TO: Chief Administrator, DEA/NFLIS Database
DATE: 28 January, 2019
SUBJECT: Opioid Use Trends in Kentucky, Ohio, Pennsylvania, Virginia, and West Virginia

Between 2010 and 2017, reports of heroin and synthetic opioids have increased in total number, and spread across the five-state area. Initially, we can see that heroin, tramadol, oxycodone, hydrocodone, and fentanyl make up 85% of all opioid reports observed. However, tracking the trends in reports across the entire area, heroin and fentanyl account for nearly all the variation of opioid reports--heroin saw a steady increase from 2010 to 2015, and fentanyl grew exponentially from 2013 onwards, which more than made up for heroin's decrease after 2015. Based on this pattern, it seems heroin and fentanyl (and its many derivatives) should be carefully watched and regulated in the coming years. Though heroin use has decreased in the last two years, the relationship between heroin and fentanyl suggests that one could be a substitute for the other, meaning a decrease in one could actually *cause* an increase in the other.

Another drug which might be a concern is tramadol. Though tramadol currently makes up an insignificant portion of opioid reports in the five states we looked at, its growth between 2010 and 2017 resembles the beginning of the exponential growth seen in fentanyl. If tramadol continues to increase at this rate, tramadol reports could surpass all opioids (excluding fentanyl) by 2025.

Geographically, it seems opioid reports (as a percentage of *total* drug reports) have migrated northeast across the region; in 2010 most counties with over 50% of drug reports coming from opioids were in northeast Kentucky, but by 2017 we found counties in most states--especially Ohio and Pennsylvania--that were hotspots for opioids, with high concentrations of opioid use in counties containing population centers, such as Cuyahoga, Hamilton, and Montgomery in Ohio, and Pittsburgh and Philadelphia in Pennsylvania. By 2017, Kentucky and West Virginia make up a much smaller portion of the raw number of opioid reports, but they are still areas for concern.

Since the most concerning trends in opioid reports seem to be those of exponential or near-exponential growth, such as fentanyl or tramadol, and most of the socio-economic variables have relatively stable linear patterns, we were unable to find any very strong predictive parameters, which is to say: though there are correlations between many of the variables and the reports of opioids, none of them were effective at predicting the opioid use in the future. Despite this, strong correlations between opioid use and the social statistics "Homeowner Living Alone - 65 years and over," "Women age 15-50 who gave birth in the last 12 months," and high school dropouts (which is a combination of two highest educational attainment categories: "9th grade or below" plus "9th-12th grade") suggest that the opioid crisis may be a symptom of economic

issues. Specifically, we believe that these indicate that individuals of low-income and high contact with medical personnel inclines an individual to opioid usage. In order to further support these claims, we believe we could benefit from additional data regarding economic status (e.g. median income) or even disability status.

Since the center of opioids reports is trending northeast-wards towards the Ohio Valley region, including west Pennsylvania and the entire state of Ohio, and affecting predominantly low-income individuals with high levels of interaction with healthcare personnel, we believe that the best course of action is to focus on this region in particular to curve any future outbreaks. A direct course of action would be to increase funding for support programs centered on helping new parents, people over the age of 65, and high school dropouts. Realistically, these can be programs meant to help low-income individuals obtain their GED, child-care programs, and check-in services for the elderly. Supplementary programs that would also help these counties further stem the opioid epidemic include, cheaper healthcare, higher education, and pre-K prep schools.