

Comparing Accidental Drug Overdose Trends in Montgomery and 23 Other Ohio Counties: 2010 – June 2013

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Summary

COMPARING MONTGOMERY COUNTY AND THE 23 COUNTY GROUP

- ❖ Overall, the number of cases of accidental drug overdose deaths increased in both Montgomery County (n=504) and the 23 County Group (n=555) from 2010 – June 2013. In Montgomery County, unintentional drug overdose deaths rose from 120 in 2010 to 152 in 2012, while in the 23 County Group these numbers increased from 132 in 2010 to 177 in 2012.
- ❖ **Opioids** (including any pharmaceutical opioids and/or heroin) were the most commonly reported drugs in accidental drug overdose deaths across both groups, ranging from 86% in the 23 County Group in 2012 to 96% in Montgomery County in 2010.
- ❖ Overall, Montgomery County had a greater proportion of deaths that tested positive for cannabis, cocaine and heroin, while the other 23 county data showed a greater proportion of decedents testing positive for pharmaceutical opioids and methamphetamine (although the number of methamphetamine mentions is quite low).
- ❖ The percentage of **oxycodone** mentions was consistently higher in the 23 County Group (26%, for all years combined) than in Montgomery County (18%, for all years combined). In the 23 County Group, oxycodone mentions declined from 32% in 2010 to 20% in 2012. In Montgomery County, oxycodone mentions remained stable between 2010 and 2012 at about 20%, but declined to 10% in the first half of 2013.
- ❖ The percentage of **methadone** mentions decreased significantly in both regions from highs of about 35% in both groups in 2010 to about 15% in 2012.
- ❖ The percentages of **pharmaceutical opioid** mentions were consistently higher in the 23 County Group (68%, for all years combined) than in Montgomery County (61%, for all years combined), but declined significantly in both regions from 2010 through 2012. In Montgomery County, pharmaceutical opioid mentions declined from 76% in 2010 to 53% in 2012. In the 23 County Group, pharmaceutical opioids declined from 80% of in 2010 to 60% in 2012.
- ❖ The percentage of **heroin** mentions in each region increased over time, although the percentages of heroin mentions remained lower in the 23 County Group. In Montgomery County, heroin was mentioned in 33% of the deaths in 2010, 37% in 2011, and then increased significantly to 57% in 2012. In the other 23 counties, heroin

was present in 21% of the deaths in 2010, increasing to 30% in 2011, and then to 44% in 2012.

- ❖ **Since 2012, more accidental overdose cases in Montgomery County tested positive for heroin than pharmaceutical opioids.**
- ❖ Similar to the decline in the percentage of pharmaceutical opioid mentions, the percentage of **benzodiazepine** mentions declined significantly from 2010 to 2012 in both regions. In Montgomery County, benzodiazepine mentions decreased significantly from 73% in 2010 to 45% in 2012. In the 23 County Group, benzodiazepine mentions decreased from 67% in 2010 to 53% in 2012.
- ❖ **Cocaine** mentions were more common the Urban Region, and there were no statistically significant changes over time. About 75% of cocaine-positive cases also tested positive for **levamisole**, an adulterant that may have dangerous health risks because it suppresses the immune system of those who are exposed to it.

COMPARING THE APPALACHIAN, RURAL, SUBURBAN, AND URBAN REGIONS

- ❖ The declines in the percentages of pharmaceutical opioid mentions in Urban (Metropolitan), Suburban, and Appalachian Regions over time, are striking.
- ❖ **The Appalachian Region had the highest proportion of deaths involving pharmaceutical opioids** in comparison with the other regions, regardless of year. For all years combined, pharmaceutical opioids were present in 79% of overdose cases in the Appalachian Region, 65% in the Rural Region, 62% in the Suburban Region, and 61% in Montgomery County.
- ❖ **Pharmaceutical opioid mentions declined in all areas, except the Rural Region.** Between 2010 and 2012, pharmaceutical opioid mentions declined significantly from 92% to 69% in the Appalachian Region, and from 76% to 53% in the Urban (Montgomery County) region. In the Suburban Region, the decline was even more substantial, from 82% in 2010 to 48% in 2012.
- ❖ In comparison with the other regions, the **rural counties are unique** with relatively consistent percentages of **pharmaceutical opioid** mentions over time, ranging from 67% in 2010 to 63% in 2012. Reasons for a lack of decline are unclear.
- ❖ **The percentage of oxycodone mentions was consistently the highest in the Appalachian Region**, ranging from 56% in 2010 to 42% in 2011, and then declining significantly to 25% in 2012.

- ❖ **Methadone mentions declined significantly in all areas, except the Rural Region.** In the Suburban Region methadone declined from 43% in 2010 to 20% in 2011, and then to 14% in 2012. Methadone mentions were consistent at about 34% in Montgomery County in 2010 and 2011, and then declined significantly to 16% in 2012. In the Appalachian Region, methadone mentions decreased significantly from 39% in 2010 to 14% in 2012.
- ❖ **Heroin mentions remained the most common in the Montgomery County and the least common in the Appalachian Region.** For all years combined, heroin was present in 30% of overdose cases in the Appalachian Region, 38% in the Rural and Suburban Regions, and 47% in Montgomery County.
- ❖ **Heroin mentions became more common in all regions over time, although increases in the Rural Region were not statistically significant.** Between 2010 and 2012, heroin mentions increased significantly from 33% to 57% in Montgomery County, and from 21% to 50% in the Suburban Region. In the Appalachian Region, heroin mentions increased significantly from 8% in 2010 to 25% in 2011, and then to 39% in 2012. Percentages of heroin mentions were stable in the Rural Region at about 31% in 2010 and 2011, and then increased to 43% in 2012, although this change was not statistically significant.
- ❖ **Regional differences in benzodiazepine mentions were not statistically significant. There were significant declines in benzodiazepine mentions in the Suburban Region** from about 64% in 2010 to about 40% in 2012, and in the **Urban Region** from 73% in 2010 to 45% in 2012. Changes in benzodiazepine mentions in other regions were not statistically significant.

Introduction

The State of Ohio is experiencing an epidemic of pharmaceutical opioid and heroin abuse that has contributed to unprecedented loss of life through unintentional drug overdoses (*2012 Drug Overdose Deaths*, Ohio Department of Health Violence and Injury Prevention Program report: March 2014). For example, from 2010 through 2012, unintentional drug overdose deaths in Ohio increased from 1,544 to 1,914—a 24% increase (*Unintentional Drug Overdose Death Rates, 2007—2012*, Ohio Department of Health Office of Vital Statistics, March 2014). Montgomery County, Ohio, has been one of the state’s epicenters of unintentional drug overdose deaths. Unintentional drug overdose deaths increased from 120 in 2010 to 125 in 2011, and up to 152 in 2012 in Montgomery County.

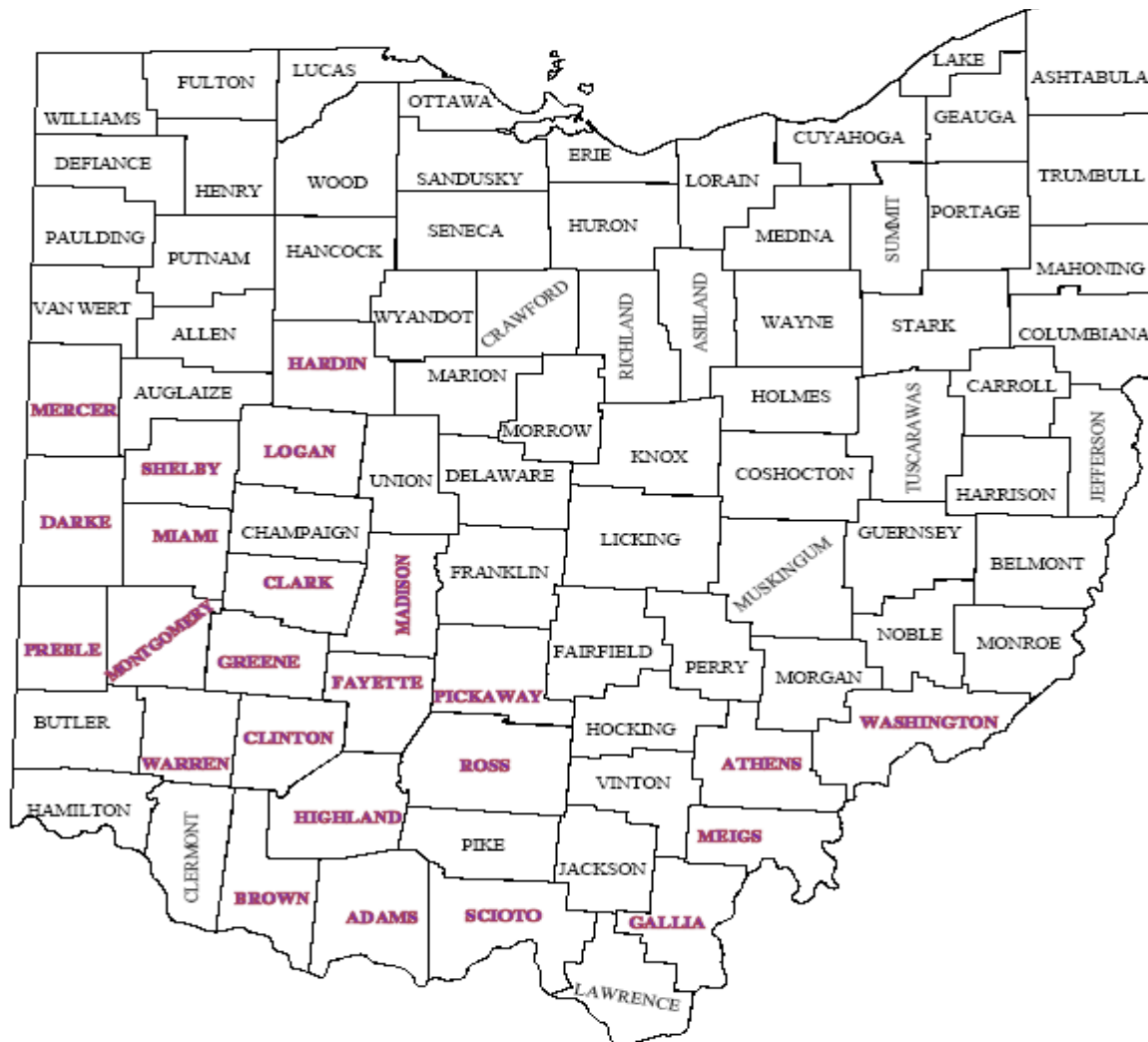
Starting in late 2011 a dramatic increase in the number of accidental drug overdoses related to heroin use was observed in Montgomery County. In 2011, 46 (37% of all cases) overdose deaths involved heroin, compared to 87 (57%) in 2012. Simultaneously, prescription opioids present in drug overdoses declined from being present in 76% of all drug overdose cases in 2010 to 66% in 2011, to 53% in 2012. The significant increase in heroin mentions in Montgomery County served as the underlying rationale for the main research question guiding this study: Are the trends in drug mentions related to unintentional drug overdose deaths in Montgomery County similar to, or different from, trends found in drug overdose deaths in other Ohio Counties?

This study is a collaborative effort between Center for Interventions, Treatment, and Addictions Research in the Wright State University Boonshoft School of Medicine and the Montgomery County Coroner’s Office, which provided the unintentional drug overdose data on which this report is based. In this Report, we compare trends observed in overdose deaths in Montgomery County from 2010 through June 2013 with drug overdose data observed in 23 other Ohio Counties grouped together. We also compare trends in unintentional drug overdose deaths in Montgomery County (the only urban county) with trends observed in standard regional groupings of the 23 other counties: Suburban; Rural; Appalachian.

Methods

Data collection: The Montgomery County Coroner's Office Toxicology Laboratory provided de-identified data electronically on 1,069 accidental overdose cases from 27 Ohio counties that covered a time period between **January 1, 2010 and June 30, 2013**. Ten cases -- 3 cases from Licking County, 3 from Butler, and 4 from Champagne-- were excluded from the final sample because they were from counties that contract with Montgomery County Coroner's Office Toxicology Laboratory only for back-up autopsy services. As such, the cases do not represent all unintentional overdose cases in each county and were deleted. In addition to Montgomery County there were 23 other counties included in the study: Adams, Athens, Brown, Clark, Clinton, Darke, Fayette, Gallia, Greene, Hardin, Highland, Logan, Madison, Meigs, Mercer, Miami, Pickaway, Preble, Ross, Scioto, Shelby, Warren, and Washington (Figure 1).

Figure 1. Counties included in the study.



Counties Included in Study

Key variables: Accidental overdose death data included information on demographic characteristics, incident county, county of residence, autopsy findings, and toxicology results. Toxicology results contained information of specific drug mentions. A drug “mention” means that a specific drug was found in a bodily system or fluid of a decedent, not that the drug was necessarily the sole cause of death. Most overdose cases involved multiple drugs. The presence of more than one drug can result in more than one mention from a single decedent.

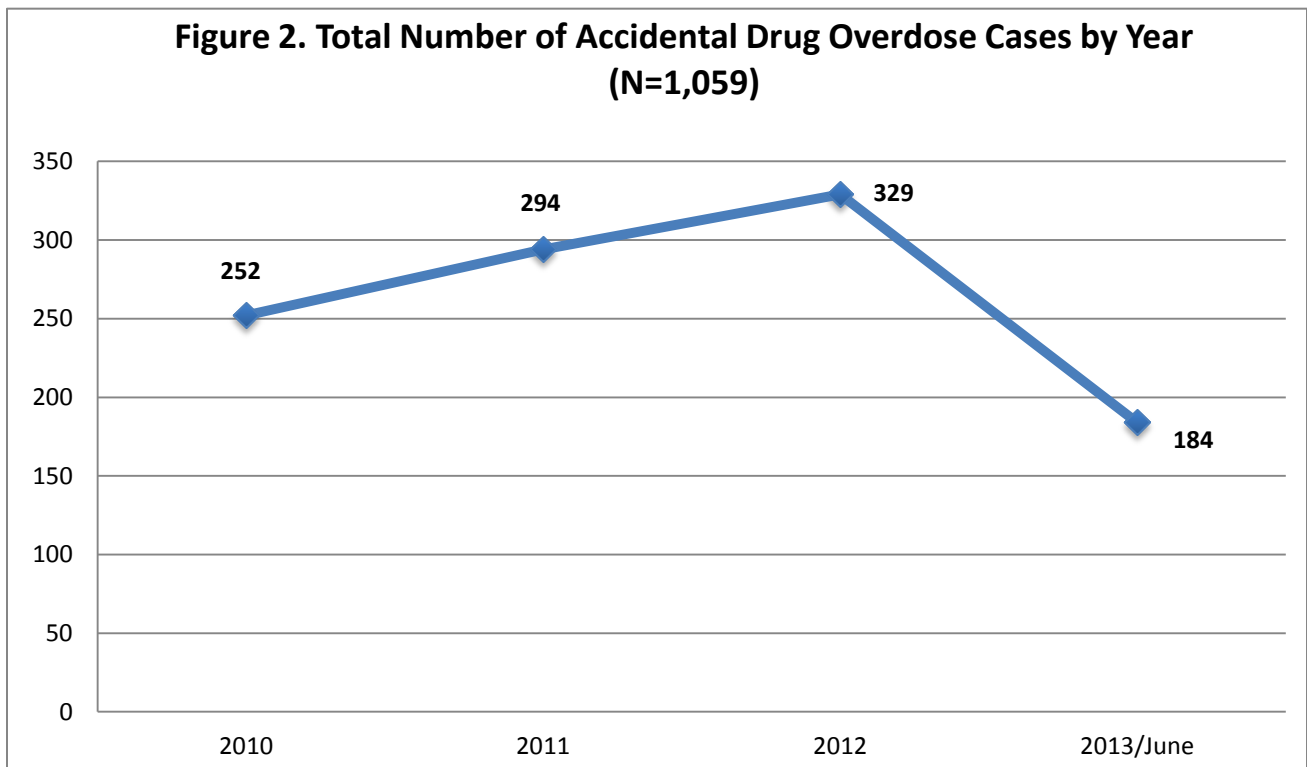
Note about the time period and reporting criteria: The original scope of work for this project included coroner data from 2010-2012. Subsequently, the coroner notified us of the availability of January - June 2013 data, which we elected to include in the analysis to obtain a more up-to-date picture of trends. However, we emphasize that the 2013 data presented in this report reflect trends from the first 6 months only. We also note that due to differences in reporting criteria, numbers of accidental drug overdoses in Montgomery County are slightly different from those reported in the Montgomery County Poisoning Death Review.

Data analysis: Using county of incident, we compare regional trends in overdose deaths related to pharmaceutical opioids, heroin, and other drugs. Regional trends are compared in two ways: **1)** Montgomery County versus all 23 other counties combined (the 23 County Group); and **2)** regional grouping of counties into Appalachian, Rural, Suburban, and Urban/Metropolitan (Montgomery County). Data were transposed into SPSS format, and SPSS was used to extract all salient demographic and toxicological information and conduct analyses. We identified metabolites of selected drugs in the electronic database and constructed a rubric for translating toxicological data into relevant counts of drugs that were present in a decedent’s system at the time of death. To identify statistically significant differences across regions and over time, comparisons were made using χ^2 tests and logistic regression analysis.

Results

The **final sample of 1,059** accidental drug overdose deaths included: **1)** Montgomery county data (N= 504); and **2)** data (N=555) from 23 additional counties (Appendix 1) that contract with Montgomery County Coroner's Office Toxicology Laboratory for autopsies.

Total numbers of accidental drug overdose deaths by year are displayed in Figure 2. Overall, accidental drug overdose deaths increased from 252 in 2010 to 329 in 2012 (Figure 2). Preliminary data from 2013 also show a continuing increase. In the first half of 2013, there were 184 accidental overdose deaths in Montgomery and other 23 counties combined.



Montgomery County vs. All Other Counties

DEMOGRAPHIC CHARACTERISTICS

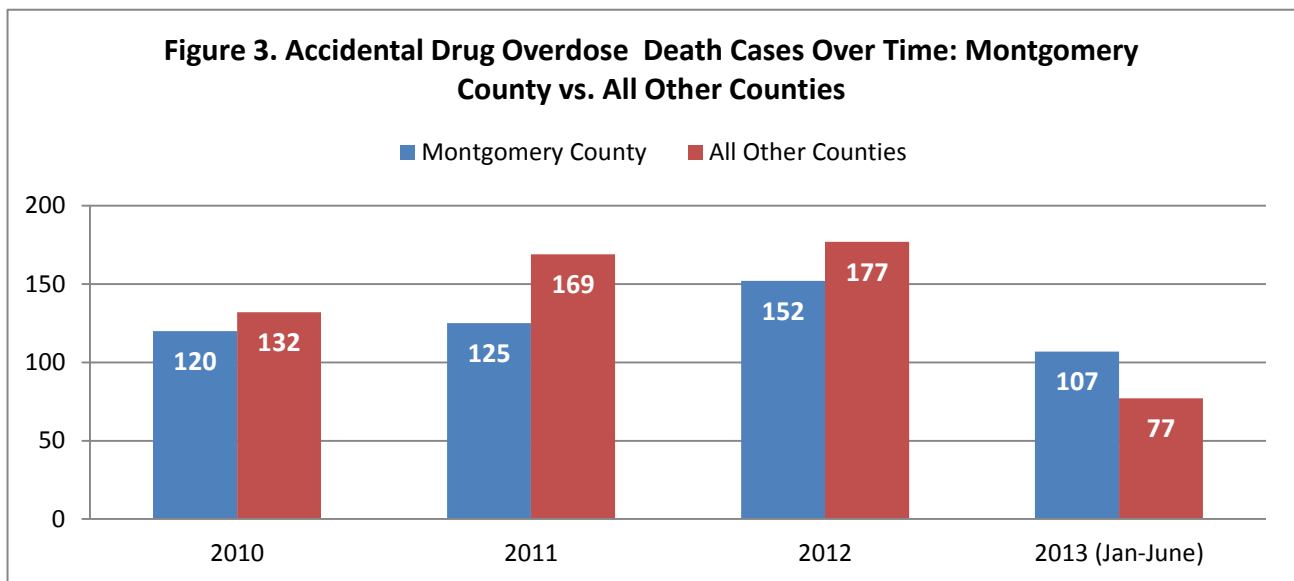
Out of 1,059 unintentional drug overdose deaths, 504 were from Montgomery County and 555 were from the other 23 counties (Appendix I). Table 1 compares the demographic characteristics of people who died from unintentional drug overdoses in Montgomery County with decedents in the other 23 counties. Overall, there were greater proportions of Whites than non-Whites and males than females in both regions. However, Montgomery County had a greater proportion of decedents who were “non-White” (12.7% vs 2.9%) and female (40.9% vs. 35.7%), but only the race difference between the two regions was statistically significant ($p < 0.001$). The mean age of decedents was 41.96 in Montgomery County and 40.64 in the 23County Group.

Demographics		Montgomery County (N=504)		All Other Counties (N=555)		All (N=1,059)	
Race*	Whites	440	87.3%	539	97.1%	979	92.4%
	Non-Whites	64	12.7%	16	2.9%	80	7.5%
Sex	Female	206	40.9%	198	35.7%	404	38.2%
	Male	298	59.1%	357	64.3%	655	61.8%
Age	Mean (SD)	41.96 (11.51)		40.64 (10.97)		41.27 (11.24)	

Race differences between the Montgomery County and all other counties were statistically significant at $p < 0.001$

DRUG TRENDS BY REGION AND OVER TIME

Overall, there was an increase in the number of cases of accidental drug overdose deaths for both Montgomery County and the 23 other counties combined (Figure 3) during



the 3.5 year period covered by the study. For example, in Montgomery County unintentional drug overdose deaths rose from 120 in 2010 to 152 in 2012, while deaths rose from 132 in the other 23 counties in 2010 to 177 in 2012.

Differences in drug mentions between county groups for all years combined are displayed in Table 2. Montgomery County had a greater proportion of deaths that tested positive for **cannabis**, **cocaine** and **heroin**, while the other county data showed a greater proportion of decedents testing positive for **pharmaceutical opioids** and **methamphetamine**, although the number of methamphetamine mentions is quite low (Table 2). Differences in mentions of specific pharmaceutical opioids--methadone, hydrocodone, and fentanyl were not statistically significant across groupings, but oxycodone was significantly less common in Montgomery County cases, compared to other counties. In addition, pharmaceutical opioids in combination with benzodiazepine mentions were more common in the 23 County Group than in Montgomery County.

DRUGS	All Years Combined (2010-2013, June)		Statistical significance (Chi-Square Test)
	Montg. (N=504)	All Others (N=555)	
Alcohol	133 (26.4%)	137 (24.7%)	Not significant
Cocaine	165 (32.7%)	86 (15.5%)	$\chi^2 = 43.4$, df=1, $P < 0.001$
Cannabis (THC)	171 (33.9%)	145 (26.1%)	$\chi^2 = 7.7$, df=1, $P = 0.006$
Methamphetamine	4 (0.8%)	14 (2.5%)	$\chi^2 = 4.7$, df=1, $p = 0.03$
Benzodiazepines	298 (59.1%)	330 (59.5%)	Not significant
Benzod. AND Pharm. Opioids	169 (33.5%)	223 (40.2%)	$\chi^2 = 5.0$, df=1, $p = 0.025$
Heroin	239 (47.4%)	194 (35.0%)	$\chi^2 = 17.0$, df=1, $p < 0.001$
Pharmaceutical opioids	309 (61.3%)	379 (68.3%)	$\chi^2 = 5.7$, df=1, $p = 0.017$
Hydrocodone	84 (16.7%)	102 (18.4%)	Not significant
Oxycodone	89 (17.7%)	146 (26.3%)	$\chi^2 = 11.4$, df=1, $p = 0.001$
Methadone	126 (25.0%)	118 (21.3%)	Not significant
Fentanyl	29 (5.8%)	36 (6.5%)	Not significant
ANY OPIOID (Pharm op. AND/OR heroin)	469 (93.1%)	505 (91.0%)	Not significant
Heroin, NO pharm. Opioids	160 (31.7%)	126 (22.7%)	$\chi^2 = 10.9$, df=1, $p = 0.001$
Pharm. Opioid AND heroin	79 (15.7%)	68 (12.3%)	Not significant
Pharm opioid, NO heroin	230 (45.6%)	311 (56.0%)	$\chi^2 = 11.4$, df=1, $p = 0.001$

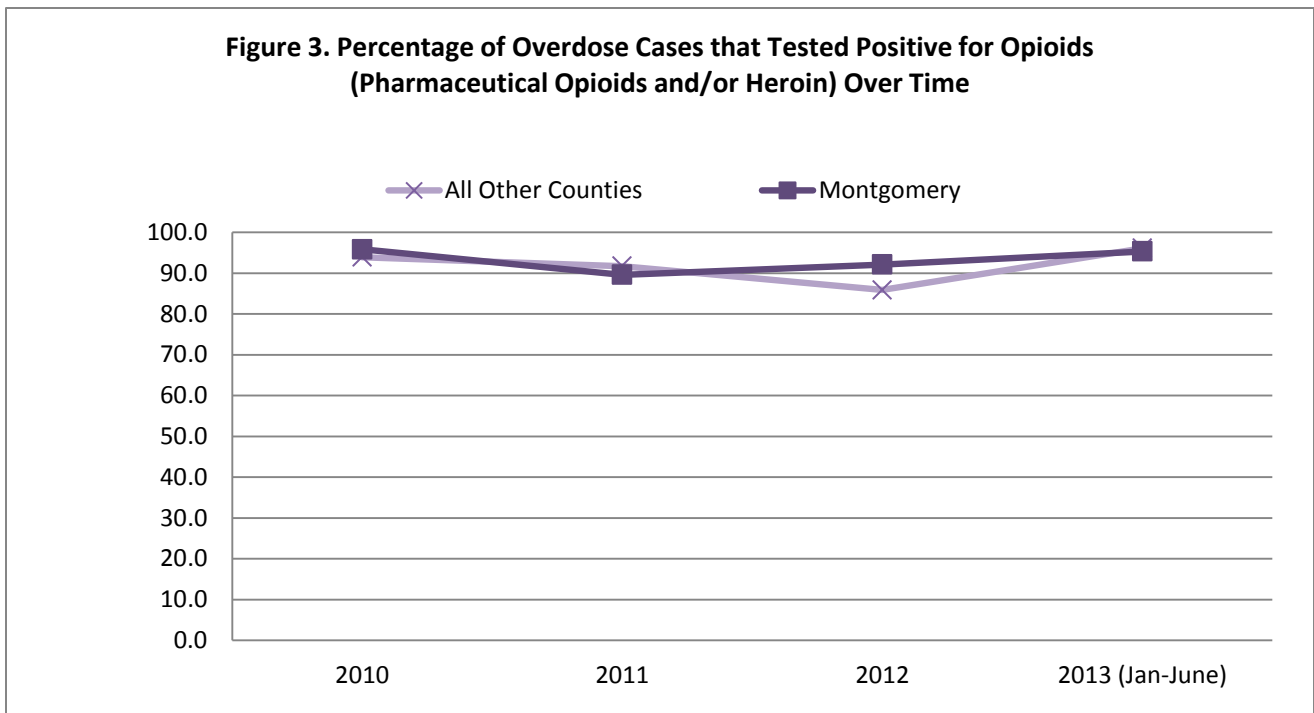
Data on drug mentions by county grouping and year are displayed in Table 3.

DRUGS	2010		2011		2012		2013 (Jan-Jun)	
	Montg. (N=120)	All Others (N=132)	Montg. (N=125)	All Others (N=169)	Montg. (N=152)	All Others (N=177)	Montg. (N=107)	All Others (N=77)
Alcohol	26 (21.7%)	29 (22.0%)	30 (24.0%)	40 (23.7%)	41 (27.0%)	39 (22.0%)	36[^] (33.6%)	29^{*^} (37.7%)
Cocaine	37 (30.8%)	24 (18.2%)	47 (37.6%)	27 (16.0%)	49 (32.2%)	28 (15.8%)	32 (29.9%)	7 (9.1%)
Cannabis (THC)	46 (38.3%)	38 (28.8%)	34 (27.2%)	43 (25.4%)	55 (36.2%)	47 (26.6%)	36 (33.6%)	17 (22.1%)
Methamphetamine	1 (0.8%)	2 (1.5%)	0 (0.0%)	3 (1.8%)	2 (1.3%)	6 (3.4%)	1 (0.9%)	3 (3.9%)
Benzodiazepines	87 (72.5%)	89 (67.4%)	82 (65.6%)	106 (62.7%)	69^{*^} (45.4%)	93[^] (52.5%)	60[^] (56.1%)	42 (54.5%)
Benzod. AND Pharm. Opioids	56 (46.7%)	60 (45.5%)	42^{*^} (33.6%)	76 (45.0%)	41[^] (27.0%)	61[*] (34.5%)	30[^] (28.0%)	26 (33.8%)
Heroin	39 (32.5%)	27 (20.5%)	46 (36.8%)	50 (29.6%)	87^{*^} (57.2%)	78^{*^} (44.1%)	67[^] (62.6%)	39[^] (50.6%)
Pharmaceutical opioids	91 (75.8%)	105 (79.5%)	83 (66.4%)	123 (72.8%)	80^{*^} (52.6%)	106^{*^} (59.9%)	55[^] (51.4%)	45[^] (58.4%)
Hydrocodone	28 (23.3%)	25 (18.9%)	21 (16.8%)	31 (18.3%)	20[^] (13.2%)	29 (16.4%)	15 (14.0%)	17 (22.1%)
Oxycodone	27 (22.5%)	42 (31.8%)	24 (19.2%)	51 (30.2%)	27 (17.8%)	36[^] (20.3%)	11[^] (10.3%)	17 (22.1%)
Methadone	41 (34.2%)	47 (35.6%)	43 (34.4%)	35[^] (20.7%)	24^{*^} (15.8%)	26[^] (14.7%)	18[^] (16.8%)	10[^] (13.0%)
Fentanyl	9 (7.5%)	9 (6.8%)	8 (6.4%)	9 (5.3%)	7 (4.6%)	16 (9.0%)	5 (4.7%)	2 (2.6%)
ANY OPIOID (Pharm op. AND/OR heroin)	115 (95.8%)	124 (93.9%)	112 (89.6%)	155 (91.7%)	140 (92.1%)	152[^] (85.9%)	102 (95.3%)	74[*] (96.1%)
Heroin, NO pharm. Opioids	24 (20.0%)	19 (14.4%)	29 (23.2%)	32 (18.9%)	60^{*^} (39.5%)	46[^] (26.0%)	47[^] (43.9%)	29[^] (37.7%)
Pharm. Opioid AND heroin	15 (12.5%)	8 (6.1%)	17 (13.6%)	18 (10.7%)	27 (17.8%)	32^{*^} (18.1%)	20 (18.7%)	10[^] (13.0%)
Pharm opioid, NO heroin	76 (63.3%)	97 (73.5%)	66 (52.8%)	105[^] (62.1%)	53^{*^} (34.9%)	74^{*^} (41.8%)	35[^] (32.7%)	35[^] (45.5%)

Statistical significance of changes over time:
*Statistically significant change (at least $p \leq 0.05$) compared to prior year data
[^]Statistically significant change (at least $p \leq 0.05$) compared to 2010 data.

Opioid Trends by Region

Opioids (including any pharmaceutical opioids and/or heroin) were the most commonly reported drugs in accidental drug overdose deaths across both groups (Figure 3). In Montgomery County, opioids (heroin and/or pharmaceutical opioids) were found in about 90% or more of the unintentional drug overdose deaths in each of the 4 years (Table 3; Figure 3). Any opioid mentions in the 23 other counties were very similar, with 94% in 2010, declining to about 86% in 2012, and then increasing again in 2013 to 96% (Table 3).



Heroin

Overall, heroin mentions were more common in Montgomery County than in the 23 County Group. For all years combined, about 47% of all accidental overdose death cases in Montgomery county tested positive for heroin, compared to 35% for 23 County Group (Table 2). Over time, heroin mentions remained more common in Montgomery County than in the 23 County Group: in 2010, heroin was present in about 35% of OD cases in Montgomery county and about 21% in 23 County Group; in 2012, these percentages were 57% and 44% respectively.

Both regions experienced increases in heroin-related overdose cases over time, with most substantial increases occurring in 2012. For example, heroin-related overdose cases in Montgomery County increased from 39 (33%) in 2010 to 87 (57%) in 2012. In the 23 County Group, heroin mentions increased from 27 (21%) in 2010 to 78 (44%) in 2012. Preliminary data from 2013 suggest the trend of increases in heroin mentions is continuing in both regions. In the first half of 2013, almost 63% of all overdose cases in Montgomery County and 51% in the 23 County Group tested positive for heroin (Table 3).

Figure 4. Pharmaceutical Opioids and Heroin in Accidental Drug Overdose Cases, Montgomery County

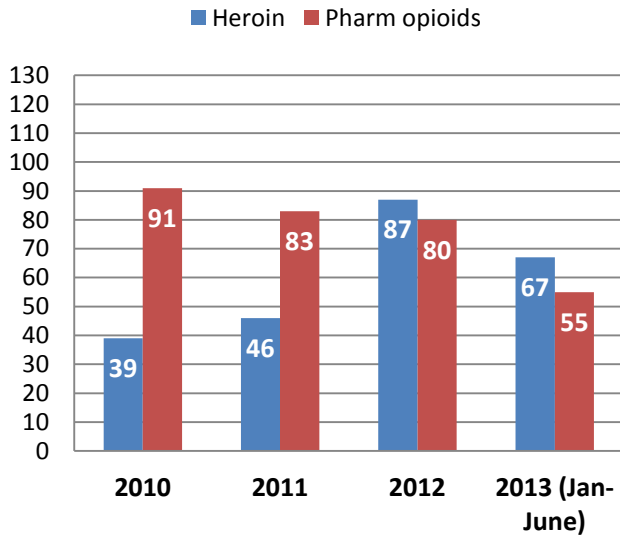


Figure 5. Pharmaceutical Opioids and Heroin in Accidental Drug Overdose Cases, Other 23 Counties

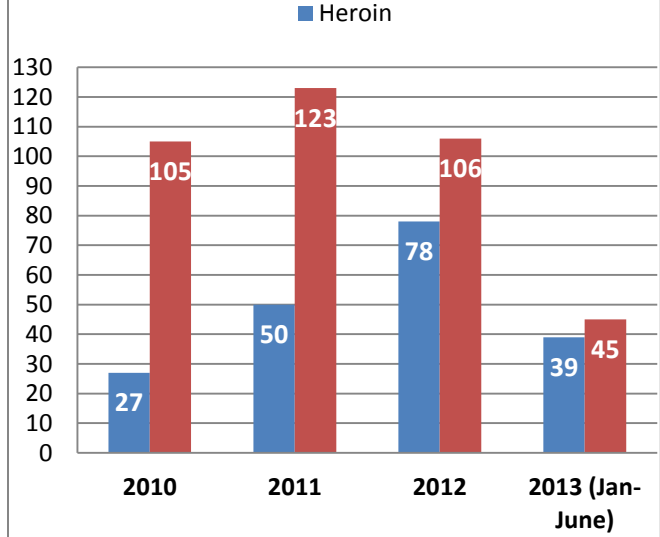
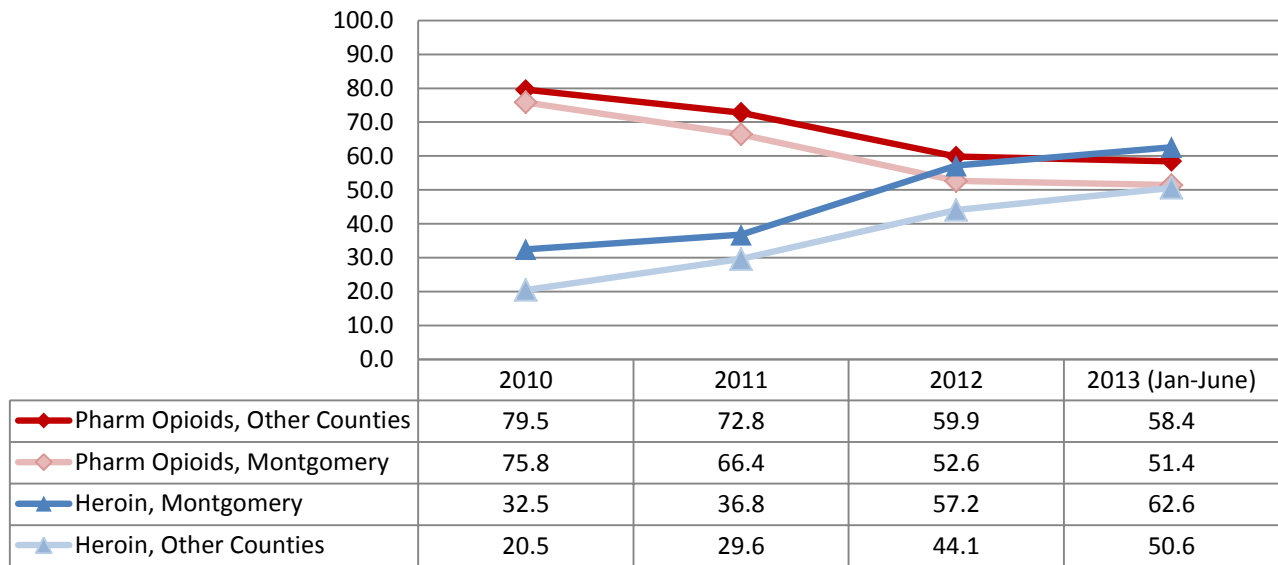


Figure 6. Percentage of Heroin and Pharmaceutical Opioid Mentions in Drug Overdose Cases Over Time: Montgomery County vs. All Other Counties



Pharmaceutical opioids

In contrast to heroin trends, pharmaceutical opioid mentions were less common in Montgomery County, compared to the 23 County Group. For all years combined, 61% of Montgomery County cases tested positive for pharmaceutical opioids compared to 68% in the 23 County Group (Table 2). Over time, pharmaceutical opioid mentions remained more common in the 23 County Group than in Montgomery County. Regional differences in pharmaceutical opioid mentions were **smaller** compared to regional differences in heroin mentions.

While heroin mentions increased, pharmaceutical opioid mentions declined over time in both regions. Similar to heroin trends, the most notable changes occurred in 2012. As seen in Table 3 and Figures 4, 5, and 6, pharmaceutical opioid mentions in Montgomery County declined from 91(76%) in 2010 to 83 (66%) in 2011 and 80 (53%) in 2012 (only changes in 2012 were statically significant). In the 23 County Group, 105 (80%) cases in 2010, 123 (73%) cases in 2011, and 106 (60%) in 2012 tested positive for pharmaceutical opioids. Logistic regression analysis revealed that 2012 numbers represent a statistically significant decline compared to 2010 and 2011 (Table 3). Data from the first half of 2013 suggest that pharmaceutical opioid mentions in both regions did not change compared to 2012 data, but remained significantly lower than in 2010 (Table 3).

Pharmaceutical opioid product mentions differed somewhat by grouping over time (Table 3). Although **hydrocodone** mentions decreased significantly in Montgomery County from 23% in 2010 to 13% in 2012, the percentage remained fairly constant in the 23 County Group —ranging from 19% in 2010 to 16% in 2012. The percentage of **oxycodone** was significantly higher in the 23 County Group (32% in 2010; 20% in 2012), compared to Montgomery County (23% in 2010; 18% in 2012) over time, although the percentage decreased significantly from 32% in 2010 to 20% in 2012 in the 23 County Group (Table 3). **Methadone** mentions decreased significantly in both groups in 2012. In both groups, the percentage of methadone mentions was almost identical at about 35% in 2010. In Montgomery County, methadone mentions remained at 34% in 2011 and then decreased significantly to 16% in 2012. In the 23 County Group, methadone mentions decreased to 21% in 2011 and then to 15% in 2012 (Table 3).

Pharmaceutical Opioids and Heroin: “Concomitant” vs. “Stand-Alone” Cases

Figures 7, 8, and 9 display numbers and percentages of cases that tested positive for different combinations of illicit opioids: “heroin only” (no pharmaceutical opioids), “heroin and pharmaceutical opioids,” and “pharmaceutical opioids only” (no heroin). In both regions, cases that tested positive for both heroin and pharmaceutical opioids were far less common than “heroin only” or “pharmaceutical only” cases. For all years combined, there were no statistically significant regional differences in cases that tested positive for both types of opioids. Over time, Montgomery County data showed no statistically significant changes in cases that contained both types of opioids. In the 23 County Group, such cases increased significantly from 6%-10% in 2010 and 2011 to 18% in 2012.

As expected, “heroin only” cases were more common in Montgomery County, while “pharmaceutical only” cases were more common in the 23 County Group (Figures 7-9, Table 2). Between 2010 and 2012, “heroin only” cases increased significantly from 20% to 40% in Montgomery County, and from 14% to 26% in the 23 County Group. “Pharmaceutical opioid only” cases declined in both regions. In the 23 County Group, a statistically significant decline occurred in 2011 and 2012 (from 74% in 2010 to 62% in 2011, and down to 42% in 2012) (Figures 7-9, Table 3). In Montgomery County, there were no statistically significant changes in “pharmaceutical opioid only” cases in 2011. However, 2012 data show a statistically significant decline compared 2010 and 2011 (Table 3).

Figure 7. Opioid-Related Overdose Deaths in 23 Other Counties

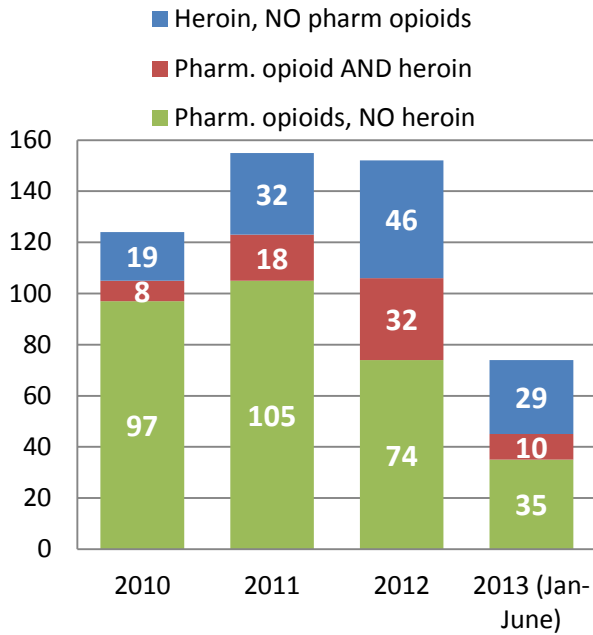


Figure 8. Opioid-Related Overdose Deaths in Montgomery County

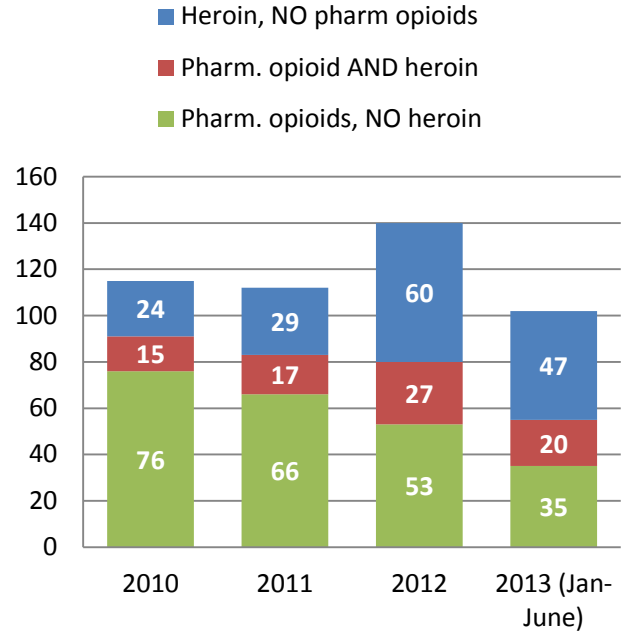
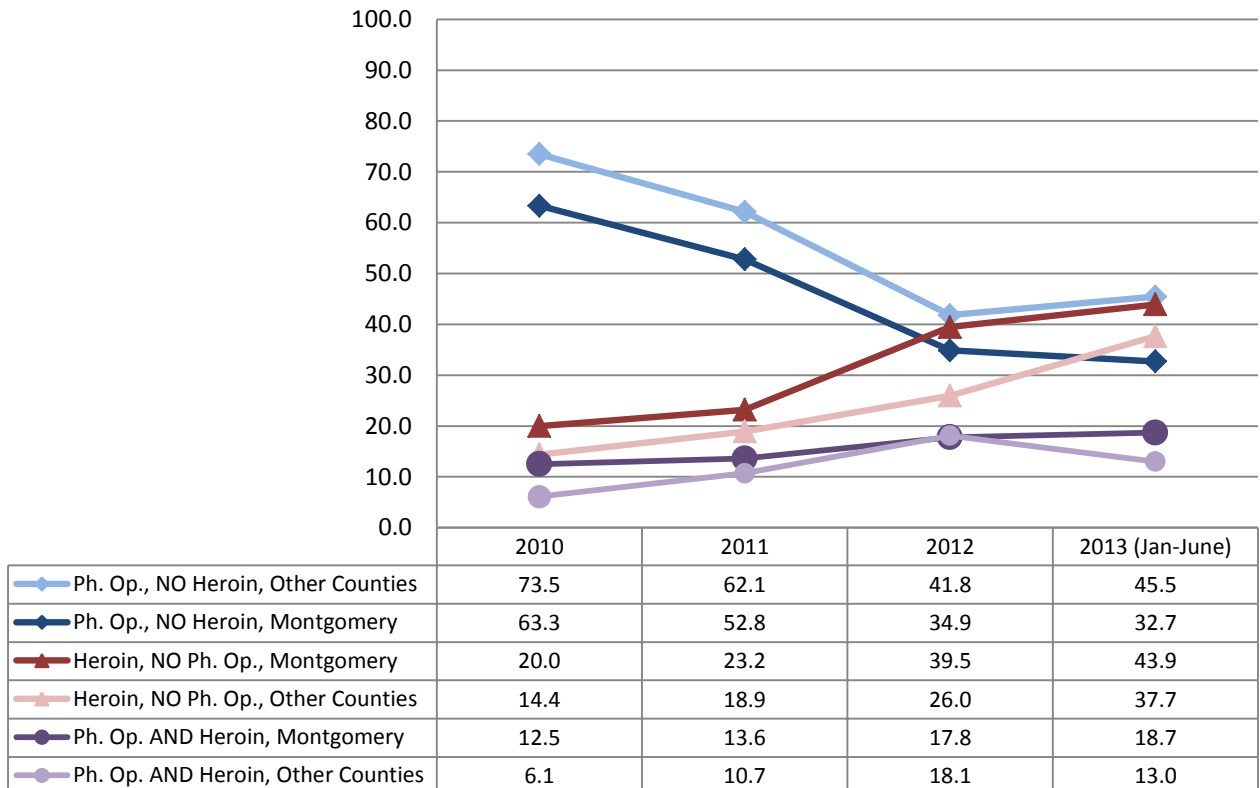


Figure 9. Percentages of Pharmaceutical Opioid and Heroin Mentions Over Time: "Concomittant" and "Stand-Alone" Cases in Montgomery County and All Other Counties



Summary of Heroin and Pharmaceutical Opioid Trends

In terms of regional differences, pharmaceutical opioid mentions were more common in the 23 County Group than in Montgomery County. Conversely, heroin mentions were less common in the 23 County Group than in Montgomery County. However, regional differences in heroin mentions were greater than regional differences in pharmaceutical opioid mentions (Figure 6).

In terms of changes over time, pharmaceutical opioid mentions declined while heroin mentions increased in both regions. The most notable increases in heroin and decreases in pharmaceutical opioid mentions occurred in 2012 both in Montgomery County and in the 23 County Group. **Since 2012, more accidental overdose cases in Montgomery County tested positive for heroin than pharmaceutical opioids.** In the other 23 counties, heroin mentions have not yet equaled pharmaceutical opioid mentions.

In both regions, **increases in heroin-related mentions were more substantial than declines in pharmaceutical opioid mentions.** As a result, the overall numbers of opioid-related deaths increased in both regions, and opioids (pharmaceutical opioid and/or heroin) remained the most commonly identified drugs in the accidental drug overdose cases.

Benzodiazepine Trends by Region

Overall, there were no statistically significant regional differences in benzodiazepine mentions (Table 2). Figure 10 illustrates a fairly clear correspondence between the percentage of benzodiazepine mentions in Montgomery County and the 23 County Group over time. Similar to pharmaceutical opioid mentions, benzodiazepine mentions declined significantly in 2012 in both regions, although the decline was greater in Montgomery County than in the 23 County Group. In Montgomery County, benzodiazepines were present in 45% of overdose cases in 2012, a statistically significant decline compared to 2010 (73%) and 2011 (66%). In the 23 County Group, benzodiazepines declined from 67% in 2010 to 53% in 2012.

The 23 County Group had a greater proportion of overdose cases that tested positive for *both* benzodiazepines *and* prescription opioids (Table 2). Figure 11 shows that both regions experienced similar declines in deaths involving *both* benzodiazepines *and* prescription opioids. In Montgomery County, the combination of pharmaceutical opioid and benzodiazepine mentions decreased significantly from 47% in 2010 to 34% in 2011, and then to 27% in 2012. By comparison, the benzodiazepine/pharmaceutical opioid combination remained constant at about 45% in the 23 County Group from 2010 to 2011, and then decreased significantly to 35% in 2012.

Figure 10. Percentage of Drug Overdose Cases that Tested Positive for Benzodiazepines: Montgomery County vs. All Other 23 Counties

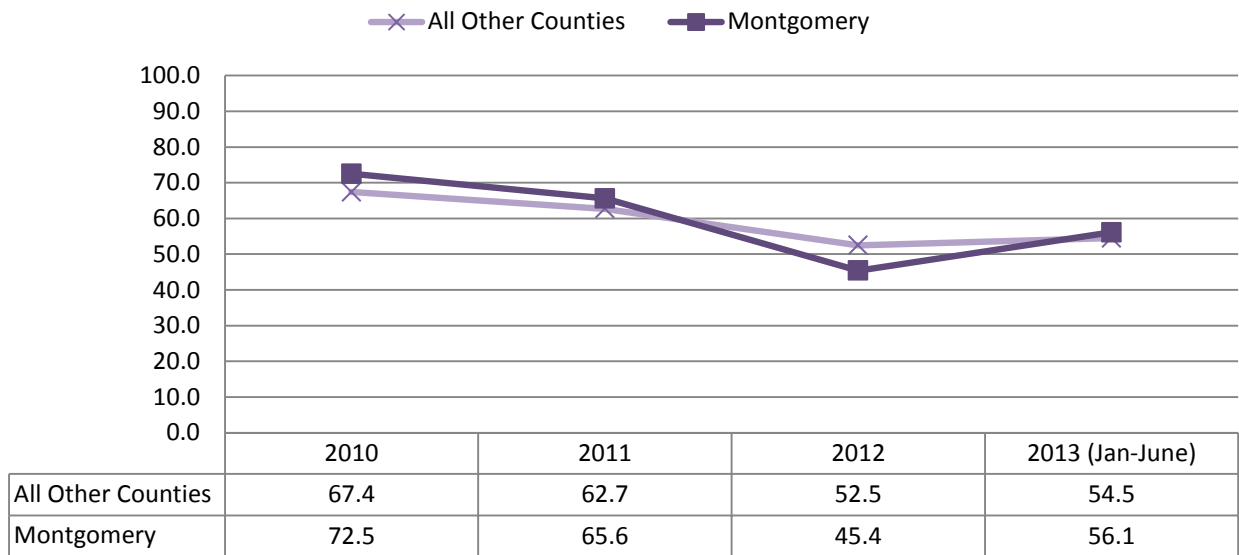
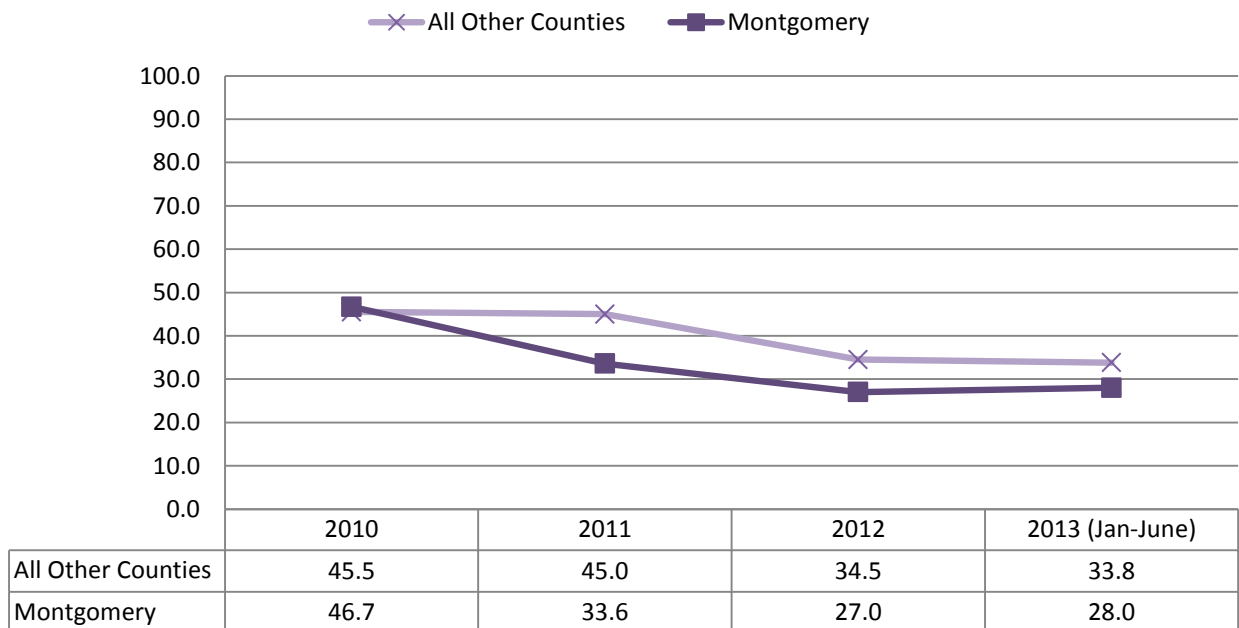


Figure 11. Percentage of Drug Overdose Cases that Tested Positive for Both Benzodiazepines and Pharmaceutical Opioids: Montgomery County vs. All Other 23 Counties

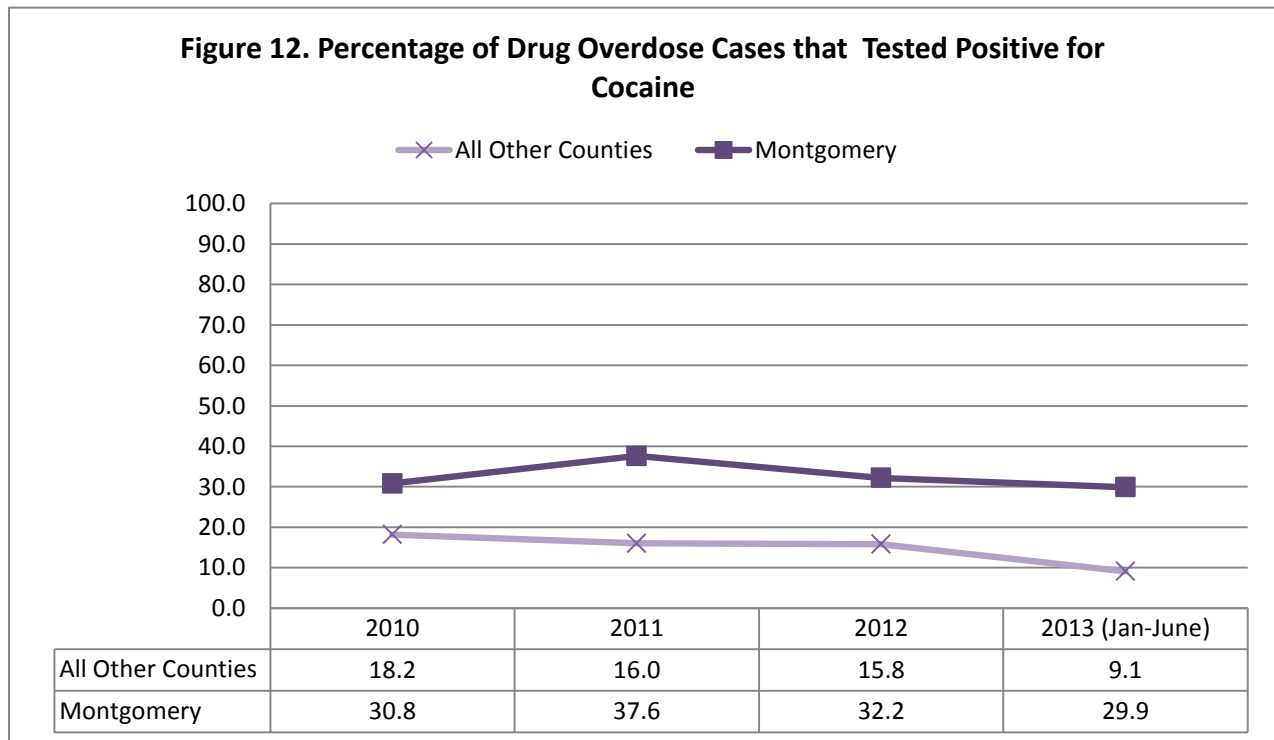


Cocaine-Related Cases and Levamisole

Cocaine mentions remained stable over time, but were more common in Montgomery County than in the non-urban counties (Table 2, Figure 12). In Montgomery County, cocaine mentions increased from 31% to 38% from 2010 to 2011 and then decreased to 32% in 2012, but these changes were not statistically significant. In comparison, cocaine mentions were consistently lower in the 23 County Group, ranging from 18% in 2010 and 16% in 2012.

Out of 1,059 unintentional drug overdose deaths, there were 189 cases that tested positive for levamisole. In the U.S., levamisole is approved for use in veterinary medicine to treat parasitic infections. It was used in human medicine as an immunomodulator in rheumatoid arthritis and colorectal cancer therapy, but is no longer available for human use in the U. S. Since 2009, the Drug Enforcement Administration reported an increase in levamisole-adulterated cocaine. Levamisole may have dangerous health risks because it suppresses the immune system of those who are exposed to it.

In our data set, almost all (n=187, 99%) of levamisole cases also tested positive for cocaine, which suggests that levamisole was consumed as an adulterant of cocaine. Overall, about 74.5% of cocaine-positive cases also tested positive for levamisole, with rates somewhat higher in Montgomery County (78%) than in all other counties combined (69%).



Regional Differences: Appalachian, Rural, Suburban, and Urban Counties

To examine regional differences, the 24 counties were grouped into 4 regions as defined by the Ohio Department of Mental Health and Addiction Services. As shown in Table 4, 9 of the 24 counties were classified as Appalachian, 9 as Rural, 5 as Suburban, and 1 as Urban (Metropolitan) County.

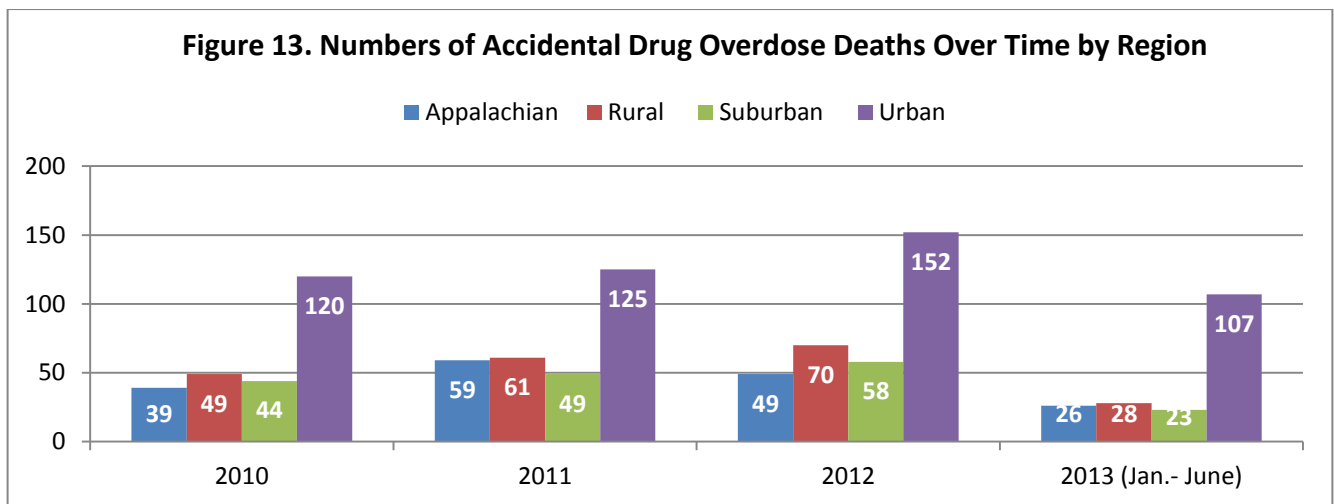
Table 4. Montgomery and Other 23 Counties Grouped by Region.

Appalachian (9)		Rural (9)		Suburban (5)		Urban (1)
Adams	Meigs	Clinton	Mercer	Clark	Montgomery	
Athens	Ross	Darke	Preble	Greene		
Brown	Scioto	Fayette	Shelby	Madison		
Gallia	Washington	Hardin	Warren	Miami		
Highland		Logan		Pickaway		

DRUG TRENDS BY REGION

As shown in Figure 13, the number of accidental drug overdose deaths increased in most regions between 2010 and 2012, but there was a decline in the number of deaths in the Appalachian Region from 59 deaths in 2011 to 49 deaths in 2012. Although data from the first six months of 2013 may indicate a slight decrease in Rural and Suburban accidental drug overdose deaths, these are partial data and may not indicate an annual decrease. By contrast, there was an apparent increase in the number of deaths in Montgomery County during the first six months of 2013.

Table 5 provides a comparison of drug mentions by region for all years combined, and Table 6 provides data on regional changes over time. There were no statistically significant regional differences or changes over time in mentions of alcohol or THC.



DRUGS	All Years Combined (2010-2013, June)				Statistical significance (Chi-Square Test)
	Montgomery (N=504)	Suburban (N=174)	Rural (N=208)	Appalachian (N=173)	
Alcohol	133 (26.4%)	44 (25.3%)	50 (24.0%)	43 (24.9)	Not significant
Cocaine	165 (32.7%)	37 (21.3%)	36 (17.3%)	13 (7.5%)	p<0.001
Cannabis (THC)	171 (33.9%)	39 (22.4%)	53 (25.5%)	53 (30.6%)	p=0.14
Methamphetamine	4 (0.8%)	1 (0.6%)	6 (2.9 %)	7 (4.0%)	-
Benzodiazepines	298 (59.1%)	91 (52.3%)	128 (61.5%)	111 (64.2%)	Not significant
Benzod. AND Pharm. Opioids	169 (33.5%)	58 (33.3%)	79 (38.0%)	86 (49.7%)	p=0.001
Heroin	239 (47.4%)	66 (37.9%)	78 (37.5%)	50 (28.9%)	p<0.001
Pharmaceutical opioids	309 (61.3%)	108 (62.1)	135 (64.9%)	136 (78.6%)	p<0.001
Hydrocodone	84 (16.7%)	24 (13.8%)	42 (20.2%)	36 (20.8%)	Not Significant
Oxycodone	89 (17.7%)	35 (20.1%)	44 (21.2%)	67 (38.7%)	p<0.001
Methadone	126 (25.0%)	39 (22.4%)	43 (20.7%)	36 (20.8%)	Not significant
Fentanyl	29 (5.8%)	9 (5.2%)	12 (5.8%)	15 (8.7%)	Not significant
ANY OPIOID (Pharm. op. AND/OR heroin)	469 (93.1%)	153 (87.9%)	187 (89.9%)	165 (95.4%)	p=0.036
Heroin, NO pharm. op.	160 (31.7%)	45 (25.9%)	52 (25.0%)	29 (16.8%)	p=0.001
Pharm. op. AND heroin	79 (15.7%)	21 (12.1%)	26 (12.5%)	21 (12.1%)	Not significant
Pharm. op., NO heroin	230 (45.6%)	87 (50%)	109 (52.4%)	115 (66.5%)	p<0.001

Cocaine mentions were more common in Montgomery County than in the other regions. For all years combined, cocaine was mentioned in 32.7% of the overdoses in Montgomery County, compared to 21.3% in the Suburban Region, 17.3% in Rural Counties, and only 7.5% in Appalachian Counties (Table 5). There were no statistically significant changes in cocaine mentions over time (Table 6). Regional differences in **benzodiazepine** mentions were not statistically significant, when data were analyzed for all years combined (Table 5). However, benzodiazepine mentions declined significantly in the Suburban Region from 64% in 2010 to 40% in 2012, and in the Urban Region from 73% in 2010 (and 66% in 2011), then to 45% in 2012. There were no statistically significant changes in benzodiazepine mentions in the Rural and Appalachian Regions. **The most notable regional differences and changes over time were observed in mentions of heroin and pharmaceutical opioids.**

Table 6. Drug Mentions in Accidental Overdose Cases by Four Regions and Year (N=1,059).

DRUGS	2010				2011				2012				2013			
	App. N=39	Rur. N=49	Sub. N=44	Urb. N=120	App. N=59	Rur. N=61	Sub. N=49	Urb. N=125	App. N=49	Rur. N=70	Sub. N=58	Urb. N=152	App. N=26	Rur. N=28	Sub. N=23	Urb. N=107
Alcohol	9 23.1%	12 24.5%	8 18.2%	26 21.7%	16 27.1%	10 16.4%	14 28.6%	30 24.0%	7 14.3%	17 24.3%	15 25.9%	41 27.0%	11 42.3%	11 39.3%	7 30.4%	36 33.6%
Cocaine	3 7.7%	14 28.6%	7 15.9%	37 30.8%	7 11.9%	9 14.8%	11 22.4%	47 37.6%	2 4.1%	9 12.9%	17 29.3%	49 32.2%	1 3.8%	4 14.3%	8 8.7%	32 29.9%
Cannabis (THC)	16 41.0%	10 20.4%	12 27.3%	46 38.3%	19 32.2%	18 29.5%	6 12.2%	34 27.2%	12 24.5%	17 24.3%	18 31.0%	55 36.2%	6 23.1%	8 28.6%	3 13.0%	36 33.6%
Meth	1 2.6%	1 2.0%	0 0.0%	1 0.8%	1 1.7%	2 3.3%	0 0.0%	0 0.0%	3 6.1%	3 4.3%	0 0.0%	2 1.3%	2 7.7%	0 0.0%	1 4.3%	1 0.9%
Benzodiazepines	30 76.9%	31 63.3%	28 63.6%	87 72.5%	36 61.0%	40 65.6%	30 61.2%	82 65.6%	30 61.2%	40 57.1%	23 [^] 39.7%	69 ^{^*} 45.4%	15 57.7%	17 60.7%	10 43.5%	60 [^] 56.1%
Benzod. AND Pharm. Opioids	23 59.0%	18 36.7%	19 43.2%	56 46.7%	31 52.5%	26 42.6%	19 38.8%	42 ^{^*} 33.6%	22 44.9%	24 34.3%	15 25.9%	41 [^] 27.0%	10 38.5%	11 39.3%	5 21.7%	30 [^] 28.0%
Heroin	3 7.7%	15 30.6%	9 20.5%	39 32.5%	15 ^{^*} 25.4%	19 31.1%	16 32.7%	46 36.8%	19 [^] 38.8%	30 42.9%	29 [^] 50.0%	87 ^{^*} 57.2%	13 [^] 50.0%	14 50.0%	12 [^] 52.2%	67 [^] 62.6%
Pharmaceutical opioids	36 92.3%	33 67.3%	36 81.8%	91 75.8%	49 83.1%	40 65.6%	34 69.4%	83 66.4%	34 [^] 69.4%	44 62.9%	28 ^{^*} 48.3%	80 ^{^*} 52.6%	17 [^] 65.4%	18 64.3%	10 [^] 43.5%	55 [^] 51.4%
Hydrocodone	5 12.8%	10 20.4%	10 22.7%	28 23.3%	14 23.7%	9 14.8%	8 16.3%	21 16.8%	9 18.4%	14 20.0%	6 10.3%	20 [^] 13.2%	8 30.8%	9 32.1%	0 0.0%	15 14.0%
Oxycodone	22 56.4%	14 28.6%	6 13.6%	27 22.5%	25 42.4%	14 23.0%	12 24.5%	24 19.2%	12 [^] 24.5%	13 18.6%	11 19.0%	27 17.8%	8 [^] 30.8%	3 10.7%	6 26.1%	11 [^] 10.3%
Methadone	15 38.5%	13 26.5%	19 43.2%	41 34.2%	12 20.3%	13 21.3%	10 [^] 20.4%	43 34.4%	7 [^] 14.3%	11 15.7%	8 [^] 13.8%	24 ^{^*} 15.8%	2 [^] 7.7%	6 21.4%	2 [^] 8.7%	18 [^] 16.8%
Fentanyl	3 7.7%	1 2.0%	5 11.4%	9 7.5%	4 6.8%	2 3.3%	3 6.1%	8 6.4%	8 16.3%	7 10.0%	1 1.7%	7 4.6%	0 0.0%	2 7.1%	0 0.0%	5 4.7%
ANY OPIOID (Ph. op. AND/OR heroin)	38 97.4%	45 91.8%	41 93.2%	115 95.8%	57 96.6%	55 90.2%	43 87.8%	112 89.6%	44 89.8%	60 85.7%	48 82.8%	140 92.1%	26 100.0%	27 96.4%	21 91.3%	102 95.3%
Heroin, NO pharm. Opioids	2 5.1%	12 24.5%	5 11.4%	24 20.0%	8 13.6%	15 24.6%	9 18.4%	29 23.2%	10 20.4%	16 22.9%	20 [^] 34.5%	60 ^{^*} 39.5%	9 [^] 34.6%	9 32.1%	11 [^] 47.8%	47 [^] 43.9%
Pharm. Opioid AND heroin	1 2.6%	3 6.1%	4 9.1%	15 12.5%	7 11.9%	4 6.6%	7 14.3%	17 13.6%	9 18.4%	14 [^] 20.0%	9 15.5%	27 17.8%	4 15.4%	5 17.9%	1 4.3%	20 18.7%
Pharm opioid, NO heroin	35 89.7%	30 61.2%	32 72.7%	76 63.3%	42 [^] 71.2%	36 59.0%	27 55.1%	66 52.8%	25 ^{^*} 51.0%	30 42.9%	19 [^] 32.8%	53 ^{^*} 34.9%	13 [^] 50.0%	13 46.4%	9 [^] 39.1%	35 [^] 32.7%

Statistical significance of changes over time within each region:

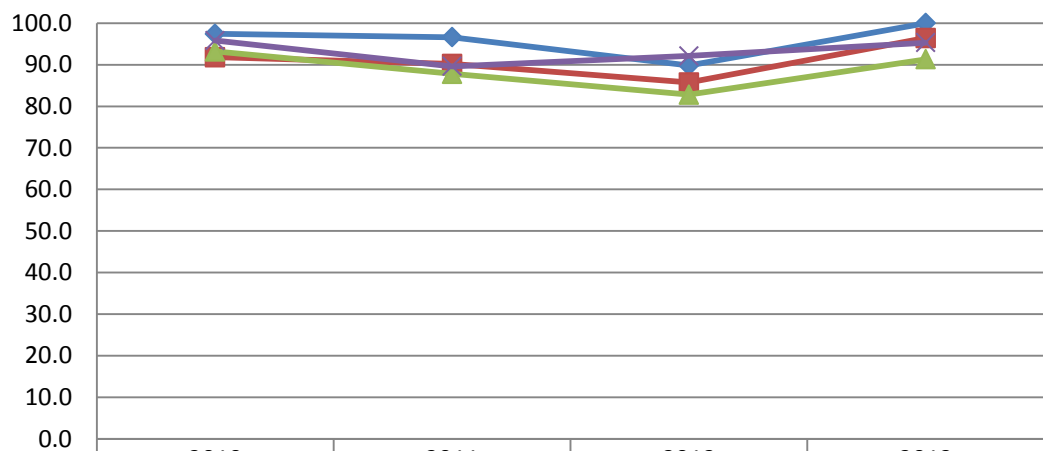
*Statistically significant change (at least $p \leq 0.05$) compared to prior year data.

[^]Statistically significant change (at least $p \leq 0.05$) compared to 2010 data.

Opioid Trends by Region

In all regions, the majority of accidental drug overdose death cases contained mentions of opioid drugs (including any pharmaceutical opioids and/or heroin). However, rates tended to be higher in the Appalachian Region and lower in the Suburban Region (Figure 14). For all years combined, regional differences were statistically significant –the rates were 95% in the Appalachian region, 90% in the Rural Region, 93% in the Urban Region, and 88% in the Suburban Region (Table 5). Over time, there were no statistically significant changes in “any opioid” (heroin and/or pharmaceutical opioid) mentions over time in any of the regions (Table 6)

Figure 14 . Percentage of OD Cases that Tested Positive for Any Opioid (Heroin and/or Pharmaceutical Opioid) Over Time by Regions



◆ Appalachian	97.4	96.6	89.8	100.0
■ Rural	91.8	90.2	85.7	96.4
▲ Suburban	93.2	87.8	82.8	91.3
× Urban/Montgomery	95.8	89.6	92.1	95.3

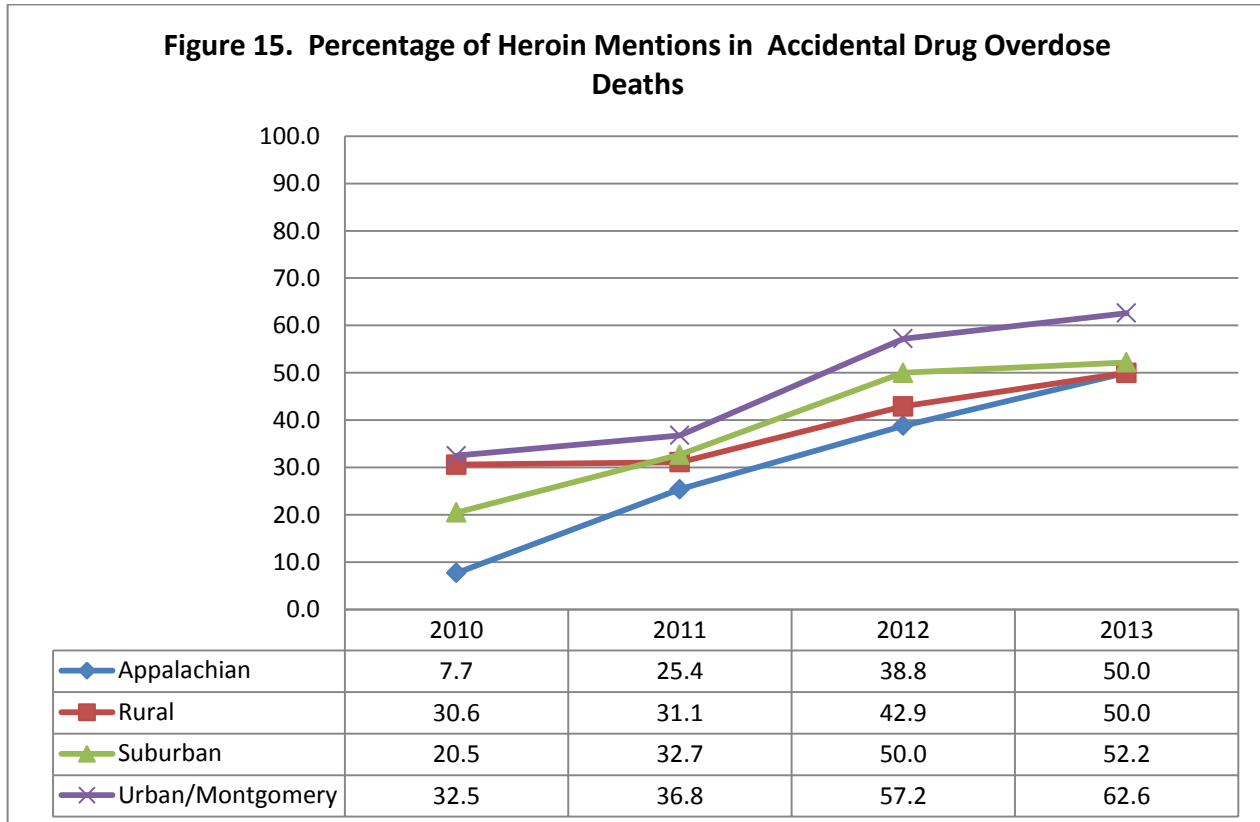
Heroin

There were significant differences in heroin mentions across the four regions (Table 5). Heroin mentions remained the most common in Montgomery County and the least common in the Appalachian Region (Figure 15). For all years combined, heroin was present in 30% of overdose cases in the Appalachian Region, 38% in the Rural and Suburban Regions, and 47% in Montgomery County (Table 5).

Over time, heroin mentions became more common in all regions, although increases in the Rural Region were not statistically significant (Figure 15, Table 6). Between 2010 and 2012, heroin mentions increased significantly from 33% to 57% in Montgomery County, and from 21% to 50% in the Suburban Region. In the Appalachian Region, heroin mentions increased significantly from 8% in 2010 to 25% in 2011, and then to 39% in 2012. Percentages of heroin mentions were stable in the Rural Region at about 31% in 2010 and

2011, and then increased to 43% in 2012, although this change was not statistically significant (Table 6).

In the first half of 2013, heroin mentions in all but the Rural Region remained significantly higher, compared to 2010 data (Table 6). In comparison to 2012, preliminary data from 2013 indicate increases in heroin mentions from 39% to 50% in the Appalachian Region, from 43% to 50% in the Rural Region, and from 57% to 63% in Montgomery County, although these changes were not statistically significant (Table 6). We stress these partial 2013 data may not reflect annual trends.



Pharmaceutical Opioids

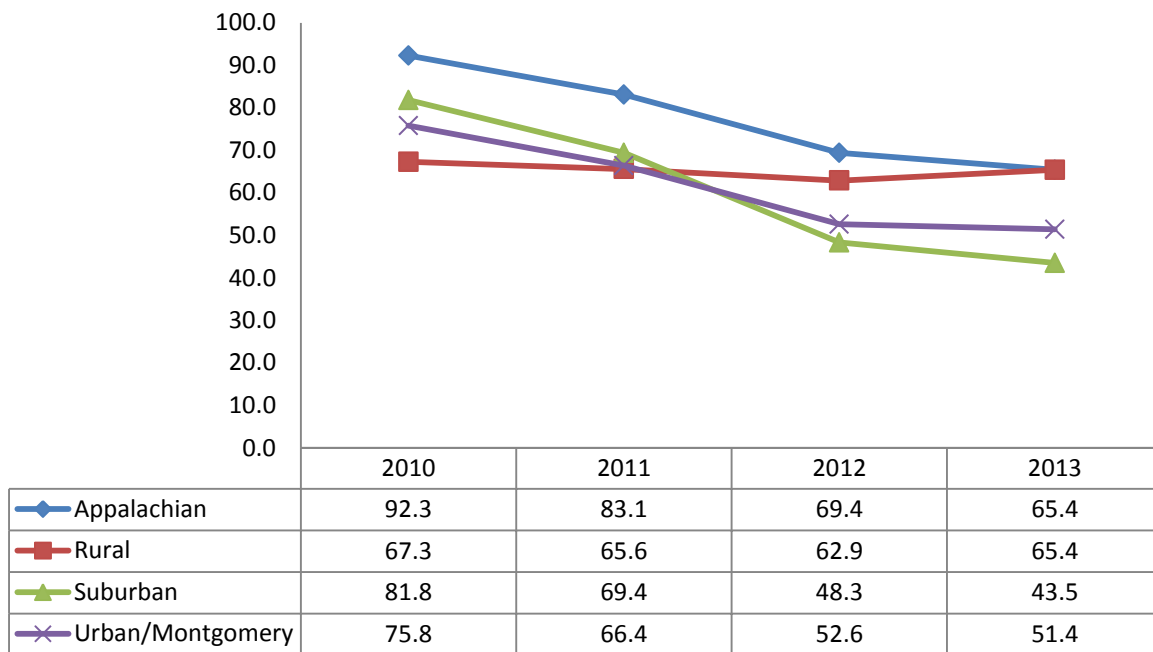
Consistent with the Montgomery County and 23 County Group comparison, pharmaceutical opioid mentions declined over time in the regional groupings, in most cases. The percentage changes in pharmaceutical opioid mentions from 2010 to 2012, in particular, are striking and vary substantially by region (Table 6).

The Appalachian Region had the highest proportion of deaths involving a pharmaceutical opioid in comparison with the other regions, regardless of year. For all years combined, pharmaceutical opioids were present in 79% of overdose cases in the Appalachian Region, 65% in the Rural Region, 62% in the Suburban Region, and 61% in Montgomery County (Table 5).

Pharmaceutical opioid mentions declined in all areas, except the Rural Region (Figure 16). Between 2010 and 2012, pharmaceutical opioid mentions declined significantly from 92% to 69% in the Appalachian Region, and from 76% to 53% in the Urban (Montgomery County) Region. In the Suburban Region, the decline was even more substantial, from 82% to 48% in 2012 (Table 6, Figure 16). In contrast to other regions, the rural counties are unique with relatively consistent percentages of pharmaceutical opioid mentions over time, ranging from 67% in 2010 to 63% in 2012. Reasons for a lack of decline in the Rural Region are unclear. Partial data from 2013 suggest that pharmaceutical opioid mentions remained at lower levels than in 2010, but not different from 2012 data.

Pharmaceutical opioid product mentions differed somewhat by regional group over time (Table 6). The percentage of **oxycodone** mentions was consistently the highest in the Appalachian Region, ranging from 56% in 2010 to 42% in 2011, and then declining significantly to 25% in 2012. As stated above, **hydrocodone** mentions decreased significantly in Montgomery County from 23% in 2010 to 13% in 2012. Hydrocodone mentions remained fairly constant in the other regions, ranging from 10% in the Suburban Region in 2010 to 24% in the Appalachian Region in 2011. **Methadone** mentions declined significantly in all areas, except the Rural Region. In the Suburban Region methadone declined from 43% in 2010 to 20% in 2011, and then to 14% in 2012. Methadone mentions were consistent at about 34% in Montgomery County in 2010 and 2011, and then declined significantly to 16% in 2012. In the Appalachian Region, methadone mentions decreased significantly from 39% in 2010 to 14% in 2012.

Figure 16. Percentage of Accidental Drug Overdose Deaths that Tested Positive for Pharmaceutical Opioids



Pharmaceutical Opioids and Heroin: “Concomitant” vs. “Stand-Alone” Cases

In all four regions, cases that tested positive for both heroin and pharmaceutical opioids were far less common than “heroin only” (heroin, but no pharmaceutical opioids) or “pharmaceutical only” (pharmaceutical opioids, but no heroin) cases (Table 6). For all years combined, there were no statistically significant differences across regions in cases that tested positive for both types of opioids (Table 5). Over time, only data from the Rural Region showed a statistically significant increase in such cases from 6% in 2010 to 20% in 2012 (Table 6).

As expected, “heroin, no pharmaceutical opioid” cases were more common in Montgomery County, while “pharmaceutical opioid, no heroin” cases were significantly more common in the Appalachian Region. “Heroin only” cases increased significantly in Montgomery County to 40% in 2012 (compared to 20% in 2010 and 23% in 2011). In 2012, “heroin only” cases in the Suburban Region also increased to 35%, compared to 11% in 2010. Rates in the Rural Region remained largely unchanged, while increases in “heroin only” cases in the Appalachian Region were not statistically significant due to low numbers (Table 6, Figure 17).

“Pharmaceutical opioid only” cases declined significantly in the Appalachian region in 2011 and then again in 2012. In the Suburban and Urban Region, statistically significant declines in “pharmaceutical opioid only” cases occurred in 2012. Changes in rates in the Rural region were not statistically significant (Table 6, Figure 18).

Figure 17. Regional Trends in "Heroin, No Pharmaceutical Opioids" Cases

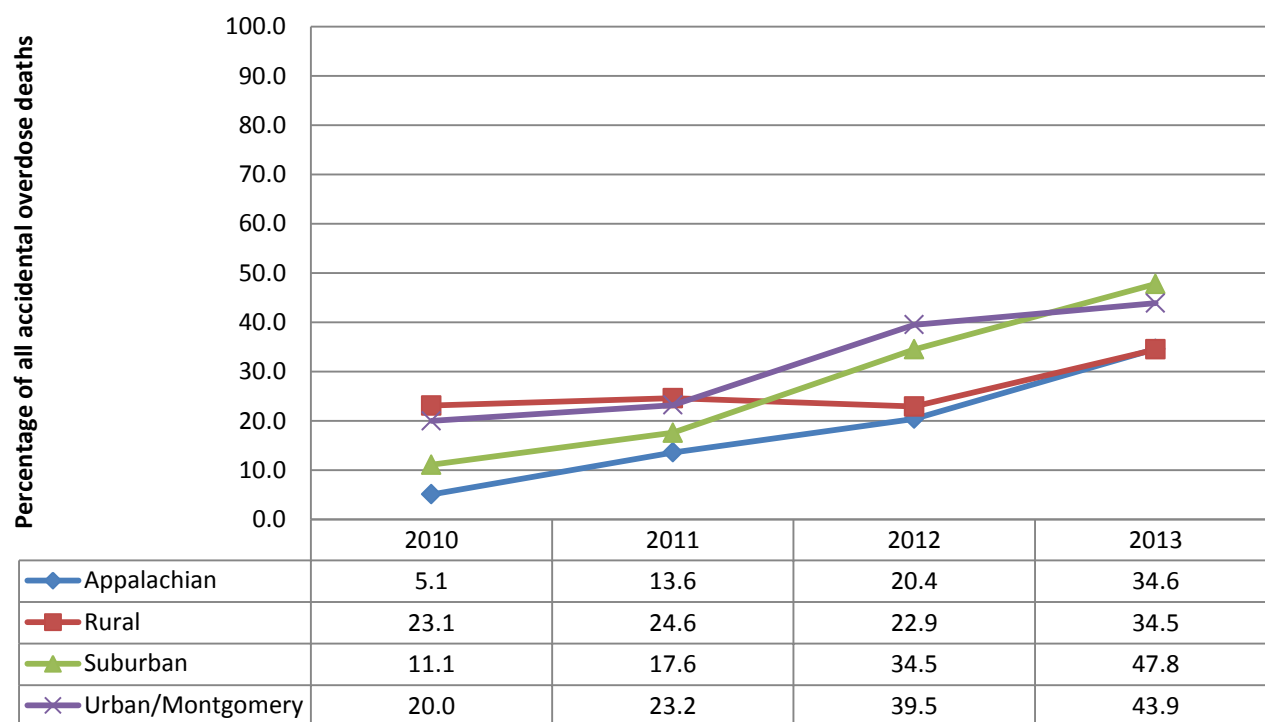
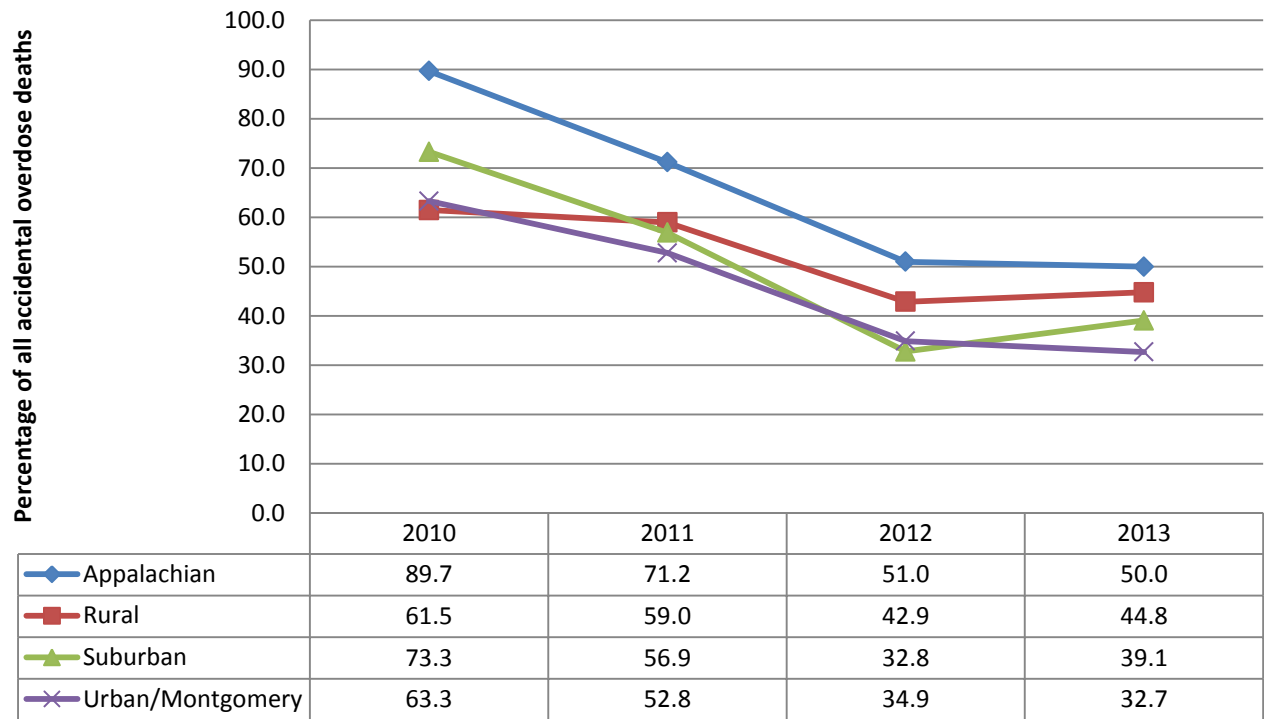


Figure 18. Regional Trends in "Pharmaceutical opioids, No Heroin" Cases



Conclusions

Limitations. Although the present study is unlike any we know of in Ohio, it does have limitations. Importantly, only 24 of Ohio's 88 counties are included in the study with most of the 23 non-urban counties being in the southern parts of the state. Only one urban county is included, but since Montgomery County is one of the state's epicenters of unintentional drug overdose deaths, it provides a meaningful comparison to trends in other parts of the state.

Pharmaceutical opioid mentions were more common in the non-urban regions, while heroin mentions were more common in the Urban Region (Montgomery County). With the exception of the Rural Region, all other areas experienced declines in pharmaceutical opioid mentions and significant increases in heroin-related cases. Since 2012, more accidental overdose cases in Montgomery County tested positive for heroin than pharmaceutical opioids. Overall, increases in heroin-related mentions were more substantial than declines in pharmaceutical opioid mentions. As a result, overdose deaths did not decline, and opioids (pharmaceutical opioid and/or heroin) remained the most commonly identified drugs in the accidental drug overdose cases.

Since accidental drug overdoses are reflective of substance abuse trends, the findings indicate that prevention and intervention initiatives across the state should be driven generally by common objectives. The opioid epidemics are having the most excruciating impacts on the state, because opioid-related accidental overdose deaths, not to mention opioid dependence, have unfathomable impacts on families in Ohio and society in general. Furthermore, the economic impacts are impossible to calculate. Ohio is losing an important percentage of young people, and the results are likely to have negative impacts in the future. Targeted interventions are urgently needed to address these epidemics.

Appendix 1. Accidental Drug Overdose Deaths by Incident County and Year (N=1,059).

Incident County	Year				Total
	2010	2011	2012	2013 (Jan. - June)	
Adams	3	4	7	1	15
Athens	6	12	10	4	32
Brown	6	10	7	7	30
Clark	9	18	21	10	58
Clinton	3	6	12	5	26
Darke	3	2	6	2	13
Fayette	3	3	3	0	9
Gallia	0	1	4	4	9
Greene	23	20	20	5	68
Hardin	3	5	2	4	14
Highland	4	4	5	3	16
Logan	6	5	7	2	20
Madison	2	1	1	1	5
Meigs	1	3	2	1	7
Mercer	2	2	0	2	6
Miami	9	10	14	2	35
Montgomery	120	125	152	107	504
Pickaway	1	0	2	5	8
Preble	5	8	10	6	29
Ross	1	1	0	0	2
Scioto	16	20	9	4	49
Shelby	5	5	4	3	17
Warren	19	25	26	4	74
Washington	2	4	5	2	13
Total	252	294	329	184	1059

Information about the location of cases was derived from the data field “county of incident” as reported by the Montgomery County Coroner’s Office. However there were 4 cases in 2013 with missing information for the “county of incident.” For this report, county information for these 4 cases was determined based on the reporting agency: 2 cases with missing county of incident were classified as “Clark County” because they were reported by Clark County Coroner; 1 case was classified as “Brown County” because it was reported by Brown County Coroner; 1 case was classified as “Gallia County” because it was reported by Gallia County Coroner.