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# Maternal and Newborn Inpatient Stays with a Substance Use or Use-Related Diagnosis

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The potential effects of maternal substance abuse and dependence — including the use of opioids, amphetamines, cocaine and alcohol — on unborn and newborn children are concerning. Among others, these effects may include a constellation of short-term symptoms generally categorized as drug withdrawal syndrome, as well as preterm labor and newborns small for gestational age, plus co-occurring diagnoses such as respiratory distress syndrome.[i] Although not universally accepted, some studies have also suggested that in utero exposure to some of these substances may increase the risk for long-term conditions associated with abnormal neurodevelopment.[ii]

In a recent national report developed by the Healthcare Cost and Utilization Project (H-CUP), trends in maternal and newborn hospital stays that included substance use or use-related diagnoses were examined for 2006 to 2012.[iii] Using the case definitions from that national report, in this report we take a more detailed look at Washington's residents' maternal hospital stays that include substance use diagnoses; assess trends in use over a longer time period; and examine the trends and rates of substance use-related conditions seen in newborns. In addition, because of the increases seen in Washington's rates for maternal opiate, marijuana and amphetamine use, we identify high-rate regions and communities, and examine the rates among newborns in those areas for conditions associated with substance use exposure.

## Background

Figure 1
Maternal Hospital Stays including Substance Use Dx
WA and U.S. Trend of Rates, 1990–2014

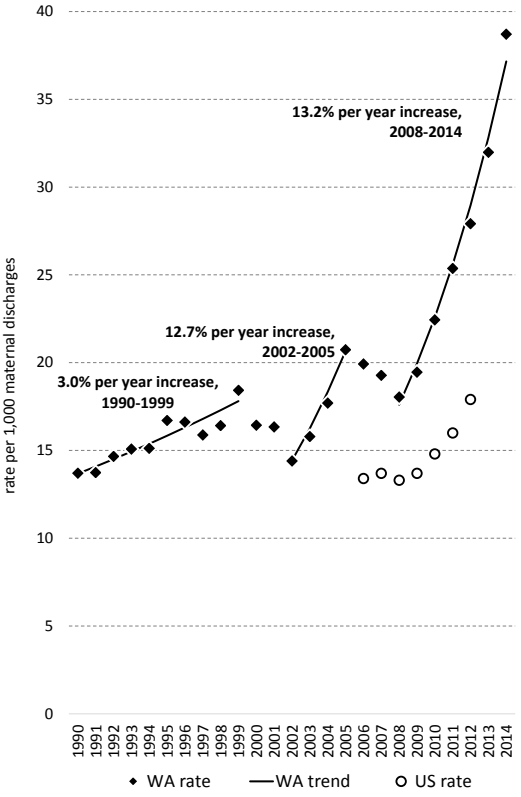
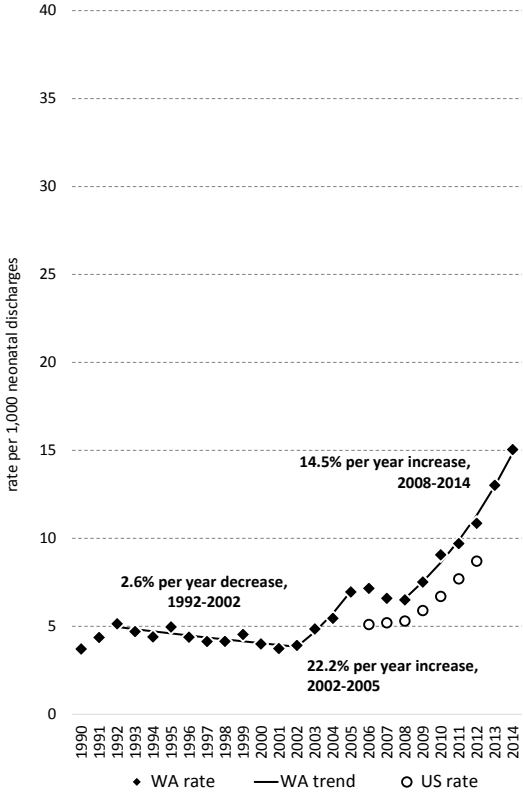



Figure 2
Newborn Hospital Stays including a Substance Use-Related Dx
WA and U.S. Trend of Rates, 1990–2014

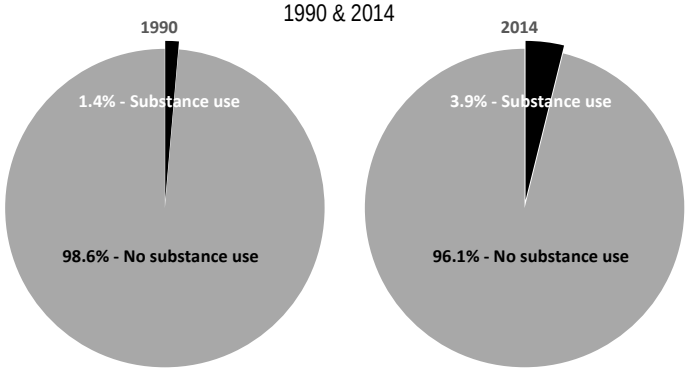


Nationally, from 2006 to 2012, there was a 33 percent increase in the rate of maternal stays that included a substance use diagnoses and a 71 percent increase in the rate of newborn stays with a diagnosis related to substance use. During that same time period, in Washington, the increase for maternal stays with a substance use diagnosis was 40 percent while for newborns it was 52 percent. As Figures 1 and 2 make clear, the rates in Washington appear to be higher than those seen nationally, and over the course of the 25 years assessed, there have been marked increases in the trends within our state.

Between 1990 and 2014, Washington state experienced a three-fold increase in the rate of maternal hospital stays that included a substance use diagnosis and a four-fold increase in the rate of newborns with a substance use-related diagnosis. Most pronounced, for both mothers and newborns, are the trends from 2008 to 2014. Among maternal stays, the average increase during those years was 13.2 percent per year, resulting in a two-fold increase in the rate during those six years. Among newborns, the average annual increase was 14.5 percent per year, resulting in a 2.3 fold increase during that same time period.

It is, however, important to keep the number and scope of these cases in perspective. As Figure 3 shows, even though there was a pronounced increase in maternal stays that included a substance use diagnosis, the percentages they represent of all maternal stays remain relatively small: 1.4 percent in 1990 and 3.9 percent in 2014. Similarly, for newborns in 1990, 0.4 percent had a diagnosis related to maternal substance use and by 2014, it was 1.5 percent.

Figure 3
Percent of Maternal Hospital Stays with a Substance Use Diagnosis
1990 & 2014




Nevertheless, given the increases seen over time, a closer examination of the components of the Washington trends is warranted.

In doing so, the maternal drug-related diagnosis codes from the H-CUP report were first grouped in nine categories: marijuana, alcohol, opiate, cocaine, amphetamine, hallucinogen, unspecified drug, other drugs and no drug use. The ICD-9 codes used for these groupings are shown in Appendix A. For newborn drug-related stays, the five diagnostic codes identified in the H-CUP report were considered individually. These were fetal alcohol syndrome (ICD-9 760.71); narcotics affecting fetus or newborn (ICD-9 760.72); hallucinogens affecting fetus or newborn (ICD-9 760.73); cocaine affecting fetus or newborn (ICD-9 760.75); and drug withdrawal syndrome in newborn (ICD-9 779.5).

Broadly, these cases include delivery records that resulted in a live birth or stillbirth at that stay, as well as pregnancy-related records that did or did not result in a delivery at that time. Newborns were limited to those younger than age 1; maternal stays were limited to females ages 15 to 44. The specific diagnoses and procedure codes are included in Appendix A.

For each category assessed, all nine diagnostic fields in each record were examined; individual cases may, therefore, be included in more than one drug or drug-related category.

## Findings

Of the eight drug categories assessed, maternal stays where opiate use were reported* had, by far, the highest rates and the greatest number of cases — and they are markedly trending upward. Those trends, the geographic distribution of those cases and the trends and rates for corresponding effects on newborns are discussed below. Similar sections on marijuana and amphetamines then follow. The remaining drug categories are discussed last. Among the five diagnostic codes used in assessing drug-related newborn inpatient stays, only two had enough cases for meaningful analyses. These were the ICD-9 categories "drug withdrawal syndrome in newborn" and "narcotics affecting fetus or newborn," and are discussed in the sections on opiates and amphetamines.

### *Opiates*

As seen in Figure 4, between 1990 and 2006, the rates per 1,000 maternal stays with an opiate-related diagnosis increased by 5.5 percent per year, from a low of 1.5 per 1,000 maternal discharges (126 cases) in 1990 to 4.9 per 1,000 (436 cases) in 2006; that is, the rates more than tripled over those 17 years. However, from 2006 to 2014, the upward trend in the rates markedly increased — to 19.4 percent per year — going from 4.9 per 1,000 stays in 2006 to 17.9 (1,524 cases) in 2014. That is more than a three-and-a-half-fold increase over those nine years.

Concurrently, and as seen in Figure 5, the rates and the number of cases of drug withdrawal syndrome in newborns have also markedly increased. While no significant trend was identified between 1990 and 2000, from 2000 to 2014, there was a 14.2 percent per year increase in the rates, starting at 1.4 per 1,000 newborns in 2000 (114 cases) and rising to 10.7 per 1,000 (881 cases) in 2014, equaling more than a seven-fold rate increase over the course of 15 years.

Figure 4
Maternal Stays with an Opiate-Related Diagnosis
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data

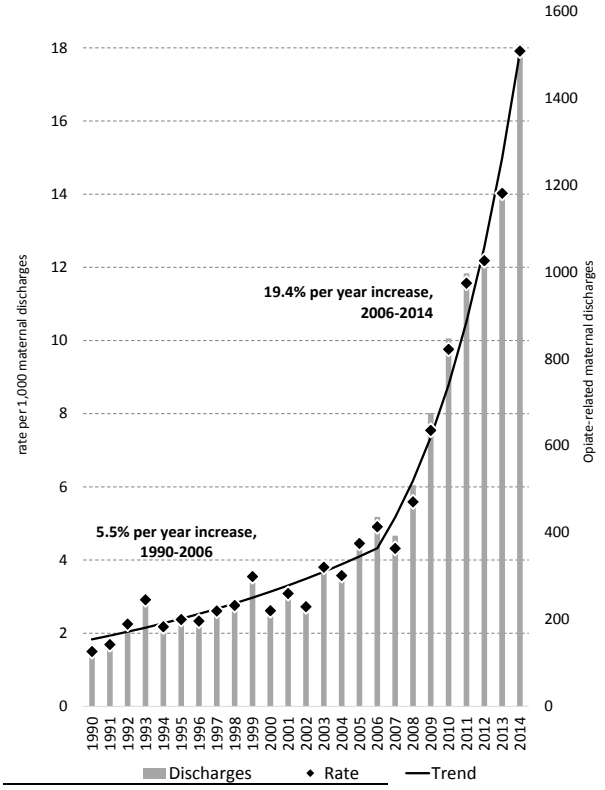
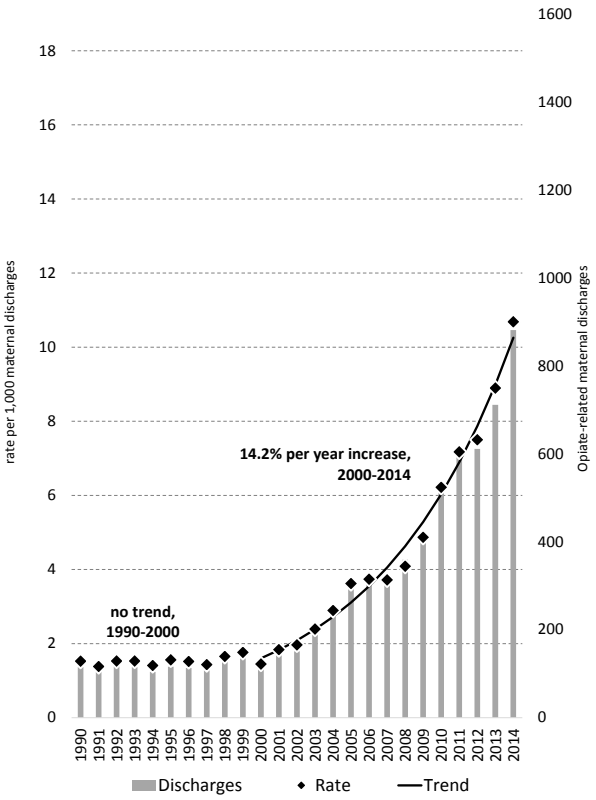



Figure 5
Newborns with Drug Withdrawal Syndrome Diagnosis
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data




*Although not differentiated in the diagnostic codes, these cases may include women in treatment with methadone or buprenorphine therapy.

In Figure 6, which is on the same scale as Figures 1, 2, 4 and 5, a similar trend, although not as pronounced, is seen in the number of cases and the rates of newborns affected by narcotics (ICD-9 760.72). For this condition, there initially was an 8.5 percent per year *decrease* in the rates from 1990 to 2000. But after 2000, the direction of the trend reverses, and from 2000 to 2014, the rates rise by 14.9 percent per year, from 0.8 per 1,000 (65 cases) in 2000 to 5.0 (412 cases) in 2014. That equals a six-fold increase in 15 years.

Rates and 95 percent confidence intervals for co-occurring diagnoses associated with the diagnostic categories narcotics affecting newborn (ICD-9 760.72) or drug withdrawal syndrome (ICD-9 779.5) are shown in Figure 7. Also shown are those newborns where no drug-related diagnoses were reported. Among those with no drug-related diagnoses, 8.9 percent had a co-occurring diagnosis of respiratory distress (ICD-9 769, 770). However, among those who were coded with narcotics affecting newborns, 23.3 percent had that co-occurring diagnosis, and among those coded with drug withdrawal syndrome, 26.1 percent had that co-occurring diagnosis.

Similarly, only 5.1 percent of those with no drug-related diagnoses had a co-occurring diagnosis of difficulty feeding (ICD-9 779.3), while 15.4 percent of those affected by narcotics and 22.9 of those with drug withdrawal syndrome had that co-occurring condition. And, finally, while 5.4 percent of those newborns with no drug-related diagnosis had a low birth weight, 15.9 percent of those affected by narcotics and 14.4 percent of those with drug withdrawal syndrome were low birth weight newborns.

Figure 6
Narcotics Affecting Fetus or Newborn
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data

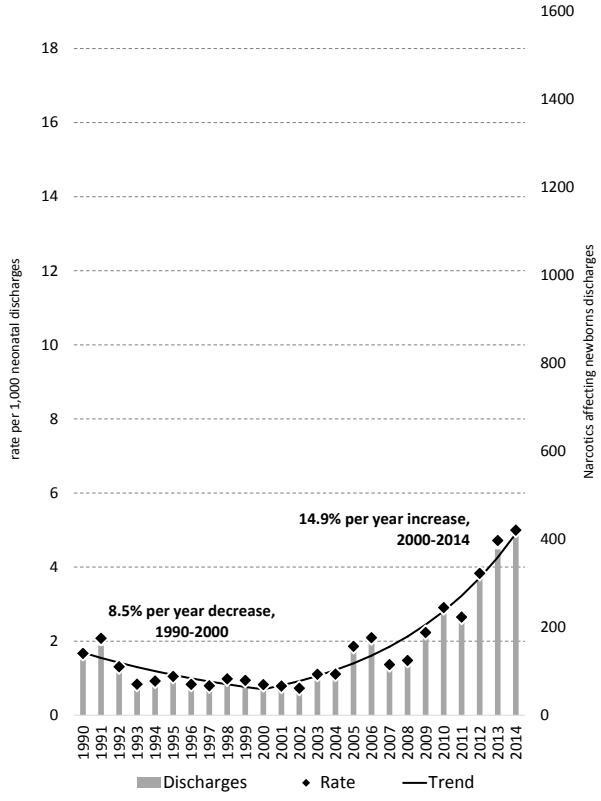
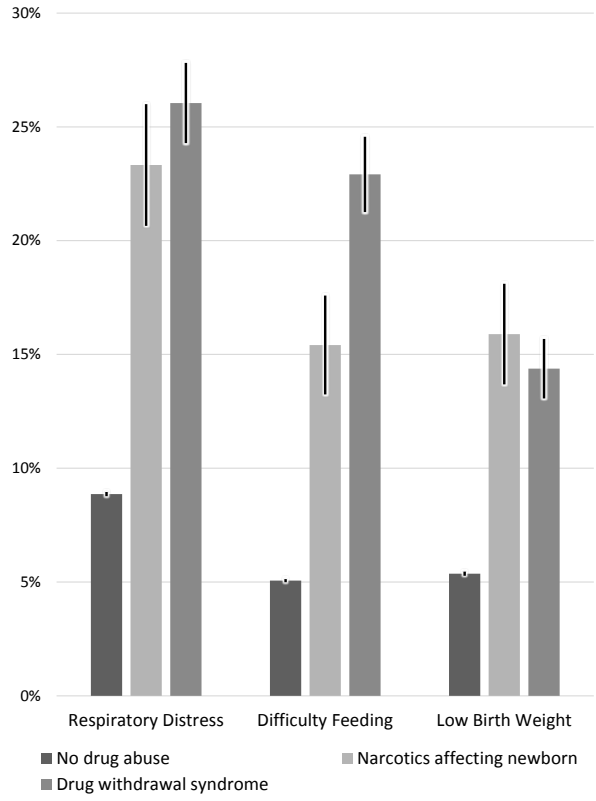


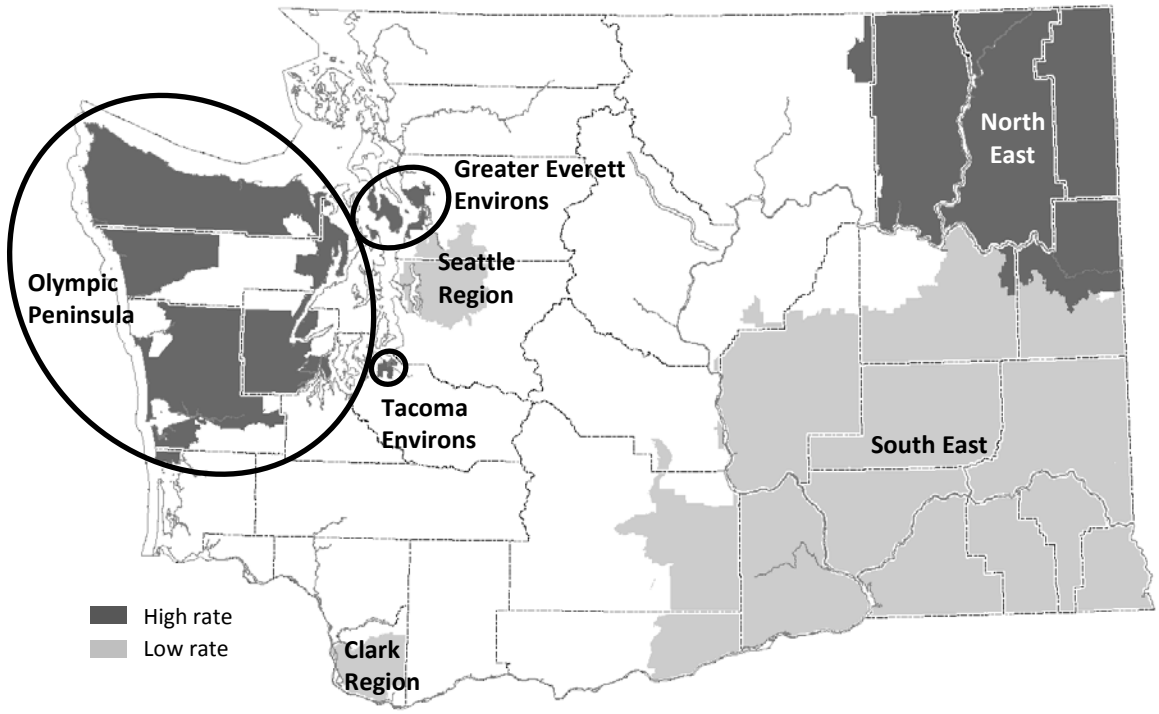

Figure 7
Co-occurring Diagnoses among Newborns
Percentages with 95% CI, 2012–14 Combined
WA and OR Inpatient Discharge Data



Using the patients' ZIP code of residence from the three most recent years' data (2012–14 for Washington residents discharged from Washington hospitals; 2012–13 for Washington residents discharged from Oregon hospitals), we identified regions in the west and east sides of the state with higher- and lower-than-expected rates of inpatient maternal stays with an opiate-related diagnosis.*

On the west side, three regions had higher-than-expected rates and are labeled on the map in Figure 8 as the Olympic Peninsula, greater Everett environs and Tacoma environs. Two additional regions on the west side, labeled Seattle region and Clark region, had lower-than-expected rates. On the east side, the North East region was identified as having higher-than-expected rates and the South East region had lower-than-expected rates. Those regions' rates and their 95 percent CI's are shown in Figure 9.

Figure 8
Maternal Stays with an Opiate-Related Diagnosis: High- and Low-Rate Regions
2012–14 Combined
WA and OR Inpatient Discharge Data




The two highest rate regions on the west side of the state are the Olympic Peninsula and greater Everett environs, with rates of 52.9 and 51.5 per 1,000 maternal stays, respectively. Although statistically significantly lower than those two regions, Tacoma environs is also high, with a rate of 31.8. Conversely, the rate in the Seattle region is 6.9 while in the Clark region it is 9.4. The rate for Western Washington in general is 16.9 per 1,000 maternal stays.

In Eastern Washington, the overall rate, by comparison, is low at 8.0 per 1,000 maternal stays. Relative to that underlying rate, the North East region's rate, 16.0, is high, even though it's on par with the overall Western Washington rate. The low-rate South East region's rate is very low at 3.5 per 1,000 maternal stays.

* SaTScan, software for the spatial scan statistic, v9.4 http://www.satscan.org/

While the pattern for drug withdrawal syndrome in newborns parallels that seen for maternal stays with an opiate-related diagnosis, the newborn rates are about half the maternal rates, in part because not all the maternal stays were for a delivery, and in part because not all newborns are necessarily affected or diagnosed. These are shown in Figure 10 and may include newborns to current users as well as newborns to those in treatment with methadone or buprenorphine.

On the west side of the state, for the Olympic Peninsula Region, that rate is 19.7 per 1,000 hospital newborns; in Everett environs, it is 27.8 per 1,000; and in Tacoma environs, 14.9 per 1,000. In the low-rate Seattle region, the rate is 4.1 per 1,000 hospital newborns, and in the Clark region, it is 5.7. For all Western Washington, the rate of drug withdrawal syndrome in newborns is 9.4. On the east side of the state, the overall rate of drug withdrawal syndrome in newborns is 8.1 per 1,000 hospital newborns. In the high-rate North East region, that rate is 16.6, while in the low-rate South East region, the rate is 3.8.

Figure 9
Rates of Maternal Stays with an Opiate-Related Diagnosis
in High- and Low-Rate Regions
Per 1,000 Maternal Discharges with 95% CI
2012–14 Combined
WA and OR Inpatient Discharge Data

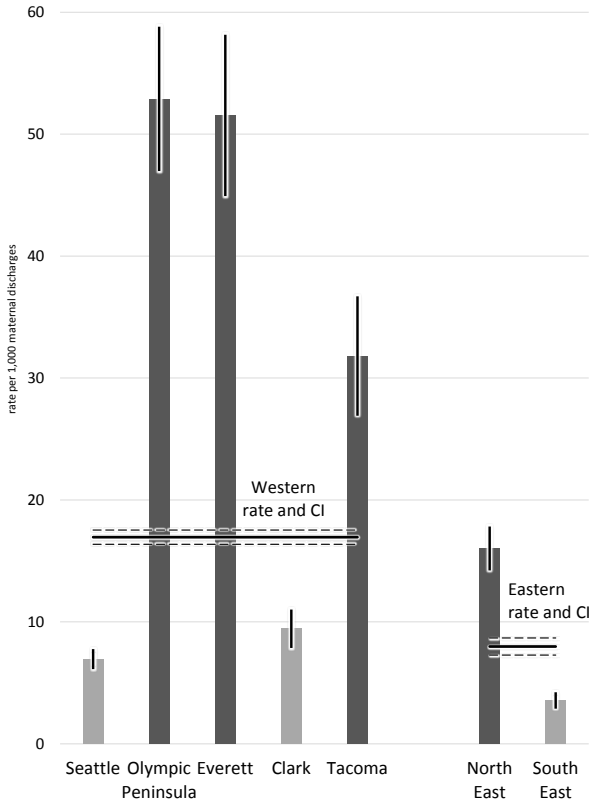
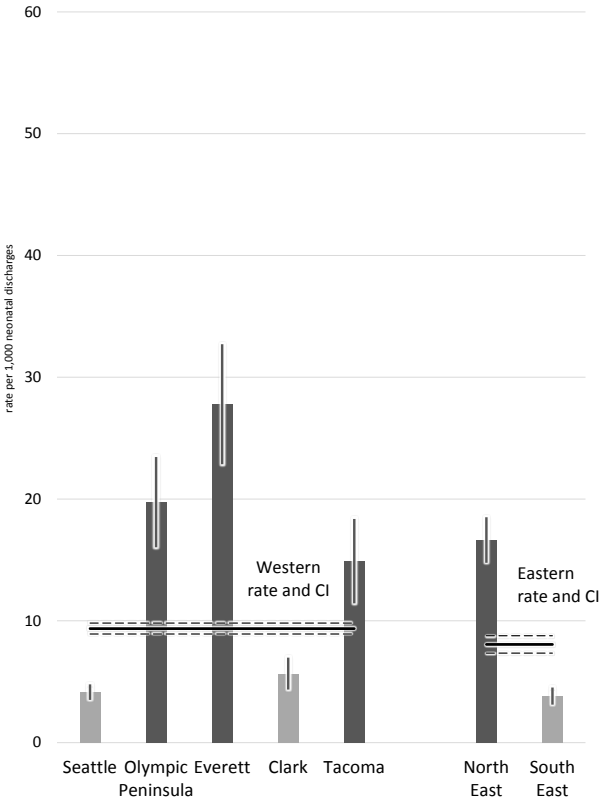



Figure 10
Rates of Neonatal Drug Withdrawal Syndrome
in High- and Low-Rate Regions
Per 1,000 Neonatal Discharges with 95% CI
2012–14 Combined
WA and OR Inpatient Discharge Data




While it is not readily apparent why some regions have higher rates than others, it is clear that the problem of maternal stays with an opiate-related diagnosis is more pronounced on the west side of the state than on the east side. It is also clear that such drug use is not limited to inner urban communities.

It should be noted, too, that in Western Washington, the total number of maternal stays in the high- and low-rate regions combined constitute 36.6 percent of all the maternal stays and 34.6 percent of all opiate-related maternal stays. That is, approximately two-thirds of the remaining cases are spread throughout the remaining Western Washington communities. In short, areas identified with high rates in this assessment are likely only the tips of an iceberg and not the sole areas of potential concern.

*Marijuana*

While the American Academy of Pediatrics notes that fetal exposure to marijuana "does not cause clinically important neonatal withdrawal signs," it does go on to note that such exposures may have "subtle effects on long-term neurobehavioral outcomes."[iv] Given recent legalization of cannabis in Washington, any such potential effects could be of concern.

Marijuana is one of the leading drugs reported among women with maternal inpatient stays, second only to opiates. As Figures 10 and 11 show, the rates and numbers of maternal stays where a marijuana-related diagnosis is reported are on the rise, whether used in conjunction with other drugs or taken alone.

As seen in Figure 11, the rate of maternal inpatient stays having a marijuana-related diagnosis with or without a diagnosis for other drugs has been steadily rising. Between 1990 and 1997, those rates increased by 10.8 percent per year, starting at 2.3 per 1,000 maternal stays (196 cases) in 1990 and increasing to 4.2 per 1,000 stays (335 cases) in 1997. That rising trend then slowed to an increase of 2.1 percent per year between 1997 and 2009, but subsequently resumed trending more markedly upward between 2009 and 2014, with an annual increase of 17.0 percent per year, from a rate of 5.2 (462 cases) in 2009 to 12.0 (1,021 cases) in 2014. Over those six years, the rate increased one-and-a-third-fold.

Figure 11
Maternal Stays with Marijuana Only or Marijuana and Other Drugs DX
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data

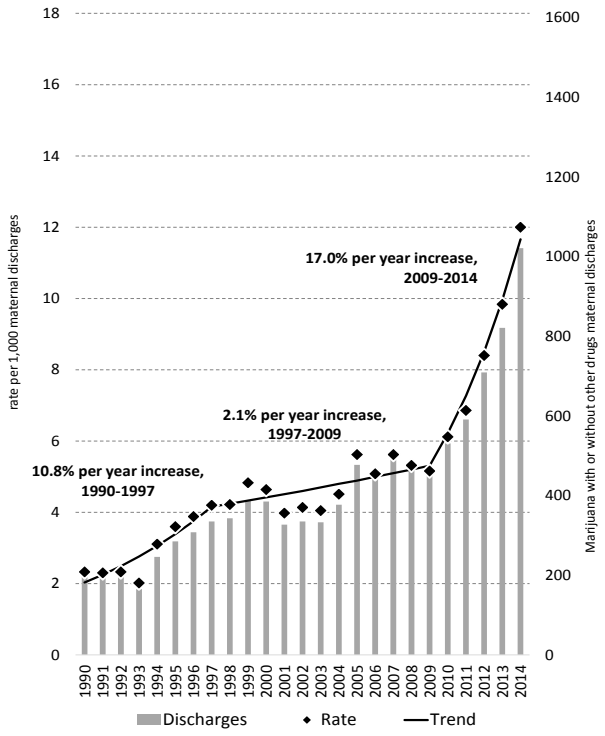
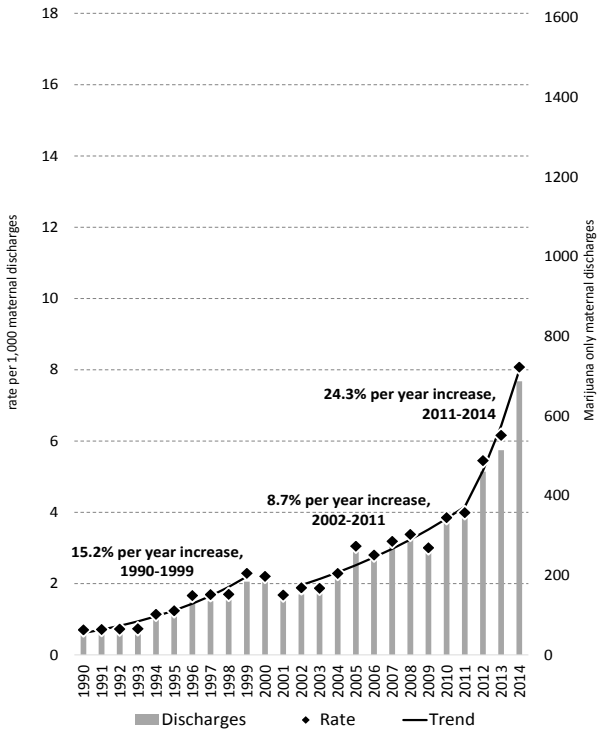


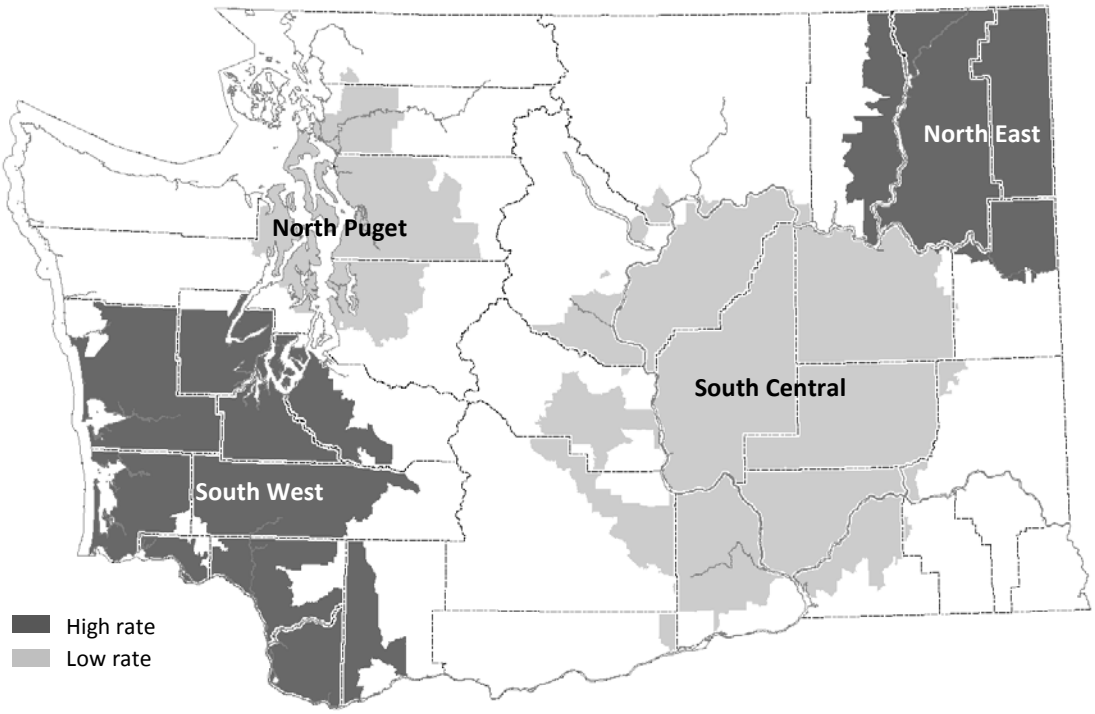

Figure 12
Maternal Stays with Marijuana Only DX
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data



As seen in Figure 12, the rate of maternal inpatient stays where only marijuana was used and no other drugs were reported has also been steadily rising. From 1990 to 1999, those rates increased by 15.2 percent per year from 0.7 per 1,000 (59 cases) in 1990 to 2.3 (184 cases) in 1999 — more than a three-fold surge. While no trend was seen between 1999 and 2002, starting in 2002, the rates again began to rise, and between 2002 and 2011, they grew by 8.8 percent per year from a rate of 1.9 (269 cases) in 2002 to 4.0 (344 cases) in 2011 — slightly more than doubling. Then, between 2011 and 2014, the rates began to markedly grow, increasing by 24.3 percent per year to a high of 8.1 per 1,000 (687 cases) in 2014 — another doubling of the rates in only four years.

Looking at cases with a marijuana-only diagnosis, in Figure 13 regions with higher- and lower-than-expected rates are shown for 2012 to 2014 combined. On the west side of the state, the South West region had a higher-than-expected rate while the North Puget region had a lower-than-expected rate. On the east side of the state, the rate in the North East region was high while in the South Central region it was low. As was discussed with the maternal stays with an opiate-related diagnosis, these regions were identified as being high or low relative to the overall rates on the east and west sides of the state.

Figure 13
Maternal Stays with Marijuana-Only Diagnosis – High- and Low-Rate Regions
2012–14 Combined
WA and OR Inpatient Discharge Data




The rates and 95 percent CI's for these four regions and for Eastern and Western Washington are shown in Figure 14. In Western Washington, the high-rate South West region had a rate of 13.6 per 1,000 maternal inpatient stays while the low-rate North Puget region had a rate of 3.4 per 1,000. Western Washington as a whole had a rate of 6.9.

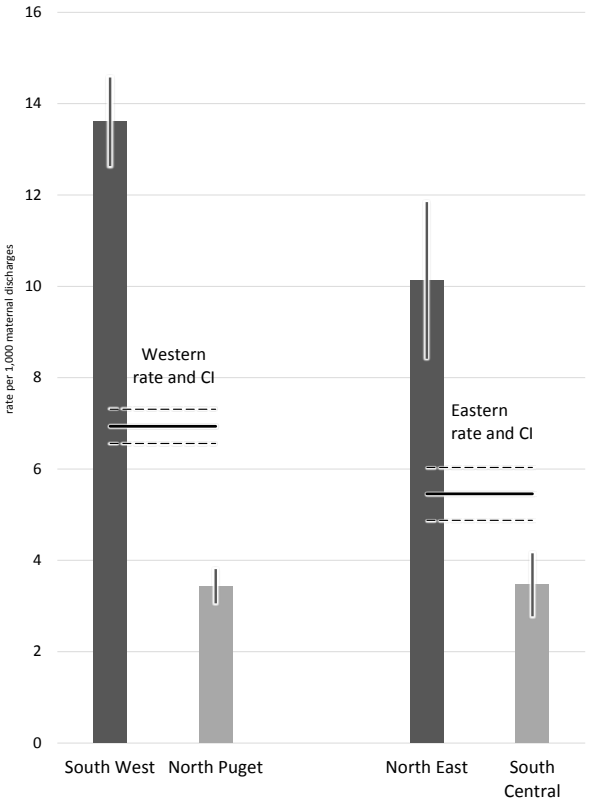
In Eastern Washington, the high-rate North East region had a rate of 10.1 while the low-rate South Central region had a rate of 3.5. The rate for Eastern Washington as a whole was 5.5.

As was seen with maternal stays that included an opiate-related diagnosis — although not nearly as pronounced and certainly not having the potential adverse consequences — the rates of maternal marijuana-only use is higher on the west side than on the east side of the state.

However, unlike maternal stays with an opiate-related diagnosis, the number of cases seen in the west side's high- and low-rate regions constitute 82 percent of all maternal stays with a marijuana-only diagnosis in that half of the state. In other words, less than 20 percent of such cases in Western Washington are outside these two regions.

Similarly, on the east side, the two high- and low-rate regions constitute 68 percent of all such cases seen there. That is, less than one-third of all such cases on the east side are found outside these two regions.

Figure 14
Rates of Maternal Stays with Marijuana-Only Diagnosis in High- and Low-Rate Regions
Per 1,000 Maternal Discharges with 95% CI
2012–14 Combined, WA and OR Inpatient Discharge Data



*Amphetamines*

Risks associated with maternal amphetamine or methamphetamine abuse or dependence include preterm birth, placental abruption, fetal distress and intrauterine growth restriction, which can lead to low birth weight. Long-term effects on newborns exposed in utero may include behavior problems, low cognitive skills and limited physical dexterity.[v]

Two trends in maternal stays with an amphetamine-related diagnosis are seen in Figure 15. Specifically, while prior to 1995 no trends are detected, from 1995 to 2005, the rates increase by 14.1 percent per year from 2.0 per 1,000 maternal stays (155 cases) in 1995 to 7.2 per 1,000 (614 cases) in 2005 — a more than three-and-a-half-fold upsurge over the course of 10 years. Then, from 2005 to 2009, the rates and number of cases seem to decline, although the trend downward is not statistically significant. However, from 2009 to 2014, the rates begin to rise again, by 18.4 percent per year from 4.2 (373 cases) to 9.5 (809 cases) — more than doubling over six years.

Figure 15
Maternal Stays with an Amphetamine-Related Diagnosis
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data

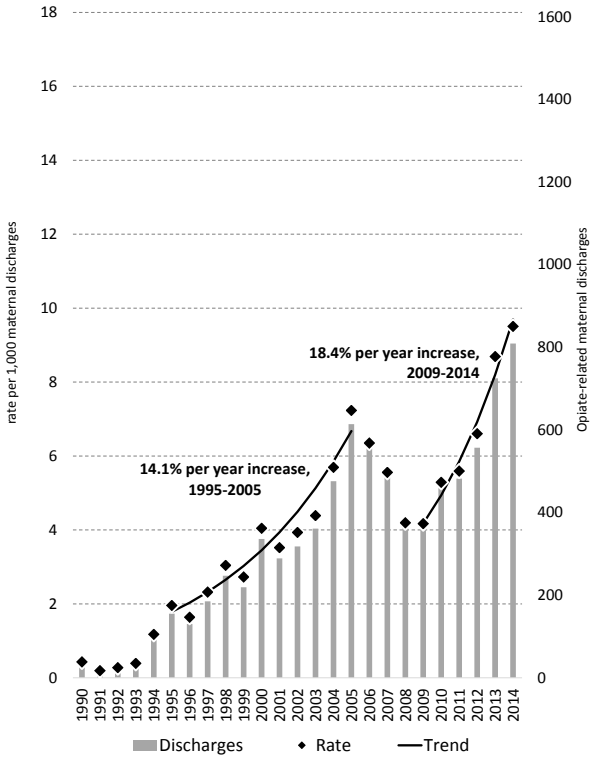
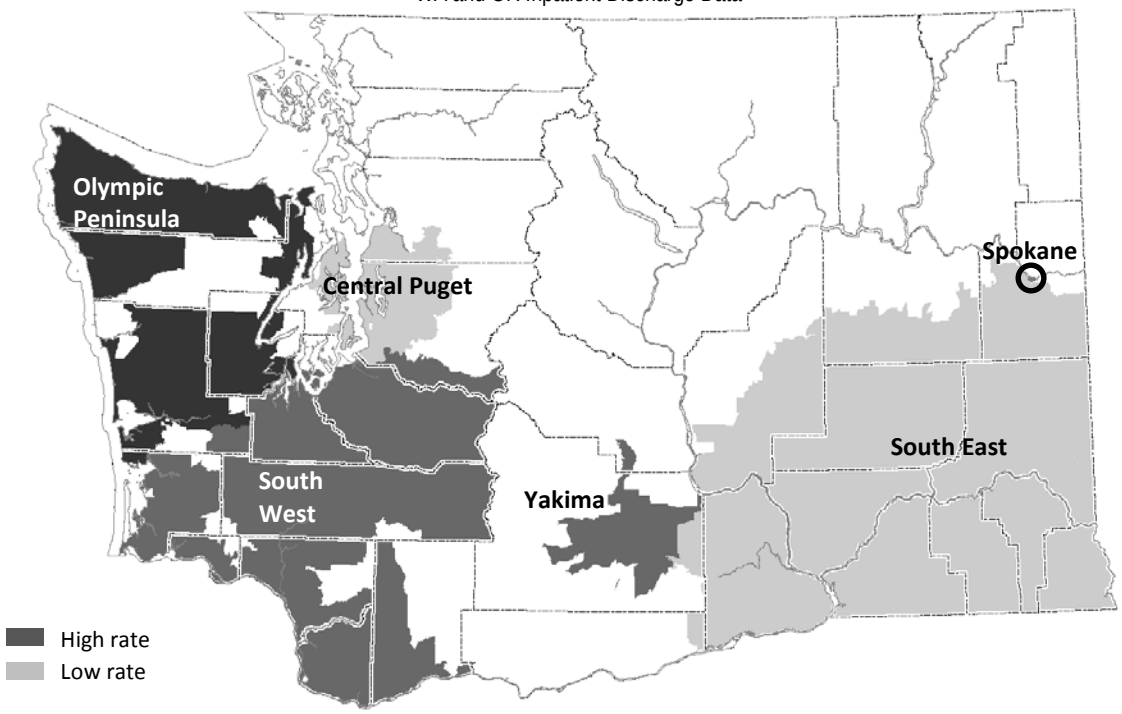



Figure 16
Maternal Stays with an Amphetamine-Related Diagnosis – High- and Low-Rate Regions
2012–14 Combined
WA and OR Inpatient Discharge Data



In looking at the geographic distribution of maternal stays with an amphetamine-related diagnosis, two large high-rate regions are seen in Western Washington: one labeled as Olympic Peninsula and an adjacent one labeled as South West. These are shown in Figure 16. (Because the two high-rate regions are adjacent, the Olympic Peninsula region is slightly darker to differentiate it.) A third region, Central Puget, is a low-rate region. In Eastern Washington, there are also two high-rate regions, although much smaller geographically than seen on the west side, that are labeled Yakima and Spokane. There is also a large low-rate region labeled South East.

As seen in Figure 17, in Western Washington, the high-rate Olympic Peninsula region had a rate of 35.8 per 1,000 maternal stays and the high-rate South West region had a rate of 10.6. The low-rate Central Puget region's rate was 4.3. For all Western Washington, the rate was 8.1. In Eastern Washington, the high-rate Yakima region had a rate of 17.6 and the high-rate Spokane area had a rate of 43.6. The low-rate South East region had a rate of 5.4. For all Eastern Washington, the rate was 8.8.

In Figure 18, the rates for the diagnosis narcotics affecting newborn* are shown for each of the high-rate maternal amphetamine regions. Their concordance with the pattern seen in the rates for maternal high- and low-rate regions is noteworthy: In the two high-rate regions in Western Washington, we see rates for narcotics affecting newborns that are significantly higher than the rates for the region as a whole, and concurrently, in the low-rate region, we see rates that are significantly lower. Specifically, the rate for Olympic Peninsula is 9.6 per 1,000 newborns; for South West, 5.6; for Central Puget, 2.4; and for Western Washington, 4.2.

Figure 17
Rates of Maternal Stays with an Amphetamine-Related Diagnosis
in High- and Low-Rate Regions
Per 1,000 Maternal Discharges with 95% CI
2012–14 Combined
WA and OR Inpatient Discharge Data

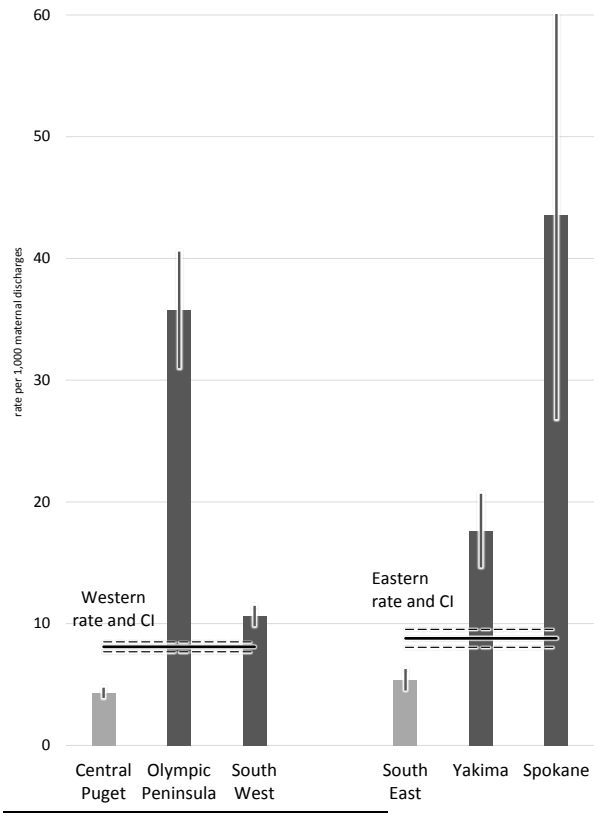
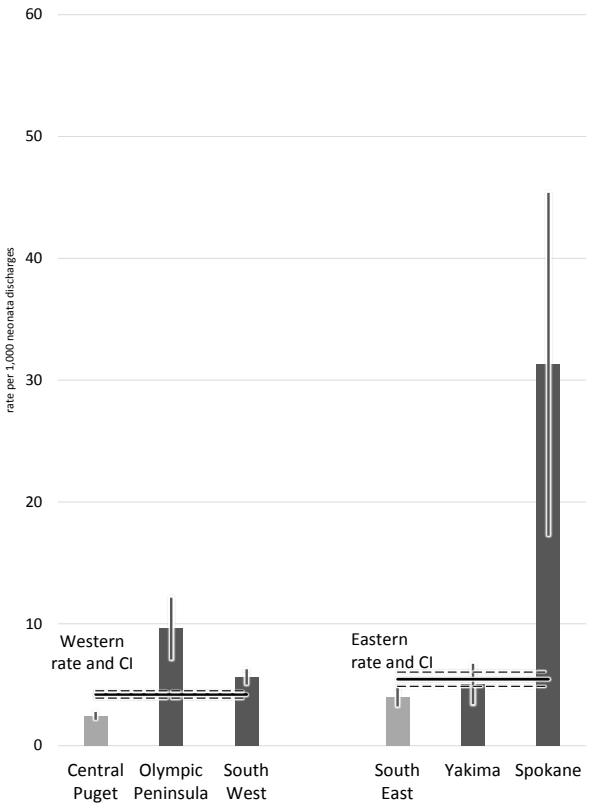



Figure 18
Rates of Narcotics Affecting Newborns
in Maternal Amphetamine High- and Low-Rate Regions
Per 1,000 Neonatal Discharges with 95% CI
2012–14 Combined
WA and OR Inpatient Discharge Data




* Although not a narcotic, this diagnosis code (760.72) by definition includes newborns affected by methamphetamines and is the only one to do so.

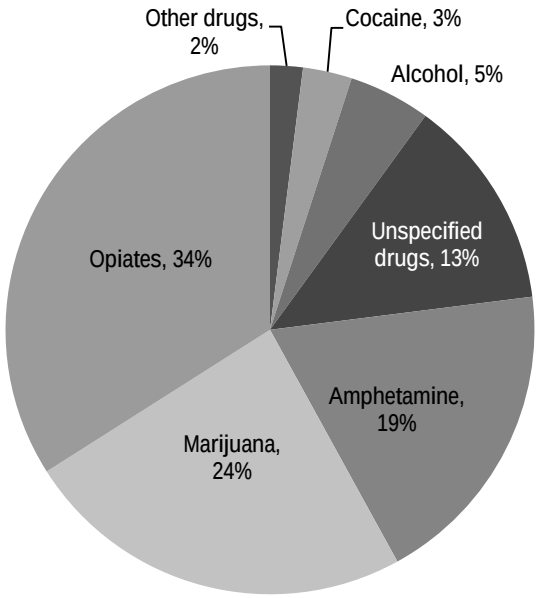
In Eastern Washington, where the overall rate of narcotics affecting newborns is 5.5, the concordance with the maternal amphetamine rates is not quite so well matched. That is, while the low-rate South East region's rate (4.0) is significantly lower than the Eastern Washington rate and the high-rate Spokane region's rate (31.3) is significantly higher, the high-rate Yakima region's rate (5.1) is not significantly different from the Eastern Washington rate.

Unlike opiates or marijuana, the rates of maternal stays with an amphetamine-related diagnosis in Eastern Washington are about the same as the rates seen in Western Washington. In Eastern Washington, the concentration seems more in urban areas, whereas in Western Washington, the high-rate regions include large swaths of rural and rural-plus-urban areas. However, in Eastern Washington, the number of cases in the high- and low-rate regions constitute only 54 percent of all such cases in that half of the state; the remaining 46 percent are located outside those regions. In Western Washington, the high- and low-rate region includes 81 percent of all such cases.

*Alcohol, cocaine and other remaining drugs*

As seen in Figure 19, for 2012 to 2014 combined, opiates, marijuana and amphetamines constitute 77 percent of all maternal inpatient stays with a diagnosis indicating substance use. Of the remaining 23 percent, unspecified drugs* was the most common drug type seen, constituting 13 percent of the total. Alcohol at 5 percent, cocaine at 3 percent, other drugs at 2 percent and hallucinogens at 0.05 percent (not shown) round out the remaining drug categories.

Figure 19
Maternal Hospital Stays Including Substance Use Diagnoses
Percentages by Drug Categories
2012–14 Combined
WA and OR Inpatient Discharge Data




With the exception of unspecified drugs, the trends for the remaining categories are either downward or flat. These are shown in Figures 20 to 23.

While it is not possible to ascertain what drugs might be included in the unspecified drugs category, it is likely that the increase seen in those rates, shown in Figure 20, reflects the inclusion of the unspecified drugs diagnosis code with other, more specific drug diagnoses. For this reason, we excluded cases with both opiates and unspecified drugs from the rates and trends shown in Figure 20.

As shown in Figure 21, the rates for maternal stays with an alcohol-related diagnosis fell 9.7 percent per year from 1996 to 2005. The rates have remained flat since then. For cocaine, the rates reached a high point in 1994 and have been dropping since, by 4.2 percent per year from 1994 to 2006, and then by 13.8 percent per year from 2006 to 2014. See Figure 22. Other drugs showed no trend in the rates over time (Figure 23).

* Excludes cases reporting opiate use.

Figures 19–22
Maternal Stays including Unspecified Drugs, Alcohol, Cocaine and Other Drugs Use Diagnoses
WA Rates, Trends and Volumes, 1990–2014
WA and OR Inpatient Discharge Data

Figure 20 - Unspecified drugs

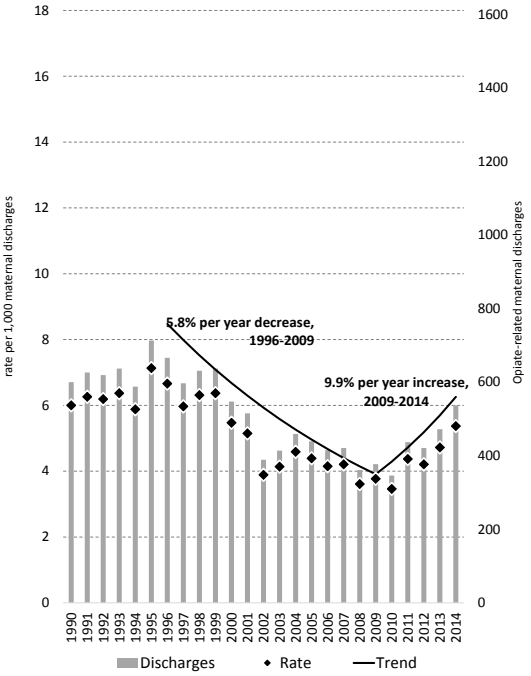



Figure 21 - Alcohol

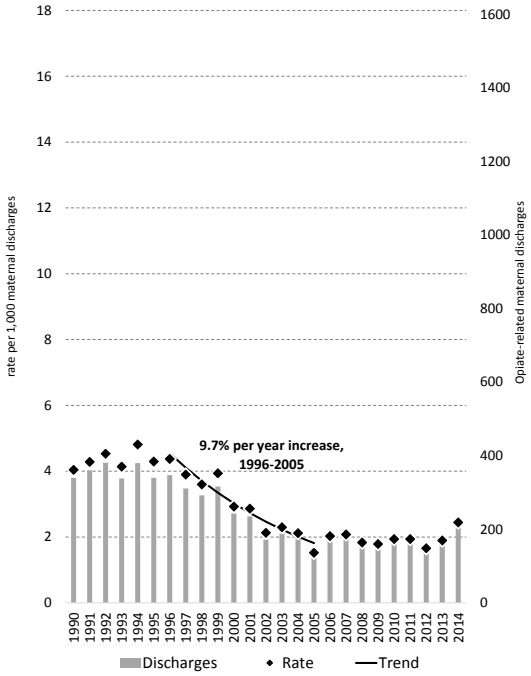



Figure 22 - Cocaine

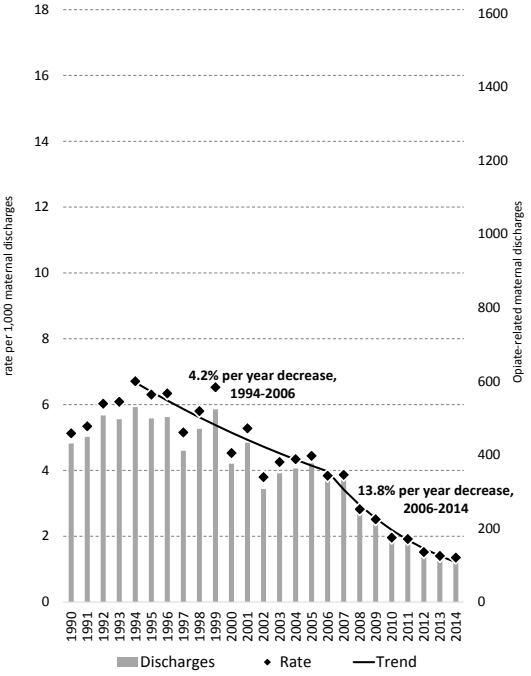
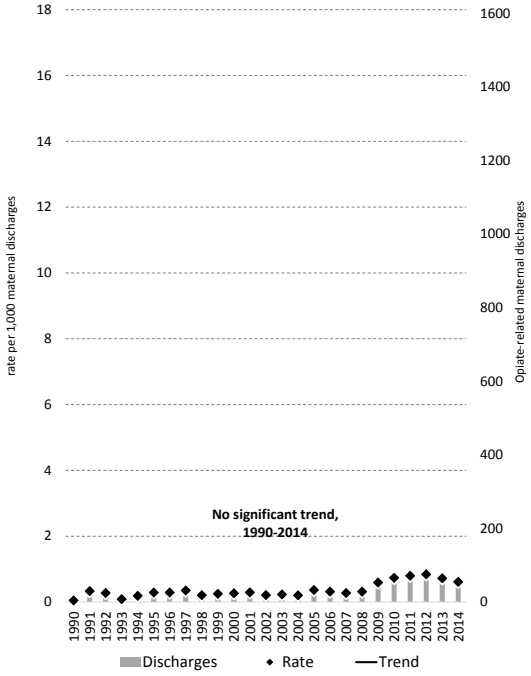



Figure 23 - Other drugs



## Summary and Conclusions

The trends seen among Washington residents in maternal and neonatal hospital stays that include a substance use or substance use-related diagnosis are concerning. In particular, those trends related to maternal opiate and amphetamine use are most troubling since these may cause pregnancy complications. The trends in marijuana use are concerning, too, because we do not yet know what the possible long-term consequences may be.

For **maternal stays with an opiate-related diagnosis,** we clearly saw trends in the diagnostic categories "neonatal drug withdrawal syndrome" and "narcotics affecting newborns" that paralleled the trends in maternal stays with an opiate-related diagnosis. In addition, we saw higher percentages of co-occurring diagnoses of respiratory distress, difficulty feeding and low birth weight among those newborns coded with neonatal drug withdrawal syndrome and with narcotics affecting newborns. The Olympic Peninsula, Everett and Tacoma environs were identified as high-rate regions in Western Washington and the North East was seen as a high-rate region in Eastern Washington. Conversely, on the west side, the Seattle and Clark regions were identified as low-rate regions while on the east side, the South East region was found to be low-rate. In those high- and low-rate regions, we saw correspondingly high and low rates of neonatal drug withdrawal syndrome. In general, we also found that the rates of maternal stays with an opiate-related diagnosis were higher on the west side than on the east side of the state.

We saw rising trends for **maternal stays with a marijuana-related diagnosis** with or without other drugs and for maternal stays with a marijuana-only diagnosis. In addition, we identified high-and low-rate regions for maternal stays with a marijuana-only diagnosis on each side of the state. On the west side, the South West was found to have a high rate of marijuana-only use while the North Puget region had a low rate. On the east side, the North East region had a high rate while the South Central area's rate was low. Overall, the rate for maternal stays with a marijuana-only diagnosis in Western Washington was significantly higher than the rate in Eastern Washington.

For **maternal stays with an amphetamine-related diagnosis,** we saw that while an upward trend had waned after a peak in 2005, by 2009, a new upward surge had begun and continues through 2014. On the west side, two high-rate regions, the Olympic Peninsula and the South West, essentially comprise the whole Pacific coastal and southwest quadrant of the state. On the east side, the two high-rate regions are much smaller and center around or in the cities of Yakima and Spokane. The major metropolitan Central Puget region on the west side was found to have a low rate, as did the South East region on the east side. Rates of narcotics affecting newborns in those high- and low-rate regions generally corresponded with the rates seen in maternal stays with an amphetamine-related diagnosis, with the exception of Yakima, where those rates were not as high as might have been expected. In general, the rates of maternal stays with an amphetamine-related diagnosis are the same on the west and east sides of the state.

For the remaining drugs assessed — **alcohol, cocaine and other drugs** — trends are either downward or flat and rates are relatively low. For the category "unspecified drugs," the rates are increasing, but this category likely includes cases with other drugs listed as well.

Most importantly, we found that rates for two drugs — maternal opiate or amphetamine use — which are associated with potential adverse effects, including withdrawal symptoms, preterm labor and small for gestational age in newborns, are at their highest point in 25 years. The long-term effects of maternal amphetamine use may also be concerning.

In identifying these trends, as well as those regions and communities with the highest rates, we hope current initiatives can be expanded and, perhaps, new initiatives implemented that target this growing epidemic and those communities most in need.

## Appendix A – Definitions

Case Definitions by ICD-9-CM Diagnostic Codes:

- Neonatal: Diagnoses 27701, 74783, 76061-76064, 76077-76078, 7620-7706, 77081-7785, 7787-7796, 77981-7799, 7966, V2031-V2032 and V290-V392. Neonatal records were restricted to newborns aged <1 year.
- Maternal: Diagnoses 630-67914, 7923, 7965, V220-V2384, V2386-V242, V270-V282, V286-V2889, V616-V617, V6511, V7242, V8901-V8909 and V9100-V9199. Procedures 720-7537 and 754-7599. Maternal records were restricted to females aged 15–45 years.

Table 1

| ICD-9-CM diagnosis codes used to identify substances or substance-related conditions among neonatal and maternal hospital stays | | |
|---|---|---|
| ICD-9-CM diagnosis code | ICD-9-CM code description | Category |
| Neonatal | | |
| 76071 | Alcohol affecting fetus or newborn via placenta or breast milk | Fetal alcohol syndrome |
| 76072 | Narcotics affecting fetus or newborn via placenta or breast milk | Narcotics affecting newborns |
| 76073 | Hallucinogenic agents affecting fetus or newborn via placenta or breast milk | Hallucinogens |
| 76075 | Cocaine affecting fetus or newborn via placenta or breast milk | Cocaine |
| 7795 | Drug withdrawal syndrome in newborn | Drug withdrawal syndrome |
| Maternal | | |
| 30300-30302 | Acute alcoholic intoxication in alcoholism, unspecified, continuous or episodic | Alcohol |
| 30390-30392 | Other and unspecified alcohol dependence, unspecified, continuous or episodic | Alcohol |
| 30400-30402 | Opioid type dependence, unspecified, continuous or episodic | Opiates |
| 30410-30412 | Sedative, hypnotic or anxiolytic dependence, unspecified, continuous or episodic | Other drugs |
| 30420-30422 | Cocaine dependence, unspecified, continuous or episodic | Cocaine |
| 30430-30432 | Cannabis dependence, unspecified, continuous or episodic | Marijuana |
| 30440-30442 | Amphetamine and other psychostimulant dependence, unspecified, continuous or episodic | Amphetamines |
| 30450-30452 | Hallucinogen dependence, unspecified, continuous or episodic | Hallucinogens |
| 30460-30462 | Other specified drug dependence (includes absinthe, glue, inhalants, phencyclidine), unspecified, continuous or episodic | Other drugs |
| 30470-30472 | Combinations of opioid type drug with any other drug dependence, unspecified, continuous or episodic | Opiates |
| 30480-30482 | Combinations of drug dependence excluding opioid type drug, unspecified, continuous or episodic | Unspecified drugs |
| 30490-30492 | Unspecified drug dependence, unspecified, continuous or episodic | Unspecified drugs |
| 30500-30502 | Alcohol abuse, unspecified, continuous or episodic | Alcohol |
| 30520-30522 | Cannabis abuse, unspecified, continuous or episodic | Marijuana |

| | | |
|---|---|---|
| 30530-30532 | Hallucinogen abuse, unspecified, continuous or episodic | Hallucinogens |
| 30540-30542 | Sedative, hypnotic or anxiolytic abuse, unspecified, continuous or episodic | Other drugs |
| 30550-30552 | Opioid abuse, unspecified, continuous or episodic | Opiates |
| 30560-30562 | Cocaine abuse, unspecified, continuous or episodic | Cocaine |
| 30570-30572 | Amphetamine or related acting sympathomimetic abuse, unspecified, continuous or episodic | Amphetamines |
| 30580-30582 | Antidepressant type abuse, unspecified, continuous or episodic | Other drugs |
| 30590-30592 | Other, mixed or unspecified drug abuse, unspecified, continuous or episodic | Unspecified drugs |
| 64830-64834 | Drug dependence of mother | Unspecified drugs |
| 96501 | Poisoning by heroin | Opiates |
| 96509 | Poisoning by other opiates and related narcotics | Opiates |
| 9696 | Poisoning by psychodysleptics (hallucinogens) | Hallucinogens |
| 97081 | Poisoning by cocaine | Cocaine |
| 9800 | Toxic effect of ethyl alcohol | Alcohol |
| E8500 | Accidental poisoning by heroin | Opiates |
| E8541 | Accidental poisoning by psychodysleptics (hallucinogens) | Hallucinogens |
| E8600 | Accidental poisoning by alcoholic beverages | Alcohol |
| E8608 | Accidental poisoning by other specified alcohols | Alcohol |
| E8609 | Accidental poisoning by unspecified alcohol | Alcohol |

Co-occurring diagnoses were identified using the following all-listed ICD-9-CM diagnosis codes and CCS categories:

- Low birth weight: as defined for the AHRQ Low Birth Weight Rate Prevention Quality Indicator[1]
- Respiratory distress: ICD-9-CM codes 769, 770
- Difficulty feeding: ICD-9-CM code 7793

[1] Agency for Healthcare Research and Quality. AHRQ QI, Prevention Quality Indicators #9, Technical Specifications, Low Birth Weight Rate. Rockville, MD: Agency for Healthcare Research and Quality. August 2011. http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V43/TechSpecs/PQI%2009%20Low%20Birth%20Weight%20Rate.pdf.

## Appendix B – Counts and Rates for High- and Low-Rate Regions

Maternal stays with an opiate-related diagnosis, 2012–14 combined

| Region | Maternal w/opiate | All maternal stays | Rate per 1,000 | 95% CI |
|---|---|---|---|---|
| Seattle | 275 | 39,5925 | 6.9 | 0.8 |
| Olympic Peninsula | 307 | 5,804 | 52.9 | 5.9 |
| Everett | 233 | 4,521 | 51.5 | 6.6 |
| Clark | 137 | 14,521 | 9.4 | 1.6 |
| Tacoma | 162 | 5,094 | 31.8 | 4.9 |
| North East | 305 | 19,037 | 16.0 | 1.8 |
| South East | 107 | 30,150 | 3.5 | 0.7 |
| Western Washington | 3,222 | 190,193 | 16.9 | 0.6 |
| Eastern Washington | 500 | 62,689 | 8.0 | 0.7 |

Maternal stays with a marijuana-only related diagnosis, 2012–14 combined

| Region | Maternal w/marijuana | All maternal stays | Rate per 1,000 | 95% CI |
|---|---|---|---|---|
| South West | 758 | 55,725 | 13.6 | 1.0 |
| North Puget | 324 | 94,347 | 3.4 | 0.4 |
| North East | 134 | 13,231 | 10.1 | 1.7 |
| South Central | 97 | 27,993 | 3.5 | 0.7 |
| Western Washington | 1,319 | 190,193 | 6.9 | 0.4 |
| Eastern Washington | 342 | 62,689 | 5.5 | 0.6 |

Maternal stays with an amphetamine-related diagnosis, 2012–14 combined

| Region | Maternal w/amphetamine | All maternal stays | Rate per 1,000 | 95% CI |
|---|---|---|---|---|
| Central Puget | 410 | 95,044 | 4.3 | 0.4 |
| Olympia Peninsula | 215 | 6,010 | 35.8 | 4.8 |
| South West | 629 | 59,172 | 10.6 | 0.8 |
| South East | 143 | 26,553 | 5.4 | 0.9 |
| Yakima | 131 | 7,426 | 17.6 | 3.0 |
| Spokane | 26 | 597 | 43.6 | 16.7 |
| Western Washington | 1,540 | 190,193 | 8.1 | 0.4 |
| Eastern Washington | 551 | 62,689 | 8.8 | 0.7 |

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[i] PEDIATRICS Volume 129, Number 2, February 2012 http://pediatrics.aappublications.org/content/129/2/e540.full.pdf
[ii] ibid
[iii] Neonatal and Maternal Hospital Stays Related to Substance Use, 2006-2012, http://hcup-us.ahrq.gov/reports/statbriefs/sb193-Neonatal-Maternal-Hospitalizations-Substance-Use.pdf
[iv] PEDIATRICS Volume 129, Number 2, February 2012 http://pediatrics.aappublications.org/content/129/2/e540.full.pdf
[v] ibid