Indiana State Epidemiological Outcomes Workgroup (SEOW)
Special Topics Research Report:

Regional Trends of Opioid Use and Consequences in Indiana

SEOW Special Topic Reports (STRs) provide current information and data on issues related to substance misuse and mental and behavioral health in Indiana. STRs are intended to be utilized for strategic planning by addictions professionals, community stakeholders, community coalitions and workgroups, and grant writers, and should also be used to inform and develop public health policies at the local and state levels.

March 16, 2023

SyraHealth

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Recommended Citation:

Chantigian, D., Holzbach, O., Minnick, D., Fultz, D, Burnett, A. & Devaraj, S, (2023) Regional Trends of Opioid Use and Consequences in Indiana, produced by Syra Health on behalf of Indiana State Epidemiological Outcomes Workgroup

Purpose of Special Topics Report

The purpose of this report is to provide an overview of the opioid epidemic, the psychological and physiological effects of opioids, and the impacts of the opioid epidemic on Indiana.

What are opioids?

Opiates are naturally occurring alkaloids, and the term "opioid" refers to compounds that act on opioid receptors on nerve cells in the body and brain. As opioids receptors are present in many organs, opioids can affect nearly all physiological systems (Benyamin et al., 2008). In the field of pharmacology, opioids are well-known as a class of drugs often prescribed for the treatment of pain. In the early 2000s, the American Pain Society campaigned to define pain as a symptom that should be treated as the "fifth vital sign", and this campaign laid the groundwork for a significant rise in opioid prescriptions as opiates were considered the most effective drug for pain relief (Soealberg et al., 2017).

Generally, opioids are safe for pain management when appropriately prescribed by a doctor and taken for a short, controlled period of time. However, opiates are known to be frequently misused and have historically been over prescribed by the medical community. If opioid use becomes regular for an individual, they can quickly become dependent on the drug, which can lead to addiction, overdoses, and death. Misuse of both legal and illegal opioids has significantly increased since the 1990s (Center for Disease Control, 2021). Thus, it is essential to understand the opioid crisis as a whole and that opioids should only be used as directed by physicians to prevent misuse (Center for Disease Control, 2021).

Legal vs. illegal opioids

Legal opioids are those prescribed by physicians to patients that desire pain management for conditions like major injuries, surgeries, dental procedures, or long-term chronic pain. Legal opioids include but are not limited to morphine, fentanyl, oxycodone, hydrocodone, and codeine. Illegal opioids are any opioids that are made, shared, or sold illegally, which includes heroin, opium, and any legal opioid obtained in a manner other than via a prescription from a licensed physician. Some legal opioids are naturally derived substances, such as morphine and codeine; others, like oxycodone and hydrocodone, are semi-synthetic substances. Fully synthetic opioids include fentanyl, tramadol, and heroin (National Center for Drug Abuse Statistics, 2022).

Many synthetic opioids are governed by the Controlled Substances Act as synthetic opioids are extremely potent and can lead to death in small doses. In 2017, approximately 60% of opioid-involved overdose deaths were attributed to synthetic opioids (Lippold et al., 2019). One synthetic opioid that became notorious in the 2010s and 2020s was fentanyl, which is legal when prescribed by certain physicians. In 2013, a surge in opioid-involved overdoses and deaths began. The rates of opioid-involved overdoses has sharply increased when comparing overdose deaths from 2013 to 2019 (National Center for Drug Abuse Statistics, 2022). As new technologies were developed, production of illegally manufactured fentanyl became more prominent, which has increased the severity of the opioid crisis. Fentanyl became increasingly found in supplied of coacine, methamphetamine, and counterfeit prescription pills. Both legally and illegally manufactured fentanyl are extremely dangerous; one kilogram of fentanyl contains 250,000 lethal doses (National Center for Drug Abuse Statistics). Heroin is another commonly known synthetic opioid that contributes to a significant number of deaths. Importantly, heroin usage rates have also been found to be higher when opioid prescription availability is low (National Center for Drug Abuse Statistics, 2022).

Evolution of the opioid epidemic

Since the 1990s, higher rates of opioid prescriptions and use of illegal opioids have significantly increased opioid-involved misuse, dependence, and death, which led to the onset of the opioid epidemic. Between 1999 and 2020, opioid overdoses accounted for over 564,000 deaths in the U.S. The number of annual opioid-involved overdose deaths has nearly quintupled from 1999 to 2019. In 2020, the CDC reported nearly 92,000 drug-involved overdose deaths with approximately 75% of the overdose deaths involving an opioid. In 2017, the U.S. Department of Health and Human Services declared the opioid epidemic a public health emergency (Center for Disease Control, 2021).

The evolution of the opioid epidemic can be described by three distinct waves of opioid-involved deaths that occurred between 1999 and 2017. Following the rise of opioid prescriptions in the late 1990s, a spike in prescription opioid overdoses and opioid-involved overdose deaths occurred in 1999, which has subsequently been termed the first wave of opioid-involved deaths (Center for Disease Control, 2021). The second wave began in 2010 as a rapid increase in heroin

use and heroin-related overdose deaths occurred during that year (Center for Disease Control, 2021). The third wave began in 2013 as synthetic opioids, namely fentanyl, became frequent contributors to opioid-involved deaths (Center for Disease Control, 2021). A 2021 article published in Preventative Medicine suggests that the United States is on the verge of a fourth wave as synthetic opioids have become increasingly used in conjunction with stimulants like methamphetamine (Jenkins, 2021). Further, the COVID-19 pandemic has appeared to contribute to this wave as there was an increase in opioid use and opioid-related overdoses after the pandemic began (Jenkins, 2021). It is currently unclear how this epidemic will evolve, but this public health emergency has affected millions throughout the United States (Jenkins, 2021).

In terms of opioid misuse during the beginning of the pandemic, the number of individuals over the age of 12 that reported opioid use disorder increased from 1.9 million in 2019 to 2.7 million in 2020. From 2017 to 2019, the number of overdose-involved deaths remained consistent at approximately 48,000 annual deaths, but after the onset of the pandemic, the number of deaths rose to 69,061 in 2020 and to 80,926 in 2021. One of the contributing factors related to the increase in opioid-related overdose deaths during the pandemic was disruption to accessible health care and treatment services for individuals with addiction issues. It has also been suggested that drug smuggling patterns changed after the pandemic started, and fentanyl became more readily available and was more commonly laced in illicit drugs, which users' may have been unaware of. The increased availability of opioids, pandemic-related stress, self-isolation, and the economic issues that arose during the pandemic also likely led to higher opioid usage rates, and there is a high probability that a lack of accessibility to treatment services also led to increased relapse rates (Joint Economic Committee Democrats, 2022).

2. Opioids in Indiana and the United States: regional and user demographics

In the United States, substance misuse and deaths involving opioids have varying regional characteristics both within and between states. Approximately 2.98% of individuals aged 12 or older in Indiana reported opioid dependence, which ranked 11th highest in the nation (amfAR, 2022). Indiana is ranked 9th and 13th in terms of highest opioid dispensation rates and age-adjusted overdose death rates, respectively.

For our regional analysis, we aggregate counties using the regions defined by NSDUH. We then created unweighted averages for the regions by using county level estimates and compare to the state of Indiana as a whole. The NSDUH regions are as follows:

Central: Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan, Shelby

East: Blackford, Delaware, Fayette, Grant, Henry, Jay, Madison, Randolph, Rush, Union, Wayne

North Central: Cass, Elkhart, Fulton, Howard, Kosciusko, LaPorte, Marshall, Miami, St. Joseph, Tipton, Wabash

Northeast: Adams, Allen, DeKalb, Huntington, LaGrange, Noble, Steuben, Wells, Whitley

Northwest: Jasper, Lake, Newton, Porter, Pulaski, Starke

Southeast: Bartholomew, Brown, Clark, Crawford, Dearborn, Decatur, Floyd, Franklin, Harrison, Jackson, Jefferson, Jennings, Lawrence, Ohio, Orange, Ripley, Scott, Switzerland, Washington

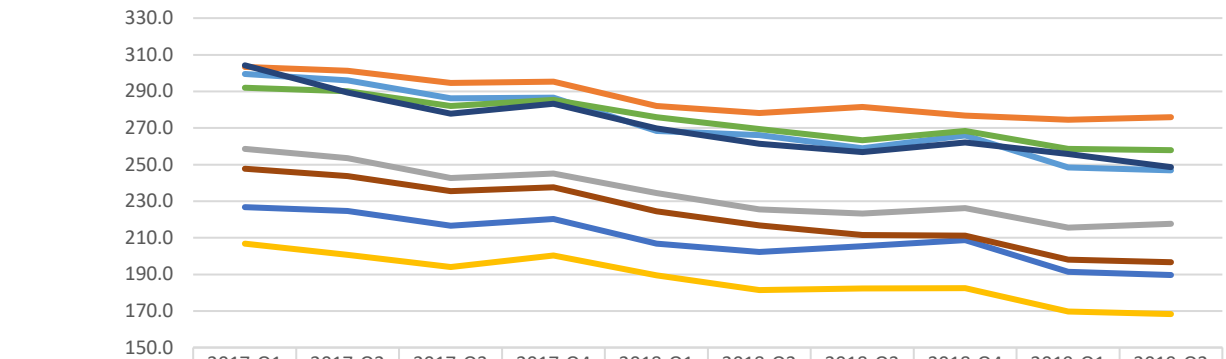
Southwest: Daviess, Dubois, Gibson, Greene, Knox, Martin, Perry, Pike, Posey, Spencer, Vanderburgh, Warrick

West: Benton, Carroll, Clay, Clinton, Fountain, Monroe, Montgomery, Owen, Parke, Putnam, Sullivan, Tippecanoe, Vermillion, Vigo, Warren, White

Opioid Dispensations

In this section, we present the regional trends of opioid dispensations and by type.

Figure 1: Opioid Prescription Dispensations, Rate per 1,000 Residents [IDOH Stats Explorer]



	2017-Q1	2017-Q2	2017-Q3	2017-Q4	2018-Q1	2018-Q2	2018-Q3	2018-Q4	2019-Q1	2019-Q2
Central	226.8	224.7	216.6	220.4	206.8	202.2	205.5	208.7	191.5	189.7
East	303.4	301.3	294.6	295.3	282.0	278.2	281.6	276.8	274.5	275.9
North Central	258.5	253.5	242.6	245.1	234.5	225.6	223.3	226.2	215.5	217.7
Northeast	206.8	200.8	194.1	200.4	189.5	181.4	182.4	182.6	169.8	168.4
Northwest	299.5	296.0	286.3	286.7	268.5	266.2	259.0	265.9	248.4	247.0
Southeast	291.9	290.1	282.1	285.5	275.9	269.4	263.3	268.5	258.6	258.0
Southwest	304.4	289.3	277.8	283.2	269.8	261.4	256.9	262.0	255.8	248.7
West	247.8	243.7	235.5	237.6	224.5	216.9	211.6	211.2	198.1	196.7

Source: IDOH Stats Explorer

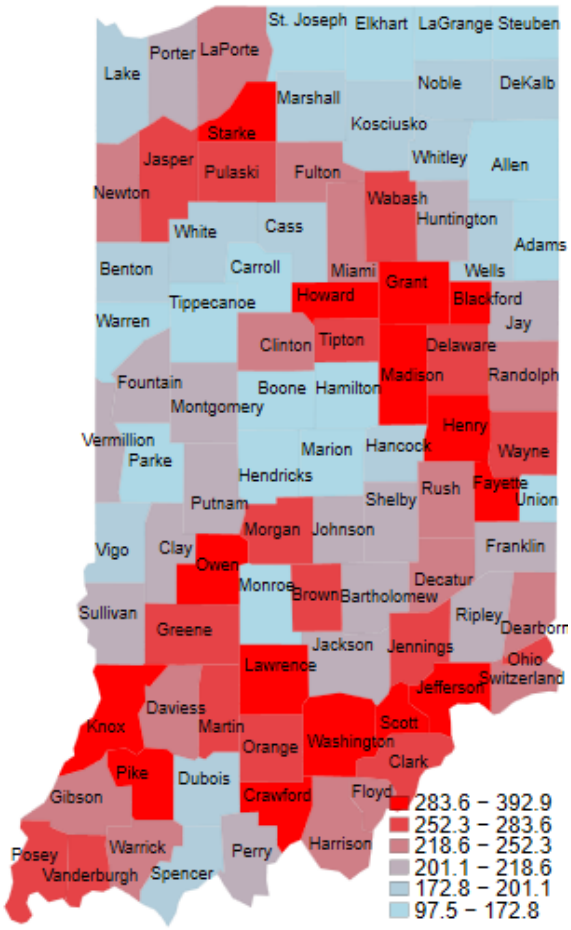


Figure 1 shows the opioid prescription dispensations in Eastern region is higher and North-easter region is lower relative to other regions.

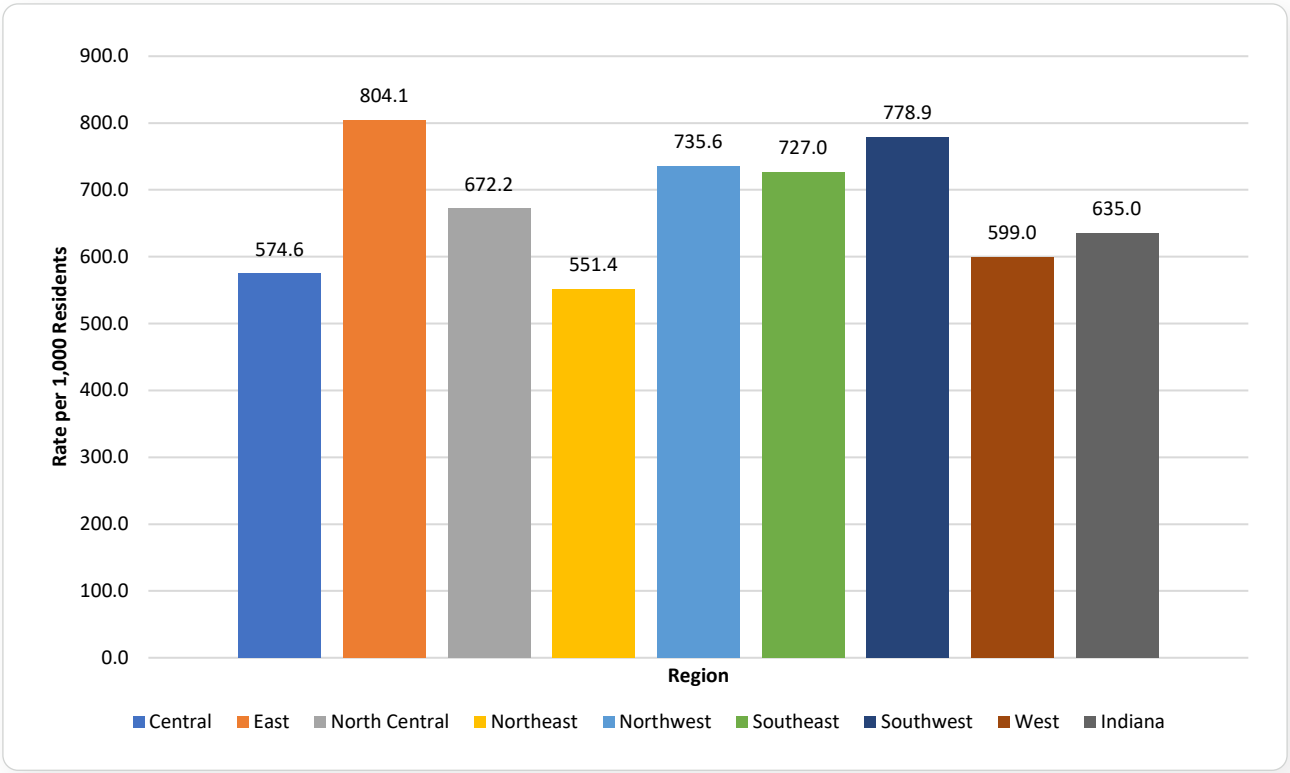
Map 1 provides county-level data in Q2 of 2019 for the data shown in Figure 1. The map shows the opioid prescription dispensation rate per 1,000 residents as published by IDOH Stats Explorer.

In 2021, the northeast, western, and central parts of Indiana had counties with relatively less dispensations compared to the south and eastern parts of the state.

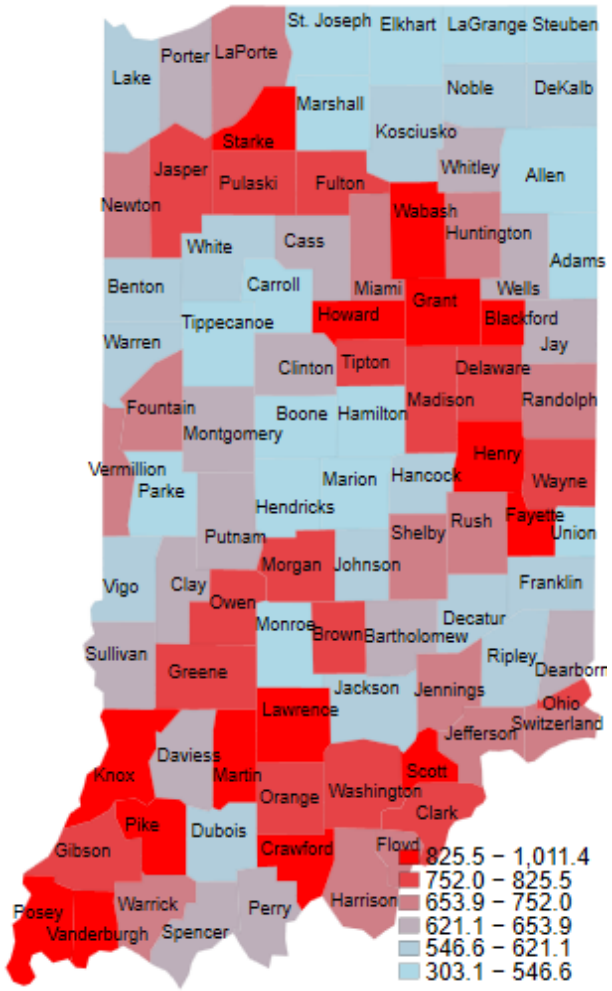
Map 1: Opioid Prescription Dispensations, Rate per 1,000 Residents, by county in Q2 of 2019

(IDOH Stats Explorer, 2019 Q2)

Figure 2: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Any Opioid [MPH PDMP]



Source: Indiana PDMP database, Management Performance Hub



Indiana PDMP reports dispensations of any opioid analgesics per 1,000 residents in 2021. According to the Indiana MPH data, East (804.1) has the highest rate of dispensation. Following behind East are Southwest (778.9), Northwest (735.6), Southeast (727.0), and North Central (672.2), all of which are higher than Indiana (635.0). Regions with a lower dispensation rate than Indiana are West (599.0), Central (574.6), and Northeast (551.4).

Using data from Indiana PDMP, Map 2 shows opioid analgesics dispensations per 1,000 residents by county in 2021.

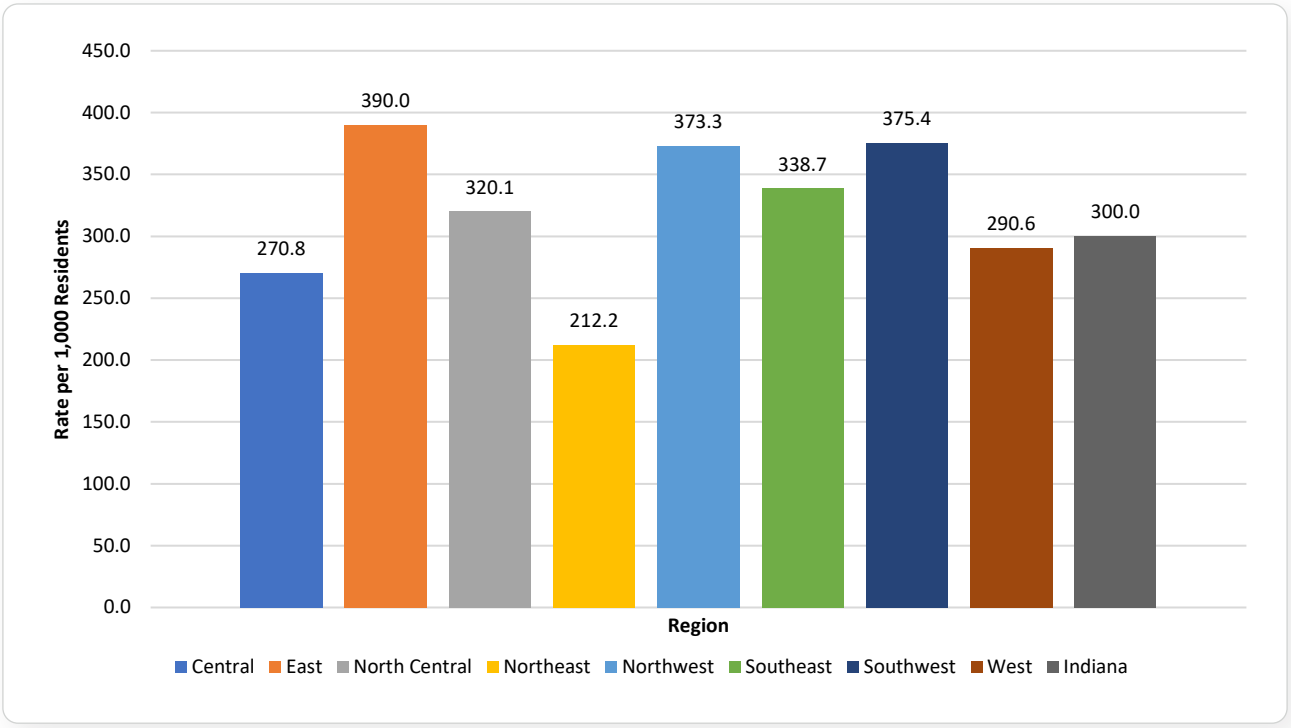
In 2021, the areas of Indiana with relatively more dispensations were counties primarily located in the south, east, and northwest.

Map 2: **Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Any Opioid**

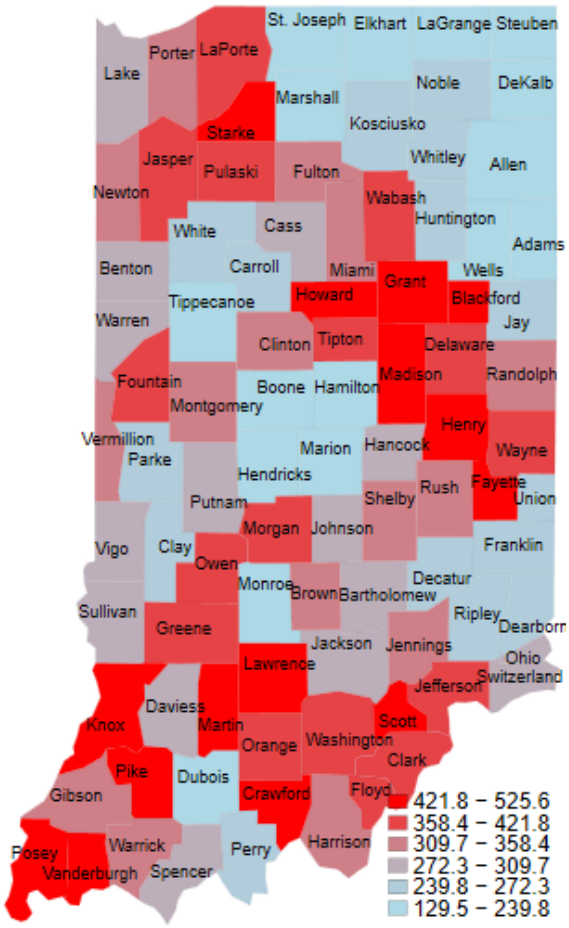
(Indiana MPH PDMP, 2021)

Indiana PDMP breaks down opioid analgesics dispensations into categories. In Figure 3, hydrocodone dispensations for each region are shown. East (390.0) has the highest dispensation rate, followed by Southwest (375.4), Northwest (373.3), Southeast (338.7), and North Central (320.1), of which all are higher than Indiana (300.0). West (290.6), Central (270.8), and Northeast (212.2) have lower dispensation rates than Indiana.

Figure 3: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Hydrocodone



(Indiana MPH PDMP, 2021)



Map 3 shows hydrocodone opioid analgesics per 1,000 residents by county in 2021 using data provided by Indiana PDMP.

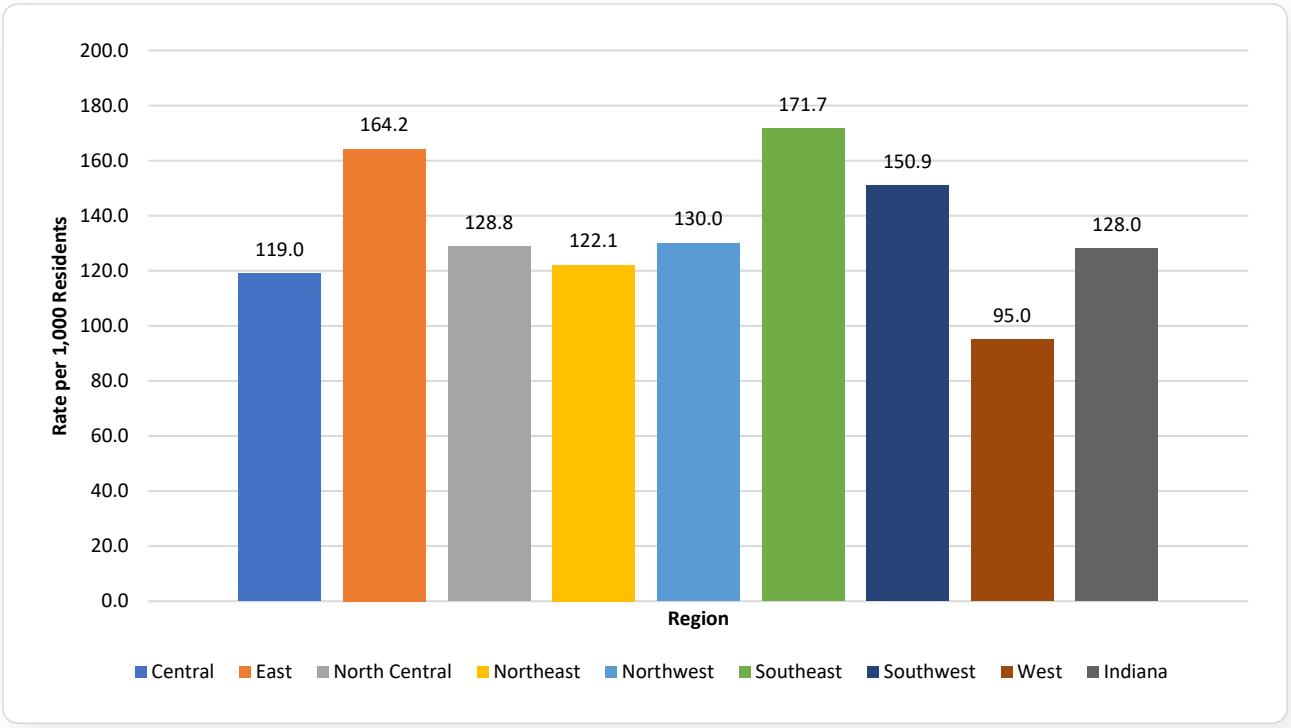
In 2021, the areas of Indiana with relatively more dispensations were in the south, east, parts of the west, and the upper northwest.

Map 3: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Hydrocodone

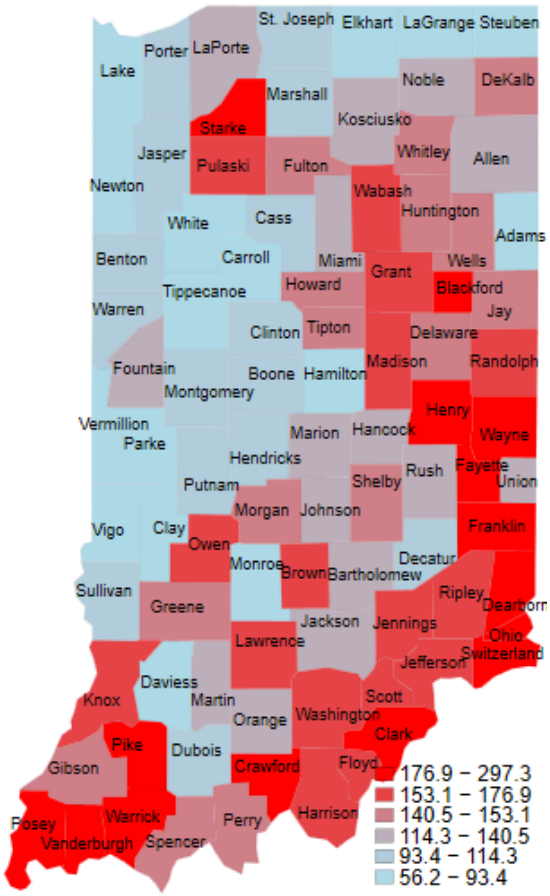
(Indiana MPH PDMP, 2021)

Oxycodone opioid analgesics dispensations by regions are shown in Figure 4. The Southeast Region (171.7) has the highest dispensation rate, followed by East (164.2), Southwest (150.9), Northwest (130.0), and North Central (128.8), which all have higher dispensation rates than Indiana (128.0). Northeast (122.1), Central (119.0), and West (95.0) have lower dispensation rates than Indiana.

Figure 3: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Oxycodone



(Indiana MPH PDMP, 2021)



Map 4 shows county-level opioid dispensations per 1,000 residents in 2021 in the form of Oxycodone.

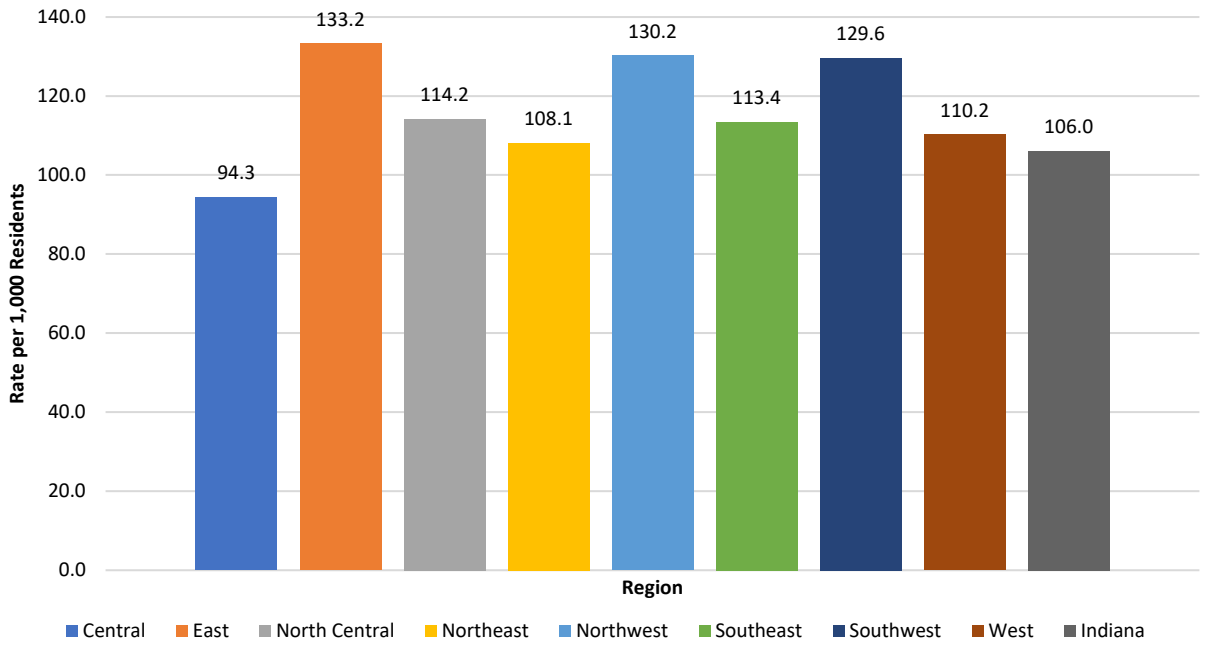
The areas where counties have relatively higher dispensation rates are the southern and eastern regions, as well as parts of central and north central Indiana.

Map 4: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Oxycodone

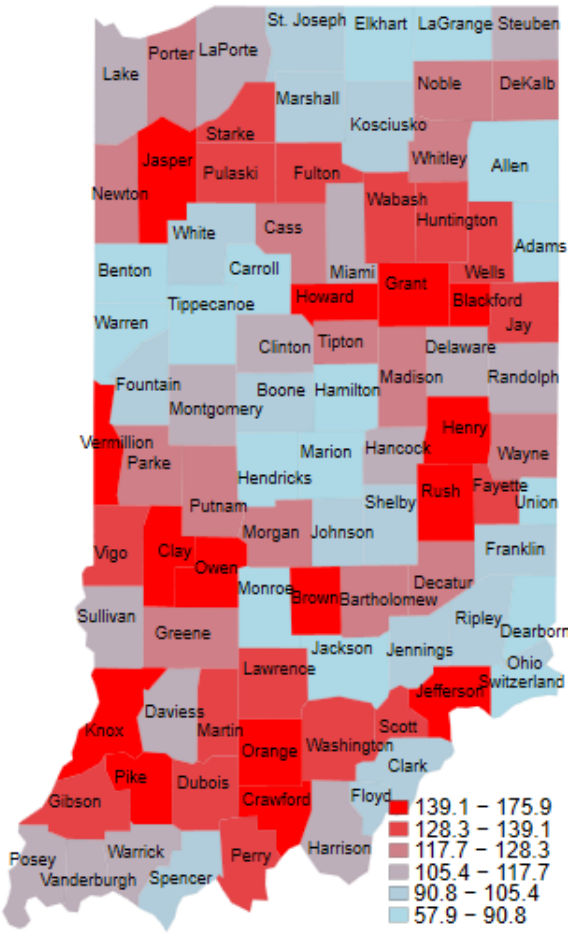
(Indiana MPH PDMP, 2021)

Figure 5 shows tramadol opioid analgesics dispensations data. The region with the highest dispensation rate is East (133.2), followed by Northwest (130.2), Southwest (129.6), North Central (114.2), Southeast (113.4), West (110.2), and Northeast (108.1). Indiana (106.0) only has a higher rate than Central (94.3).

Figure 5: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Tramadol



(Indiana MPH PDMP, 2021)



Map 5 shows the county-level dispensations of tramadol opioid analgesics per 1,000 residents. A graph of the data can be found below.

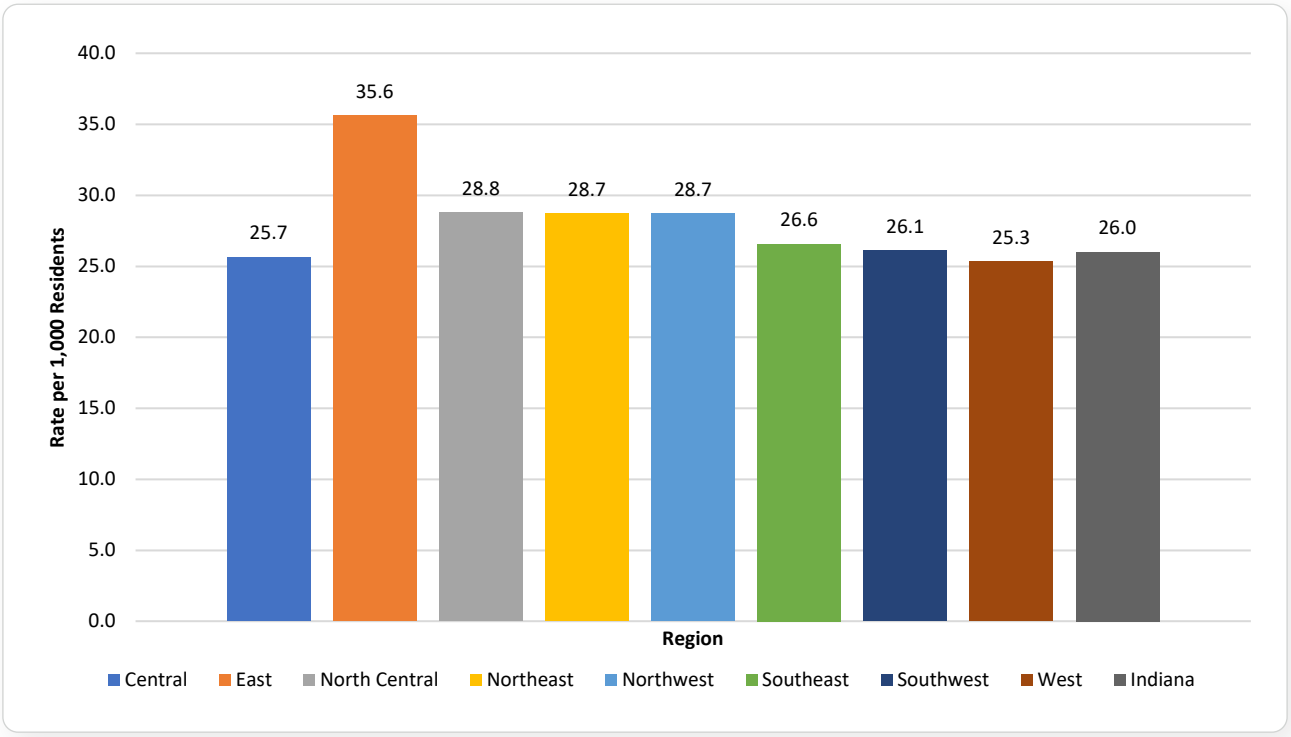
The counties with relatively higher dispensations are clustered in the southern, western, northwestern, eastern, and parts of the central part of the state.

Map 5: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Tramadol

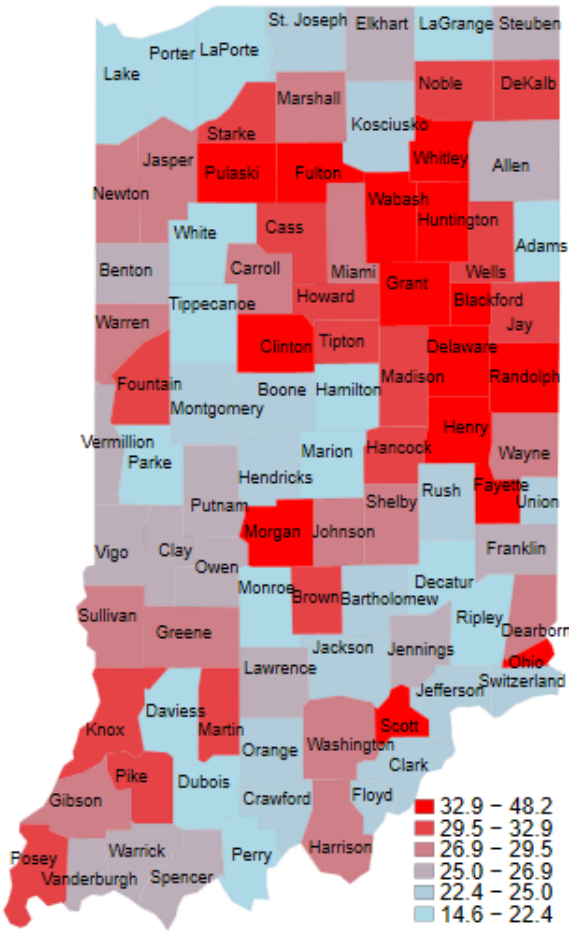
(Indiana MPH PDMP, 2021)

Morphine opioid analgesics dispensations are shown in Figure 6. The East Region (35.6) has the highest rate of dispensation, followed by North Central (28.8), Northeast (28.7), Northwest (28.7), Southeast (26.6), and Southwest (26.1), all of which have higher rates than Indiana (26.0). Central (25.7) and West (25.3) have lower rates than Indiana.

Figure 6: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Morphine



(Indiana MPH PDMP, 2021)



Opioid analgesics dispensations in the form of morphine in 2021 per 1,000 residents is shown in Map 6. Available data was used to create a county-level data map.

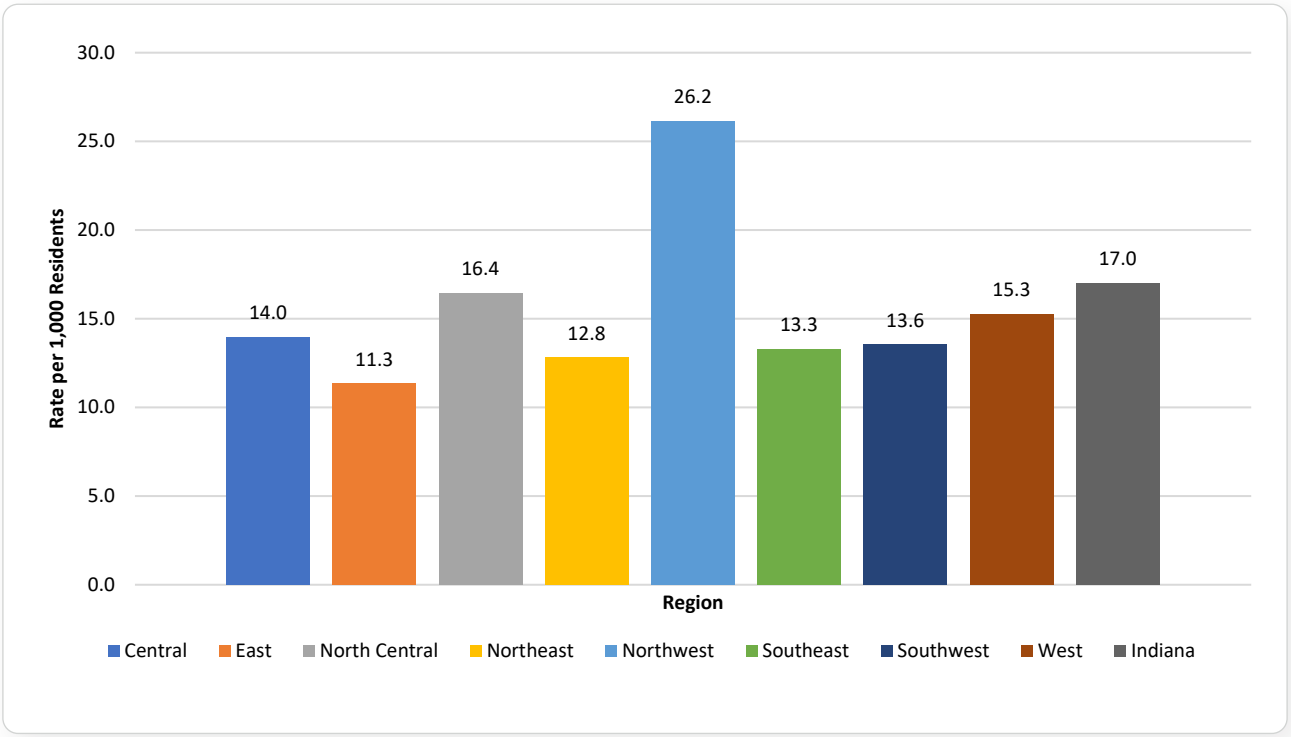
The counties with relatively higher dispensation rates are primarily located in the northeast and east, with some also in the western and southern parts of Indiana.

Map 6: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Morphine [MPH PDMP]

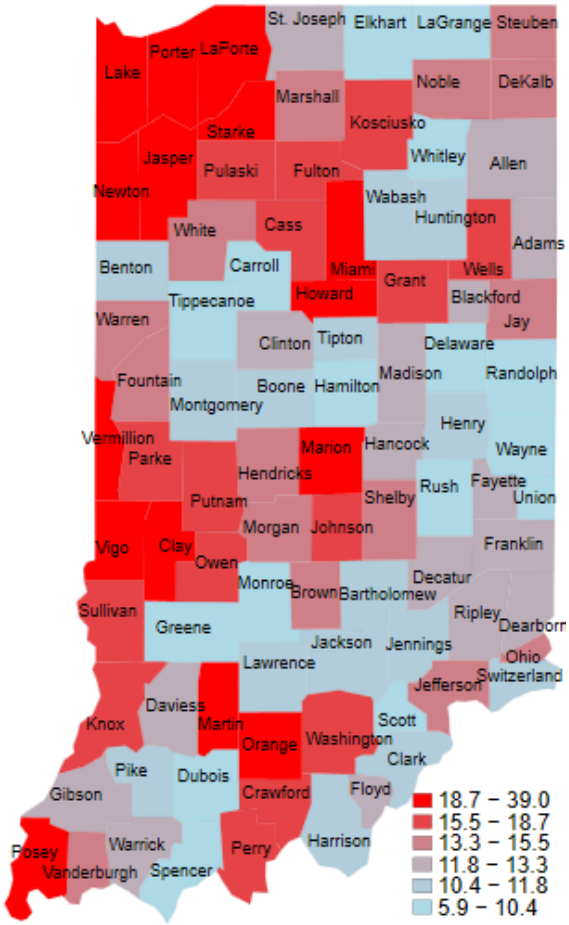
(Indiana MPH PDMP, 2021)

Codeine opioid analgesics dispensations are shown in Figure 7. Northwest (26.2) has the highest dispensation rate and is the only region higher than Indiana (17.0). Indiana has a higher dispensation rate than North Central (16.4), West (15.3), Central (14.0), Southwest (13.6), Southeast (13.3), Northeast (12.8), and East (11.3).

Figure 7: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Codeine



(Indiana MPH PDMP, 2021)



Map 7 shows the county-level data gives codeine opioid analgesics dispensations per 1,000 residents in 2021.

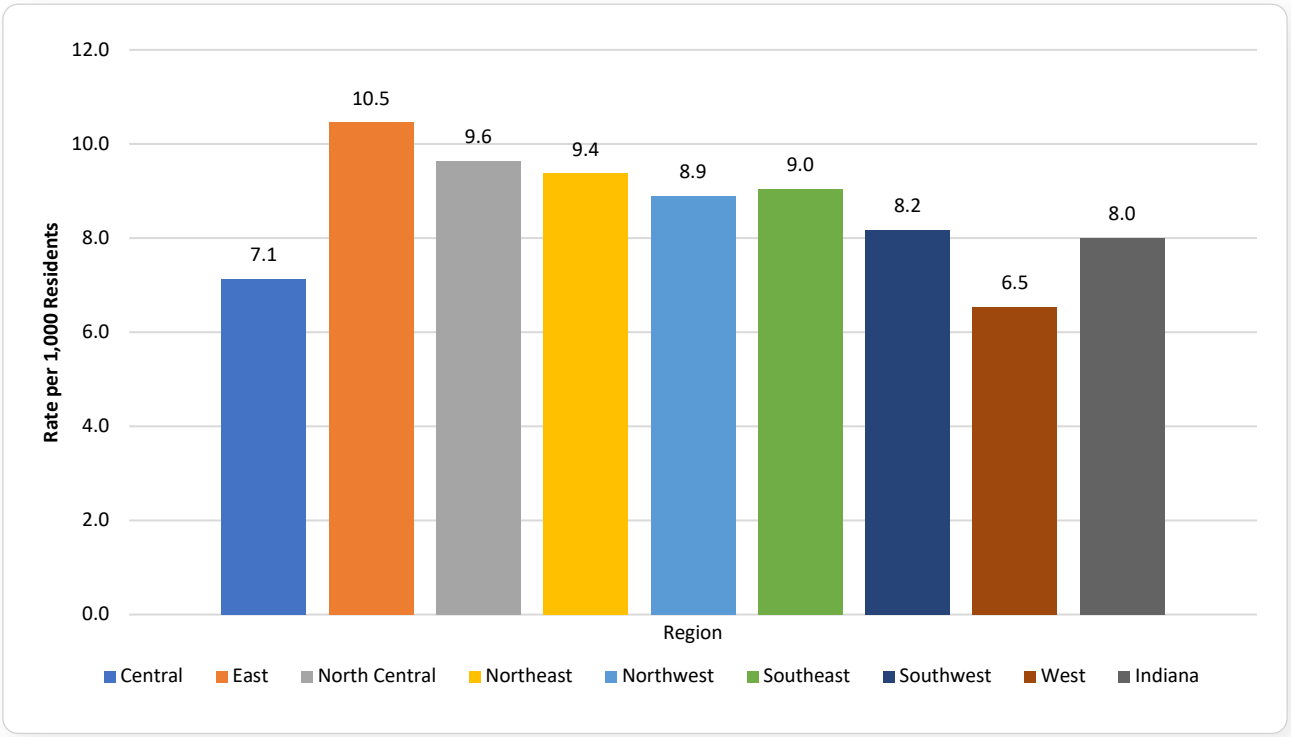
Counties with relatively higher dispensations are located in the northwest, west, and southern regions, followed by the northeast region.

Map 7: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Codeine

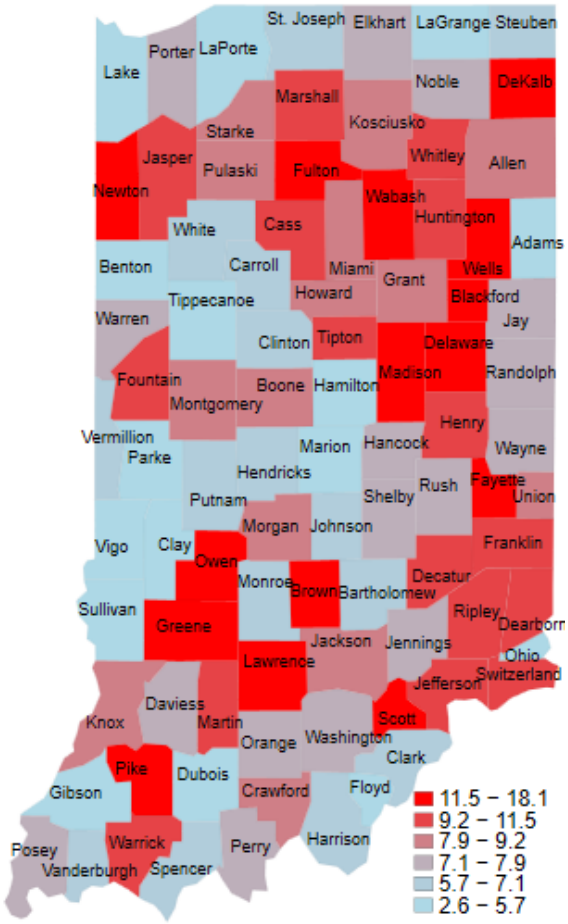
(Indiana MPH PDMP, 2021)

Fentanyl opioid analgesics dispensations are shown in Figure 8. East (10.5) has the highest dispensation rate, followed by North Central (9.6), Northeast (9.4), Southeast (9.0), Northwest (8.9), and Southwest (8.2), of which all have higher rates than Indiana (8.0). Central (7.1) and West (6.5) have lower rates than Indiana.

Figure 8: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Fentanyl



(Indiana MPH PDMP, 2021)



Using data from Indiana PDMP, Map 8 shows county-level dispensations per 1,000 residents in 2021 of fentanyl opioid analgesics.

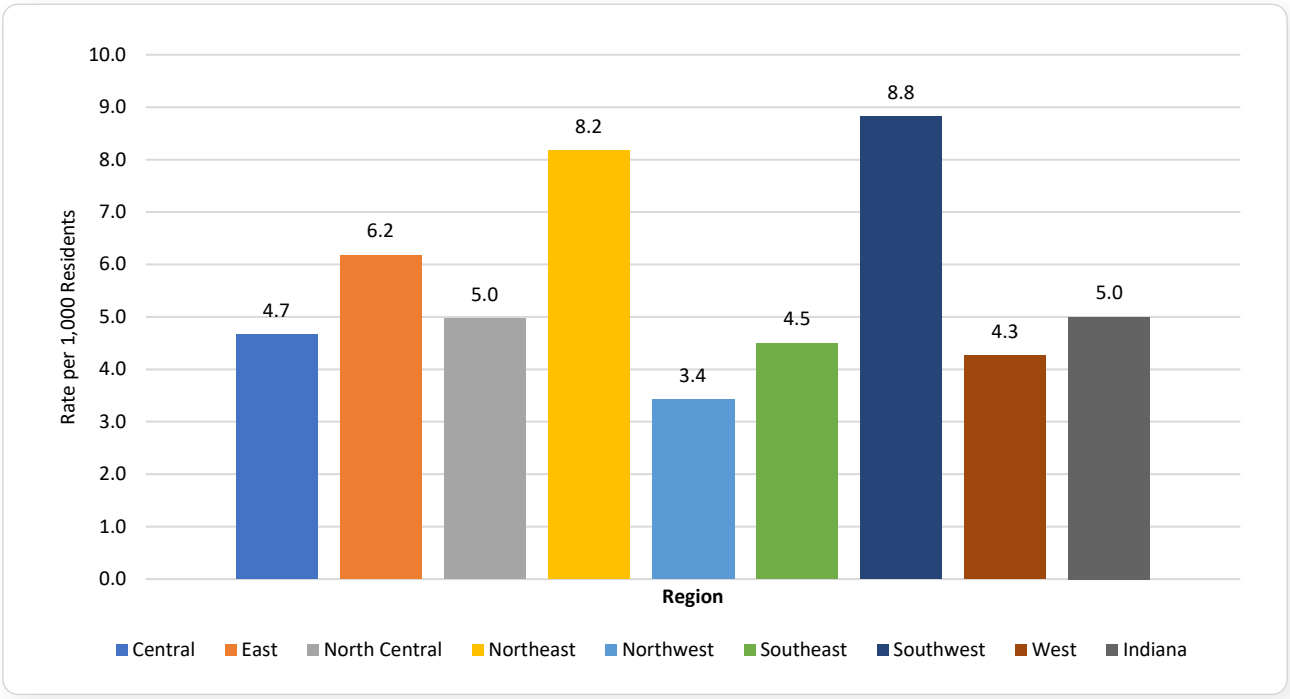
The counties that have relatively higher dispensations are found primarily in the eastern, central, southern, and north central parts of the state.

Map 8: Opioid Analgesics Dispensations per 1,000 Residents, by county in 2021: Fentanyl

(Indiana MPH PDMP, 2021)

Hydromorphone opioid analgesics dispensations are shown in Figure 9. The Southwest Region (8.8) has the highest rate of dispensation, followed by Northeast (8.2) and East (6.2). North Central (5.0) has the same dispensation rate as Indiana (5.0). Central (4.7), Southeast (4.5), West (4.3), and Northwest (3.4) have lower dispensation rates than Indiana.

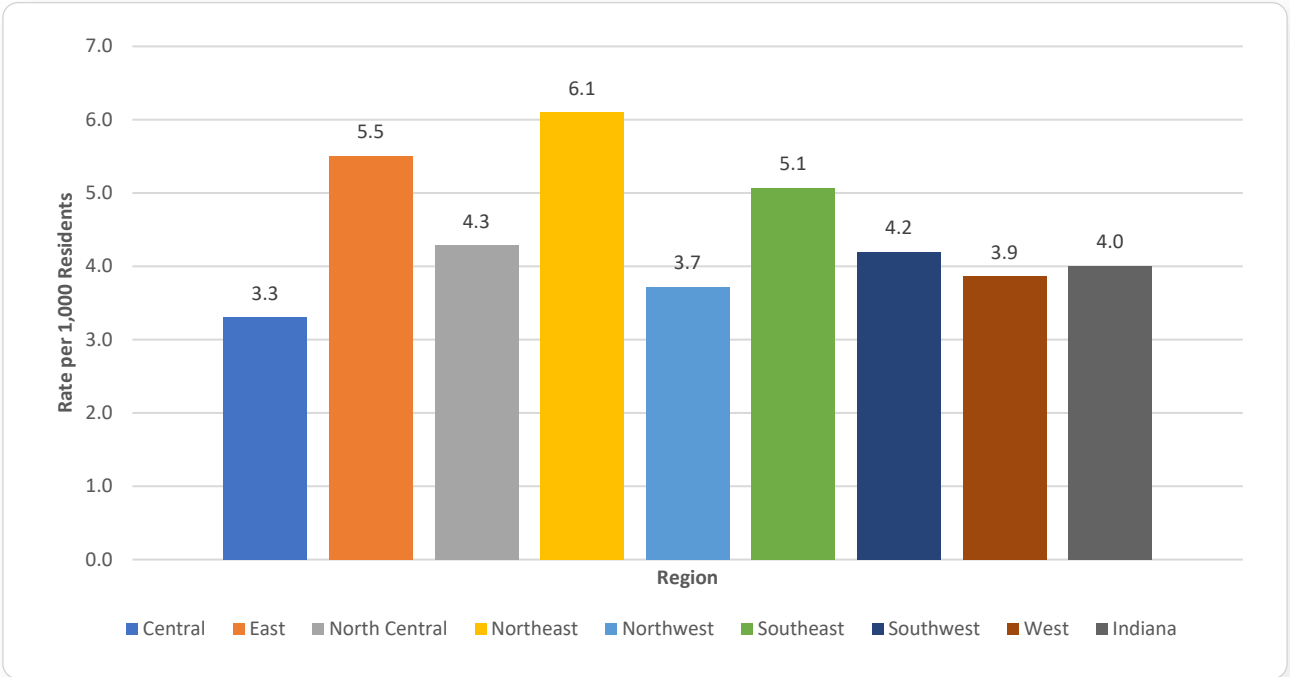
Figure 9: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Hydromorphone



(Indiana MPH PDMP, 2021)

Figure 10 shows methadone opioid analgesics dispensations. Northeast (6.1) has the highest dispensation rate, followed by East (5.5), Southeast (5.1), North Central (4.3), and Southwest (4.2), all of which have higher rates than Indiana (4.0). West (3.9), Northwest (3.7), and Central (3.3) have lower rates of dispensations than Indiana.

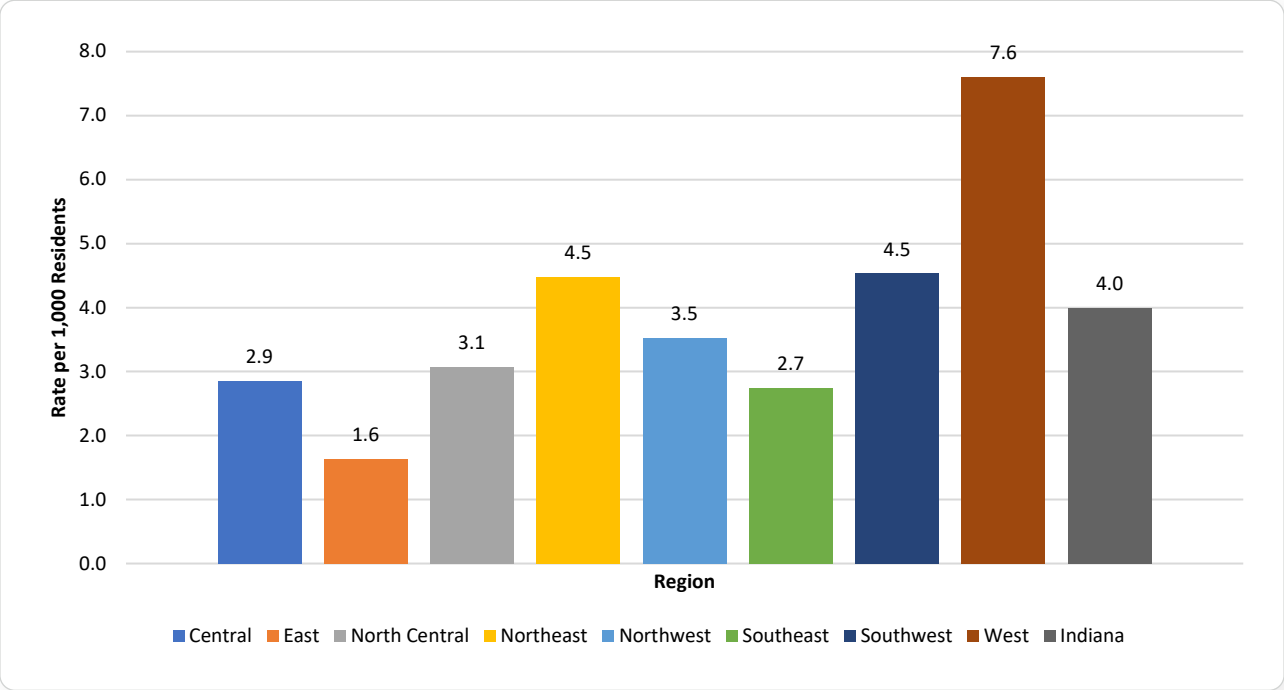
Figure 10: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Methadone



(Indiana MPH PDMP, 2021)

Buprenorphine opioid analgesics dispensations are shown in Figure 11. West (7.6) has the highest dispensation rate, followed by Northeast (4.5) and Southwest (4.5). Indiana (4.0) has a higher rate than Northwest (3.5), North Central (3.1), Central (2.9), Southeast (2.7), and East (1.6)

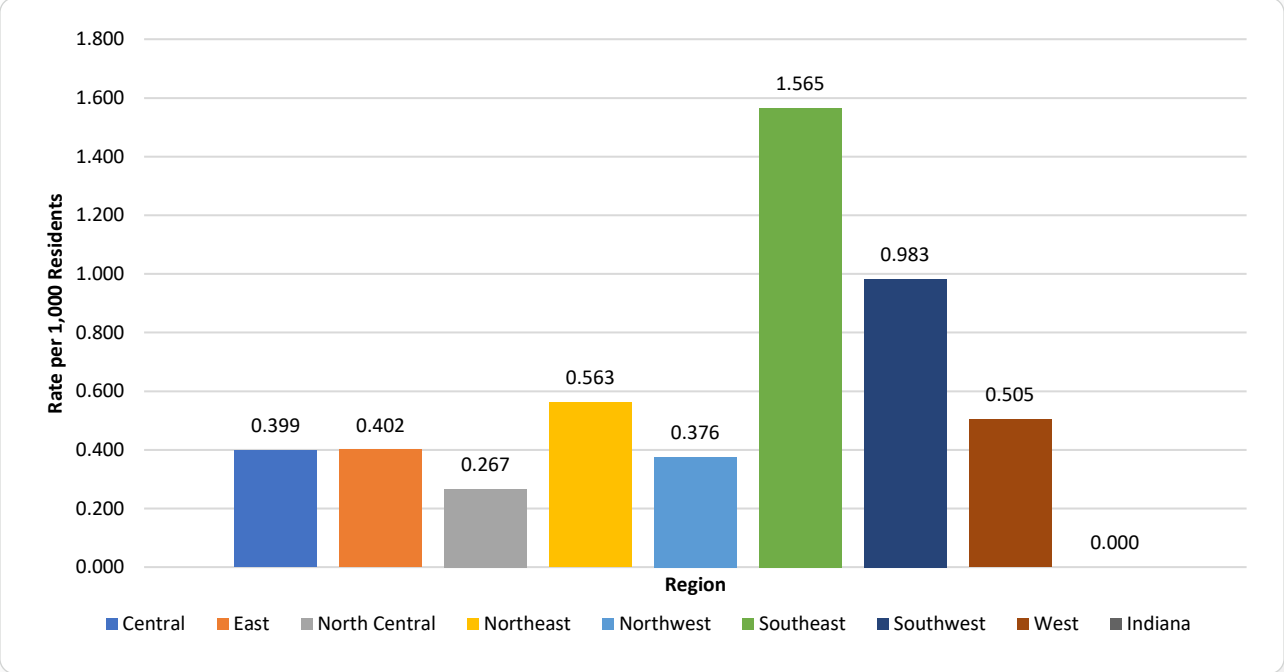
Figure 11: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Buprenorphine



(Indiana MPH PDMP, 2021)

Dispensation of butorphanol opioid analgesics are shown in Figure 12 . Southeast (1.6) has the highest rate, followed by Central (1.0), Northeast (0.6), and West (0.5). Central, East, and Northwest all have a dispensation rate of 0.4. Northwest (0.4) and North Central (0.3) have the lowest dispensation rates..

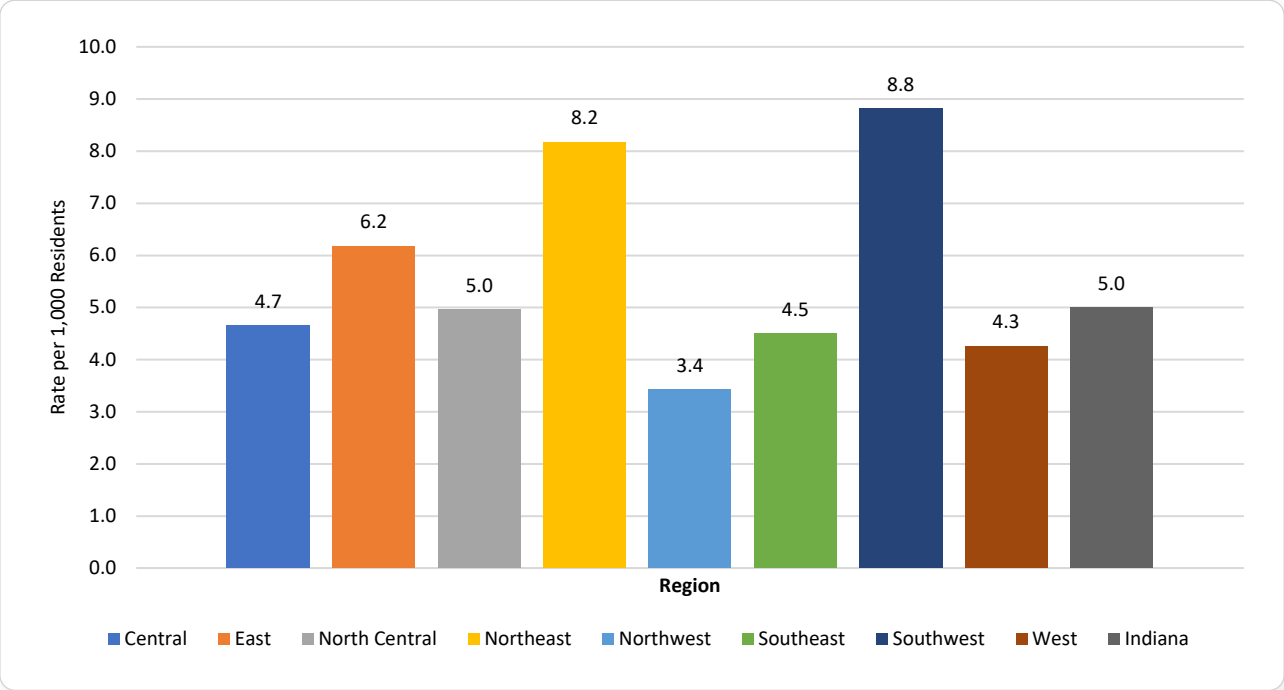
Figure 12: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Butorphanol*



(Indiana MPH PDMP, 2021)

Hydromorphone opioid analgesics dispensations are shown in Figure 9. The Southwest Region (8.8) has the highest rate of dispensation, followed by Northeast (8.2) and East (6.2). North Central (5.0) has the same dispensation rate as Indiana (5.0). Central (4.7), Southeast (4.5), West (4.3), and Northwest (3.4) have lower dispensation rates than Indiana.

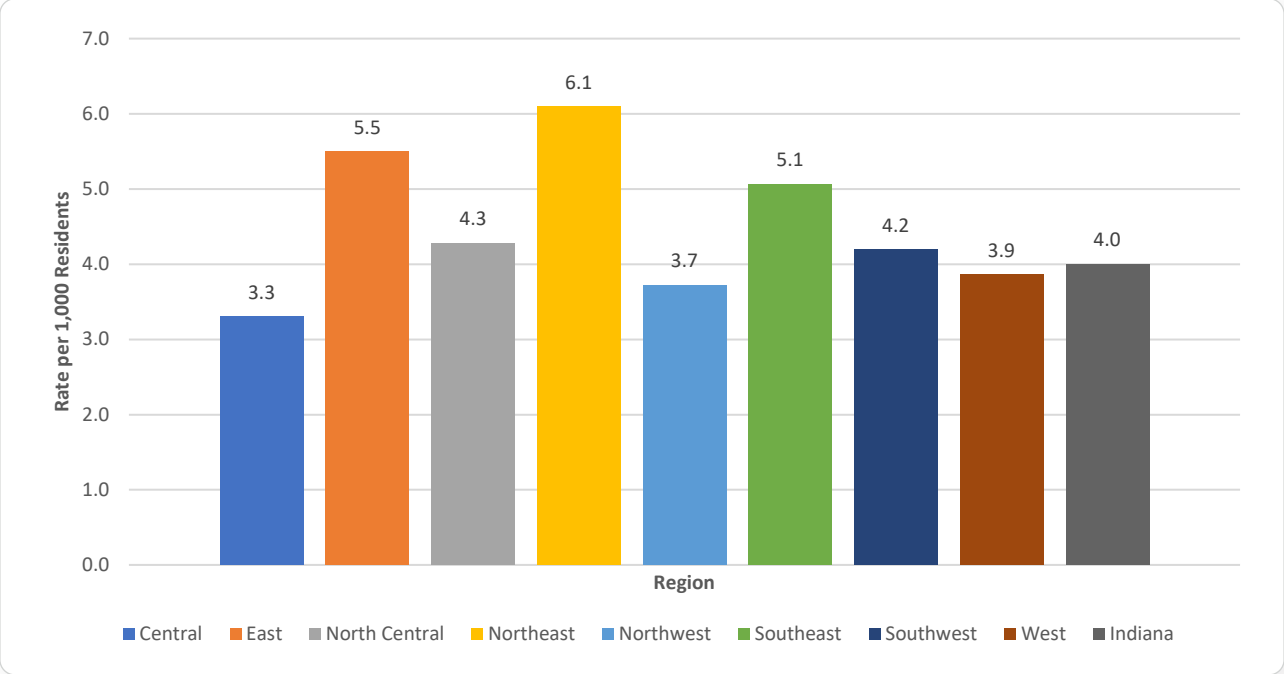
Figure 9: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Hydromorphone



(Indiana MPH PDMP, 2021)

Figure 10 shows methadone opioid analgesics dispensations. Northeast (6.1) has the highest dispensation rate, followed by East (5.5), Southeast (5.1), North Central (4.3), and Southwest (4.2), all of which have higher rates than Indiana (4.0). West (3.9), Northwest (3.7), and Central (3.3) have lower rates of dispensations than Indiana.

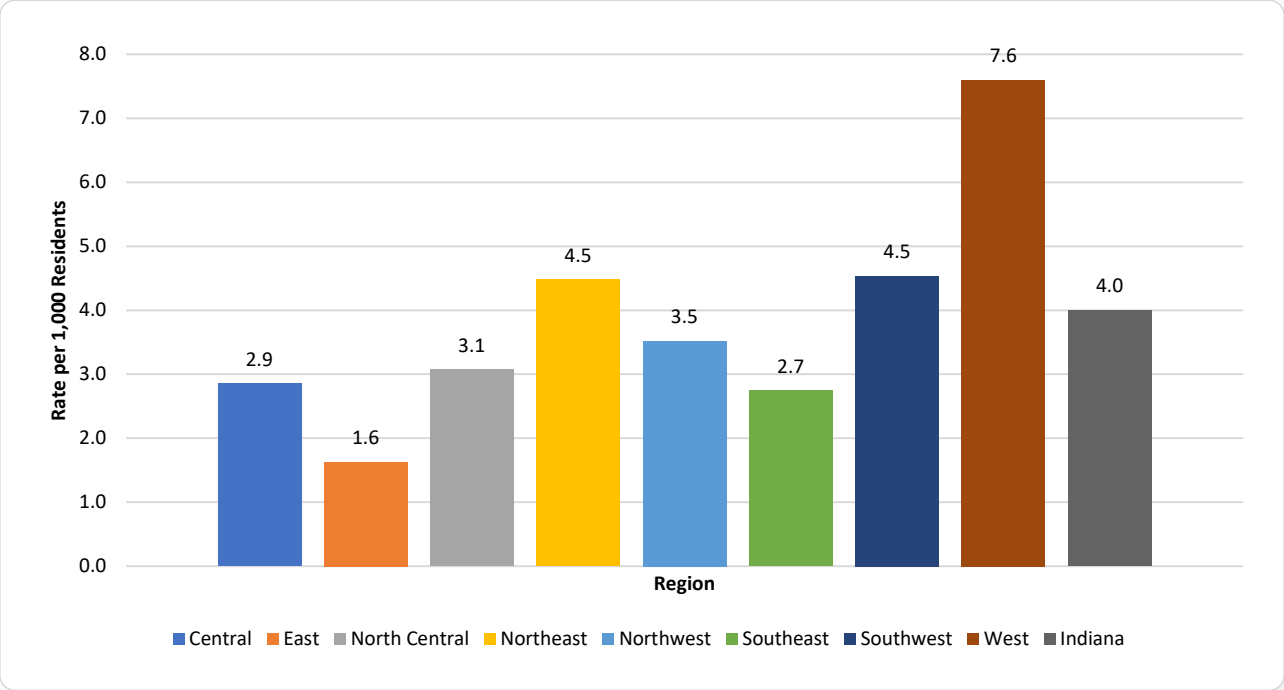
Figure 10: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Methadone



(Indiana MPH PDMP, 2021)

Buprenorphine opioid analgesics dispensations are shown in Figure 11. West (7.6) has the highest dispensation rate, followed by Northeast (4.5) and Southwest (4.5). Indiana (4.0) has a higher rate than Northwest (3.5), North Central (3.1), Central (2.9), Southeast (2.7), and East (1.6)

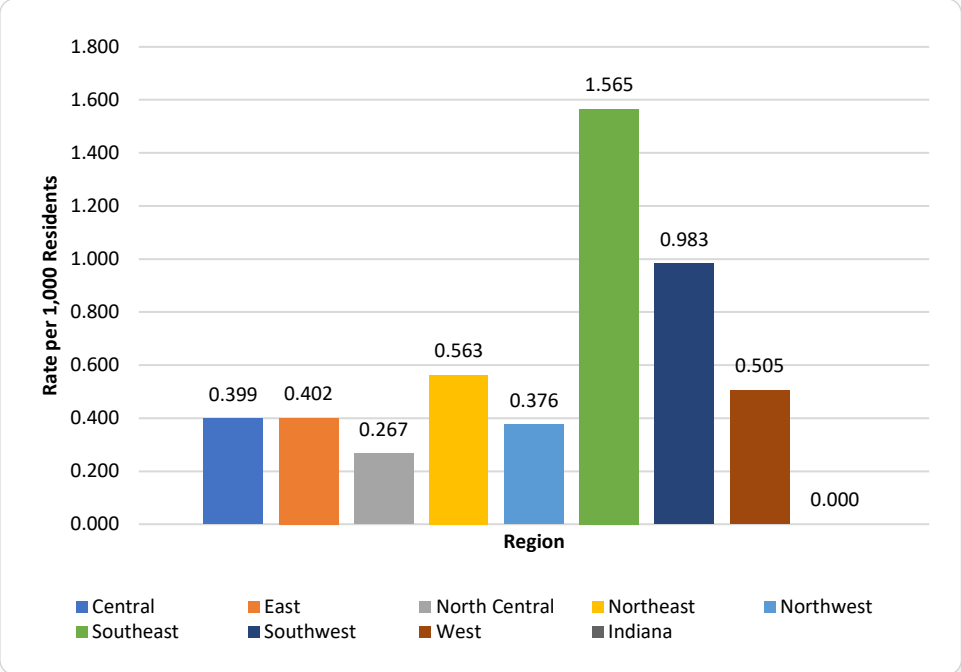
Figure 11: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Buprenorphine



(Indiana MPH PDMP, 2021)

Dispensation of butorphanol opioid analgesics are shown in Figure 12 . Southeast (1.6) has the highest rate, followed by Central (1.0), Northeast (0.6), and West (0.5). Central, East, and Northwest all have a dispensation rate of 0.4. Northwest (0.4) and North Central (0.3) have the lowest dispensation rates..

Figure 12: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Butorphanol*

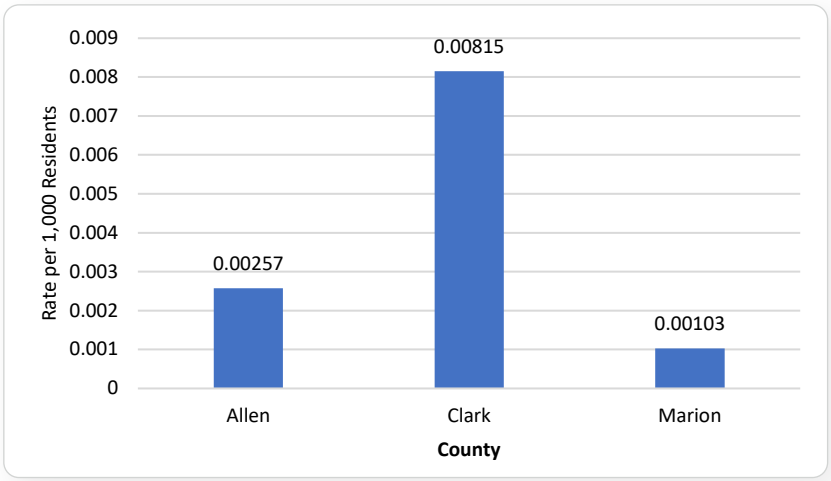


(Indiana MPH PDMP, 2021)

*Data was missing for following counties:
Central: Hancock
East: Blackford, Jay, Rush, Union
North Central: Fulton, Marshall, Miami, Wabash
Northeast: Huntington, LaGrange, Steuben
Northwest: Jasper, Newton, Starke
Southeast: Brown, Decatur, Jackson, Jennings, Ohio, Ripley, Switzerland
Southwest: Martin, Perry, Pike
West: Carroll, Clinton, Fountain, Montgomery, Owen, Putnam, Tippecanoe, Warren

Figure 13 shows dispensations data for dihydrocodeine opioid analgesics. Of the counties that had data available, Clark (0.00815) had the highest dispensation rate, followed by Allen (0.00257) and Marion (0.00103).

Figure 13: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Dihydrocodeine

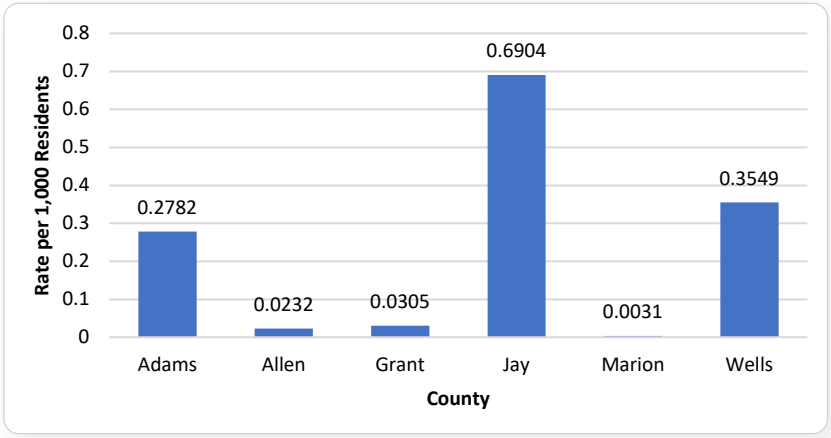


(Indiana MPH PDMP, 2021)
Note: County-level data only available for Allen, Clark, and Marion.

Dispensations data for Levorphanol opioid analgesics are shown in Figure 14. Jay County (0.6904) has the rate of the counties available, followed by Wells (0.3549), Adams (0.2782), Grant (0.0305), Allen (0.0232) and Marion (0.0031).

Note: County-level data only available for Adams, Allen, Grant, Jay, Marion, and Wells.

Figure 14: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Levorphanol

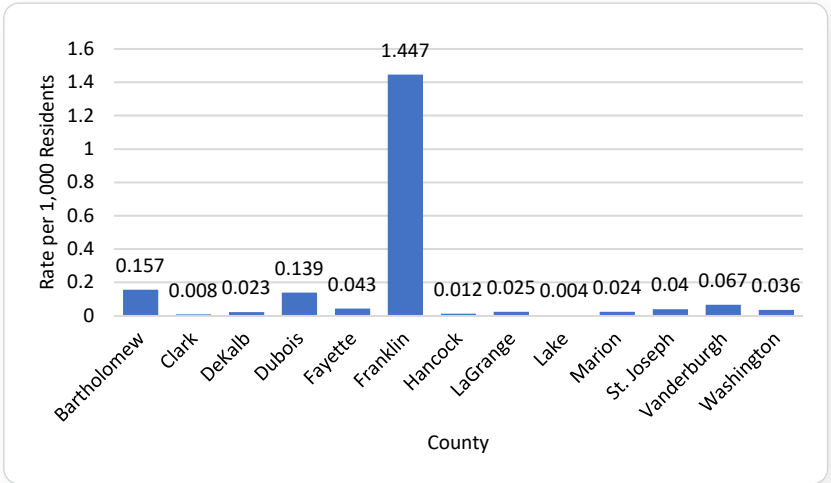


(Indiana MPH PDMP, 2021)

Data regarding dispensations of meperidine opioid analgesics are shown in Figure 15. Of the counties with data available, Franklin (1.447) has the highest dispensation rate, followed by Bartholomew (0.157), Dubois (0.139), Vanderburgh (0.067), Fayette (0.043), Lake (0.040), St. Joseph (0.040), Washington (0.036), LaGrange (0.025), Marion (0.024), DeKalb (0.023), Hancock (0.012), and Clark (0.008).

Note: County-level data are only available for Bartholomew, Clark, DeKalb, Dubois, Fayette, Franklin, Hancock, LaGrange, Lake, Marion, St. Joseph, Vanderburgh, and Washington.

Figure 15: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Meperidine

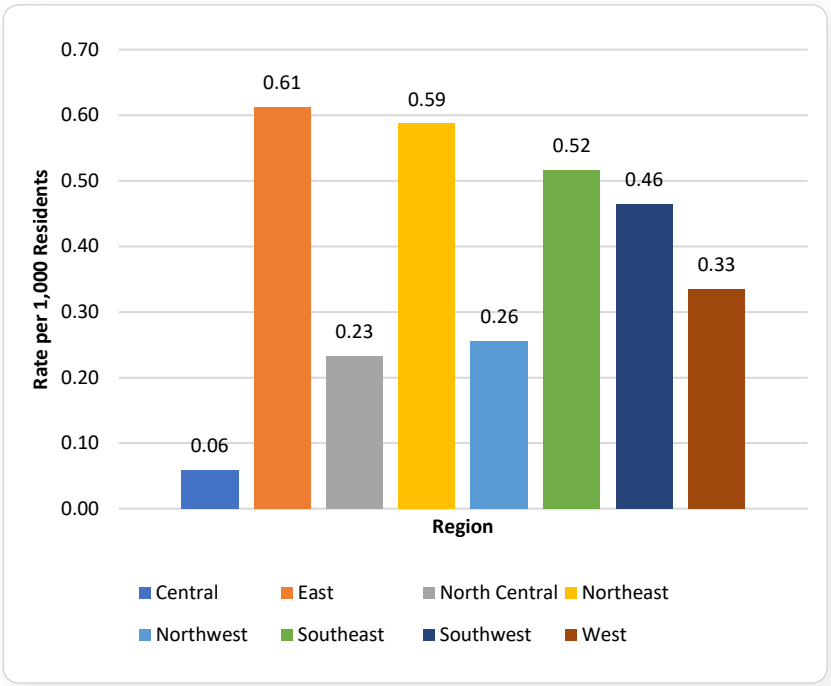


(Indiana MPH PDMP, 2021)

Opioid analgesics dispensations of naloxone; pentazocine are shown in Figure 16. East (0.61) and Northeast (0.59) have the highest dispensations, followed by Southeast (0.52), Southwest (0.46), West (0.33), Northwest (0.26), North Central (0.23), and Central (0.06).

Missing counties:
Central: Morgan
East: Blackford, Jay
North Central: Tipton
Northeast: Adams, LaPorte, Whitley
Northwest: Newton
Southeast: Decatur, Franklin, Harrison, Jackson, Jennings, Lawrence, Ohio, Ripley, Scott, Washington
Southwest: Greene, Posey
West: Carroll, Clinton, Fountain, Putnam, Sullivan, Vermillion, Warren, White

Figure 16: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Naloxone; Pentazocine

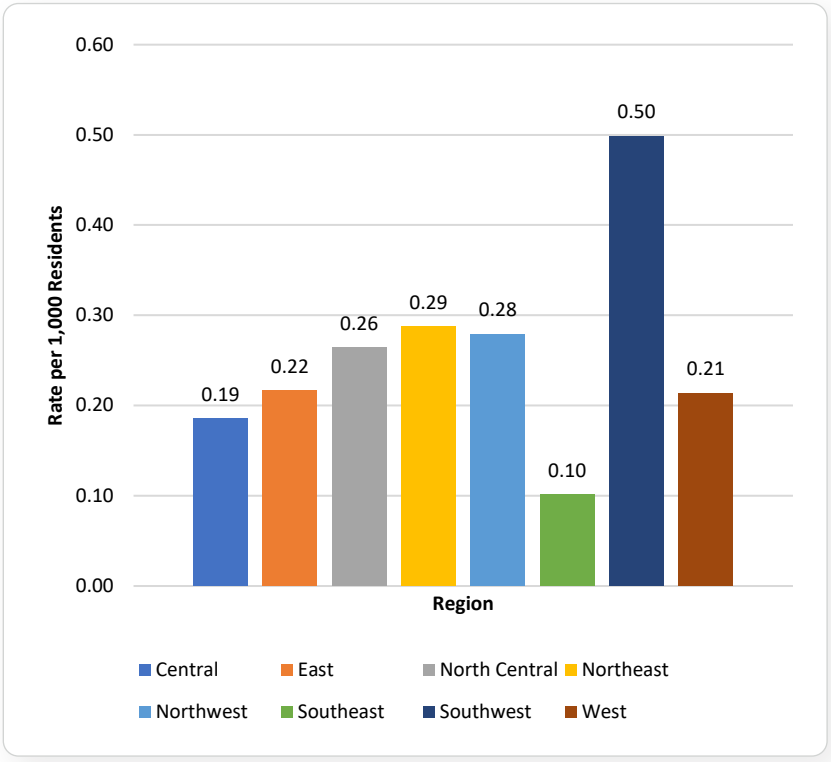


(Indiana MPH PDMP, 2021)

Opioid analgesics dispensations of oxymorphone are shown in Figure 17. The Southwest Region (0.50) has the highest dispensation rate, followed by Northeast (0.29), Northwest (0.28), North Central (0.26), East (0.22), West (0.21), Central (0.19), and Southeast (0.10).

Missing counties:
Central: Boone
East: Blackford, Jay, Randolph, Rush, Union
North Central: Fulton, Kosciusko, Miami
Northeast: Adams, LaGrange, Whitley
Northwest: Jasper, Newton, Pulaski, Starke
Southeast: Bartholomew, Brown, Crawford, Dearborn, Decatur, Franklin, Harrison, Jackson, Jefferson Ohio, Orange, Washington
Southwest: Dubois, Greene, Pike, Posey
West: Benton, Carroll, Clay, Clinton, Fountain, Montgomery, Owen, Sullivan, Vermillion

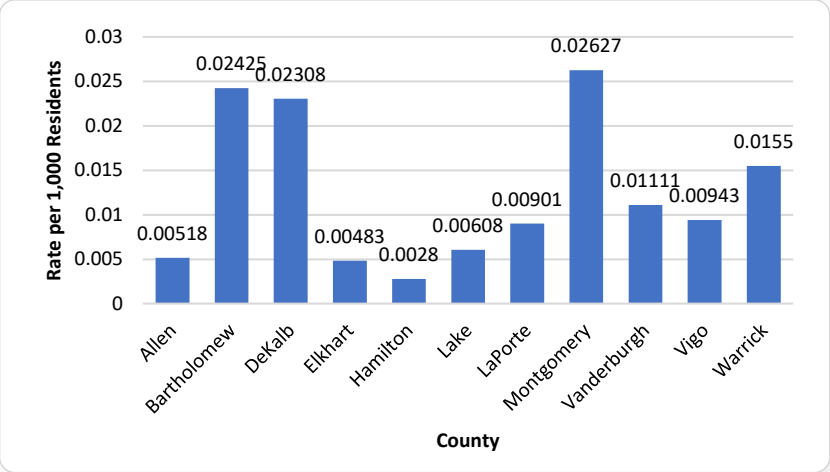
Figure 17: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Oxymorphone



(Indiana MPH PDMP, 2021)

Tapentadol opioid analgesics dispensations are shown in Figure 18. Of the counties that have available data, Montgomery County (0.02627) has the highest dispensation rate, followed by Bartholomew (0.02425), DeKalb (0.02308), Warrick (0.0155), Vanderburgh (0.01111), Vigo (0.00943), LaPorte (0.00901), Lake (0.00608), Allen (0.00518), Elkhart (0.00483), and Hamilton (0.0028).

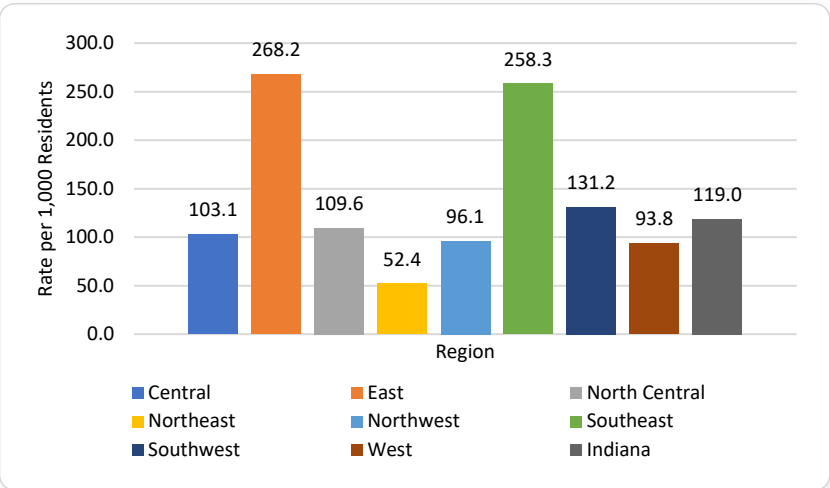
Figure 18: Opioid Analgesics Dispensations per 1,000 Residents, 2021: Tapentadol



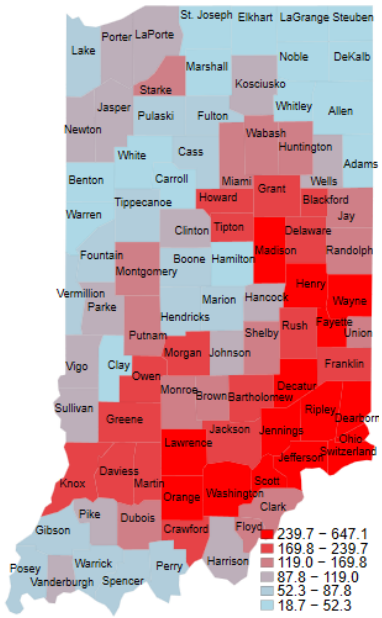
(Indiana MPH PDMP, 2021)
Note: County-level data only available for Allen, Bartholomew, DeKalb, Elkhart, Hamilton, Lake, LaPorte, Montgomery, Vanderburgh, Vigo, and Warrick.

Figure 19 shows data on dispensations of opioid antagonists and addiction treatments. East (268.2) has the highest dispensation rate, followed by Southeast (258.3) and Southwest (131.2), of which all have a higher rate than Indiana (119.0). Indiana has a higher dispensation rate than North Central (109.6), Central (103.1), Northwest (96.1), West (93.8), and Northeast (52.4).

Figure 19: Opioid Antagonists and Addiction Treatments Dispensations per 1,000 Residents, 2021: Any Opioid



(Indiana MPH PDMP, 2021)



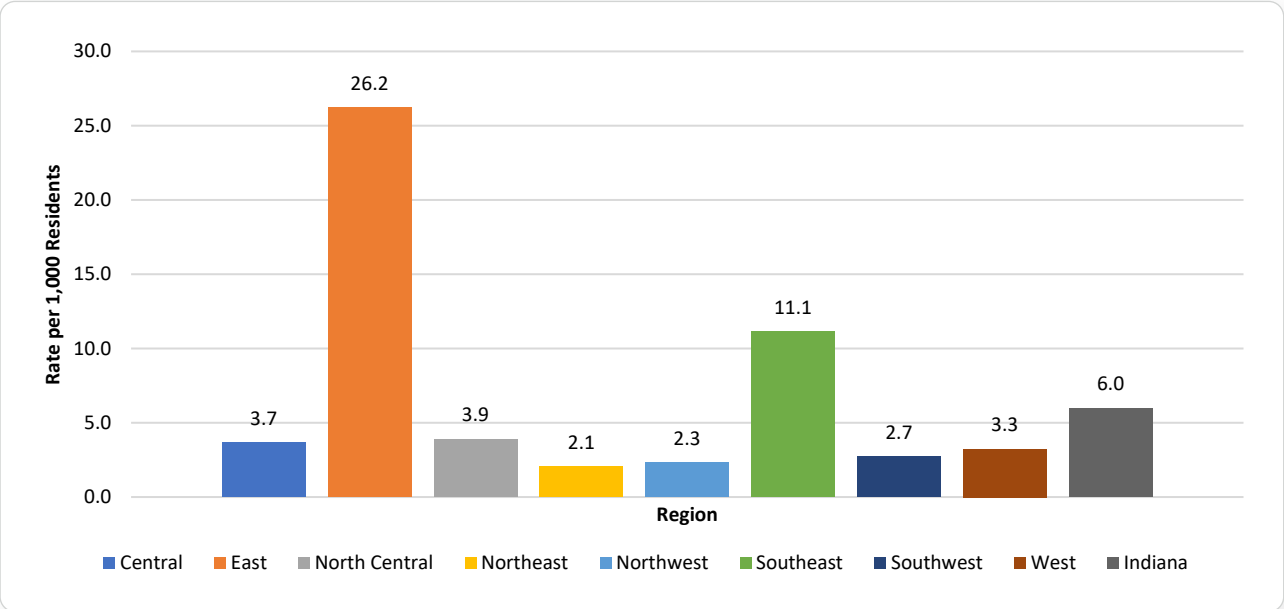
Map 9 shows the county-level data that depicts 2021 opioid antagonists and addiction treatments dispensations per 1,000 residents.
The counties with relatively higher dispensations are primarily found in the southern, eastern, and central parts of Indiana.

Map 9: Opioid Antagonists and Addiction Treatments Dispensations per 1,000 Residents, by county in 2021: Any Opioid

(Indiana MPH PDMP, 2021)

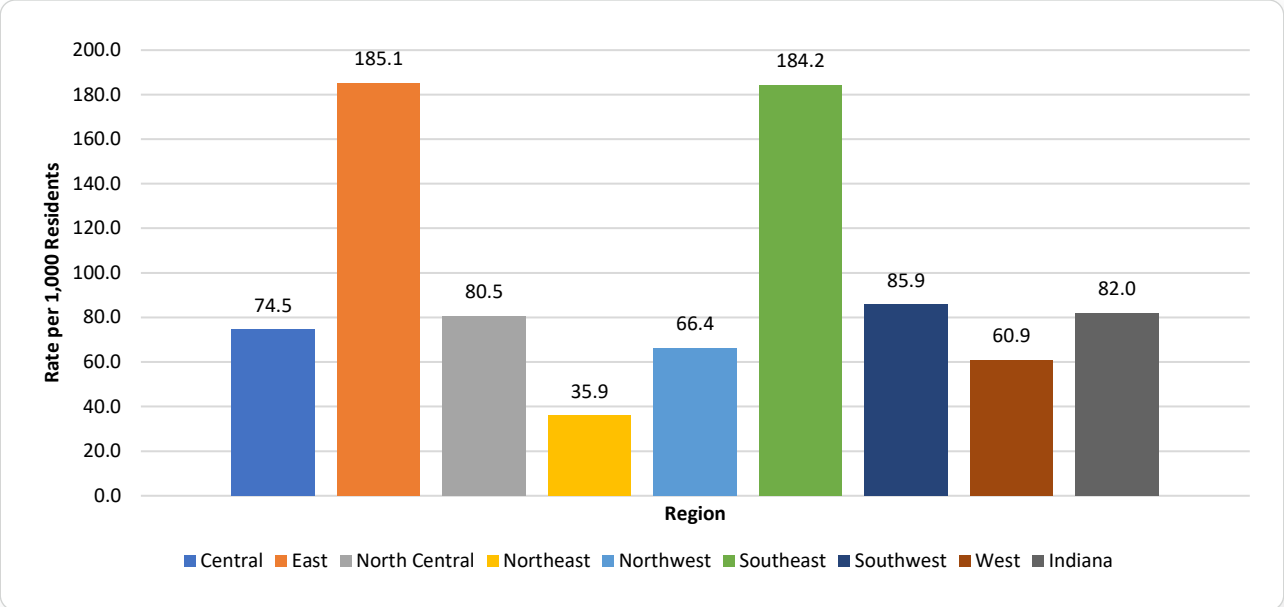
Indiana PDMP provides further data on dispensations of opioid antagonists and addiction treatments in the form of buprenorphine. East (26.2) and Southeast (11.1) both have a higher dispensation rate than Indiana (6.0). North Central (3.9), Central (3.3), West (3.3), Southwest (2.7), Northwest (2.3) and Northeast (2.1) all have lower dispensation rates than Indiana.

Figure 20: Opioid Antagonists and Addiction Treatments Dispensations per 1,000 Residents, 2021: Buprenorphine



(Indiana MPH PDMP, 2021)

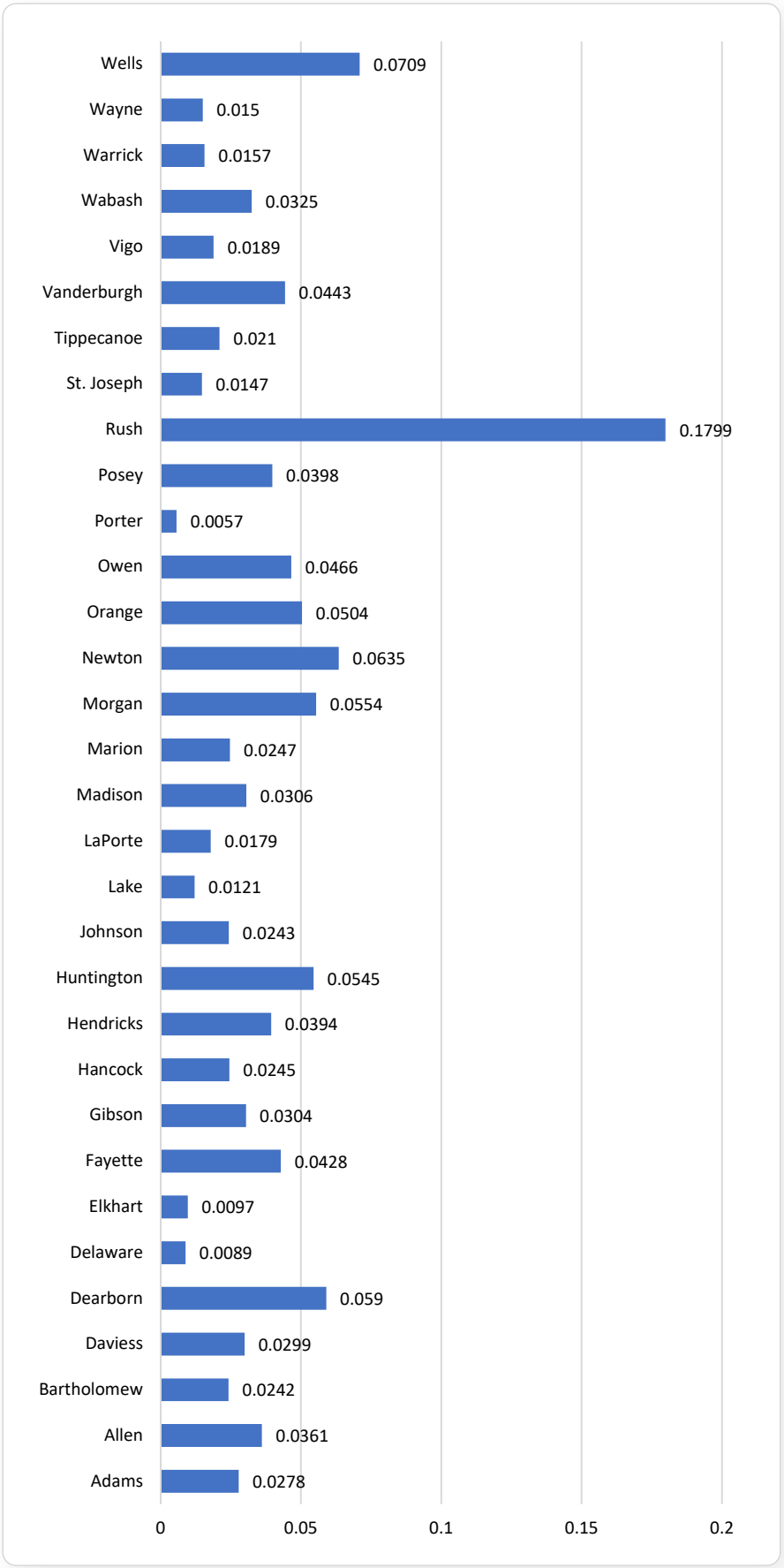
Figure 21: Opioid Antagonists and Addiction Treatments Dispensations per 1,000 Residents, 2021: Buprenorphine; Naloxone



(Indiana MPH PDMP, 2021)

Figure 22: Opioid Antagonists and Addiction Treatments Dispensations per 1,000 Residents, 2021: Naloxone

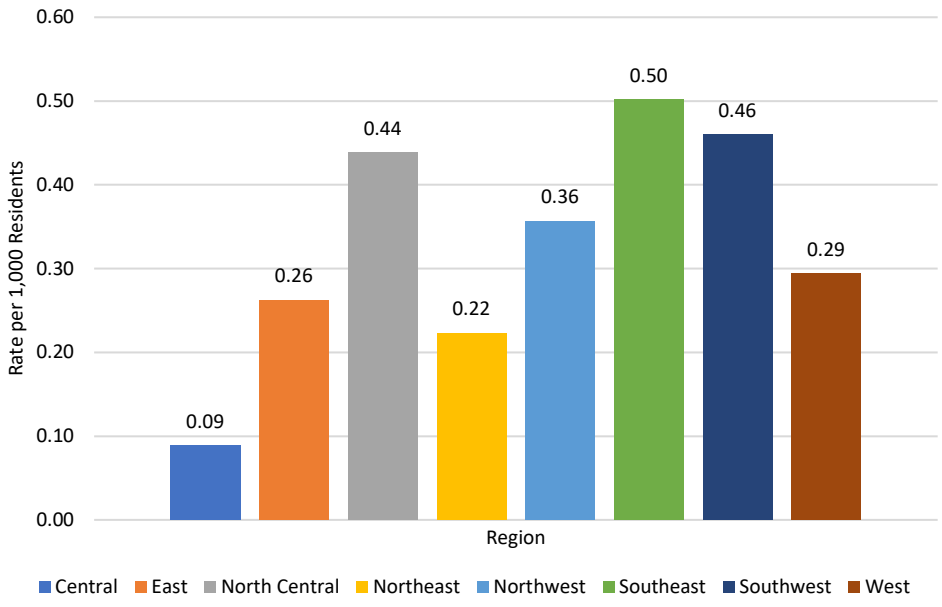
Buprenorphine; naloxone opioid antagonists and addiction treatments dispensations are shown in Figure 21. The East Region (185.1) has the highest dispensation rate, followed by Southeast (184.2) and Southwest (85.9), all of which have higher rates than Indiana (82.0). Regions that have a lower rate than Indiana are North Central (80.5), Central (74.5), Northwest (66.4), West (60.9), and Northeast (35.9). Figure 22 shows rate by county



(Indiana MPH PDMP, 2021)

Figure 23 shows dispensations of opioid-containing antidiarrheals/antitussives. Southeast had the highest dispensation rate of 0.51, followed by Southwest (0.46), North Central (0.45), Northwest (0.36), West (0.30), East (0.28), Northeast (0.24), and Central (0.09). Indiana (0.0) had a lower rate than the unweighted averages of all regions. Figure 24 shows rates by county.

Figure 23: Opioid-containing Antidiarrheals/antitussives Dispensations per 1,000 Residents, 2021: Any Opioid



Missing counties:
East: Blackford
Southeast: Brown, Crawford
Southwest: Martin, Pike
West: Fountain

(Indiana MPH PDMP, 2021)

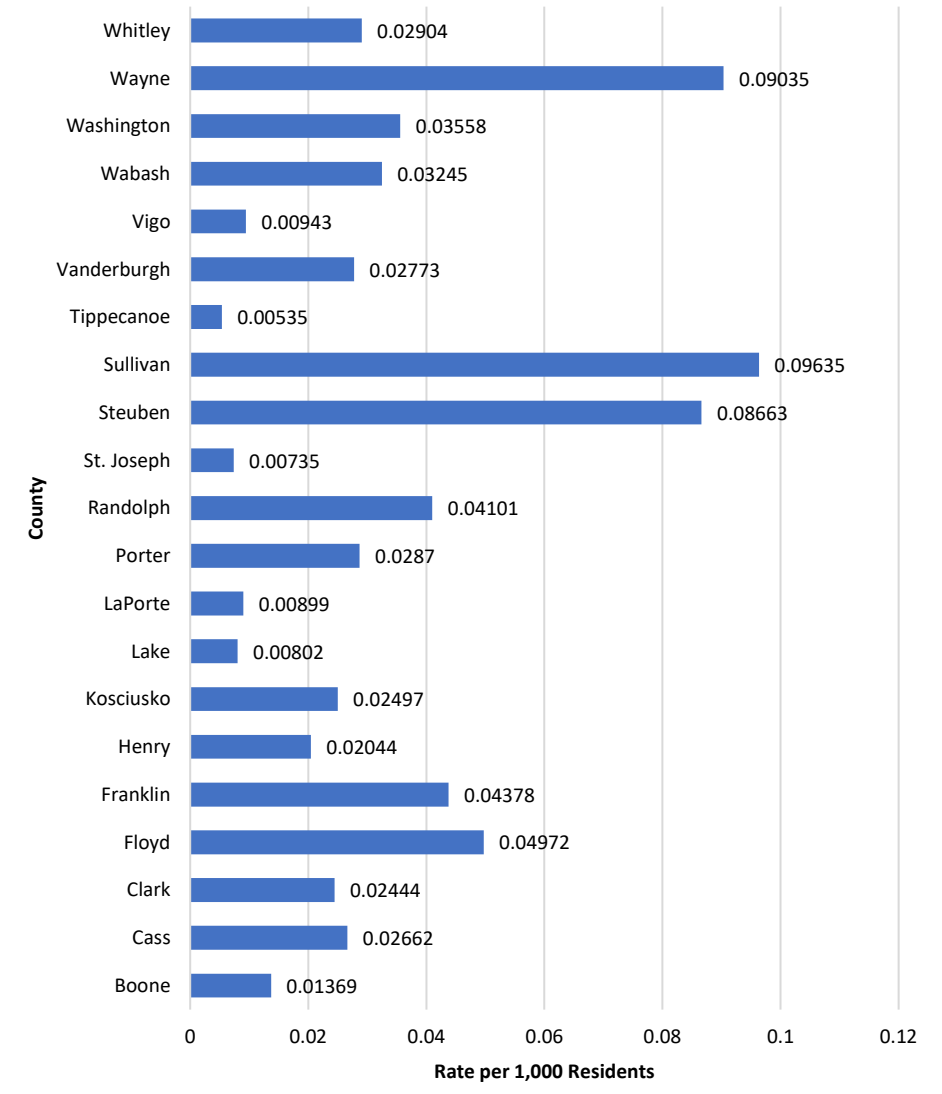
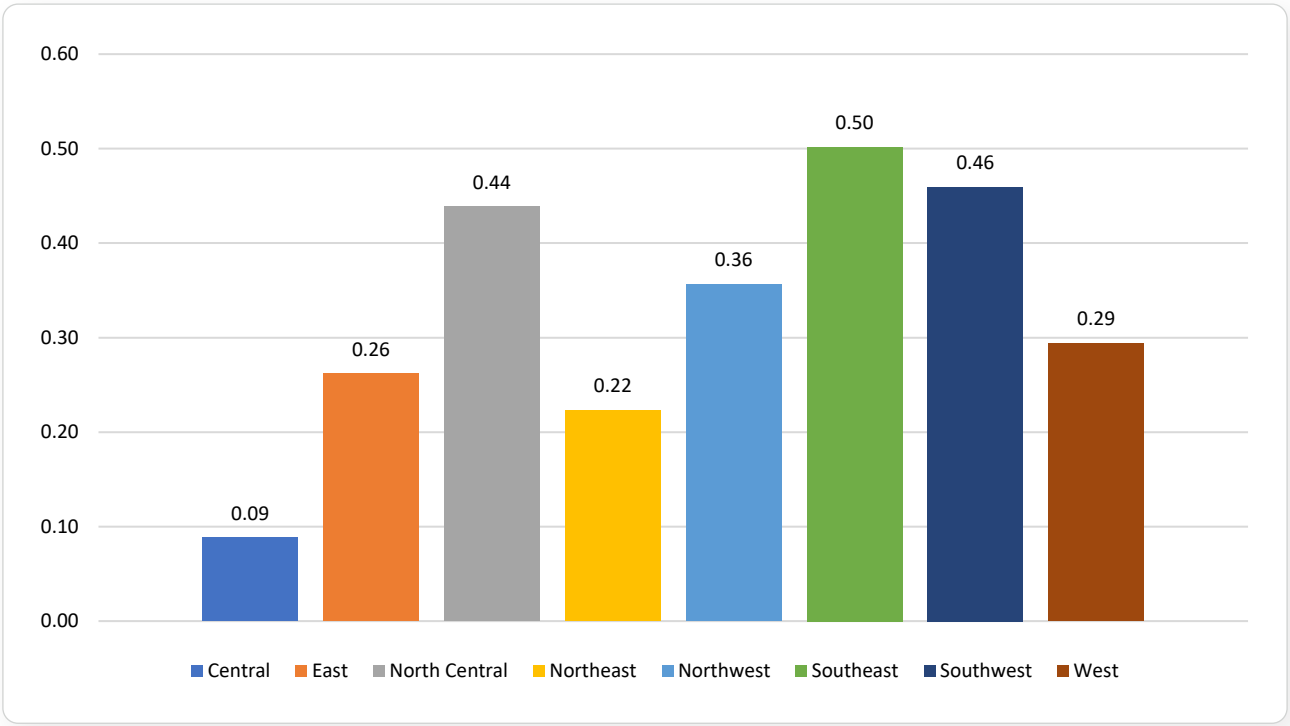


Figure 24: Opioid-containing Antidiarrheals/antitussives Dispensations per 1,000 Residents, 2021: Any Opioid

(Indiana MPH PDMP, 2021)

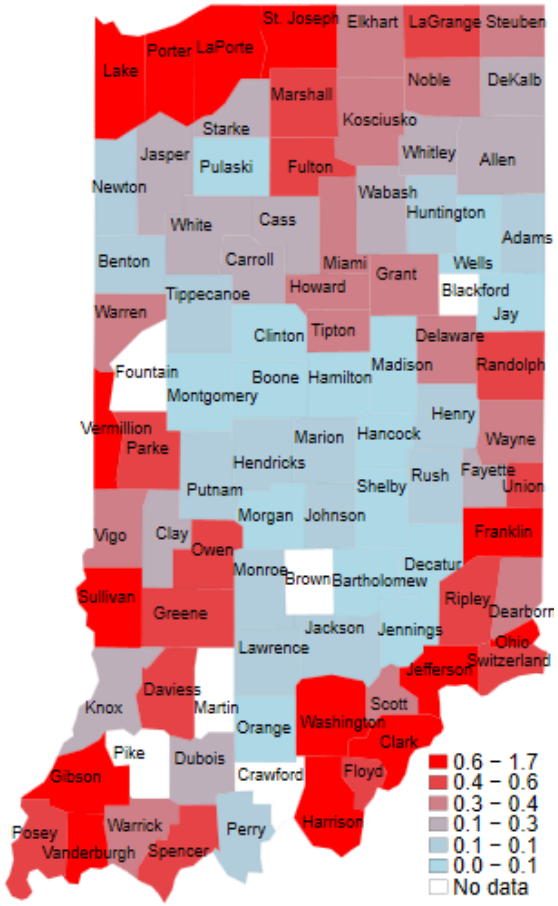
Figure 25 shows the codeine; promethazine opioid-containing antidiarrheals/antitussives dispensations data. Southeast (0.50) has the highest dispensation rate, followed by Southwest (0.46), North Central (0.44), Northwest (0.36), West (0.29), East (0.26), Northeast (0.22) and Central (0.09). The Indiana rate of 0.0 is lower than all the regions as a result of missing data points.

Figure 25: Opioid-containing Antidiarrheals/antitussives Dispensations per 1,000 Residents, 2021: Codeine; Promethazine



(Indiana MPH PDMP, 2021)

Missing counties:
East: Blackford
Southeast: Brown, Crawford
Southwest: Martin, Pike
West: Fountain



Map 10 depicts 2021 county-level dispensations per 1,000 residents of opioid-containing antidiarrheals/antitussives.

The counties that have the highest dispensations tend to be located along the state borders with each of Indiana's neighbors.

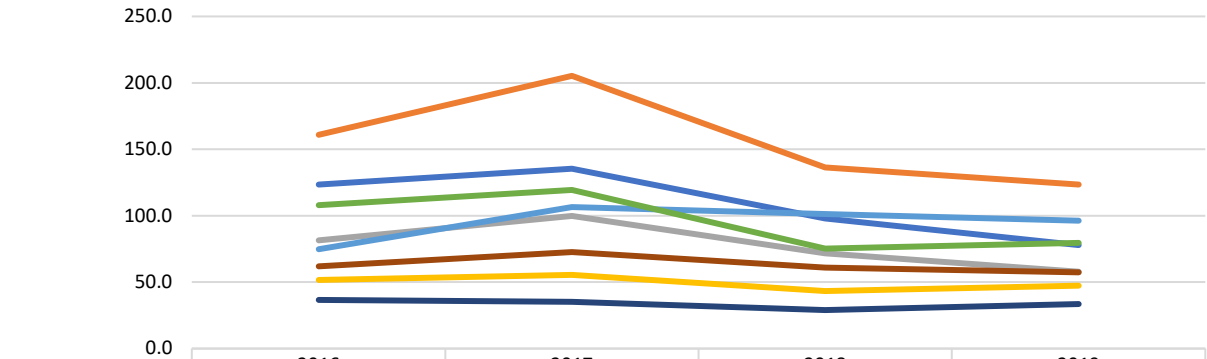
Map 10: Opioid-containing Antidiarrheals/ antitussives Dispensations per 1,000 Residents, by county in 2021: Any Opioid

(Indiana MPH PDMP, 2021)

Emergency Department Visits

In this section, we show regional trends in ED visits. We use data from the Indiana Department of Health at the county level on non-fatal emergency department visits involving any opioid overdose. Rates per 100,000 residents are obtained. Figure 26 shows the regional trends and Map 11 shows the 2019 data of non-fatal emergency department visits for any opioid overdose across all counties in Indiana.

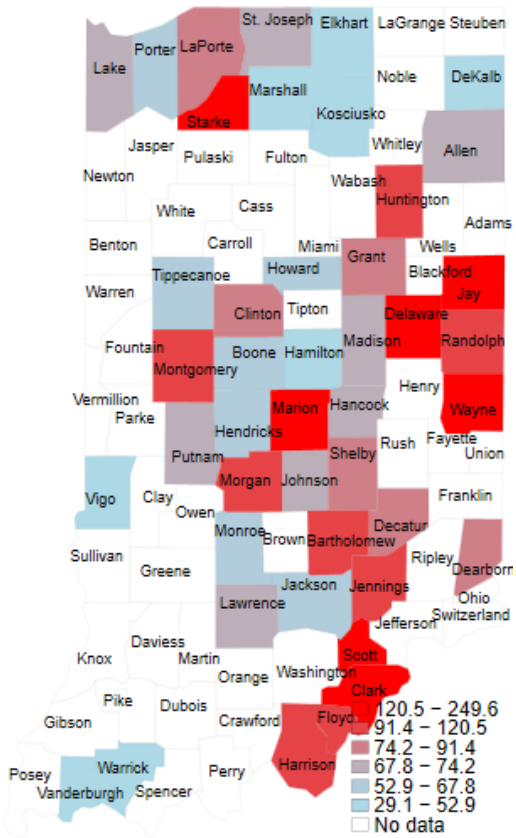
Figure 26: Non-Fatal Emergency Department Visits Involving Any Opioid Overdose, Rate per 100k



	2016	2017	2018	2019
Central	123.6	135.3	97.9	78.0
East	160.8	205.3	136.2	123.5
North Central	81.4	99.9	71.6	57.7
Northeast	51.5	55.4	43.3	47.3
Northwest	74.8	106.5	101.3	96.3
Southeast	108.0	119.4	75.2	79.5
Southwest	36.7	35.2	28.8	33.5
West	61.9	72.7	60.9	57.3

Central East North Central Northeast Northwest Southeast Southwest West

(IDOH Stats Explorer, 2016-2019)
**Includes missing data, so averages do not account for those missing*



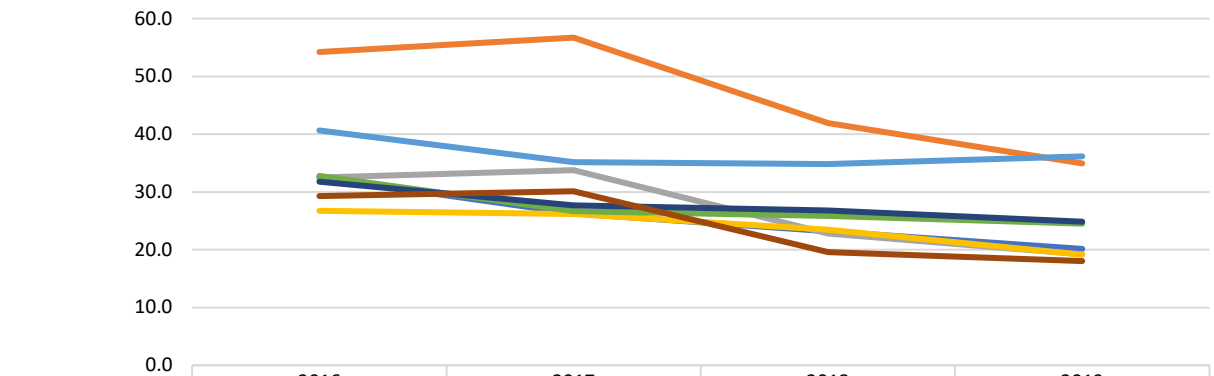
We find that counties with the highest rate tend to be located in the eastern, central, and northwestern parts of the state.

Map 11: Non-Fatal Emergency Department Visits Involving Any Opioid Overdose, Rate per 100k, by county in 2019

(IDOH Stats Explorer, 2019)

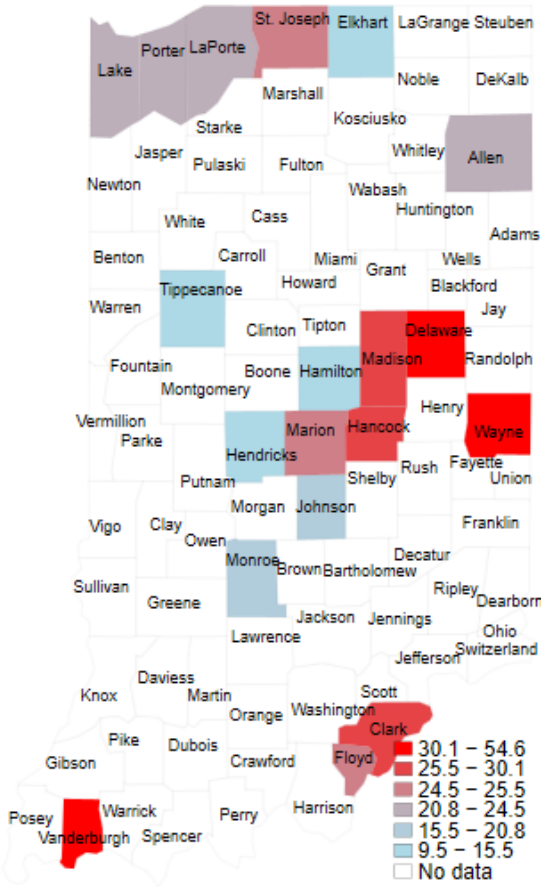
Next, we obtain data from the 2019 IDOH Stats explorer was used to create a county-level map depicting rates per 100,000 residents of non-fatal inpatient hospitalizations involving any opioid overdose. Figure 27 shows the trends across regions. Eastern and Northwestern regions appear to have highest hospitalization rates relative to other regions.

Figure 27: Non-Fatal Inpatient Hospitalizations Involving Any Opioid Overdose, Rate per 100k



	2016	2017	2018	2019
Central	32.5	26.3	23.2	20.1
East	54.2	56.7	41.9	35.0
North Central	32.5	33.8	22.8	19.2
Northeast	26.7	26.2	23.4	19.1
Northwest	40.7	35.1	34.8	36.1
Southeast	32.8	26.7	25.8	24.5
Southwest	31.8	27.7	26.8	24.9
West	29.3	30.1	19.6	18.1

(IDOH Stats Explorer, 2016-2019)
**Includes missing data, so averages do not account for those missing*



Map 12 shows non-fatal inpatient hospitalization rates involving any opioid overdose for the counties where data is available. Of the counties that have available data, data suggests that the counties with the highest rates are Starke, Pulaski, Clinton, Blackford, Delaware, Wayne, Fayette, and Vanderburgh.

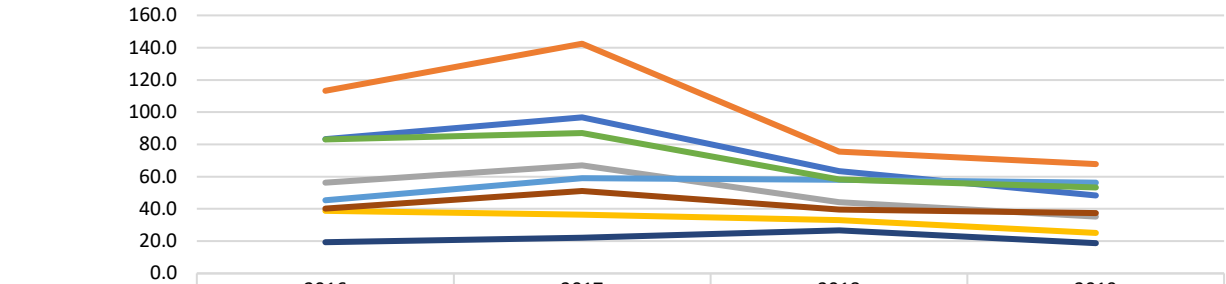
Map 12: Non-Fatal Inpatient Hospitalizations Involving Any Opioid Overdose, Rate per 100k, by county in 2019

(IDOH Stats Explorer, 2019)

Next, we use data from the 2019 IDOH Stats Explorer is used to depict county-level data of non-fatal emergency department visits involving heroin overdose per 100,000 residents.
We focus only on the counties with available data, the data suggests that the counties with the highest rates are LaPorte, Starke, Pulaski, Jay, Delaware, Wayne, Marion, Scott, Clark, and Floyd.

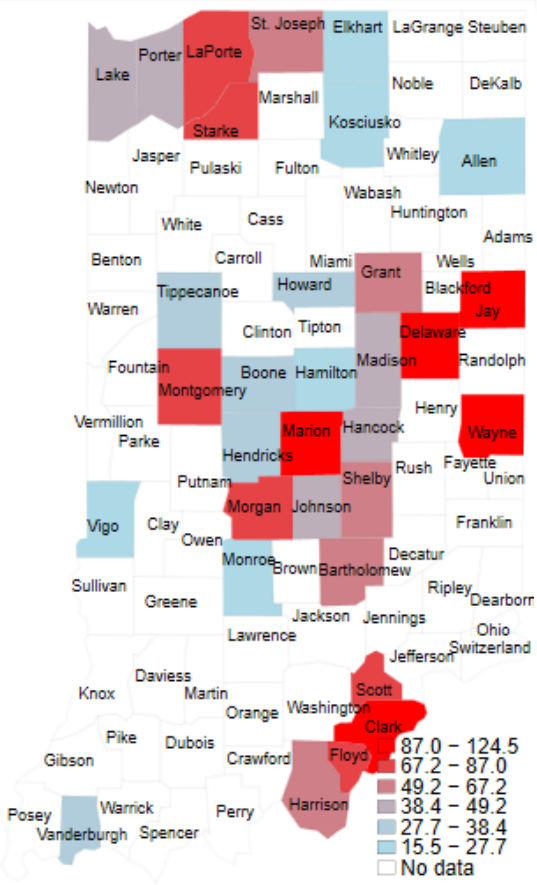
Figure 28 shows the regional trends and Map 13 shows the rates of non-fatal emergency department visits involving heroin across counties in 2019.

Figure 28: **Non-Fatal Emergency Department Visits Involving Heroin Overdose, Rate per 100k**



	2016	2017	2018	2019
Central	83.2	96.9	63.5	48.4
East	113.4	142.5	75.7	67.8
North Central	56.3	67.0	44.2	35.2
Northeast	38.8	36.4	33.1	25.0
Northwest	45.5	59.0	58.2	56.2
Southeast	83.2	87.2	58.4	53.2
Southwest	19.4	22.2	26.7	18.8
West	40.3	51.2	39.5	37.4

(IDOH Stats Explorer, 2016-2019)
**Includes missing data, so averages do not account for those missing*



Map 13: **Non-Fatal Emergency Department Visits Involving Heroin Overdose, Rate per 100k, by county in 2019**

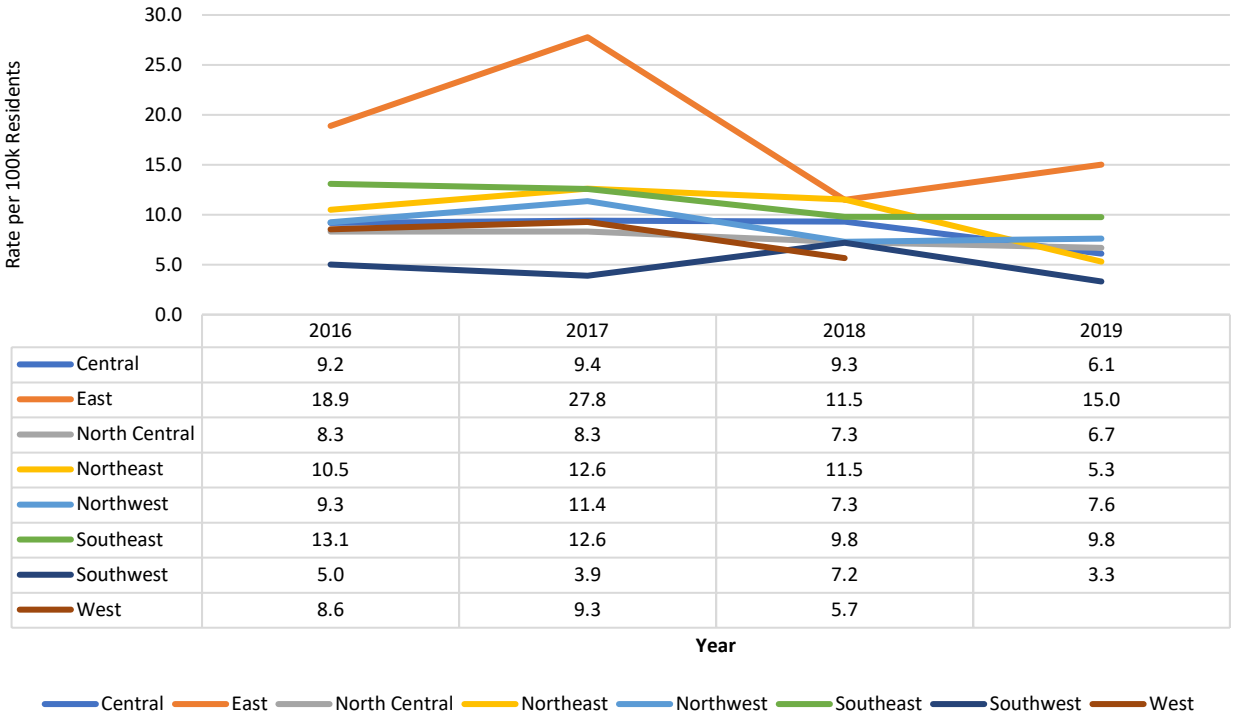
(IDOH Stats Explorer, 2019)

Next, we use data from the 2019 IDOH Stats Explorers is used to provide county-level non-fatal inpatient hospitalizations involving heroin overdose per 100,000 residents.

Of the counties that have data available, data suggests that Delaware, Wayne, and Fayette have the highest rates. LaPorte, Marion, and Floyd also have relatively higher rates than some of the other counties.

Figure 29 shows regional trends.

Figure 29: Non-Fatal Inpatient Hospitalizations Involving Heroin Overdose, Rate per 100k



	2016	2017	2018	2019
Central	9.2	9.4	9.3	6.1
East	18.9	27.8	11.5	15.0
North Central	8.3	8.3	7.3	6.7
Northeast	10.5	12.6	11.5	5.3
Northwest	9.3	11.4	7.3	7.6
Southeast	13.1	12.6	9.8	9.8
Southwest	5.0	3.9	7.2	3.3
West	8.6	9.3	5.7	

(IDOH Stats Explorer, 2016-2019)

**Includes missing data, so averages do not account for those missing*

Within Indiana in 2019, opioids were involved in 67.8% of all drug overdose deaths. Heroin was a factor in 28.2% and prescription opioids were a factor in 33.5% of opioid-involved deaths. Between 2013-2017, the counties in Indiana with highest number of overdose deaths were Fayette, Wayne, and Scott counties (Indiana State Department of Health, 2019).

A review published in 2019 assessed group differences in opioid-involved overdose deaths in various metro areas between 2015 and 2017. In the United States in 2017, approximately 47,600 individuals died from opioid-involved overdoses. Nearly 60% of these deaths involved synthetic opioids. The findings of this review identified that all racial/ethnic and age groups displayed statistically significant rises in opioid-involved overdose deaths (Lippold et. al. 2019). Indiana in 2017, individuals aged 30-39 accounted for 30% of opioid-involved deaths, which was the largest for any age-group assessed, and the 18-29 age group had the 2nd highest number of opioid-involved deaths. Although the most overdose deaths occurred in the Caucasian population, Black Americans in large central metro areas aged 45-64 experienced the largest increase in the rates of opioid-involved overdose deaths between 2015-2017 (Indiana State Department of Health, 2019).

The increased rates of opioid misuse and overdoses is linked to findings of opioids being found in street drugs like cocaine, methamphetamine, and others. Additionally, sex differences existed in the rates of overdoses due to opioids. Men accounted for 64% of opioid overdose deaths in 2017, resulting in a higher incidence of overdose deaths compared to women (Indiana State Department of Health, 2019). In terms of racial background, Caucasians have the largest number of opioid-involved deaths in all regions of the United States. Regardless of age group, in metro areas, the rates of increase in opioid-involved deaths from 2015-2017 was significantly higher for Black (central metro: 103%, fringe metro: 100% and Hispanic (central metro: 57%, fringe metro: 75%) populations as compared to Caucasians (central metro: 35%, fringe metro: 50%), and this has been linked to the increased prevalence of opioids being found in more common street drugs (Lippold et al., 2019).

Opioid use: physiologic and psychologic

Opioids bind and act upon receptors throughout the body, and primarily are prescribed for pain management. Frequently, side effects are noticeable in patients and include tolerance to opioids, constipation, sleep disturbances, bladder dysfunction, potentially reduced fertility, and psychomotor issues (Benyamin et al. 2008). Tolerance, or a loss of analgesic efficacy, is a common complication of opioid treatment for chronic pain management and is typically addressed by increasing the dosage (Vuong et al. 2010). Consistent, long-term use of opioids can lead to a need for higher dosages and, eventually, physical dependence (Benyamin et al. 2008, Vuong et al. 2010). When physical dependence occurs, it leads to numerous physiological and psychological changes that may be long lasting (Benyamin et al. 2008, Vuong et al. 2010).

Generally, the immune system, central nervous system, and the endocrine system are all significantly affected by opioid dependence. The immune system is affected by both acute and chronic opioid usage, which lead to inhibitory effects on antibody and cellular responses, phagocyte activity, and natural killer cell activity. Furthermore, severe pain alone causes immunosuppression, and the interaction of opioids may increase the severity of immunosuppression. The effects of opioids on the central nervous system are diverse. These include sleep disturbances, psychomotor impairment, delirium, and toxic effects on neurons within the CNS. The endocrine system is also affected in various ways. Both estrogen and testosterone levels were seen to decrease in response to opioids acutely and chronically. Notably, the reduction of estrogen in women may have implications for osteoporosis and bone fractures as age increases. Overall, the effects of opioid misuse on the physiological systems are far reaching and have significant impacts on quality of life (Benyamin et al. 2008, Vuong et al. 2010).

The relationship between opioid use and mental health is complex. Opioid dependence can cause mental health conditions to arise, and individuals with mental health conditions are at higher risk for developing opioid dependence. Individuals with mental health conditions, approximately 16% of Americans as of 2017, accounted for the receipt of about half of all opioid prescriptions written. It has been indicated that individuals with mental health conditions are more likely to be prescribed opioids and to take them long-term, which increases the likelihood of opioid dependence and further mental health treatment and management challenges (Davis et al. 2017).

Opioid use has been linked to an increased risk of major depressive disorder as well as anxiety and stress-related disorders; the longer the use of opioids, the greater the risk of developing mental health conditions (Scherrer et al. 2016). The data reported was in the form of hazard ratios, which are probabilities of an event occurring in the user group as compared to a control group over a period of time. As compared to use of 30 days or less, users were at higher risk of developing depression when using for 31 to 90 days (hazard ratio: 1.18 - 1.33) and for more than 90 days (hazard ratio: 1.35 – 2.05) (Scherrer et al. 2016). Misuse is known to change brain chemistry, which can lead to the mental health issues noted above. Opioid dependence is also implicated in the dysregulation of reward circuitry. This dysregulation may cause reduced reward sensation and reduced pain relief. The

lack of pain relief, autonomic dysfunction, and endocrine dysfunction are implicated to be probable reasons for the observable symptoms of depression in response to chronic use of opioids (Davis et al. 2017, Scherrer et al., 2016).

Societal impact of opioid use

Crime is a common discussion topic regarding individuals with drug use disorders. Winkelman et al. states, "more than half of individuals with a prescription opioid use disorder or heroin in the past year (2017) reported contact with the criminal justice system… as the level of opioid use increased, involvement with the criminal justice system also increased." Treatment for opioid use is extremely limited when individuals are incarcerated. Research suggests that treatment of opioid use disorders has typically not been available to individuals while incarcerated, and forced withdrawal is common. Evidence also suggests that individuals forced into withdrawal typically do not attempt to re-commit to treatment after completing their sentence. The likelihood of relapse in this population is high and increases the burden placed on the healthcare system (Winkelman et al., 2017).

In addition to opioid-related crime, the opioid crisis has cost the United States trillions of dollars in healthcare costs totaling $4.57 million from 2017-2020. These numbers have also begun to steadily increase since the onset of the COVID-19 pandemic. Before the pandemic, the cost of the opioid-related healthcare burden was slowly decreasing from $1.07 trillion in 2017 to $1.04 trillion in 2018 to $0.99 trillion in 2019. However, in 2020, the burden increased to $1.47 trillion, nearly 150% of the cost in 2019. The federal government is also allocating significant amounts of funding to attempt to combat the opioid crisis. It was reported that nearly $10 billion in funding has been allocated from 2019-2021 to help states fight, track, and develop treatment strategies for the opioid crisis (Joint Economic Committee Democrats, 2022).

Conclusion

In summary, state opioid use trends show that opioids continue to be a significant problem in Indiana. It was identified that misuse rates and the associated consequences were also exacerbated by the COVID-19 pandemic. In an analysis of state regions, it was determined that all but two regions had rates of non-fatal emergency department visits involving opioids > 55 per 100,000 residents, though rates in every region decreased from 2016-2019. Table 1 shows the state-by-state comparisons of opioid dispensation rates and age adjusted overdose death rates. Indiana is ranked 9th and 13th in terms of highest opioid dispensations and overdose deaths, respectively.

Table 1: Opioid dispensation rate and overdose death rates by state (CDC, 2020)

FIPS	STATE	Opioid Dispensing Rate per 100 Residents (CDC, 2020)	Opioid dispensing rate rank	Drug Overdose Death Rate Per 100,000 Residents, age-adjusted (CDC, 2020)	Drug overdose death rate rank
	United States	43.3		28.3	
1	Alabama	80.4	1	22.3	30
2	Alaska	36.1	42	22	31
4	Arizona	40.5	27	35.8	14
5	Arkansas	75.8	2	19.1	37
6	California	28.5	49	21.8	33
8	Colorado	37.5	38	24.9	29
9	Connecticut	37	39	39.1	10
10	Delaware	45.2	24	47.3	3
12	Florida	43.4	25	35	15
13	Georgia	53.9	13	18	41
15	Hawaii	27.3	50	18.3	40

FIPS	STATE	Opioid Dispensing Rate per 100 Residents (CDC, 2020)	Opioid dispensing rate rank	Drug Overdose Death Rate Per 100,000 Residents, age-adjusted (CDC, 2020)	Drug overdose death rate rank
16	Idaho	49.9	16	15.9	44
17	Illinois	40.2	30	28.1	24
18	Indiana	56.9	9	36.7	13
19	Iowa	40.2	30	14.3	47
20	Kansas	59.8	7	17.4	42
21	Kentucky	68.2	5	49.2	2
22	Louisiana	68.3	4	42.7	7
23	Maine	40.3	29	39.7	9
24	Maryland	39.5	34	44.6	6
25	Massachusetts	33.3	45	33.9	17
26	Michigan	54.4	11	28.6	23
27	Minnesota	30.2	48	19	38
28	Mississippi	64.2	6	21.1	34
29	Missouri	54.4	11	32.1	19
30	Montana	46.1	22	15.6	45
31	Nebraska	48	18	11.3	49
32	Nevada	47.4	19	26	27
33	New Hampshire	35.2	43	30.3	22
34	New Jersey	31.8	47	32.1	19
35	New Mexico	40.5	27	39	11
36	New York	31.9	46	25.4	28
37	North Carolina	52.8	15	30.9	21
38	North Dakota	36.7	40	15.6	45
39	Ohio	47.4	19	47.2	4
40	Oklahoma	59.3	8	19.4	36
41	Oregon	45.6	23	18.7	39
42	Pennsylvania	43.1	26	42.4	8
44	Rhode Island	36.5	41	38.2	12
45	South Carolina	56.6	10	34.9	16
46	South Dakota	39.9	32	10.3	50
47	Tennessee	68.5	3	45.6	5
48	Texas	37.9	36	14.1	48
49	Utah	48.4	17	20.5	35

FIPS	STATE	Opioid Dispensing Rate per 100 Residents (CDC, 2020)	Opioid dispensing rate rank	Drug Overdose Death Rate Per 100,000 Residents, age-adjusted (CDC, 2020)	Drug overdose death rate rank
50	Vermont	34.8	44	32.9	18
51	Virginia	37.6	37	26.6	26
53	Washington	39.5	34	22	31
54	West Virginia	53.7	14	81.4	1
55	Wisconsin	39.6	33	27.7	25
56	Wyoming	46.7	21	17.4	42
	Source:	https://www.cdc.gov/drugoverdose/rxrate-maps/state2020.html		https://www.cdc.gov/drugoverdose/deaths/2020.html	

Key Highlights

- There have been 564,000 overdose deaths in the United States since 1990-2020.
- 75% of U.S. overdose deaths in 2020 involved an opioid.
- The COVID-19 pandemic impacted rates of opioid use disorder, with rates increasing from 1.9 million individuals to 2.7 million from 2019-2020.
- Indiana and Ohio are tied for 8th highest among states for opioid misuse.
- From 2013-2017 Fayette, Wayne, and Scott County had the highest number of overdose deaths.
- Individuals aged 30-39 had the highest number of opioid-involved deaths from 2015-2017.
- In Indiana, males have higher rates of opioid related overdoes than females.
- Half of the opioid prescriptions written in America are connected to individuals with mental health conditions.
- Opioid use is linked to an increased risk of major depressive disorder, anxiety, and stress related disorders.
- There are limited services to address opioid use disorder in the criminal justice system while more than half of individuals with prescription opioid use disorder reported having contact with the criminal justice system.
- The opioid crisis cost the United States $4.57 trillion dollars from 2017-2020.

There are limited services to address opioid use disorder in the criminal justice system while more than half of individuals with prescription opioid use disorder reported having contact with the criminal justice system.

	Central	East	North Central	Northeast	Northwest	Southeast	Southwest	West
Non-Fatal ED Visits, Opioid Overdose (per 100k);								
IDOH Stats Explorer, 2019	78.0	123.5	57.7	47.3	96.3	79.5	33.5	57.3
Non-Fatal ED Visits, Heroin Overdose (per 100k);								
IDOH Stats Explorer, 2019	48.4	67.8	35.2	25.0	56.2	53.2	18.8	37.4
Non-Fatal Inpatient Hospitalizations, Opioid Overdose (per 100k);								
IDOH Stats Explorer, 2019	20.1	35.0	19.2	19.1	36.1	24.5	24.9	18.1
Non-Fatal Inpatient Hospitalizations, Heroin Overdose (per 100k);								
IDOH Stats Explorer, 2019	6.1	15.0	6.7	5.3	7.6	9.8	3.3	
Opioid Dispensations (per 1,000);								
IDOH Stats Explorer, 2019 Q2	189.7	275.9	217.7	168.4	247.0	258.0	248.7	196.7
Opioid Analgesics Dispensations (per 1,000);								
Indiana PDMP, 2021	574.6	804.1	672.2	551.4	735.6	727.0	778.9	599.0
Opioid Antagonists and Addiction Treatments Dispensations (per 1,000);								
Indiana PDMP, 2021	103.1	268.2	109.6	52.4	96.1	258.3	131.2	93.8
Opioid-containing Antidiarrheals/antitussives (per 1,000);								
Indiana PDMP, 2021	0.09	0.28	0.45	0.24	0.36	0.51	0.46	0.30

Key Highlights

- East Indiana had the highest rate of tramadol opioid, morphine opioid, fentanyl opioid, naloxone, dispensation while northeast has the lowest rate.
- Southeast Indiana had the highest rate of oxycodone opioid, hydromorphone opioid, butorphanol opioid, opioids containing antidiarrheals/antitussives, promethazine opioids containing antidiarrheals/antitussives dispensations.
- Northwest Indiana had the highest rate of codeine opioid dispensations.
- Northeast Indiana had the highest rate of methadone opioid dispensations.
- West Indiana had the highest rate of buprenorphine opioid dispensations.
- Southwest Indiana had the highest rate of oxymorphone dispensations.
- East and Southeast Indiana had the highest rate of dispensation of opioid antagonist and addiction treatments in the form of buprenorphine.
- East Indiana has the highest rate of naloxone opioid antagonist and addiction treatments.
- Highest counties with non-fatal emergency department visits involving opioids are eastern, central, and northwestern areas of Indiana.

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This report was funded by the Indiana Division of Mental Health and Addiction (DMHA).
The views expressed here do not necessarily reflect the views of the DMHA

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