

DROP THE NEEDLE: HEROIN SEIZURES IN THE UNITED STATES FOLLOWING
THE PASSING OF MEDICAL CANNABIS LAWS

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*** NOTE TO PEER REVIEWERS: Apologies about the style of this paper. Since we were supposed to adhere to a certain journal's style, I had to place all figures at the end of the paper which I think is really inconvenient. To help with this, I've made internal links in order to make it easier to view. Click the Figure link in the text and it will bring you to the correct figure at the end of the document. ***

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KEYWORDS

heroin; medical cannabis; drug legalization

ABSTRACT

Background

With more and more US states legalizing the use of medical cannabis, we are beginning to see a shift in which illicit drugs are being seized at the US border, from cannabis to heroin. This research—assuming the more a drug is seized at the border, the more of a demand there is for its import—asks whether the legalization of medical cannabis is influencing which drugs are grown and smuggled into the United States.

Methods

This research utilizes bivariate analysis, particularly scatterplot analysis and Pearson's r in order to test if there is a positive linear relationship between time and the amount of heroin smuggled across the border into the United States—as well as to test the relationship between time and the illegality of medical cannabis in US states. Furthermore, this research uses the inferential statistical method of linear regression in order to predict possible heroin smuggling futures.

Results

There seems to be a correlation between the legality of cannabis within the United States and an increase in heroin trafficking. Furthermore, there also seems to be a correlation between the legality of cannabis in the United States and the decrease of seizures of cannabis by the DEA.

Conclusion / Discussion

Further research is needed in order to causally link the increase of heroin importation—as well as the decrease of cannabis importation—and the legality of medical cannabis. However, if there exists a link between drug legalization and a decrease in illicit import, perhaps the United States needs to consider reallocating resources to prevention and rehabilitation, rather than attempting to block the illicit import of drugs at its borders.

BACKGROUND

The conversation about illegal drug use—and smuggling—in the United States has frequently monopolized political discourse. Often, the conversation centers around the flowering cannabis plant, referred to in the common parlance as marijuana or pot¹. Cannabis has been used medicinally and recreationally by humans for thousands of years (Bauer et al. 2015). Gaining widespread popularity in the United States with members of the counterculture movements in the 1960s, cannabis activists began to promulgate its medicinal qualities. Starting in 1996 and accelerating rapidly after 2010, cannabis use for medical purposes has been made legal by many state legislatures (ProCon.org 2016).

The hotly contested “War on Drugs” in the United States has not seen the anticipated decrease in drug use. In fact, illicit drug consumption has increased while street prices for drugs have fallen, creating higher accessibility to illicit drugs for first-time users (Félix and Portugal 2015). In the United States, Cesar Augusto Peniche—the Chihuahua state delegate for the Mexican federal attorney general’s office—has said that there seems to be a higher demand for heroin, as opposed to demand for cannabis, due to the legal steps that the United States has taken to produce their own medicinal and decriminalized cannabis that is regulated by US state law (VICE News 2016). Unfortunately, this decreased demand for Mexican cannabis has shifted the efforts of

¹ In this article, I will refrain from utilizing the slang vernacular. I will instead refer to the plant by its scientific name: cannabis. This is a deliberate decision due to the negative connotation that names like marijuana, pot, dope, grass, ganja, etc. have for many people. Furthermore, when I refer to cannabis, I am referring to the totality of the processed plant to be used medicinally or recreationally for its psychoactive and medicinal properties: both the dried flower buds (marijuana) and the resin (hashish) from the three plant species—*Cannabis sativa*, *Cannabis indica*, and *Cannabis ruderalis*.

drug producers. According to Peniche, the land previously used to grow cannabis is also very good land for the cultivation of the poppy flower, the raw ingredient in opiate products such as morphine and heroin (VICE News 2016). The Mexican government is beginning to see an increase in the growth of poppies. Furthermore, poppies are an attractive crop for *campesinos* (poor Mexican farmers, frequently exploited by drug cartels) because they can be cultivated and harvested three times per year, a relatively high turnaround compared to cannabis (Parenti 2015).

Anthony Williams, a special agent with the Drug Enforcement Administration (DEA), has agreed with Peniche, noting that heroin seizures at border crossings in the Southwestern United States have significantly increased, while cannabis seizures have decreased (VICE News 2016). This qualitative, journalistic interview is backed up by the DEA's own statistics on seizures of illicit drugs at border stations. As can be seen in [Figure 1](#), cannabis (marijuana) seizures sharply decrease after 2010, while heroin seizures begin to rise steadily after the same year (Drug Enforcement Administration 2015).

With this in mind, my research questions are: has the legalization of regulated, medicinal cannabis within the United States decreased demand for illegal cannabis? Furthermore, has the decreasing demand for illegal cannabis increased the importation of “harder” drugs—with a particular focus on heroin?

There are a few major caveats—or assumptions—made within this research that should be disclosed. First, I will be analyzing DEA *seizure* data, rather than drug *use* data. I have chosen these data to analyze because of the unreliability/inconsistency of self-reported drug use data in the United States (Harrison 1995; O'Malley et al. 1983).

As such, I am making the assumption that if a certain type of drug is being seized in quantity at the border, it means that that particular drug's *import* is in greater demand. Inversely, if a certain type of drug is being seized less at the border, it means that that particular drug is in less demand for *import*. This does not necessarily mean the drug itself is in greater or lesser demand for human consumption or use. Instead, the research assumption is that a particular drug's demand only has a functional relationship with import statistics *vis-à-vis* DEA seizures.

The second caveat of this research is that I will only be focusing on the relationship that legal *medicinal* cannabis has on the importation/smuggling of illegal cannabis into the United States. Four US states (Colorado, Washington, Oregon and Alaska) have legalized the recreational use of cannabis. Recreational legalization may have a more complex relationship with the importation of illegal cannabis, but due to the small sample size, I will not be discussing this possible relationship. However, these four states *will* be included in my data about state legalization of medicinal cannabis because all four of these states passed medicinal legislation prior to decriminalization and legalization.

METHODS

My primary methodology consists of utilizing descriptive statistics. More specifically, I employ bivariate analyses by interpreting scatterplots showing cannabis legality in US states, as well as DEA seizures of illicit drugs—particularly heroin—at the US border. Furthermore, I employ the Pearson Product-Moment Correlation Coefficient (Pearson's *r*) in order to test if there is a positive linear relationship between time and

the amount of heroin smuggled across the border into the United States—as well as to test the relationship between time and the illegality of medical cannabis in US states.

I also utilize the inferential statistical method of linear regression in order to predict possible heroin smuggling futures. In order to do that, I acquired raw data from the DEA website (Drug Enforcement Administration 2015) showing the year (X) and the amount (in kilos) of heroin seized (Y). I then found the $X \cdot Y$ and the X^2 , shown below.

X	Y	$X \cdot Y$	$X \cdot X$
2000	546	1092000	4000000
2001	747	1494747	4004001
2002	709	1419418	4008004
2003	788	1578364	4012009
2004	669	1340676	4016016
2005	622	1247110	4020025
2006	816	1636896	4024036
2007	623	1250361	4028049
2008	605	1214840	4032064
2009	622	1249598	4036081
2010	713	1433130	4040100
2011	1077	2165847	4044121
2012	1010	2032120	4048144
2013	1044	2101572	4052169
2014	1020	2054280	4056196

I then found the sum of every column.

$$\sum X = 30105, \sum Y = 11611, \sum X \cdot Y = 23310959, \sum X^2 = 60421015$$

Once the sums were found, I used the following equations in order to find a and b within the regression equation formula—that is, $y = a + b \cdot x$.

$$a = \frac{\sum Y \cdot \sum X^2 - \sum X \cdot \sum XY}{n \cdot \sum X^2 - (\sum X)^2} = \frac{11611 \cdot 60421015 - 30105 \cdot 23310959}{15 \cdot 60421015 - 30105^2} \approx -54289.412$$

$$b = \frac{n \cdot \sum XY - \sum X \cdot \sum Y}{n \cdot \sum X^2 - (\sum X)^2} = \frac{15 \cdot 23310959 - 30105 \cdot 11611}{15 \cdot 60421015 - (30105)^2} \approx 27.436$$

Once I found a and b , I was able to plug those values into the regression equation formula below:

$$y = -54289.412 + 27.436 \cdot x$$

RESULTS

DEA seizures of cannabis and heroin have fluctuated since 2000—as seen in [Figure 2](#)—however, after 2009 / 2010, there is a rapid drop in the seizure of cannabis and a spike in the seizure of heroin. The exponential trend lines within [Figure 2](#) also illustrate the downward trend of cannabis smuggling and the growth of illicit importation of heroin. This trade-off in DEA seizures between cannabis and heroin may be due to the demand for cannabis being satisfied by American growers due to the legalization of medical cannabis, as seen in [Figure 3](#). As such, *campesinos* may be planting poppies in order to fill a demand that is not satisfied by the US growers; heroin remains illegal in all 50 states and the District of Columbia.

[Figure 3](#) illustrates US states (including Washington DC) that forbid cannabis for medical purposes. It slowly declines after 1996 as more states legalize medicinal cannabis use. Interestingly, there is a sharp decline in 2009 / 2010 as more states begin to pass medical cannabis legalization. Could this relate to the 2009 / 2010 collapse of illicit cannabis smuggling and the subsequent spike in heroin importation seen in [Figure 2](#)?

In order to solidify these graphic linear relationships, I calculated the Pearson's r for these data. The correlation for heroin seizures between 2000-2014 is: $r \approx 0.6827$ which illustrates a strong positive relationship between the progression of time and the

importation/seizures of illicit heroin. The correlation with illicit cannabis seizures between 2000-2014 is: $r \approx 0.1790$ which is a very weak positive correlation. However, this positive correlation may be misleading due to the fluctuations in drug seizures.

I decided to calculate the Pearson's r for cannabis and heroin seizures from 2010-2014 in order to investigate the period of time when cannabis and heroin seizures were beginning to swap in relative amount seized. The results—particularly with cannabis seizures—were far more stark. Illicit seizures of cannabis between 2010-2014 showed $r \approx -0.9977$ which is an incredibly strong negative relationship between the progression of time and the seizures of cannabis. Heroin between the same time period showed $r \approx 0.6228$, which is still a strong positive relationship with the passage of time and heroin seized. As is seen in the scatterplot in [Figure 2](#), the Pearson's r results seem to reinforce the fact that cannabis seizures dropped incredibly quickly while heroin seizures increased steadily after 2009 / 2010. Interestingly, the Pearson's r results for states that do not allow for medical cannabis showed $r \approx -0.9743$ for 1995-2014 and $r \approx -0.9959$ for 2010-2014, showing a strong negative relationship between the illegality of medical cannabis and time.

With this spiking of heroin seizures, I wanted to analyze inferentially what smuggling futures may look like by using a linear regression model. As was discussed in my methods section, I will utilize my calculated formula in which x will be my projected year:

$$y = -54289.412 + 27.436 \cdot x$$

According to my linear regression model, 1268.488 kgs of heroin will be seized in 2025 by the DEA. In 2053—according to this inferential model—2036.696 kgs of heroin

will be seized, almost double the amount seized in 2014. It should be noted, this predictive model only utilizes the variables that we know contemporarily. If I run a linear regression predictive model for states that do not allow medical cannabis, I arrive at the following formula:

$$y = 2227.614 - 1.091 \cdot x$$

According to this model, if we assume $x = 2041$ then $y = 0.883$. In this case, y represents the number of states in which medicinal cannabis is illegal and x still represents the forecasted year. Therefore, if this model is accurate, medicinal cannabis will be legalized in all states sometime between 2040–2042. However, if there does exist a relationship between state legalization of medicinal cannabis and the exponential increase in heroin seizures, there could be a higher spike than was previously predicted.

CONCLUSION / DISCUSSION

This paper provides initial data on the importation of illicit drugs into the United States. I have focused mainly on the relationship between cannabis and heroin smuggling for the sake of length and specificity. As can be seen in the raw data in the [Appendix](#)—despite the rapid fall of smuggled cannabis seized—the sheer amount of cannabis being seized at the border is still enormous. However, it is important to note that the weight differences between heroin and cannabis can be deceiving. A dosage of heroin is significantly smaller than a dosage of cannabis. Heroin is also highly addictive, far more addictive than cannabis (Hall 2014).

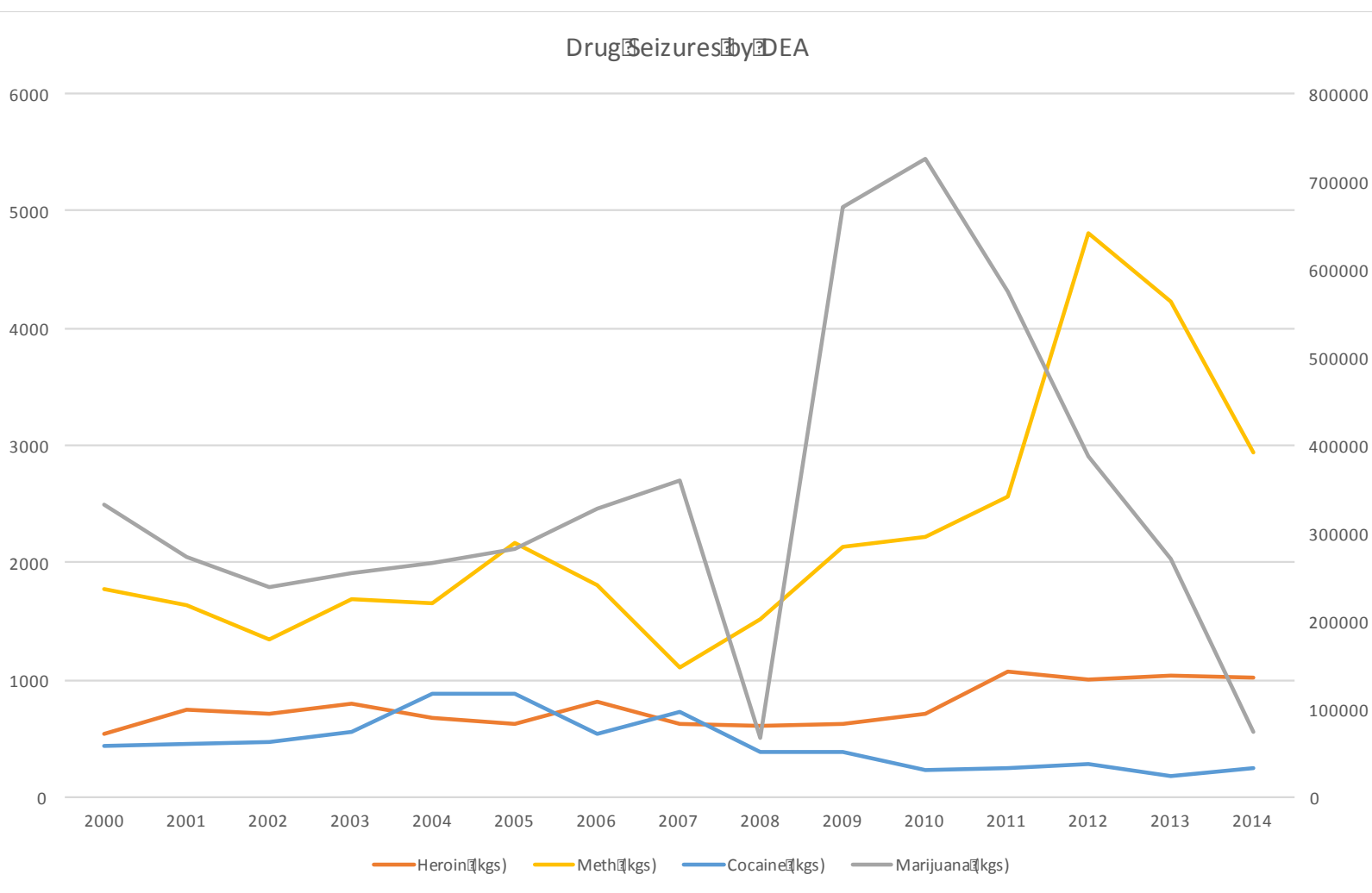
There seems to be a correlation between the legality of cannabis within the United States and an increase in heroin trafficking. Furthermore, there also seems to be

a correlation between the legality of cannabis in the United States and the decrease of seizures of cannabis by the DEA. However, it is important to recognize that this does not necessary show a causation between these variables. Further research is needed in order to properly link these elements and definitively say that this is a causal relationship. However, the qualitative evidence from news stories and interviews with DEA and Mexican officials seem to make this causal connection.

If the legalization of cannabis in the United States decreases the illicit importation of cannabis, would the same outcome be observed if the United States legalized “harder” drugs like heroin? Portugal recently legalized possession of all drugs and the street prices of drugs—including “harder” drugs like heroin and cocaine—did not fall, as is often the chief criticism from anti-drug lobbyists, citing that it would be easier to access if the price were cheaper (Félix and Portugal 2015). If the United States is able to legalize drug possession and siphon the money spent on seizing illegal drugs at the border to prevention and rehabilitation, perhaps the largest importer of illegal heroin would begin to see a decrease in users. This is obviously speculation; but it is also a call for further qualitative and quantitative research on this topic.

FIGURES

Figure 1



Note: Heroin and meth seizures are measured by the y-axis on the left while cocaine and marijuana seizures are measured by the y-axis to the right.

Figure 2

Cannabis vs Heroin Seizures

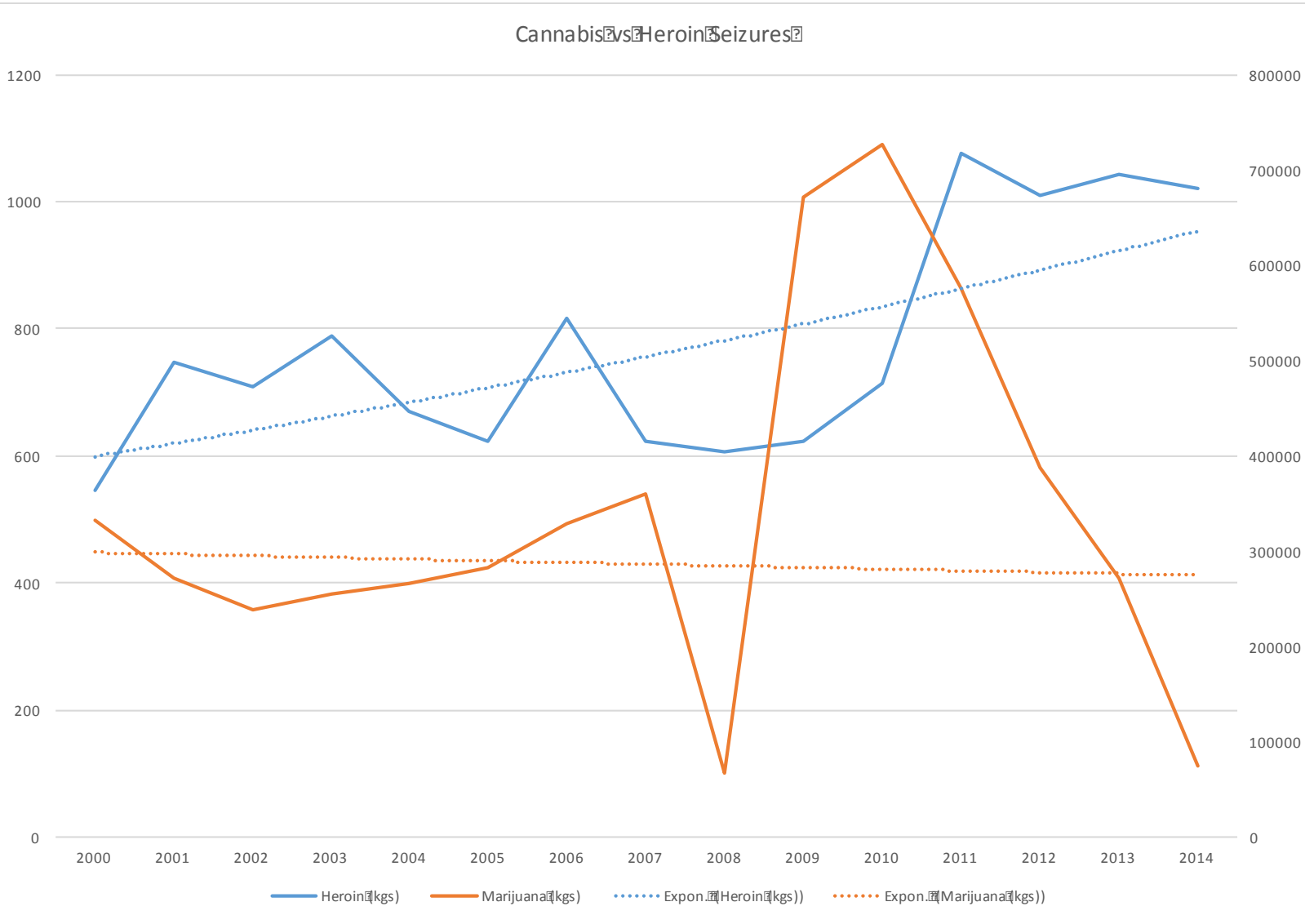
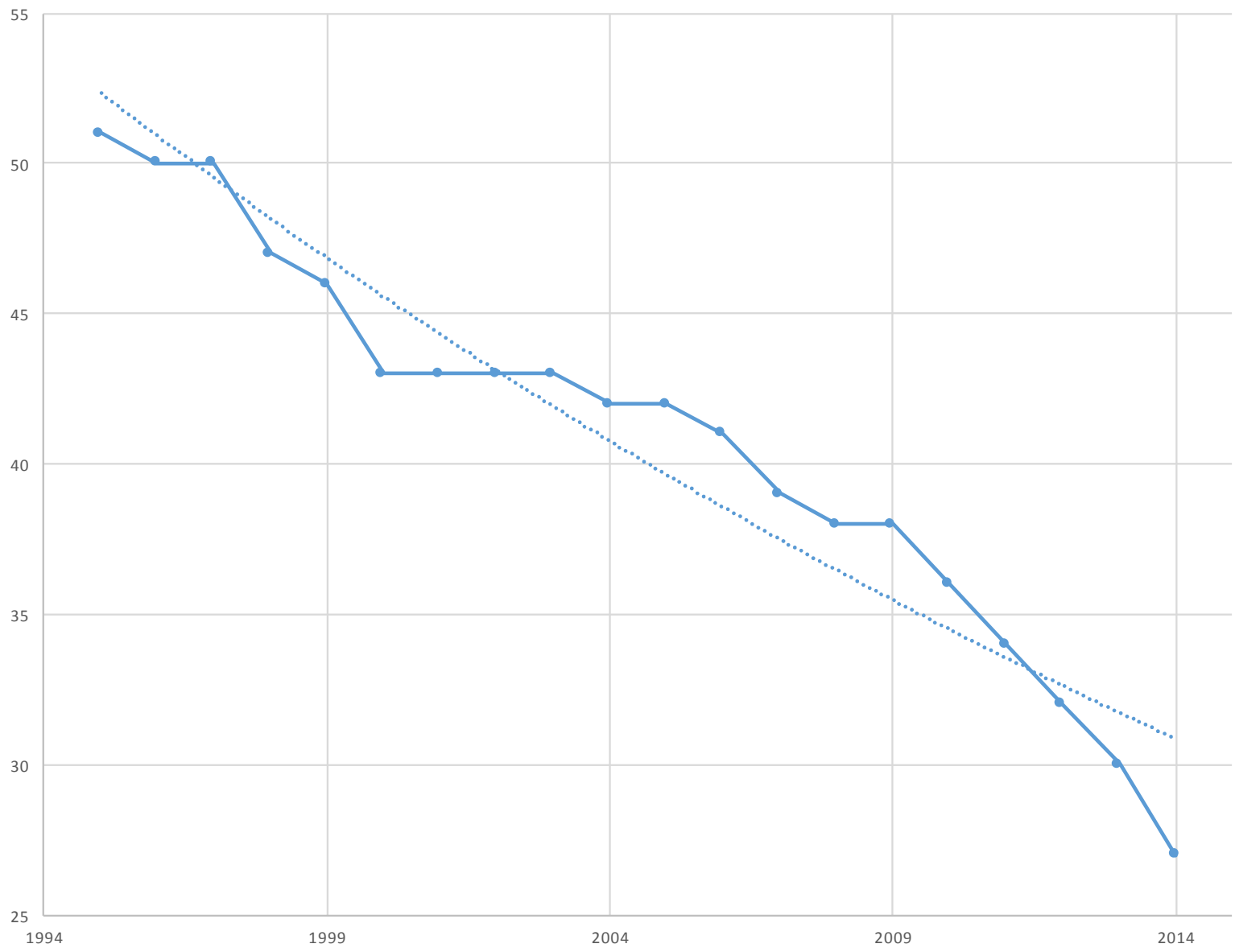


Figure 3

States (including DC) in which (Medical) Cannabis is legal



APPENDIX

Raw Data

The follow tables contain the raw data that I extracted from the Drug Enforcement Administration (2015) and ProCon.org (2016).

Calendar Year	Cocaine (kgs)	Heroin (kgs)	Marijuana (kgs)	Meth (kgs)
2000	58674	546	331964	1771
2001	59415	747	272120	1634
2002	63513	709	238646	1347
2003	73720	788	254242	1680
2004	117844	669	266088	1656
2005	118128	622	283382	2161
2006	71604	816	328275	1804
2007	98065	623	360708	1112
2008	50461	605	66213	1518
2009	50705	622	671650	2129
2010	30061	713	725862	2224
2011	32151	1077	575972	2561
2012	36736	1010	388064	4813
2013	24103	1044	270823	4227
2014	33770	1020	74225	2946

Calendar Year	States (including DC) in which (Medical) Cannabis is Illegal
1995	51
1996	50
1997	50
1998	47
1999	46
2000	43
2001	43
2002	43
2003	43
2004	42
2005	42
2006	41
2007	39
2008	38
2009	38
2010	36
2011	34
2012	32
2013	30
2014	27

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