

Opioid prescription drug patterns in diagnosed and non-diagnosed opioid use disorder populations

Exploring prescription patterns among commercially insured patients with diagnosed opioid use disorder and non-diagnosed “super-users”

Stoddard Davenport
Alexandra Weaver, ASA, MAAA
Matt Caverly



A study published in the *American Journal of Psychiatry* last year found that two-thirds of those who died from opioid overdoses were prescribed opioids to treat chronic pain in the year before their death.¹ While opioid prescriptions have decreased each year since 2012, the amount of opioids prescribed in 2015 remained approximately three times as high as in 1999.² This elevated level of opioid prescriptions remains a concerning issue in the United States, and prescribing practices are a major contributing factor to our country’s opioid epidemic.

In an earlier research paper, we explored the prevalence of diagnosed opioid use disorder in the United States.³ We found that over 1.5 million privately and publicly insured Americans were diagnosed with an opioid use disorder in 2015. This likely represents just a fraction of the population that struggles with opioids, as many individuals with problematic opioid use may not have had their disorder formally recognized by a medical professional.

This paper expands on the prevalence of problematic opioid use beyond those diagnosed with a use disorder. We explore opioid use patterns for both individuals with a diagnosed opioid use disorder (OUD)⁴ and those without a diagnosis who fill extraordinarily high volumes of opioid prescriptions in a year (coined “super-users”). With the majority of opioid-related deaths starting with a single prescription, prescribing practices of opioids in the United States are an important issue that many stakeholders are beginning to address.

While specific decisions regarding the levels and types of opioids prescribed to any given patient are the domain of clinicians, we hope this analysis will shed some light on opioid prescription patterns for the commercially insured population in the United States as of 2015.

Prescription patterns for OUD patients

We used the Truven MarketScan Commercial Claims and Encounters Database to analyze the opioid use patterns of commercially insured members in 2015. Our analysis in this section focuses on the 65,000-member cohort of individuals with a diagnosed OUD and at least one opioid prescription in the year.⁵ Figure 1 shows that about one-third of the diagnosed population did not have an opioid prescription in the year analyzed, which may be due to nonprescription drug use, non-opioid prescription drug use, or individuals successfully abstaining from opioids.

¹ Rausch, Natasha (November 28, 2017). How opioids started killing Americans. Bloomberg. Retrieved August 9, 2018, from <https://www.bloomberg.com/news/articles/2017-11-28/how-opioids-started-killing-americans>.

² Guy, G.P., Jr., Zhang, K., Bohm, M.K. et al. (July 7, 2017). Vital Signs: Changes in Opioid Prescribing in the United States, 2006-2015. CDC Morbidity and Mortality Weekly Report (MMWR);66:697–704. Retrieved August 9, 2018, from <http://dx.doi.org/10.15585/mmwr.mm6626a4>.

³ Davenport, Stoddard & Matthews, Katie (March 2018). Opioid Use Disorder in the United States: Diagnosed Prevalence by Payer, Age, Sex, and State. Milliman White Paper. Retrieved August 9, 2018, from http://us.milliman.com/uploadedFiles/insight/2018/Opioid_Use_Disorder_Prevalence.pdf.

⁴ Opioid use disorder was identified in the data using diagnosis codes for opioid abuse, dependence, or poisoning. This includes ICD-9-CM codes beginning with 304.0, 304.7, and 305.5, 965.0, and ICD-10-CM codes beginning with F11, T40.0, T40.1, T40.2, and T40.3.

⁵ Individuals with a diagnosed opioid use disorder but no associated opioid prescription drug claims were excluded from this analysis because their opioid use (possibly illicit) could not be analyzed using available administrative claims data.

FIGURE 1: MARKETSCAN SAMPLE SIZES, 2015

COHORT	MEMBERS	MEMBERS WITH AN OPIOID PRESCRIPTION	NUMBER OF OPIOID PRESCRIPTIONS
TOTAL POPULATION	29,207,000	3,994,000	12,063,000
MEMBERS DIAGNOSED WITH OUD	93,000	65,000	752,000
MEMBERS NOT DIAGNOSED WITH OUD	29,114,000	3,929,000	11,311,000

In this section, we explore the average days' supply, days per script, morphine milligram equivalents (MME), and proportion of days covered (PDC) by opioid prescriptions for members with a diagnosed OUD and at least one opioid prescription in 2015.

DAYS' SUPPLY

In order to understand the volume of opioids typically prescribed to patients with opioid use disorder, we looked at the distribution of total days' supply over the course of a year.

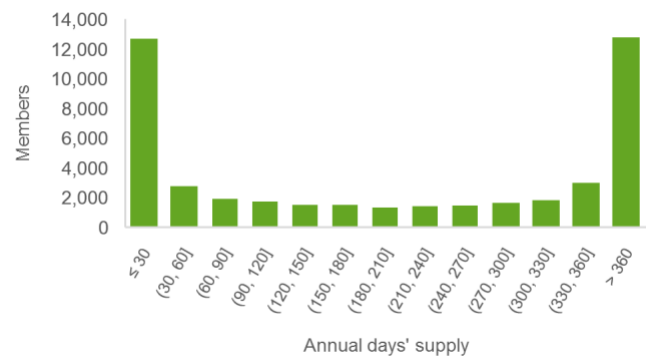
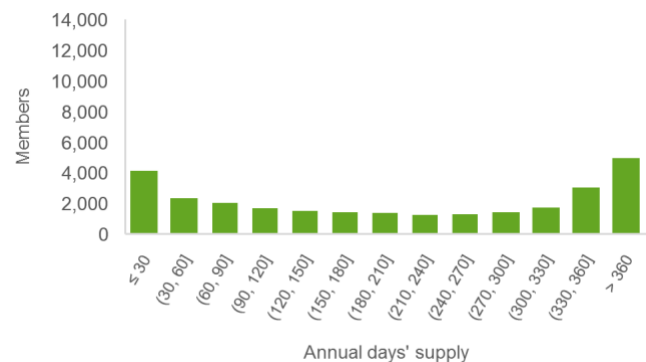
Approximately one-third of individuals with an OUD that were prescribed opioids filled scripts totaling at least 360 days' supply in 2015, equivalent to a 30-day supply for each month of the year. In order to distinguish between opioids prescribed for pain versus opioids that could potentially be prescribed to treat addiction, we further analyzed the distribution of days' supply by type of opioid (full agonist vs. partial agonist). Full agonists, such as hydrocodone, oxycodone, and fentanyl, are drugs that activate opioid receptors in the brain and elicit the full opioid effect. Some opioid partial agonists such as buprenorphine block other opioids while activating opioid receptors in the brain to a much lesser degree than full agonists.⁵ For this reason, some partial agonists are used as part of medication-assisted treatment (recovery) of opioid use disorder.⁶

Breaking out days' supply by type, a higher proportion of members had at least 360 days' supply of opioid agonists (31%) than partial agonists (22%). In other words, the large proportion of members with a 360 days' supply of opioids is not solely driven by opioid partial agonists that may have been prescribed to treat addiction.

⁵ National Alliance of Advocates for Buprenorphine Treatment. FAQ: "What's this agonist/antagonist stuff?" Retrieved August 9, 2018, from https://www.naabt.org/faq_answers.cfm?ID=5.

⁶ Opioid agonists and partial agonists were identified using therapeutic class, as described in the Methodology section of this report. Opioid antagonists, which cause no opioid effect, are excluded from this analysis. Antagonists such as naloxone block full agonist opioids and are often used to treat opioid overdose.

Figures 2 and 3 show the distributions of opioid full and partial agonist prescriptions for this population. Note that individuals without any opioid prescriptions in 2015 are excluded from these distributions.

FIGURE 2: DISTRIBUTION OF TOTAL ANNUAL DAYS' SUPPLY OF OPIOID AGONISTS FOR OUD POPULATION, 2015**FIGURE 3: DISTRIBUTION OF TOTAL ANNUAL DAYS' SUPPLY OF OPIOID PARTIAL AGONISTS FOR OUD POPULATION, 2015**

For both full and partial opioid agonists, the distribution is bimodal, with significant concentrations at both the low (30 days or fewer) and high (more than 360 days) ends of the distribution. Opioid agonists show a higher distribution at the tails of the graph, while partial agonists are more evenly distributed across different supply levels.

DAYS PER SCRIPT

In order to understand the typical days' supply ordered per script, we looked at the distribution of days' supply per script for patients with opioid use disorder.

For the diagnosed OUD population, the most common prescribing practice is at least 30 days per opioid script. For comparison, the Centers for Disease Control and Prevention

(CDC) recommends three days of opioids or fewer for the treatment of acute pain.⁷ Chronic (non-cancer) pain treatment is more complicated, as chronic opioid therapy has been proven effective but there is a high risk of potential abuse or addiction.⁸

As with total days' supply, we analyzed days per script for opioid agonists and partial agonists separately. Figures 4 and 5 show the distribution of days per script for opioid partial and full agonists for the diagnosed OUD population.

FIGURE 4: DAYS PER SCRIPT DISTRIBUTION OF OPIOID AGONISTS FOR OUD POPULATION, 2015

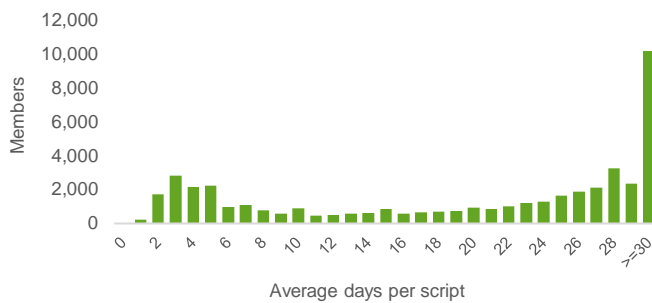
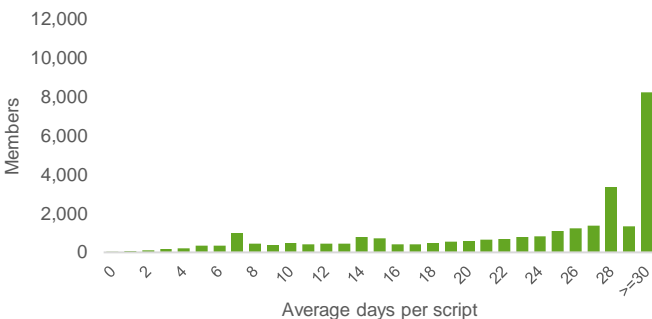


FIGURE 5: DAYS PER SCRIPT DISTRIBUTION OF OPIOID PARTIAL AGONISTS FOR OUD POPULATION, 2015



In both cases, the most common supply per script is 30 days or more. Opioid agonists, which may be prescribed for acute pain in accordance with the CDC's recommended dosage, show higher frequency of scripts for fewer than seven days' supply than partial agonists.

⁷ Dowell, D., Haegerich, T.M., & Chou, R. (March 18, 2016). CDC Guideline for Prescribing Opioids for Chronic Pain – United States, 2016. CDC MMWR;65(No. RR-1):1-49. Retrieved August 9, 2018, from <http://dx.doi.org/10.15585/mmwr.rr6501e1>.

⁸ Chou, Roger et al. (February 2009). Clinical Guidelines for the Use of Chronic Opioid Therapy in Chronic Noncancer Pain. The Journal of Pain 113–130. Retrieved August 9, 2018, from <http://doi.org/10.1016/j.jpain.2008.10.008>.

MORPHINE MILLIGRAM EQUIVALENTS

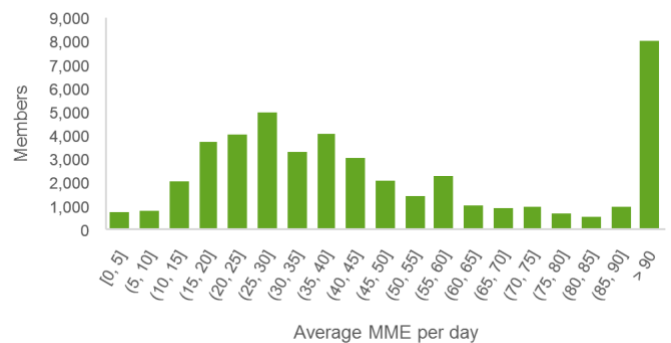
In order to understand the effective dose strength typically prescribed, we looked at the distribution of MMEs per day for opioids prescribed to patients with opioid use disorder. Morphine milligram equivalents represent the relative potency of various opioids, expressed in terms of their equivalencies to morphine.

We analyzed the MMEs for prescription opioid pain medications using the MME conversion factors published by the CDC.⁹ Per CDC guidance, the conversion factors for drugs prescribed as part of medication-assisted treatment for opioid use disorder should not be used to benchmark against dosage thresholds for pain treatment, and thus, the results in this section only include opioid agonist prescriptions.

The CDC recommends prescribing the lowest effective opioid dosage, which generally should not exceed 90 MME per day.¹⁰ Approximately 18% of individuals with an OUD and at least one opioid prescription were prescribed average dosages that exceeded this level in 2015. Further, 37% exceeded 50 MME per day, at which level the CDC cautions reassessing the benefits and risks of this high of a dosage.

Figure 6 shows the distribution of MME per day for this population.

FIGURE 6: MME PER DAY DISTRIBUTION OF OPIOID AGONISTS FOR OUD POPULATION, 2015



Notably, 8% of this population had over 75,000 MME in total for the year, which translates to an average of at least 200 MME per calendar day across the entire year.

⁹ CDC (September 29, 2017). Analyzing Prescription Data and Morphine Milligram Equivalents (MME). Opioid Overdose: Data Resources. Retrieved August 9, 2018, from <https://www.cdc.gov/drugoverdose/resources/data.html>.

¹⁰ Dowell, D. et al., *ibid.*

PROPORTION OF DAYS COVERED

In order to understand the proportion of time across a year that is typically covered by an opioid prescription, we looked at the distribution of the PDC by opioid prescriptions for patients diagnosed with opioid use disorder. Measuring the PDC is helpful for distinguishing between recurring prescriptions spread across time as opposed to a high volume of prescriptions filled at a single point in time.

Proportion of days covered is a common medication adherence measure, calculated as the number of days in a period for which a person has a drug supply divided by the total number of days in a period for which the person is eligible for prescription drug coverage. Nearly half of the individuals in the diagnosed OUD population had a PDC of 75% or higher in 2015, meaning they had opioid prescriptions for at least three-quarters of their eligibility. This includes both opioid agonists and partial agonists.

The PDC distributions for this population follow a pattern that is similar to the total days' supply, where a large portion of the population shows the highest level of usage, with more than 90% of their eligibility covered by a prescription opioid. Figures 7 and 8 give the distribution of PDC for agonists and partial agonists in 2015 for patients with opioid use disorder.

For opioid partial agonists, more of the member distribution falls on the right tail of the graph than for opioid agonists. In other

words, a higher proportion of the OUD population is covered with an opioid partial agonist prescription (which could be prescribed to treat addiction) for over half the year than with an opioid agonist prescription. Still, about half of individuals with an OUD had a PDC for opioid agonists over 50% in 2015.

Diagnosed OUD: Tip of the iceberg?

We know that individuals with diagnosed OUD utilize large amounts of opioids, but what do opioid use patterns look like for individuals without diagnosed OUD? Does there appear to be a significant proportion of the population not diagnosed with OUD that still uses opioids at a level comparable to the population with diagnosed OUD?

This section explores opioid use patterns for the 3.9 million commercially insured members in our research database that were prescribed opioids in 2015 but do not have a diagnosed OUD. Overall, individuals without diagnosed OUD were prescribed significantly fewer opioids and were less likely to have high use patterns than those with diagnosed OUD, although in absolute terms the number of people without diagnosed OUD who were still prescribed high levels of opioids was quite significant. For this reason, our focus was on super-users who appeared to use opioids at levels comparable to the highest-use patients with diagnosed OUD.

FIGURE 7: PDC DISTRIBUTION OF OPIOID AGONISTS FOR OUD POPULATION, 2015

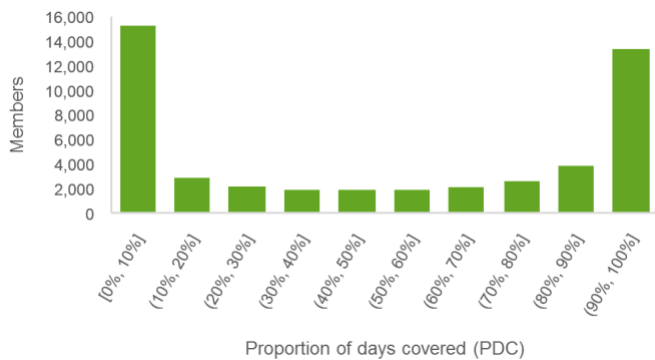
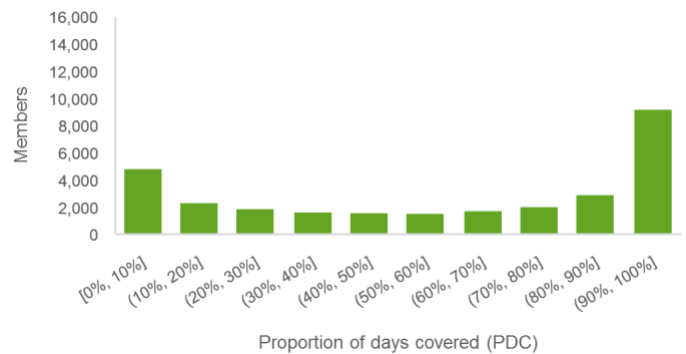


FIGURE 8: PDC DISTRIBUTION OF OPIOID PARTIAL AGONISTS FOR OUD POPULATION, 2015



We found that there were 5.5 to 9.4 times as many people who were not diagnosed with OUD as there were people diagnosed with OUD who had opioid use levels above key thresholds. Figure 9 displays the relative number of people without diagnosed OUD who had opioid use levels that exceeded key thresholds for dosing quantity and potency. Figure 10 gives extrapolations of these findings to national totals for the commercially insured population.

While in many cases these high levels of opioid use may be clinically appropriate (particularly for chronic pain patients who don't find effective pain control at lower doses, as well as cancer and terminal patients), use at these levels also presents increased risk of developing OUD and other associated side effects. These findings suggest that the number of patients diagnosed with OUD may represent just the tip of the iceberg for those at risk of developing serious complications from high opioid use.

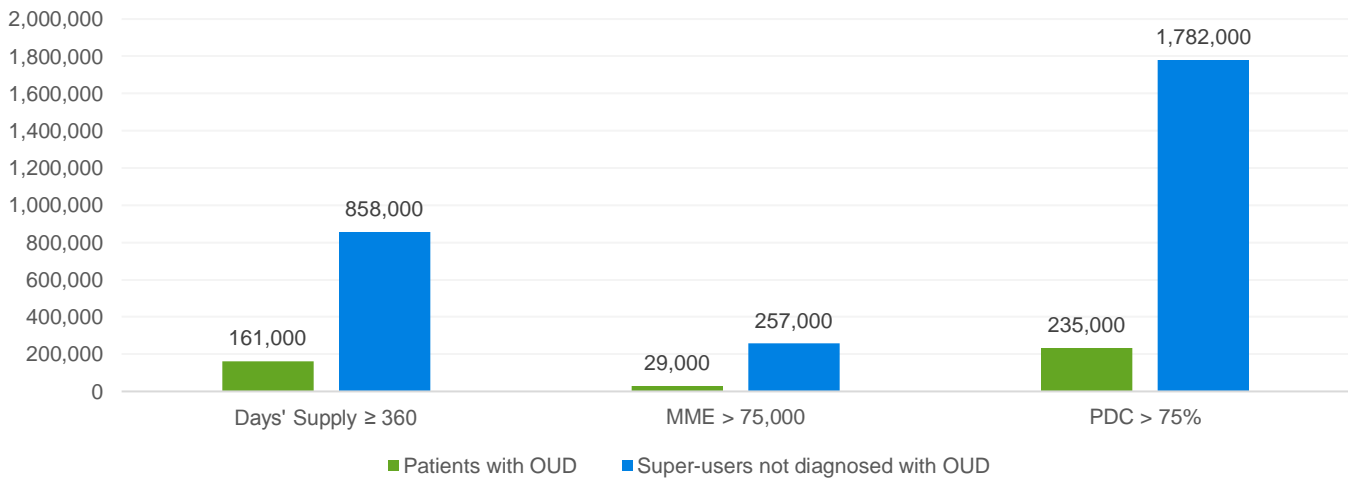
In an earlier analysis, we estimated that about 1.5 million privately and publicly insured individuals in the United States have been diagnosed with OUD, and about 600,000 of those had commercial insurance coverage. In order to put these findings in perspective, we extrapolated our findings for the number of OUD patients and super-users exceeding certain key thresholds of opioid use to national totals for the commercially insured population. Figure 10 shows these extrapolations for each measure of quantity or potency that we studied.

FIGURE 9: OPIOID USE PATTERNS FOR SUPER-USERS COMPARED TO PATIENTS DIAGNOSED WITH OUD, 2015

Quantity	There were 5.5 times as many people without diagnosed OUD who had at least 360 days' supply as there were with diagnosed OUD.
Potency	There were 9.4 times as many people without diagnosed OUD who had more than 75,000 total MME in 2015 as there were with diagnosed OUD.
Days covered	There were 7.5 times as many people without diagnosed OUD who had PDCs over 75% as there were with diagnosed OUD.

As illustrated in Figure 10, a significant number of patients without diagnosed OUD use the same elevated level of opioids as those with a known use disorder. In absolute terms, there are significantly more opioid super-users among those without diagnosed OUD than among those with diagnosed OUD. This indicates that there may be many more individuals at risk for complications of high opioid usage than have been formally diagnosed.

FIGURE 10: NATIONAL ESTIMATES FOR THE NUMBER OF OUD PATIENTS AND SUPER-USERS EXCEEDING KEY OPIOID USE THRESHOLDS, 2015



Next steps

Opioid prescribing practices are controversial in the United States, as pressures to reduce prescriptions challenge the needs of chronic pain patients. Overprescribing opioids can lead to abuse and addiction, but limiting the prescriptions available to chronic pain patients can leave those patients feeling abandoned by the healthcare system, and in some cases may exacerbate a shift toward illicit opioid use, which can be far more dangerous. Some clinical experts believe that opioid therapy continues to be the appropriate course of action for certain chronic pain patients, although prescribing practices suggest weighing the potential benefits of opioids against the risks. Opioid therapy is a complicated topic, and we do not suggest or endorse any particular prescribing strategy.

In response to the national debate regarding opioid prescribing practices, many states, insurers, and providers have begun making moves to limit opioid prescriptions.

Express Scripts, the largest pharmacy benefit management organization in the country, began a program last year to limit the number of opioid medications that can be prescribed to first-time users, which has reduced the average days per script by 60% since inception.¹¹ The Centers for Medicare and Medicaid Services (CMS) also announced a proposal to address prescription opioid overuse, expecting sponsors to limit opioid prescriptions to a seven-day supply allowance at a 90 morphine milligram equivalent level.¹²

Reducing the number of opioid prescriptions may be one component of the national strategy in addressing the opioid epidemic, but access to comprehensive treatment options for both chronic pain and substance use disorders will be critical to ensure that patient needs are not left out of the discussion. As the national conversation about best prescribing practices continues, it will be important to continue to monitor changes in opioid use patterns in years to come.

In a future report, we will analyze the prevalence and economic impact of opioid use and medical condition comorbidities among the diagnosed use disorder and non-diagnosed super-user populations. We have found that, in the general population, medical costs for treating patients with chronic medical and comorbid mental health/substance use disorder

(MH/SUD) conditions are two to three times higher on average compared to those who do not have comorbid MH/SUD conditions,¹³ but opioid use and medical comorbidities have yet to be specifically studied in the same fashion. This analysis will help shed more light on the impact of opioid use disorder on total healthcare costs in the United States.

Data sources and methodology

This analysis is based on the 2014 and 2015 Truven MarketScan Commercial Claims and Encounters Databases®. These research databases reflect the healthcare experience of employees and dependents covered by the health benefit programs of large employers, health plans, and government organizations. These claims data are collected from approximately 350 payers. The MarketScan Commercial Claims and Encounters Database includes data from active employees, early retirees, COBRA continuees, and dependents insured by employer-sponsored plans.

This report presents an analysis of opioid use patterns in the United States as identified by diagnosis codes related to opioid abuse, dependence, or poisoning. Opioids were identified in prescription drug data using a list of National Drug Code (NDC) codes published by the CDC.¹⁴ We also relied on the associated morphine milligram equivalent factors produced by the CDC for this analysis.

Opioid partial agonists were identified in the data using the Analgesic/Antipyretics Opiate Partial Agonists therapeutic class according to MarketScan 2015 Redbook®. Opioid agonists were identified using the Analgesic/Antipyretics Opiate Agonists class. Tramadol was also added by Generic Product Identifier (which is classified under the broad Analgesics/Antipyretics, Not Elsewhere Classified therapeutic class) to the partial agonist opioid class.

Estimates of nationally extrapolated populations were based on Current Population Survey (CPS) data produced by the U.S. Census Bureau.¹⁵

¹¹ Express Scripts (January 11, 2018). Safer opioid prescribing: Express Scripts significantly reduces inappropriate selection and excessive dispensing of opioids for new patients. News release. Retrieved August 9, 2018, from <https://expressscriptsholdingco.gcs-web.com/news-releases/news-release-details/safer-opioid-prescribing-express-scripts-significantly-reduces>.

¹² CMS.gov (February 1, 2018). 2019 Medicare Advantage and Part D Advance Notice Part II and Draft Call Letter. Newsroom. Retrieved August 9, 2018, from <https://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2018-Fact-sheets-items/2018-02-01.html>.

¹³ Melek, S., Norris, D., et al. (January 2018). Potential Economic Impact of Integrated Medical-Behavioral Healthcare: Updated Projections for 2017. Milliman Research Report. Retrieved August 9, 2018, from <http://www.milliman.com/uploadedFiles/insight/2018/Potential-Economic-Impact-Integrated-Healthcare.pdf>.

¹⁴ CDC, Analyzing Prescription Data and Morphine Milligram Equivalents (MME), *ibid*.

¹⁵ U.S. Census Bureau. Current Population Survey (CPS). Retrieved August 9, 2018, from <https://www.census.gov/cps/data/cpstablescreator.html>.

Caveats and limitations

The results in this analysis reflect commercial large group employer-sponsored insurance and thus likely under-represent lower-income households that purchased individual coverage under the Patient Protection and Affordable Care Act (ACA). Noncommercial populations such as Medicare and Medicaid were not studied. Additionally, while sampling errors are quite small due to the large sample sizes available in each data set used for this analysis, sampling bias could be present to the extent that health plans and payers that contribute to the research databases differ systematically from non-contributors.

The diagnosis codes used to identify opioid use disorder include a range of severities, including some cases of uncomplicated use and some remission. Additionally, opioid overdose does not always happen within the context of an opioid use disorder, especially in the elderly or opioid-naïve. Due to lack of available data, we were not able to analyze opioid use patterns for individuals who obtain opioids outside of a prescription.

This analysis is intended to highlight opioid prescribing practices in the United States. Opioid therapy is a complicated medical practice, and we do not suggest or endorse any particular opioid prescribing strategy.

Milliman has not audited the research data set used for this analysis, but we have extensive experience working with this data and have found it to be reasonable. To the extent that there are errors or omissions in any of the data sources relied upon for this analysis, these results may also be in error. This report does not represent conclusive recommendations regarding treatment of opioid use disorder or legal advice. Milliman does not intend to benefit or create a legal duty to any recipient of this work.

Milliman did not receive any external funding for this analysis. Any opinions or views expressed in this report are those of the authors, not of Milliman.

The authors would like to thank Steve Melek, Christine Mytelka, and Melanie Kuester for their helpful input and peer review of this material.



Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACT

Stoddard Davenport

Healthcare Management Consultant
stoddard.davenport@milliman.com

Alexandra Weaver

Associate Actuary
ally.weaver@milliman.com

Matt Caverly

Actuarial Analyst
matt.caverly@milliman.com