | Ref | |
| Female | 7,594,130 | 59.48 | 12,696,083 | 58.78 | | 0.975 | 0.808, 1.177 |
| Age | | | | | <.0001 | | |
| 18 - 24 | 336,467 | 2.64 | 2,270,587 | 10.51 | | Ref | |
| 25 - 44 | 2,630,481 | 20.60 | 7,303,853 | 33.82 | | 2.726* | 1.496, 4.965 |
| 45 - 64 | 6,046,134 | 47.36 | 8,196,963 | 37.95 | | 5.929* | 3.239, 10.853 |
| 65 - 85 | 3,753,748 | 29.40 | 3,828,135 | 17.72 | | 7.069* | 3.913, 12.770 |
| Race | | | | | 0.0308 | | |
| White | 10,485,006 | 82.13 | 17,643,368 | 81.68 | | Ref | |
| Black | 1,616,980 | 12.66 | 2,839,586 | 13.15 | | 0.827 | 0.673, 1.016 |
| Asian | 123,893 | 0.97 | 477,357 | 2.21 | | 0.501* | 0.269, 0.936 |
| American Indian Alaska Native Native Hawaiian Pacific Islander | 220,772 | 1.73 | 280,419 | 1.30 | | 0.990 | 0.523, 1.873 |
| Other (includes multiple races) | 320,179 | 2.51 | 358,808 | 1.66 | | 1.579 | 0.906, 2.750 |
| Census Region | | | | | 0.2093 | | |
| Northeast | 1,824,634 | 14.29 | 3,517,892 | 16.29 | | | |
| Midwest | 2,806,749 | 21.98 | 5,247,401 | 24.29 | | | |
| South | 5,440,802 | 42.62 | 8,059,650 | 37.31 | | | |
| West | 2,694,645 | 21.11 | 4,774,595 | 22.11 | | | |
| Family Income | | | | | <.0001 | | |
| Poor/Negative ($< 100\%$ FPL) | 2,766,055 | 21.67 | 3,010,893 | 13.94 | | 2.456* | 1.741, 3.463* |
| Near Poor ($100\% - 125\%$ FPL) | 961,247 | 7.53 | 1,016,463 | 4.71 | | 1.927* | 1.294, 2.871 |
| Low Income ($125\% - 200\%$ FPL) | 1,867,920 | 14.63 | 3,207,813 | 14.85 | | 1.441 | 0.996, 2.084 |

| | | | | | | | |
|------------------------------------|-----------|-------|------------|-------|--------|--------|--------------|
| Middle Income (200% - 400% FPL) | 3,742,127 | 29.31 | 6,234,279 | 28.86 | | 1.497* | 1.123, 1.994 |
| High Income (> 400% FPL) | 3,429,480 | 26.86 | 8,130,090 | 37.64 | | Ref | |
| | | | | | | | |
| Insurance Coverage | | | | | <.0001 | | |
| Any Private | 6,926,804 | 54.25 | 14,606,805 | 67.63 | | Ref | |
| Public Only | 5,010,674 | 39.25 | 4,569,271 | 21.15 | | 1.627* | 1.276, 2.073 |
| Uninsured | 829,352 | 6.50 | 2,423,463 | 11.22 | | 0.664* | 0.460, 0.956 |

+ p-value from Chi-square test

* p < 0.05

** From multiple logistic regression

Table 9a. Other Associated Variables

| | Sustained Use N = 1,279 Weighted N / % | | Infrequent Use N = 2,209 Weighted N / % | | p-value ⁺ |
|-----------------------------------|--|-------|---|-------|----------------------|
| Education* | | | | | 0.0022 |
| < High School Diploma | 1,704,447 | 26.38 | 1,829,165 | 16.67 | |
| GED or High School Diploma | 1,755,453 | 27.17 | 2,839,356 | 25.88 | |
| Some College - No Degree | 1,264,582 | 19.57 | 2,136,715 | 19.48 | |
| Associate Degree | 665,427 | 10.30 | 1,638,750 | 14.94 | |
| Bachelor's Degree | 702,949 | 10.88 | 1,552,327 | 14.15 | |
| Master's Degree | 195,457 | 3.02 | 717,529 | 6.54 | |
| Professional School | 97,222 | 1.50 | 102,126 | 0.93 | |
| Doctorate | 76,224 | 1.18 | 153,651 | 1.41 | |
| BMI* | | | | | 0.0004 |
| Underweight (Less than 18.5) | 201,859 | 1.62 | 379,933 | 1.79 | |
| Normal/healthy weight (18.5 – 24) | 2,739,255 | 22.04 | 6,308,932 | 29.74 | |
| Overweight (25 – 29) | 3,893,622 | 31.32 | 6,616,099 | 31.19 | |
| Obese (30-40) | 5,596,248 | 45.02 | 7,906,963 | 37.28 | |

+ p-value from Chi-square test

*Percentages do not include missing values.

Table 10. Comparing Intensive Users to Non-Intensive Users (Adults 18+)

| | Intensive User N = 200 Weighted N / % | | Non-Intensive User N = 1,079 Weighted N / % | | p-value ⁺ |
|---|---|-------|---|-------|----------------------|
| Sex | | | | | 0.8084 |
| Male | 933,658 | 41.52 | 4,239,042 | 40.30 | |
| Female | 1,315,140 | 58.48 | 6,278,989 | 59.70 | |
| Age | | | | | 0.0903 |
| 18 - 24 | 48,556 | 2.15 | 287,911 | 2.74 | |
| 25 - 44 | 615,406 | 27.37 | 2,015,075 | 19.15 | |
| 45 - 64 | 1,090,374 | 48.49 | 4,955,760 | 47.12 | |
| 65 - 85 | 494,462 | 21.99 | 3,259,286 | 30.99 | |
| Race | | | | | 0.1463 |
| White | 1,932,415 | 85.93 | 8,552,591 | 81.31 | |
| Black | 183,634 | 8.16 | 1,433,347 | 13.63 | |
| Asian | 13,240 | 0.59 | 110,653 | 1.05 | |
| American Indian Alaska Native Native Hawaiian Pacific Islander | 39,743 | 1.77 | 181,029 | 1.72 | |
| Other (includes multiple races) | 79,767 | 3.55 | 240,412 | 2.29 | |
| Census Region | | | | | 0.4538 |
| Northeast | 323,298 | 14.38 | 1,501,336 | 14.27 | |
| Midwest | 377,873 | 16.80 | 2,428,876 | 23.10 | |
| South | 1,001,188 | 44.52 | 4,439,614 | 42.21 | |

| | | | | | |
|---|-----------|-------|-----------|-------|--------|
| West | 546,440 | 24.30 | 2,148,205 | 20.42 | |
| | | | | | |
| Family Income | | | | | 0.0242 |
| Poor/Negative ($< 100\%$ FPL) | 713,321 | 31.72 | 2,052,734 | 19.52 | |
| Near Poor ($100\% - 125\%$ FPL) | 128,657 | 5.72 | 832,590 | 7.91 | |
| Low Income ($125\% - 200\%$ FPL) | 257,397 | 11.45 | 1,610,522 | 15.31 | |
| Middle Income ($200\% - 400\%$ FPL) | 589,932 | 26.23 | 3,152,196 | 29.97 | |
| High Income ($> 400\%$ FPL) | 559,491 | 24.88 | 2,869,989 | 27.29 | |
| | | | | | |
| Insurance Coverage | | | | | 0.4527 |
| Any Private | 1,293,244 | 57.51 | 5,633,560 | 53.56 | |
| Public Only | 773,703 | 34.40 | 4,236,971 | 40.28 | |
| Uninsured | 181,851 | 8.09 | 647,501 | 6.16 | |

+ p-value from Chi-square test

Table 10a. Other Associated Variables

| | Intensive User N = 200 Weighted N / % | | Sustained User N = 1,079 Weighted N / % | | p-value ⁺ |
|-----------------------------------|---|-------|---|-------|----------------------|
| Education* | | | | | 0.7505 |
| < High School Diploma | 250,261 | 22.98 | 1,454,186 | 27.07 | |
| GED or High School Diploma | 358,923 | 32.95 | 1,396,530 | 26.00 | |
| Some College - No Degree | 241,673 | 22.19 | 1,022,909 | 19.04 | |
| Associate Degree | 101,770 | 9.34 | 563,657 | 10.49 | |
| Bachelor's Degree | 73,169 | 6.72 | 629,780 | 11.72 | |
| Master's Degree | 24,931 | 2.29 | 170,526 | 3.17 | |
| Professional School | 23,374 | 2.15 | 73,848 | 1.37 | |
| Doctorate | 15,067 | 1.38 | 61,157 | 1.14 | |
| | | | | | |
| BMI* | | | | | 0.1578 |
| Underweight (Less than 18.5) | 38,363 | 1.78 | 163,496 | 1.59 | |
| Normal/healthy weight (18.5 – 24) | 545,732 | 25.38 | 2,193,523 | 21.34 | |
| Overweight (25 – 29) | 789,548 | 36.71 | 3,104,074 | 30.19 | |
| Obese (30-40) | 776,880 | 36.13 | 4,819,368 | 46.88 | |

+ p-value from Chi-square test

*Percentages do not include missing values.

Table 11. Comparing Intensive Users to Infrequent Users (Adults 18+)

| | Intensive User N = 200 Weighted N / % | | Infrequent User N = 2,209 Weighted N / % | | p-value ⁺ | OR** | 95% CI of OR |
|---|---|-------|--|-------|----------------------|--------|---------------|
| Sex | | | | | 0.9465 | | |
| Male | 933,658 | 41.52 | 8,903,455 | 41.22 | | Ref | |
| Female | 1,315,140 | 58.48 | 12,696,083 | 58.78 | | 0.896 | 0.618, 1.299 |
| | | | | | | | |
| Age | | | | | 0.0016 | | |
| 18 - 24 | 48,556 | 2.15 | 2,270,587 | 10.51 | | Ref | |
| 25 - 44 | 615,406 | 27.37 | 7,303,853 | 33.82 | | 4.996* | 1.531, 16.307 |
| 45 - 64 | 1,090,374 | 48.49 | 8,196,963 | 37.95 | | 8.900* | 2.969, 26.683 |
| 65 - 85 | 494,462 | 21.99 | 3,828,135 | 17.72 | | 8.374* | 2.583, 27.145 |
| | | | | | | | |
| Race | | | | | 0.0215 | | |
| White | 1,932,415 | 85.93 | 17,643,368 | 81.68 | | Ref | |
| Black | 183,634 | 8.16 | 2,839,586 | 13.15 | | 0.461* | 0.302, 0.704 |
| Asian | 13,240 | 0.59 | 477,357 | 2.21 | | 0.254 | 0.058, 1.109 |
| American Indian/Alaska Native/Native | 39,743 | 1.77 | 280,419 | 1.30 | | 1.081 | 0.245, 4.773 |

| | | | | | | | |
|---------------------------------|-----------|-------|------------|-------|--------|--------|---------------|
| Hawaiian/Pacific Islander | | | | | | | |
| Other (includes multiple races) | 79,767 | 3.55 | 358,808 | 1.66 | | 2.115 | 0.868, 5.153 |
| | | | | | | | |
| Census Region | | | | | 0.2013 | | |
| Northeast | 323,298 | 14.38 | 3,517,892 | 16.29 | | | |
| Midwest | 377,873 | 16.80 | 5,247,401 | 24.29 | | | |
| South | 1,001,188 | 44.52 | 8,059,650 | 37.31 | | | |
| West | 546,440 | 24.30 | 4,774,595 | 22.11 | | | |
| | | | | | | | |
| Family Income | | | | | <.0001 | | |
| Poor/Negative (< 100% FPL) | 713,321 | 31.72 | 3,010,893 | 13.94 | | 5.132* | 2.575, 10.227 |
| Near Poor (100% - 125% FPL) | 128,657 | 5.72 | 1,016,463 | 4.71 | | 1.990 | 0.902, 4.395 |
| Low Income (125% - 200% FPL) | 257,397 | 11.45 | 3,207,813 | 14.85 | | 1.424 | 0.736, 2.755 |
| Middle Income (200% - 400% FPL) | 589,932 | 26.23 | 6,234,279 | 28.86 | | 1.586 | 0.858, 2.935 |
| High Income (> 400% FPL) | 559,491 | 24.88 | 8,130,090 | 37.64 | | Ref | |
| | | | | | | | |
| Insurance Coverage | | | | | 0.0056 | | |
| Any Private | 1,293,244 | 57.51 | 14,606,805 | 67.63 | | Ref | |
| Public Only | 773,703 | 34.40 | 4,569,271 | 21.15 | | 1.145 | 0.683, 1.921 |
| Uninsured | 181,851 | 8.09 | 2,423,463 | 11.22 | | 0.568 | 0.224, 1.438 |

+ p-value from Chi-square test

* p < 0.05

** From multiple logistic regression

Table 11a. Other Associated Variables

| | Intensive User N = 200 Weighted N / % | | Infrequent User N = 2,209 Weighted N / % | | p-value ⁺ |
|-----------------------------------|---|-------|--|-------|----------------------|
| Education* | | | | | 0.1477 |
| < High School Diploma | 250,261 | 22.98 | 1,829,165 | 16.67 | |
| GED or High School Diploma | 358,923 | 32.95 | 2,839,356 | 25.88 | |
| Some College - No Degree | 241,673 | 22.19 | 2,136,715 | 19.48 | |
| Associate Degree | 101,770 | 9.34 | 1,638,750 | 14.94 | |
| Bachelor's Degree | 73,169 | 6.72 | 1,552,327 | 14.15 | |
| Master's Degree | 24,931 | 2.29 | 717,529 | 6.54 | |
| Professional School | 23,374 | 2.15 | 102,126 | 0.93 | |
| Doctorate | 15,067 | 1.38 | 153,651 | 1.41 | |
| | | | | | |
| BMI* | | | | | 0.5081 |
| Underweight (Less than 18.5) | 38,363 | 1.78 | 379,933 | 1.79 | |
| Normal/healthy weight (18.5 – 24) | 545,732 | 25.38 | 6,308,932 | 29.74 | |
| Overweight (25 – 29) | 789,548 | 36.71 | 6,616,099 | 31.19 | |
| Obese (30-40) | 776,880 | 36.13 | 7,906,963 | 37.28 | |

+ p-value from Chi-square test

*Percentages do not include missing values.

Table 12. Common Diagnoses Among Any Use Opioid Population (Adults 18+)

| | N | Weighted N | % |
|---|-------|------------|--------|
| Most Common Diagnoses among Opioid Population* | 3,488 | 34,366,368 | 100.00 |
| Spondylosis; intervertebral disc disorders; other back problems | 607 | 5,942,649 | 17.29 |
| Other non-traumatic joint disorders | 626 | 5,718,490 | 16.64 |
| Residual codes; unclassified | 361 | 3,766,411 | 10.96 |
| Other connective tissue disease | 281 | 2,920,027 | 8.50 |
| Disorders of teeth and jaw | 219 | 2,060,001 | 6.00 |
| Osteoarthritis | 203 | 2,039,545 | 5.93 |
| Other nervous system disorders | 183 | 1,962,457 | 5.71 |

| | | | |
|--|-----|-----------|------|
| Sprains and strains | 157 | 1,718,240 | 5.00 |
| Rheumatoid arthritis and related disease | 155 | 1,460,734 | 4.25 |
| Other injuries and conditions due to external causes | 137 | 1,257,524 | 3.66 |
| Headache; including migraine | 89 | 924,431 | 2.69 |
| Calculus of urinary tract | 59 | 637,641 | 1.85 |
| Administrative/social admission | 61 | 614,810 | 1.79 |
| Joint disorders and dislocations; trauma-related | 50 | 597,455 | 1.74 |
| Biliary tract disease | 51 | 592,670 | 1.72 |
| Fracture of upper limb | 51 | 531,996 | 1.55 |
| Fracture of lower limb | 55 | 492,274 | 1.43 |
| Normal pregnancy and/or delivery | 53 | 482,625 | 1.40 |

*Using Agency for Healthcare Research & Quality Clinical Classification Codes (AHRQ – CCC)

Table 13. Common Diagnoses Among Sustained Use Opioid Population (Adults 18+)

| | N | Weighted N | % |
|---|-------|------------|-------|
| Most Common Diagnoses among Sustained Use Opioid Population* | 1,279 | 12,766,830 | |
| Spondylosis; intervertebral disc disorders; other back problems | 390 | 3,879,376 | 30.39 |
| Other non-traumatic joint disorders | 398 | 3,631,165 | 28.44 |
| Residual codes; unclassified | 207 | 2,267,042 | 17.76 |
| Other connective tissue disease | 165 | 1,838,925 | 14.40 |
| Osteoarthritis | 153 | 1,442,669 | 11.30 |
| Rheumatoid arthritis and related disease | 121 | 1,196,829 | 9.37 |
| Other nervous system disorders | 97 | 1,009,964 | 7.91 |
| Other injuries and conditions due to external causes | 56 | 561,228 | 4.40 |

*Using Agency for Healthcare Research & Quality Clinical Classification Codes (AHRQ – CCC)

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