Fentanyl Interdiction in the U.S. Mail: A Cost-Benefit Analysis

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Executive Summary

In 2018, the Centers for Disease Control and Prevention (CDC) reported 31,600 deaths linked to fentanyl and other opioids, and the White House Council of Economic Advisers estimated the cost of the epidemic in 2015 to be $504 billion. Fentanyl, a synthetic opioid, is a key driver in the mortality and overall social costs of the opioid epidemic. Fentanyl can be anywhere from 100 to 10,000 times more powerful than morphine – depending on the exact variant or chemical analogue. This potency makes fentanyl incredibly lethal, and its increased availability has worsened the opioid epidemic. Between 2013 and 2017, synthetic opioid overdoses increased by an average of 72 percent annually, reaching 9 deaths per 100,000 people. Fentanyl is often mixed with other illicit substances and most users consume it unknowingly. The primary source of illicit fentanyl in the United States is from mail entering through the United States Postal Service (USPS) from China. The Government Accountability Office (GAO) reports that Customs and Border Patrol (CBP) currently lacks the infrastructure needed to effectively screen all packages deemed suspicious. In this report, we propose a robust fentanyl interdiction program to address this issue and limit the supply of illicit fentanyl available in the U.S. We perform a cost-benefit analysis of this proposed program. We find that at fentanyl interdiction rates of 5, 10, and 15 percent, the program would result in median net benefits of $6.6 billion, $17.2 billion, and $27.9 billion, respectively.

We anticipate that the interdiction program will restrict supply and increase the price of fentanyl, which will ultimately reduce consumption. We argue that the reduced consumption will generate benefits in four main categories: lives saved, decreased health expenditures, increased productivity, and foster care savings. We anticipate the costs of the program will include personnel, equipment, canine teams, offsite location and transportation, and protective equipment for officers.

To account for the many uncertainties in this analysis, we complete a Monte Carlo simulation. At all interdiction rates, our simulation found positive net present benefits in all cases. Based on the positive net benefits we found in the vast majority of trials, we recommend implementation of the interdiction program described in this report.

Introduction

The opioid crisis has ravaged the United States with three waves of drug overdoses, cost the economy hundreds of billions of dollars each year, and killed hundreds of thousands of Americans (Council of Economic Advisers 2017; Ahmad et al. 2019). The opioid epidemic has evolved over the past two decades, becoming increasingly lethal, with annual death totals higher than those at the height of the HIV/AIDS outbreak (Ahmad et al. 2019; Katz and Sanger-Katz 2018). The crisis began in the 1990s with prescription painkillers and shifted a decade ago as individuals suffering from opioid addiction began using heroin. Beginning in 2013, drug overdoses surged again as fentanyl and its analogues filtered into drug markets in the eastern United States (Pardo et al. 2019 b; Centers for Disease Control and Prevention 2018). In 2018, the latest calendar year for which data are available, the Centers for Disease Control and Prevention (CDC) reported 31,600 deaths linked to fentanyl and its chemical cousins (Ahmad et al. 2019).

As officials look to halt the trafficking of illicit fentanyl and related substances into the country, they seek to strengthen detection systems at our nation's mail processing facilities, where the most potent versions of the drug enter the United States from China (McCauley et al. 2018; Westhoff 2019). Our cost-benefit analysis investigates whether additional interdiction efforts targeted at incoming international mail would generate net economic benefits. We use a Monte Carlo simulation to conduct sensitivity analysis of our cost-benefit projections. We provide background regarding the fentanyl crisis, suggest additional interdiction methods, project costs and benefits of the new techniques, and make a recommendation for federal policymakers.

Background

Fentanyl is particularly concerning to policymakers because of its potency. The substance is classified as a synthetic opioid and is estimated to be up to 100 times more powerful than morphine. Similarly-defined drugs include fentanyl's chemical cousins, as well as the prescription drug Tramadol (Pardo et al. 2019 b).[1] In addition, Fentanyl's analogues, such as carfentinal, can be up to 10,000 times more potent than morphine (Pardo et al. 2019 b). Experts estimate that only 20 micrograms of carfentinal – a dose the size of a few grains of sand – can kill an adult, posing risks to users, first responders, and laboratory technicians (N.H. Division of Public Health Services 2017).

Mortality data indicates the severe threat synthetic opioids pose to public health. In 1999, there were 0.3 overdose deaths involving synthetic opioids per 100,000 people. By 2013, deaths linked to synthetic opioids had jumped to 1 per 100,000 people. Between 2013 and 2017, synthetic opioid overdoses increased by an average of 72 percent annually until they reached 9 deaths per 100,000 people (Hedegaard, Warner, & Miniño 2018). The increase in deaths caused by synthetic opioids, coupled with dramatic spikes in fentanyl-related drug seizures, indicates that the substance has largely overtaken heroin's prominence in Ohio, West Virginia, and parts of New England (Pardo et al. 2019 b). Fentanyl is often mixed with other illicit substances and most users consume it unknowingly; however, there is growing evidence that a small cadre of drug users seek it out on its own (Gryczynski et al. 2019; Palmer 2019).

From Foreign Soil to a Neighborhood Mailbox: Current Mail Interdiction Processes

Federal agencies and independent analysts have concluded that almost all of the fentanyl entering the United States through the mail is sourced from China (Pardo 2018; Overacker 2019). In 2016 and 2017, officials recorded that 97 percent of the fentanyl seized through the mail was produced in China (DEA 2018). Federal grand juries in Ohio, Mississippi and North Dakota have indicted Chinese nationals on charges of trafficking the

[1] For the purposes of this report, we refer to synthetic opioids and fentanyl interchangeably. CDC tracking data does not distinguish between fentanyl and its analogues (Ahmad 2019). Moreover, we only refer to illicit fentanyl and not the previously used prescription painkiller. Evidence indicates that the drug's surge is not coming from diversion of the legal supply (Pardo et al. 2019 b).

drug into the United States (U.S. v. Yan 2017; U.S. v. Zhang 2017; U.S. v. Zheng 2018). In recent months, Beijing has pledged to shut down the illicit manufacture of fentanyl and has sentenced nine people to prison for trafficking the substance (Myers 2019 b). However, the problem continues to persist. "It's just like water: They're finding the gaps and the cracks," Bryce Pardo, a researcher at the RAND Corporation told the *New York Times* in November (Myers 2019 a). He reiterated the point when we contacted him via email (Pardo 2019b).

Policymakers are focused on stemming the flow of opioids and other substances into the country via the U.S. Postal Service (USPS).[2] Approximately 95 percent of incoming international mail is processed at facilities located near airports in New York, Chicago, Miami, San Francisco, and Los Angeles (USPS 2017). Customs and Border Protection (CBP), an agency within the federal Department of Homeland Security, is responsible for searching vehicles at the border, inspecting sea cargo, and investigating suspicious mail packages. CBP collaborates with the USPS to interdict fentanyl distributed through the mail (GAO 2017).

Prior to leaving foreign airports, the Transportation Safety Administration mandates that flight crews screen cargo aircraft for security threats, such as explosives. When the mail arrives in the United States, it is screened for radiation and CBP selects packages of interest to inspect. If an item is determined to have illegal contents, then the package is seized and cataloged as evidence. Unseized mail is then distributed by USPS to Americans' homes and businesses (GAO 2017).

CBP's Efforts to Identify and Seize Items Containing Fentanyl

[2] Evidence indicates that the fentanyl interdiction challenge posed by express consignment carriers is significantly less than that of the postal service. This is because electronic tracking data is more complete for delivery services (Portman 2018).

CBP uses a variety of techniques to identify mail parcels suspected of carrying illicit drugs. Although much of the information regarding targeting practices has been redacted from public documents, federal law enforcement officials have identified China as the primary sources of fentanyl shipped to the United States (McCauley et al. 2018; Cronin 2018). In one law-enforcement blitz, more than half of express-mail packages from China and Hong Kong were randomly sampled. Among parcels sampled, 43 percent were seized and 5.31 pounds of fentanyl was interdicted (McCauley et al. 2018).

Fentanyl is often purchased through the dark web using cryptocurrencies such as Bitcoin and mailed to customers in the United States (Cronin 2018). CBP uses x-ray machines, physical searches, and mobile chemical testing devices to detect whether suspicious packages contain illegal items (McCauley et al. 2018).

An important way CBP identifies packages to target for screening is by analyzing the advanced electronic data (AED) collected on packages. AED includes basic package information such as the sender, the receiver, a description of contents, and the weight. USPS has been working to improve collection of AED. Over three years, USPS increased the AED collected on inbound international shipments from nearly zero to over 40 percent in March 2018 (Roskam et al. 2018). Additionally, in 2018 Congress enacted the STOP Act, which requires USPS to collect AED on at least 70 percent of inbound international shipments by the end of 2018 and on 100 percent of inbound international shipments by the end of 2020. Additionally, because a great deal of illicit fentanyl originates in China, the act required USPS to obtain AED on 100 percent of shipments originating from China by the end of 2018 (Barksdale 2019).

Nevertheless, federal auditors have identified gaps in CBP's ability to interdict illicit substances (GAO 2017; McCauley et al. 2018). A 2018 review of CBP processes at John F. Kennedy (JFK) International Airport in New York indicated that the agency could not screen all mail identified as suspicious. The report blamed old devices, poor chemical-testing capabilities, and an absence of administrative guidance. It also noted that the agency's inspection facility was aged and did not offer sufficient physical security measures (McCauley et al. 2018). Additionally, CBP did not accurately catalog x-rayed mail parcels (McCauley 2019).

A Critical Gap within the Literature

Multiple teams of researchers have sought to quantify the economic pain of the opioid crisis. Florence et al. (2016) determined that prescription drug abuse cost the United States $78.5 billion dollars in 2013. The White House Council of Economic Advisers (2017) estimated that opioid addiction caused $504 billion in expenses in 2015. At the state level, Rembert et al. (2017) estimated that the opioid crisis cost Ohio, one of the nation's hardest hit states, between $6.6 and $8.8 billion in 2015.

Some studies have evaluated the cost-effectiveness of interventions intended to mitigate the epidemic. For instance, Coffin and Sullivan (2013) found that distributing doses of naloxone, a medicine used to reverse overdoses, to heroin users was cost effective under a variety of assumptions, including the most conservative. Other studies have investigated the effectiveness of harm-reduction programs on drug users (Jacobs et al. 1999). Nevertheless, to our knowledge, this is the first cost-benefit analysis of a national drug interdiction program aimed at controlling the spread of synthetic opioids.

Enhanced Fentanyl Interdiction (EFI)

To address the various societal costs caused by fentanyl use, we developed an Enhanced Fentanyl Interdiction (EFI) program to limit the amount of illicit fentanyl available in the United States. EFI incorporates the following elements: First, the U.S. government obtains advanced electronic data (AED) on 100 percent of all incoming international packages. As noted in the background section, current law already requires USPS to collect AED on 100 percent of incoming packages by the close of 2020. Second, CPB uses this information to determine which packages are suspicious and should be subject to additional inspection. Third, USPS then seizes all packages identified as suspicious and transports them to off-site warehouses for additional inspection. The additional space is necessary due to the volume of packages that will be inspected and to limit exposure of employees to dangerous substances. We estimate that CBP annually interdicts between 2 and 4.5 percent of fentanyl that flows through the mail. EFI, through increased allocation of resources to USPS and CBP, seeks to increase interdiction to to levels between 5 and 15 percent (see Appendices B and C for more information on interdiction rates and the behavior of drug supply routes over time).

Next, at the off-site warehouses, CBP inspects all packages using dogs trained to detect fentanyl and other illicit drugs. CBP then opens all packages the dogs deem suspicious. Portable spectrometers will be used to identify any substances found in these packages. Mail containing illicit materials will be confiscated, while packages that do not contain illegal materials will be repacked and sent back to USPS international mail processing centers for delivery. As most fentanyl comes from China, we focus this program on mail from this source. This program will be implemented at the USPS's International Service Centers (ISC) in New York, Chicago, Miami, San Francisco, and Los Angeles. An obvious limitation of this approach is that suppliers will adapt their behavior as they realize their shipments are not reaching the intended destinations.

Benefits

We anticipate that the interdiction program will increase the price of fentanyl, which will ultimately reduce consumption. We believe that the reduced consumption will create benefits in four main categories: lives saved, decreased health expenditures, increased productivity, and foster care savings. Because fentanyl is a particularly lethal drug (Pardo et. al. 2019 b), reducing its consumption will decrease the number of overdose deaths. We use a value of statistical life (VSL) to estimate the economic benefit of saving these lives. Decreased consumption will also diminish healthcare costs by reducing both fatal and non-fatal overdoses. Fentanyl and other synthetic opioid overdoses are responsible for considerable healthcare spending (Honig 2017; DePasquale 2019). In our analysis, we estimate the savings that would accrue to the healthcare system from the reduced number of overdoses. Reduced consumption will also generate benefits by increasing productivity. Florence et al. (2016) calculated an estimate of the significant domestic and paid productivity losses associated with prescription opioid abuse, and we use this information in our analysis. Finally, by saving lives, the program would lower the number of children entering foster care, and as a result, it would create savings for the foster care system.

Lives Saved

The fentanyl crisis is of particular concern because of the mortality risks associated with the drug. In 2018, the overdose death rate of fentanyl was nine per 100,000 people. This is approximately double the death rate from the next-most deadly illicit substance, heroin, which had a death rate of five per 100,000 people (Pardo et. al. 2019 b). In addition, over half of all overdose deaths from heroin and cocaine also included a synthetic opioid (Pardo et. al. 2019 b). Because consumption of fentanyl and its analogs are causing many overdose deaths in the United States, policies that reduce their consumption could yield large benefits.

Evidence suggests that disruption of illicit drug supply chains and drug seizures have the potential to limit overdose deaths. When illicit drugs are interdicted, the cost to suppliers of delivering the substances increases and at least part of that price increase is passed on to the consumers. If the price elasticity of demand for the substance is not zero (perfectly inelastic), then the price increase will lead to a reduction in consumption of the drug and potentially a reduction in overdose deaths (Caulkins and Reuter 2010). Empirical investigations of supply-side interdictions have found increases in the street prices (at least in the short term) and subsequent decreases in overdose deaths (Crane et. al. 1997; Dobkin and Nicosia 2009). Under the 5 percent and 15 percent scenarios, our median estimates predict that the policy would save between 800 and 3,200 lives, respectively (see Appendices D and E for further explanation). We then employ a value of statistical life estimation to determine the economic savings derived from reduced overdose deaths (see Appendix F for more information). We determine that this policy would generate between $1 billion and $80 billion in economic savings from decreased deaths due to fentanyl overdose over five years. However, our best estimate of economic gains from lives saved is $16.2 billion.

Reduced Fentanyl-Related Health Expenditures

The literature indicates that drug overdoses have a profound economic impact on the U.S. health system each year. The high health costs linked to fentanyl and other forms of opioid overdoses have negatively affected the budgets of states and municipalities (Honig 2017; DePasquale 2019). For instance, Florence et al. (2016) note that prescription drug addiction among 1.9 million users in 2013 spurred $29 billion in non-fatality related health and treatment costs. More than 35 percent of the cost fell on taxpayers through programs such as Medicare, Medicaid, and state-funded substance abuse treatment programs. Researchers have used Florence et al.'s techniques to calculate average costs per drug user and estimate the average costs of the opioid crisis in their geographic areas of analysis (Council of Economic Advisers 2017; Rembert et al. 2017).

We use a similar approach in calculating the non-fatal health costs linked to fentanyl and potential savings from increased interdiction. In making our estimates, we categorize non-fatal and fatal health costs separately because they are distributed differently. (Non-fatal health costs are averaged among all living opioid users, while fatal health costs are averaged among those killed.) We adjusted the average non-fatal health costs per abuser of opioid prescriptions found by Florence et al. (2016) for inflation. Next, we multiplied the average by our estimates of the number of American fentanyl consumers (see Appendix G). Finally, we assume that there would be a proportional relationship between reductions in fentanyl consumption and non-fatal health costs. We discounted benefits at an annual rate of 3.5 percent (see Appendix H for more information on how we calculated non-fatal health expenditures).

Our work is grounded in research indicating the potency of mere exposures to fentanyl. Quantities ranging in the thousandths of a gram can kill people without tolerance to opioids (Suzuki and El-Hadad 2017). Our best projection indicates that improved mail screening processes would generate $986 million in health savings not linked to deaths over five years. Our highest possible estimate is $5.23 billion and our lowest estimate is $62 million.

In order to calculate health costs linked to deaths, we used Florence et al.'s estimates of expenses per overdose death and adjusted them for inflation. Then we multiplied the average cost of death by the number of lives we expect to save through fentanyl interdiction. After using a discount rate, our highest estimate of health savings linked to reduced fatalities during the five-year program was $40 million, while the lowest was $1 million. We believe our most plausible projection is $11 million. When we combine health expenses linked to both fatalities and non-fatalities, we conclude from our best estimates that improved fentanyl interdiction measures would save the U.S. economy $1.0 billion in health expenditures over the course of the program. Our upper- and lower-bounds indicate that increased inspections would reduce costs linked to total health expenditures from between $65 million and $5.25 billion (see Appendix I for more information on how we calculated fatality-related health expenditures).

We acknowledge that our estimates might undercount the health savings from reduced fentanyl consumption. The literature indicates that health costs – including those linked to overdose treatment – have increased at rates that outpaced inflation as calculated by the federal Bureau of Labor Statistics' Consumer Price Index (Gupta 2016; Martin et al. 2018).

Productivity Gains from Reduced Fentanyl Consumption

Recent research has pointed to the devastating impact of drug abuse on the economic productivity of abusers. For instance, Krueger (2017) concluded that labor force participation rates dropped in communities with high quantities of opioid prescriptions. Krueger's empirical work supports the findings of Vance (2016) who acknowledged the impact of opioid addiction on labor market outcomes in small-town Ohio. We believe that reducing access to fentanyl, a drug that is more potent than heroin, would diminish lost economic output caused by the synthetic opioid's consumption. For instance, if less fentanyl entered the United States, employees at risk for addiction might miss fewer days on the job and have higher earnings. We include reduced productivity losses in our estimate of benefits in order to account fully for fentanyl's economic costs.

Florence et al. (2016) included calculations linked to economic productivity in their estimate of prescription drug abuse costs in the United States. The researchers' calculations considered addiction as a form of disability. We adjust their calculations of average productivity lost per user for inflation and multiply that amount by our estimates of the total number of Americans consuming fentanyl. We only include lost productivity from the costs linked to fentanyl abuse's disability-like effect on a worker's output. Moreover, productivity costs linked to premature death are included within the value of statistical life estimation. In this section, we only seek the reduction in lost productivity among living fentanyl consumers.

We estimate that lost productivity linked to fentanyl costs the U.S. economy between $5 billion and $20 billion annually. However, our best estimate is a cost of $10.5 billion. We multiply our productivity losses by the percentage reduction in fentanyl consumption caused by our intervention (see Appendix J for more information on our estimates of productivity savings). We expect that our strengthened interdiction efforts could produce between $31 million and $2.9 billion over five years in productivity gains. However, we believe our best estimate of savings is approximately $548 million.

Foster Care Savings

Reducing the number of deaths linked to fentanyl would diminish expenditures related to foster care. Data collected from the federal Substance Abuse and Mental Health Services Administration indicates that 2.1 million American children have a parent experiencing illicit drug addiction (Lipari and Van Horn 2017). From 2012 to 2016, the number of children in foster care spiked from 398,000 to more than 437,000 – a 10 percent increase. During that same period, the number of children entering foster care increased by 9 percent (Children's Bureau 2017). This growth has wreaked havoc on the budgets of children's services agencies, causing local governments to turn to taxpayers for greater fiscal support (Welsh-Higgins 2017). An accurate projection of fentanyl's costs to society should consider the drug's impact on foster care expenditures.

We calculate this by first finding the relationship of foster care entries with respect to overdose deaths. We found that for a 1 percentage point increase in overdose deaths between 2012 and 2018, there was a 0.07 percentage point increase in foster care entries. We multiplied the elasticity by the number of foster care entries projected in a year, the percentage reduction in deaths from increased interdiction, the average annual cost of foster care, and the median stay in years. After applying a standard discount rate, our best estimate of foster care savings over the five-year period is $33 million, while our highest estimate was $115 million, and our lowest estimate was $3 million (see Appendix K for more information on calculations).

Costs

EFI will require significant investment to reduce the amount of fentanyl from entering the United States. We anticipate costs accruing in several distinct areas: personnel, equipment, canine teams, off-site location and transportation, and protective equipment for officers. Our analysis of the literature alerted us to the personnel shortage at international service centers (GAO 2017). Furthermore, personnel require the necessary equipment to detect fentanyl in packages more easily and safely. Currently, mail centers have outdated x-ray machines and lack other necessary equipment to process all international mail efficiently (GAO 2017). New technology will help CBP officers seize higher quantities of fentanyl per year due to improved detection abilities. Additional canine teams can also improve CBP officers ability to inspect mail at a faster rate. CBP has canine teams at ports of entry but has not trained many additional teams in the past 10 years due to a lack of funding. Lastly, we anticipate needing additional facilities to help process mail and store new equipment. CBP officers will also require protective equipment to limit their exposure to the harmful chemicals that may be found in the packages.

Personnel

CBP, in collaboration with USPS, screens suspicious packages for illicit substances, including fentanyl. CBP officers are required to execute most package inspection methods (McCauley et al. 2018). Therefore, we anticipate the employment of additional CBP officers to constitute a major cost of enhanced screening. In order to capture the costs associated with hiring, training, and employing additional CBP officers, we will first estimate how many additional officers will be required. From there we can use the federal government's grade level progression for CBP officers, which includes average fringe benefits, overtime, and relevant locality pay to estimate yearly costs of employment (CPB 2019 c.). We estimate that approximately 960 additional CBP officers would be required to conduct searches at international service centers, which will cost approximately $323 million over the course of the five-year period (see Appendix L for more details).

Equipment

Outfitting a new off-site location for screening suspicious packages requires purchasing new equipment. An advantage of an off-site facility is that it can house equipment that can screen higher volumes of packages. We have identified available x-ray inspection systems ranging from $50,000 to $90,000 per unit that would be suitable for screening packages (AS&E 2016). We determined the GEMINI 100100 Parcel X-Ray Inspection Systems was most suited to our target capacity because it had the highest conveyor capacity and advanced image analysis features (AS&E 2016). Miniature mass spectrometers have also shown promise in detecting and identifying fentanyl (MRI Global 2018). These handheld devices use simple swab tests to verify unknown substances in suspicious packages. Miniature mass spectrometers also limit exposure to potentially harmful amounts of fentanyl for CBP officers, making them a relevant technology to explore. We obtain our estimate of cost for these devices from 908 Devices, a leading manufacturer and distributer of miniature mass spectrometers. Upfront costs include purchasing devices at $65,000 with the only recurring costs being the purchase of additional swabs at $95/100 swabs (MRI Global 2018). Based on our calculations, we anticipate new technology and maintenance will cost $33.4 million over a five-year period (see Appendix M for more information).

Protective Equipment

Effective risk management is vital when handling a dangerous substance like fentanyl. The National Institute for Occupational Safety and Health (NIOSH) and CDC issued guidelines for the safe handling of fentanyl and its analogs. NIOSH recommends that employees wear an approved half-mask filtering facepiece respirator rated P100 or a tight-fitting, full-face air-purifying respirator with multi-purpose P100 cartridges/canisters, nitrile gloves, and safety glasses (CDC 2017). Our estimate for the cost of this equipment for 960 employees over the five-year period is approximately $934,000, discounted at the standard rate (see Appendix N for calculations).

Canine Teams

Canine teams can help reduce the number of fentanyl packages coming into the United States. In 2008, CBP determined that 8 percent of canines did not pass required training tests. Based on a review of CBP from 2006 to 2007, on average an untrained dog costs $4,500 (Skinner 2008). In 2007, the average total annual cost to board and train a canine team was about $16,500. We also must consider the salary for CBP Dog Handlers. Current CBP officers earn between roughly $42,000 and $104,000 per year (CBP 2019 c). We use these prices to calculate the costs of adding more canine teams to help inspect packages.

The CBP Canine Program has two training locations: the Canine Center Front Royal and the Canine Center El Paso (Skinner 2008). According to the Office of Training and Development, the Front Royal and El Paso facilities have the capacity to train a maximum of 250 and 150 canine teams, respectively, each year (Skinner 2008). EFI would seek to operate both facilities at capacity. We project the cost at approximately $21.5 million to train 400 more canine teams and to use them in the upcoming year (see Appendix O for calculations).

Off-Site Location & Transportation

Currently, CBP and USPS collaborate to identify and interdict fentanyl arriving through the international mail system. The screening and interdiction occur at five USPS International Service Centers located at major airports: New York, Miami, San Francisco, Los Angeles, and Chicago (McCaskill 2017). However, these agencies are neither coordinating effectively nor efficiently to interdict fentanyl. At a July 2019 hearing of the House of Representatives Committee on Homeland Security, the Assistant Inspector General for Audits, Sondra McCauley, stated that during a pilot program at the JFK International Service Center (ISC), CBP targeted 0.01 percent of the international mail arriving daily (McCauley 2019). A large volume of mail is processed through the USPS International Service Centers annually: in FY 2019, this quantity was 855 million pieces of international mail (USPS Regulatory Commission 2019). The JFK Airport ISC processes over half of this volume (McCauley 2017). This breaks down to a daily rate of 1.2 million pieces of mail, with only 120 pieces being screened by CBP. EFI can increase the rate to 1 percent of all international mail being screened, which is 12,000 pieces of mail daily at JFK Airport and roughly 12,000 pieces of mail allocated amongst the four other ISCs where screening of international mail occurs (see Appendix P for more information).

We propose renting an industrial warehouse of 50,000 square feet within 10 miles of JFK Airport. Determining the cost of transportation to the warehouse includes projecting the cost of trucks, fuel, and truck driver wages. Our estimate for outfitting this warehouse includes accessory equipment (conveyor belts, tables for agents to use hand-held spectrometers, mail carts) and personal protective equipment for CBP agents. The cost estimate for the warehouse, trucks, and truck drivers is approximately $13.8 million, which is for all five ISCs. We apply the estimate for JFK Airport to the other four locations of international mail processing facilities as all are located in large metropolitan cities (Chicago, Los Angeles, Miami, San Francisco) and have a range of $5 to $20 per square foot, so using JFK as our base case gives us a conservative cost estimate (Loopnet 2019) (see Appendix Q for calculations).

Non-Monetized Values

Criminal Justice Costs and Benefits

The opioid crisis has generated large criminal justice costs to society estimated at $7.8 billion during 2013 alone (Council of Economic Advisers 2017). While the fentanyl interdiction program would likely affect criminal justice expenditures, it is difficult to predict by how much. One possibility is that the program would increase criminal justice costs. Presumably, as additional fentanyl and other illicit drugs are captured in the mail screening process, drug arrests and convictions would rise because of the additional number of perpetrators exposed through the screening process. This could result in higher incarceration levels for both distributers and users. Further complicating matters, this effect may only last a time, as distributers and suppliers adapt their tactics. Another source of increased criminal justice costs could be from those whose lives are saved as a result of the program. For example, a fentanyl consumer whose life is saved as a result of the program, will likely still be addicted to opioids for some time, and will likely continue their illicit drug use. This would effectively increase the population of individuals who are involved in illicit drug use and thus at risk of arrest for their usage. Another possibility is that the fentanyl interdiction program would reduce criminal justice system costs. The program would, at least temporarily, increase fentanyl prices and thus reduce consumption. This decreased consumption could ultimately make consumers less likely to become criminally involved. Additionally, the criminal justice costs associated with usage of different drugs may vary (Council of Economic Advisers 2017), and it is uncertain whether fentanyl consumers would substitute drugs associated with higher or lower criminal justice costs. Due to these numerous uncertainties and the dynamic nature of these effects, we did not include criminal justice costs and benefits in our analysis.

Costs from Reduced Mail System Efficiency

The fentanyl interdiction program will also reduce USPS's efficiency in handling international mail. The pieces of mail selected for additional screening will undoubtedly take longer to reach their destinations. As many pieces of mail that are subject to additional screening will not contain illicit materials, these packages will have been delayed unnecessarily. There are many uncertainties surrounding this issue. It is difficult to determine the volume of these packages and the average length of delay, as well as the actual economic cost resulting from these delays. As a result, we did not monetize these values for this analysis.

Benefits from Interdicting Other Illicit Drugs and Contraband

In our analysis, we only calculate benefits derived from interdicting fentanyl. Undoubtedly, the program will also interdict other illicit drugs and contraband; however, attempting to monetize these values is beyond the scope of this analysis. There are too many uncertainties to quantify these benefits in a reliable way. For example, it is difficult to predict what other drugs will be captured and in what quantities. It is also difficult to determine if those quantities would be large enough to affect market prices. Furthermore, monetizing values for each of these possibilities would require extensive additional research on the health and societal effects of each of these drugs, as well as on the methods suppliers use to transport the drugs. We did not monetize these benefits due to these uncertainties.

Analysis and Results

We calculate the net present value of increasing the interdiction of fentanyl by CBP at international mail facilities. To account for the high degree of uncertainty with many of our parameters, we utilize a Monte Carlo simulation with 10,000 trials. Monte Carlo simulation allows us to specify a likely range of values for variables and then draw randomly from those distributions (see Appendix U for the model's software code). Justifications for parameters and distributions used in this report can be found in the accompanying appendices.

Using a social discount rate of 3.5 percent over five years, we conducted Monte Carlo simulations for estimated 5, 10, and 15 percent interdiction rates (see Appendix R for results by category and interdiction level). In all three cases we find that net benefits are positive in all 10,000 trials. Figure 1 shows the distribution of values of the present value of net benefits over the entire five-year lifetime of interdicting 10 percent of fentanyl flowing through USPS International Service Centers.

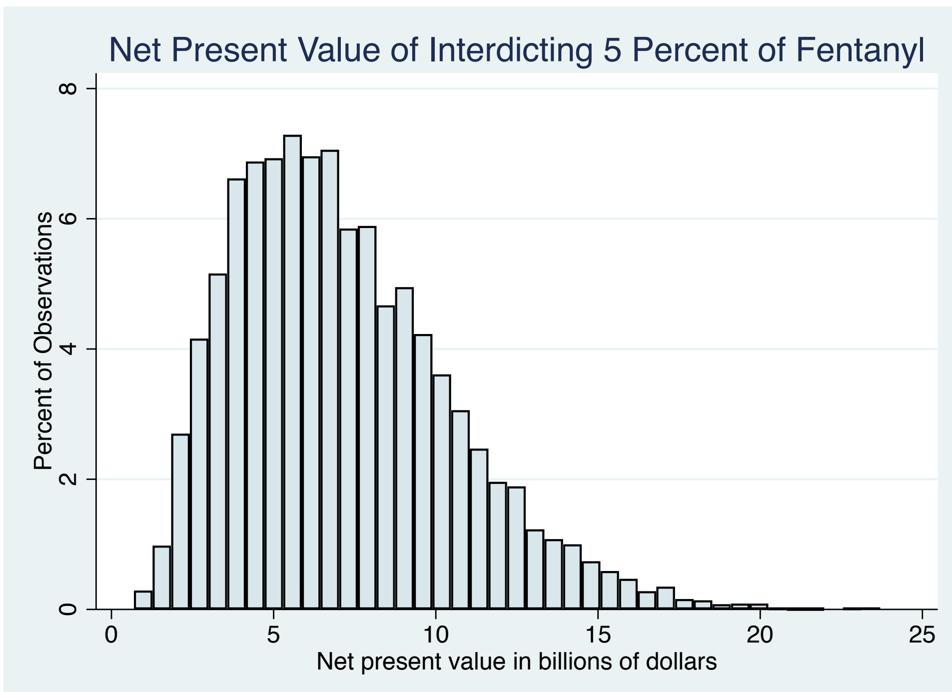

Figure 1: Net Present Value, 5 percent interdiction rate

At this interdiction rate, we find a median present value of $6.6 billion, with a high estimate of $23.7 billion and low estimate of $692 million. At a 10 percent interdiction rate the median present value jumps to $17.2 billion, with a high estimate of $53.6 billion and low estimate of $3.4 billion. Finally, at a 15 percent interdiction rate, the median present value of net benefits comes in at $27.9 billion, with a high estimate of $83.8 billion and low estimate of $6 billion.

Figures 2 and 3 show the distribution of values of the present value of net benefits for 10 percent and 15 percent interdiction rates, respectively.

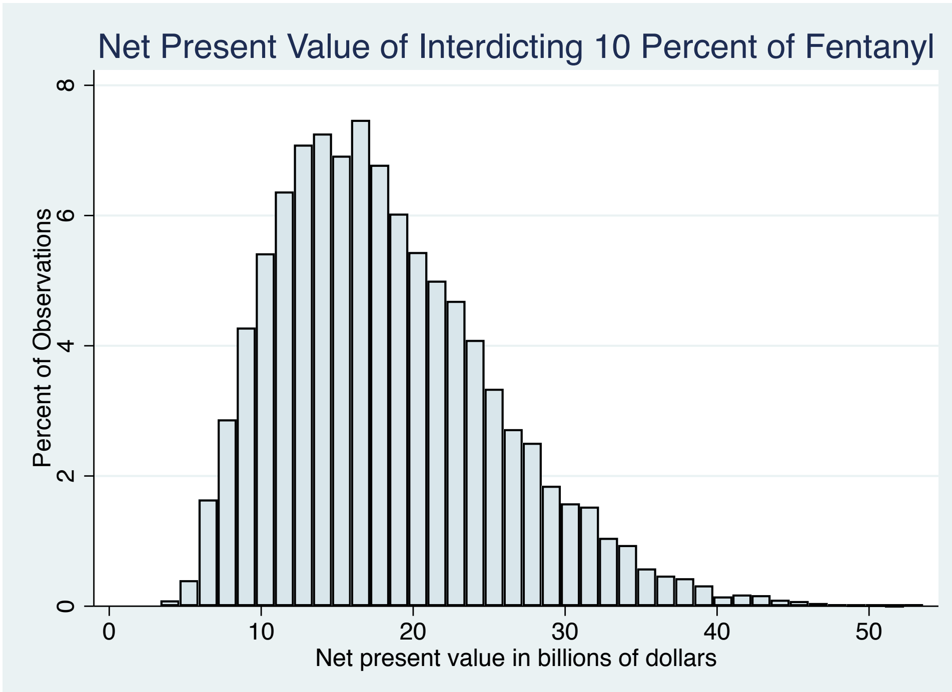

Figure 2: Net Present Value, 10 percent interdiction rate

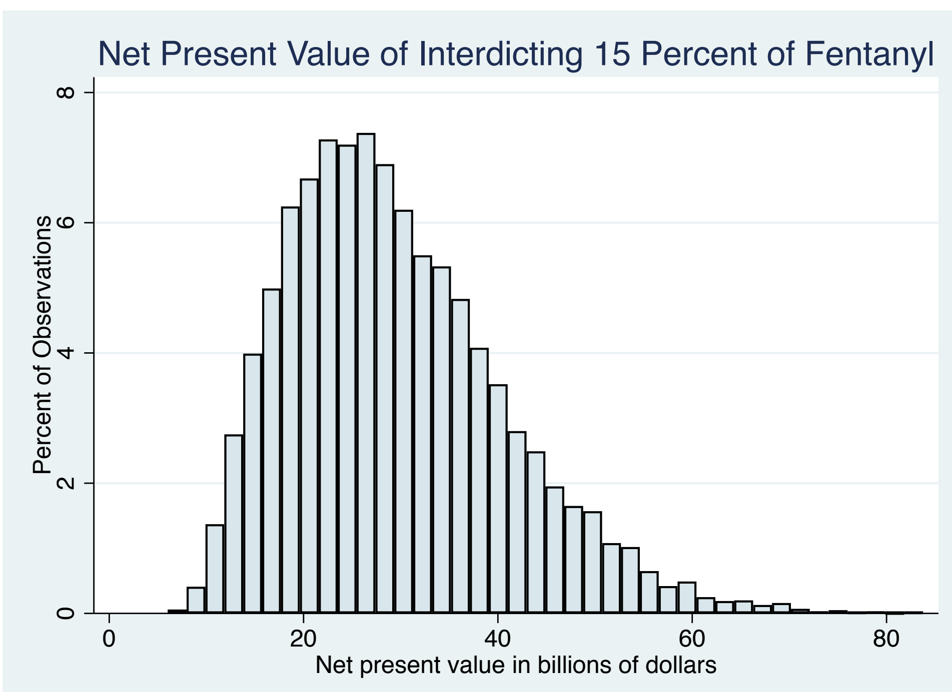

Figure 3: Net Present Value, 15 percent interdiction rate

Limitations

By their very nature, cost-benefit analyses involve uncertainty. As we sought to analyze the costs and benefits of a proposed government interdiction program aimed at an illicit substance that has entered drug markets within the last seven years, our analysis faced a series of hurdles for which there was little or no accessible data.

- The federal government has liberally exercised its authority to redact information from authoritative reports on the issue. For instance, a key Department of Homeland Security report on fentanyl interdiction at international mail facilities was 20 to 30 percent redacted (McCauley et al. 2018).
- The DEA has taken steps to reduce researchers' access to a key database on drug use and price. At the same time, key drug use surveys have been discontinued (Casteel 2017).
- In the face of a rapidly evolving drug crisis, data collection delays and the peer review process for scholarly articles make it difficult to know how the epidemic is evolving in real-time. For instance, as this report is being completed, the CDC has only released overdose fatality data through April of this year – a six-month lag (Ahmad et al. 2019).
- As the CEA report, The Underestimated Cost of the Opioid Crisis (2017), makes the case that the true costs of the opioid epidemic are under-estimated, we would like to highlight a non-monetized cost that is difficult to quantify: the emotional burden of having a family member addicted to opioids. As the social science and health care fields move closer to quantifying caregiving work, this is a cost area that is likely to be further studied and explicitly monetized.
- Over the course of this project we sought information from drug policy experts. One contact from the General Accounting Office cited the lack of publicly available data

regarding our topic. Instead, she directed us to budget reports that contained estimates that we used in our analysis.

- Our modeling does not account for further changes in the Chinese legal environment, which could impact the amount of fentanyl entering the United States.

Although we sought creative solutions grounded in evidence-based research, a lack of data hindered the precision of our analysis. This is conveyed through the wide distribution of parameters used in our estimates of costs and benefits. In addition, we do not consider how fentanyl interdiction would have impacted usage of other drugs such as heroin or cocaine. It seems possible that usage of these drugs might change as synthetic opioid prices increase or as the risk of fentanyl contaminating the drugs declines.

Recommendations

We find that increasing the fentanyl interdiction rate at the USPS International Service Centers for international mail from China at 5, 10, and 15 percent would result in median net benefits of $6.6 billion, $17.2 billion, and $27.9 billion, respectively. Therefore, we recommend that EFI be implemented at the staffing, equipment, and off-site location parameters sufficient to operate in order to achieve these interdiction rates. We recognize that these increased interdiction rates are dependent on cooperation between CBP and USPS and their capacity to increase the screening rate of international mail from .01 percent to 1 percent.

Of the main categories of benefits that we examined, (lives saved, decreased health expenditures, increased productivity, and foster care savings) the category of lives saved is responsible for the largest portion of benefits. As discussed, there are non-monetary benefits that our cost-benefit analysis did not capture, such as potential benefits to the criminal justice system in reducing the consumption of an illicit drug and therefore decreasing criminal activity. Another potential non-monetized benefit is the interdiction of other illicit substances and materials through increased screening of international mail from China. Lastly, decreases in the number of deaths due to fentanyl is a hard to quantify, but important and far-reaching, benefit of reducing the emotional toll on families of individuals who are addicted to opioids. Nonetheless, based on our estimated positive net benefits we recommend adoption of the EFI.

Appendix A: Abbreviations

CDC: Centers for Disease Control and Prevention

CEA: Council of Economic Advisers

CBP: Customs and Border Protection

DHS: Department of Homeland Security

EFI: Enhanced Fentanyl Interdiction

GAO: U.S Governmental Accountability Office

HHS: U.S. Department of Health and Human Services

HSGAC: Committee on Homeland Security and Governmental Affairs

IACM: Interagency Assessment of Cocaine Movement

ISC: International Service Center

JFK: John F. Kennedy International Airport

NFLIS: National Forensic Laboratory Information System

NII: Non-Intrusive Inspection Technology

NIOSH: National Institute for Occupational Safety and Health

OBP: Office of Border Operations

OFO: Office of Field Operations

PAC: Purity Adjusted Consumption

UPS: United Parcel Service

USPS: U.S. Postal Service

Appendix B: Interdiction Rate of Fentanyl

We seek to calculate the current interdiction rate of fentanyl through the United States Postal Service in order to determine how to allocate resources to better curb the flow of fentanyl into the United States. We utilize Department of Homeland Security reports regarding the effectiveness of various border-security activities as well as staff reports from the Committee on Homeland Security & Governmental Affairs (HSGAC) to estimate upper and lower bounds on the effectiveness of Customs and Border Protection's efforts to interdict fentanyl through the USPS. Our best estimate indicates that CBP currently interdicts between 2 percent and 4.5 percent of inbound fentanyl trafficked through international service centers.

Determining the Proportion of Fentanyl Entering Through Airports

In order to set a baseline estimate of how effective current operations are at seizing fentanyl at ISCs, we must estimate what proportion of current fentanyl consumption is being trafficked through the mail. To date there have been no reports indicating what this proportion might be and as such we are left to make our estimate based on the characteristics of fentanyl seized at airports versus the southern border. First, the weight of fentanyl seized at the southern border is far greater than that seized in international mail facilities (U.S. Senate Committee on Homeland Security & Governmental Affairs 2018). Second, this fentanyl is typically of a much lower purity, as low as 7 percent (McCaskill 2018). As a result, we predict that fentanyl seized at international mail facilities actually represents a larger share of purity-adjusted fentanyl amounts flowing through airports as these shipments usually consist of smaller but more potent quantities. Given these characteristics, and a review of the literature, we estimate that fentanyl trafficked through international mail facilities represents between 60 percent and 90 percent of the share of total purity-adjusted fentanyl consumed in the United States.

Department of Homeland Security Cocaine Seizure Effectiveness Rate

The DHS estimated the effectiveness rate of cocaine seizure at points-of-entry to be 2.45 percent for FY2017 (Department of Homeland Security 2019). This estimate is calculated using cocaine seizure data from the Office of Field Operations (OFO) administrative records and estimated total cocaine flow from Office of National Drug Control Policy (ONDCP) (DHS 2019). Flow estimates prior to 2015 are obtained from the Interagency Assessment of Cocaine Movement (IACM) reports and represent a "mid-point" estimate compiling potential production, domestic consumption, and Consolidated Counter Drug Database documented movements (DHS 2019). The National Defense Authorization Act report points out that while the seizure effectiveness rate has declined steadily from FY2012 to FY2017, the total number of seizures has increased over the same period. This indicates that total flow of cocaine increased at a higher rate than total seizures over the stated time period. At its lowest, the cocaine seizure effectiveness rate was 2.2 percent for FY2016 and highest for FY2012 at 4.29 percent. Data regarding fentanyl seizures were first reported for FY2016 and were unavailable for FY2017 at the time DHS published its report, however we estimate that fentanyl flow and seizures follow a similar trend. Therefore, we extrapolate these figures for fentanyl flowing through U.S. airports.

Table 1: Estimates of Seizure Effectiveness Rate (%)

Estimate	Cocaine	Fentanyl
High	4.29	4.29
Best	**3.19**	**3.19**
Low	2.2	2.2

Source of cocaine estimates: Department of Homeland Security (2019)

Fentanyl Seizures Through International Mail

During the most recent years with available data (2016 and 2017), CBP seized more individual fentanyl shipments at mail facilities than at express consignment facilities such as FedEx or UPS. Mail facilities in 2017 had five times as many fentanyl seizures than ports of entry. Individual seizures of fentanyl increased from 51 in 2016 to 277 in 2017, representing a 345 percent increase (McCaskill 2018). As of July 2019, current seizure statistics indicated that international seizures were decreasing relative to prior years (Barksdale 2019).

Critical Assumptions

We assume that the interdiction rates of cocaine at the southern border are similar to those of fentanyl at ISCs. Given the lack of available data regarding estimated flow and reliable seizure trends, the effectiveness rates of cocaine seizures reported by DHS stand as the best estimates for current effectiveness

EFI

Given these baseline values, EFI seeks to increase interdiction of fentanyl at USPS International Service Centers. We will run a Monte Carlo simulation using 5, 10, and 15 percent interdiction rates. This represents a substantial increase over current interdiction and reflects the impact of expansion of CBP facilities and capabilities.

Appendix C: How Fentanyl Shipments and Interdiction Change Over Time

Because we are evaluating this program over the course of five years, an important step in our analysis is determining how fentanyl suppliers will react to changes in the success rate of their shipments reaching consumers. That is to say, if suppliers receive an increasing number of complaints of shipments not being delivered to consumers, how will they change their behavior? There have been few studies that have sought to answer this question. A 2009 study by Dobkin and Nicosia looked at one of the single-largest supply disruptions of a drug market in the United States, a 1995 mass interdiction of methamphetamine precursors in California. Their study found that the interdiction created a significant, immediate decrease in supply and increase in price of methamphetamines, but that within 5 months the price had returned to its pre-interdiction level (Dobkin and Nicosia 2009). The ability of illicit drug markets to stabilize price so quickly is due to the existence of "backstop technology" (Caulkins et al. 1993). When suppliers observe a decrease in the proportion of shipments that successfully reach their customers, they adapt by switching to alternative shipping routes and methods, the "backstop technologies." As they do not know the actual proportion of shipments that law enforcement successfully interdicts, they only have an observed decline in successful shipments, so that they typically continue to ship small amounts across the original route, while focusing their efforts mainly on alternative routes. This way, if law enforcement efforts change at the original route or the new routes, they can observe these changes and continually shift their behavior accordingly (Caulkins et al. 1993).

There is no way to predict with certainty how fentanyl suppliers will change their behavior when they observe a decrease in successful shipments going through the mail. However, the literature suggests that if the suppliers observe decreased success in supplying to customers via their preferred method, they will resort to their backstop methods. We predict that if this change in policy increases interdiction rates of fentanyl coming through the mail to about 10 percent, that suppliers will reduce the amount of shipments coming through the mail in years two through five of the program by 50 to 90 percent. That is to say that we predict they will send 50 to 90 percent of what they were shipping through the U.S. Postal Service through other channels. This means that if EFI maintains the same 5, 10, or 15 percent interdiction rate of shipments coming through the mail in years 2 through 5, those interdictions will have a smaller impact on price because they are interdicting less fentanyl as a percentage of the total fentanyl supply, thus diminishing the impacts of the program in those years. We rely on our Monte Carlo simulation to draw randomly from a uniform distribution of adaptive responses between 50 and 90 percent to give us a range of possible responses to use in our analysis.

Calculating Net Present Value of EFI

Variations in the amount of fentanyl interdicted over time are reflected in our net-present value estimates for each year. In order to calculate the net-present value of EFI, we discounted each category of costs and benefits over the five-year period of the program at a rate of 3.5 percent. Because the program's costs and benefits accrue over the entirety of a year, we discounted at the half-year point. We then added the costs and benefits together and accounted for upfront costs.

Our formula for the present value of benefits for year i are outlined below, where benefits are listed as PVB_i and d is the 3.5 percent annual discount rate. In addition, VSL_i is the value of lives saved, H_{snf^i} represents discounted savings from non-fatality related health expenses, H_{sf^i} is the discounted value of reduced health costs linked to fatalities, P_{la^i} is the value of non-fatality-related productivity losses avoided and F_{cs^i} is the discounted value of foster care savings.

(1)

$$PVB_i = \frac{VSL_i + \ H_{snf^i} + H_{sf^i} + P_{la^i} + F_{cs^i}}{(1+d)^{i-0.5}}$$

We next calculate the present value of costs for the year i of interdiction. In our equation, PVC_i is the present value of costs in year i, C_{CBP^i} is the ongoing cost of hiring additional CBP officers, C_{em^i} is the maintenance cost of new equipment, C_{oc^i} is the ongoing cost of new canine teams, C_{wh^i} is the rental cost of new inspection warehouses, and C_{ot^i} is the ongoing cost of transportation.

$$PVC_i = \frac{C_{CBP^i} + C_{em^i} \ + C_{oc^i} + C_{wh^i} + C_{ot^i}}{(1+d)^{i-0.5}} \tag{2}$$

In order to calculate the net-present value of benefits (NPV_{EFI}) our model subtracts each year's PVC from the corresponding PVB. In addition, we include upfront costs of new equipment ($C_{e.}$) such as x-ray machines and miniature mass spectrometers, accessory equipment (C_a), and trucks needed to transport suspicious packages (C_t). These costs accrue at time zero and therefore are not discounted.

$$\begin{gathered} NPV_{EFI} = (PVB_1 - PVC_1) + (PVB_2 - PVC_2) + (PVB_3 - PVC_3) + \\ (PVB_4 - PVC_4) + (PVB_5 - PVC_5) - C_a - C_e - C_{CBP} - C_t \end{gathered} \tag{3}$$

Appendix D: Calculating Annual Amounts of Fentanyl Consumption in the United States and Quantity Entering through Incoming International Mail

We seek to identify total fentanyl consumption in the United States to learn how increased interdiction would change consumers' behavior and save lives. We use seizure data from CBP's Office of Field Operations and the RAND Corporation's heroin and cocaine consumption projections to achieve estimates for total fentanyl consumption in the United States. We estimate the total quantity of fentanyl illicitly consumed in the United States in 2020 to be 6 metric tons with upper and lower bounds of 5 and 30 metric tons.

Relationships between Fentanyl and Common Carrier Drugs

Like fentanyl, heroin and cocaine have long been trafficked into the United States from foreign countries. Heroin largely originates in Mexican poppy fields across the southwestern border, while cocaine production largely occurs in Central and South America (Bureau for International Narcotics and Law Enforcement Affairs 2019). We consider heroin and cocaine seizure data over that of marijuana or methamphetamine because the latter are produced in large quantities within the United States, inconsistent with projecting CBP's seized imports as a proportion of total quantities consumed.

Heroin and Cocaine Consumption

The RAND Corporation projected the total consumption of heroin to be 47 metric tons in 2016, the latest year for which data are available. It notes that consumption increased 10 percent per year from 2010 to 2016 (Midgette et. al., 2019). In keeping with the trend, we inflate the RAND's projection for 2016 by 10 percent for calendar years 2017-2020. We choose to use 2020 as a base year for our estimates of fentanyl because it is the first year during which the program would be implemented.

$$\begin{aligned}47 \text{ metric tons } &\times 1.1 \text{ (2017 average growth) } \times 1.1 \text{ (2018 average growth)}\\ &\times 1.1 \text{ (2019 average growth)} \times 1.1 \text{ (2020 average growth)}\\ &= 68.8 \text{ metric tons of projected heroin consumption in 2020}\end{aligned}$$

It is more difficult to project RAND's cocaine estimate into 2018 because of market fluctuations. (Midgette et. al. 2019). From 2010 to 2016, cocaine consumption averaged 130.14 metric tons. We will use this average to predict the amount in 2020.

Calculating Fentanyl Consumption

We project the total amount of fentanyl consumed in the United States using a formula similar to the one in Equation 4. The Office of Field Operations is the division of CBP that guards the nation's ports of entry and is responsible for airport interdiction efforts. Critically, it excludes drugs seized by Border Patrol agents. In the section below, we propose two different ratios to model fentanyl consumption. In the Monte Carlo, we use a uniform distribution to select points between the amounts. In the following equation, we let *S* equal the projected amount of drug *d* seized by OFO and *C* equal the estimated amount of drug *d* consumed in the United States.

$$\frac{S_d}{C_d} = \frac{S_f}{C_f} \tag{4}$$

CBP records indicate that from fiscal year 2015 through fiscal year 2019, the Office of Field Operations (the unit that monitors international mail packages) interdicted an annual average of 58,880 pounds of cocaine and 4,855 pounds of heroin (CBP 2019). We are comfortable using averages for cocaine and heroin because there is no clear trend over the period examined. We began our analysis at FY 2015 because it was the first year for which fentanyl was recorded. The amount of fentanyl seized in FY 2017 was more than 25 times greater than the amount seized in FY 2015 (CBP 2019). Similar increases are found in fentanyl seizure data throughout the country during this timeframe (Pardo et al. 2019 b). To account for this, we took an average of fentanyl's seizure amounts from the last three fiscal years, a period in which there was less variation. We assume the consumption and seizure amounts are held constant over the duration of the five-year benefits period.

Table 2: CBP Office of Field Operations Nationwide Drug Seizures (in Pounds)

Drug	FY 15	FY 16	FY 17	FY 18	FY 19	Average
Cocaine	38,346	52,838	62,415	51,592	89,207	58,880
Heroin	6,023	4,224	3,398	5,205	5,427	4,855
Fentanyl	70	596	1,875	1,895	2,545	1,396

Source: Customs and Border Patrol Enforcement Statistics (2019)

$$58{,}880\ pounds\ of\ cocaine = 26.71\ metric\ tons\ of\ cocaine$$
$$4{,}855\ pounds\ of\ heroin = 2.20\ metric\ tons\ of\ heroin$$
$$2{,}105\ pounds\ of\ fentanyl = 0.95\ metric\ tons\ of\ fentanyl$$

In Equation 5, we calculate the total amount of fentanyl where heroin is drug h and fentanyl is drug f.

$$\frac{S_h}{C_h} = \frac{S_f}{C_f} \tag{5}$$

Using information from Table 2 we solve for C_f and get:

$$\text{Fentanyl Consumed in the U.S. in 2020} = 29.7\text{ metric tons}$$

In Equation 6, we calculate the total amount of fentanyl where cocaine is drug c.

$$\frac{S_c}{C_c} = \frac{S_f}{C_f} \tag{6}$$

Using information from Table 2 we solve for C_f and get:

$$\text{Fentanyl Consumed in the U.S. in 2020} = 4.6\text{ metric tons}$$

In Equation 7, we calculate the total amount of fentanyl where heroin and cocaine combined comprise drug *hc* and fentanyl is drug *f*.

$$\frac{S_{hc}}{C_{hc}} = \frac{S_f}{C_f} \tag{7}$$

Solving for C_f we get:

$$\text{Fentanyl Consumed in the U.S. in 2020} = 6.2\text{ metric tons}$$

Parameters

We choose to use the heroin-informed estimate and cocaine-informed estimate as upper and lower bounds, respectively, for our projection of fentanyl consumption in the United States. We project this amount to be between approximately 5 and 30 metric tons. We believe that the mode of the distribution is 6.2 metric tons, the amount calculated through the combined cocaine and heroin ratio. This is the most accurate estimation because fentanyl is increasingly infiltrating both heroin and cocaine markets (Pardo 2019a). In the Monte Carlo simulation, we use a triangular distribution from which to draw consumption amounts.

Adjusting for Purity

We take steps to account for variations in the purity of fentanyl entering the United States. For instance, CBP notes that fentanyl entering the United States through the mail is 90 percent pure, while the amount that enters through the southwest border is 7 percent pure (Pardo 2019 b). We multiply the amounts entering the United States through each entry point by the corresponding purity rate. We measure the total amount of fentanyl entering the United States by using purity-adjusted consumption (PAC) – a metric indicating the quantity of non-diluted fentanyl consumed in the country.

Based on our review of dozens of sources and hundreds of pages of documents, we believe that between 60 to 90 percent of purity-adjusted fentanyl flows through the mail. The remainder enters through the southwest border. In the Monte Carlo, we use a uniform distribution to identify possible percentages over the range. Moreover, we note that another scholar has a similar estimate. Pardo (2018) used seizure data to project that nearly 80 percent of the purity-adjusted fentanyl enters the United States through the mail or express consignment. Using the Monte Carlo simulation, we draw the specific amount entering through the mail from the distribution. We use the following equation:

$$X - (M * X) = Y \tag{8}$$

where X equals total consumption, M is the percent of fentanyl entering through the mail, and Y is the total entering through the southwest border. We then enter the mail and southwest border quantities and solve for PAC_{2020}, or purity-adjusted fentanyl consumption in base-year 2020. The purity-adjusted fentanyl consumption is used in later benefits calculations.

$$[MX(0.9)] + [Y(0.07)] = PAC_{2020} \tag{9}$$

The purity-adjusted fentanyl consumption total is used in later benefits calculations including health care savings and productivity gains.

Appendix E: Calculating Deaths Avoided from Increased Fentanyl Interdiction

Base Deaths

As EFI will start in 2020 and the latest annual data available on fentanyl-related deaths is for 2018, we must project current data forward to calculate how many deaths there would be in 2020 in absence of this program. Current data on fentanyl-related deaths suggest that the number of deaths is increasing at a rate of about 10 percent per year (Ahmad et al. 2019). The number of overdose deaths in 2018 was 31,866 (Ahmad et al. 2019). We inflate that number by 10 percent into 2019, and then again into 2020 to arrive at our number of base deaths, 38,582.

Change in Fentanyl Consumption

We calculate the number of deaths avoided due to increased fentanyl interdiction by first determining how interdiction increases the price of fentanyl. Programs aimed at controlling the supply of illicit substances limit consumption by increasing the cost to producers of supplying the substance, who in turn pass a certain percentage of those increased costs on to consumers (Rydell and Everingham 1994). If demand for these substances is not perfectly inelastic, then the increased price will lead to a decrease in consumption. As for how increased interdictions will impact price, we will use a "multiplicative model" (Caulkins and Reuter 2010). In this model, any increase in costs to the dealer of producing and supplying the illicit substance is passed down to the consumers, so a 25 percent increase in production costs leads to a 25 percent increase in the street price of the drug (Caulkins and Reuter 2010). As these interdictions are happening after the costs have been incurred to produce and ship the drug, we argue that the increase in costs to suppliers will be proportionate to the percentage of the total fentanyl supply interdicted. For example, if 20 percent of the fentanyl supply is interdicted, then costs to producers will increase by 20 percent because 20 percent more fentanyl will have to be produced to meet demand. Using the multiplicative model, the 20 percent increase in costs to suppliers would lead to a 20 percent increase in the street price of fentanyl. As we are simulating an interdiction rate of 5, 10, or 15 percent, we assume these interdictions will raise prices by 5, 10, and 15 percent, respectivey.

We then use an estimate for the demand elasticity of fentanyl, along with our estimate of total fentanyl, to determine how this change in the price in fentanyl will change consumption. A 2013 meta-analysis of studies on demand elasticities of illicit drug users finds the demand elasticity for Heroin users to be between -0.27 and -0.5, depending on control variables included (Gallet 2013). The study also establishes similar demand elasticities for cocaine users, implying that users of "hard drugs" have similar demand elasticities. We argue that these elasticities are the best analogs for the elasticity of fentanyl users (some of whom are also heroin or cocaine users). The calculation we use to determine change in consumption, which is determined by rearranging the equation for elasticity of demand (E_d), is as follows:

$$\Delta_c = \left(\frac{\Delta_p}{p}\right) * E_d * PAC_{2020} \tag{10}$$

Where Δ_c indicates the change in fentanyl consumption from increased interdiction, $\left(\frac{\Delta_p}{p}\right)$ is the percentage change in the price of fentanyl.

Change in Fentanyl-Related Deaths

Evidence suggests that presence of fentanyl in illicit drug markets largely increases the number of deaths rather than number of users (Pardo et al. 2019). Fentanyl is often pushed by suppliers due to its relatively high potency and extremely low cost, and suppliers of illicit substances such as heroin or cocaine often "cut" their products with fentanyl to simulate the intensity of the high from the original drug while lowering the cost, without the consumers realizing it is there. Fentanyl effects are also very unpredictable because fentanyl varies widely in its purity and the potency of its various analogs. These factors tend to drive up the death rates associated with fentanyl (Pardo et al. 2019). All of this is by way of saying that it is reasonable to assume that fentanyl deaths are distributed randomly across users. Because of this randomness, the best available way to calculate how supply interdiction impacts deaths from fentanyl is to calculate the ratio of deaths per volume of fentanyl consumed in the United States. That ratio can then be applied to the new rate of fentanyl consumption to determine the new total number of deaths from fentanyl. Our median estimates for deaths avoided over five years as well as just in the first year are listed in Tables 3 and 4 below.

Table 3: Median Estimates for Deaths Avoided from Fentanyl Interdiction Over Five Years

Interdiction Rate	Median Deaths Avoided
5 percent	825
10 percent	2,012
15 percent	3,205

Table 4: Median Estimates for Deaths Avoided from Fentanyl Interdiction in First Year

Interdiction Rate	Median Deaths Avoided in First Year
5 percent	187
10 percent	736
15 percent	1,292

Appendix F: Value of Statistical Life (VSL)

After predicting number of deaths prevented from the interdiction program, we estimate the benefit of saving these lives. To do this, we multiply the reduction in deaths by a VSL adjusted for income (VSL_i). We adjust the VSL for income based on evidence that the individuals most likely to be saved by the program, those who abuse opioids, are likely to have lower incomes compared to the general population. A study conducted with data from the nationally representative National Inpatient Sample found that low-income populations make up a disproportionate share of those who have been hospitalized due to opioids (Song 2017). As a result, utilizing a VSL based on the general population would overstate the benefits, so it is important to adjust the VSL for this population. To make the income adjustment to VSL, we utilize the following equation adapted from Robinson & Hammitt (2015) where VSL is the VSL estimate for the general population, $\bar{X}_i$ is the median income for our relevant population, m_i is median income for the U.S. population, and E_i is income elasticity.

$$VSL_i = VSL * \left(\frac{\bar{X}_i}{m_i}\right)^{E_i} \tag{11}$$

Baseline VSL Estimates

To compute the values needed for this equation, we first calculate a baseline central VSL estimate by following guidance issued by the Department of Health and Human Services (HHS) to its analysts for conducting cost-benefit analyses. HHS recommends using a 2014 VSL of $9.3 million with low and high parameters of $4.4 million and $14.2 million respectively (U.S. Department of Health and Human Services 2016). These figures are all in 2014 real dollars. To adjust for inflation, we follow HHS guidance and convert the values to 2019 real dollars using the Bureau of Labor Statistics inflation calculator (U.S. Bureau of Labor Statistics 2019). The table below contains the results of these calculations.

Table 5: Department of Health and Human Services Value of Statistical Life Estimates in 2019 dollars (millions of dollars)

Low VSL Estimate	Central VSL Estimate	High VSL Estimate
$4.73	$10.01	$15.28

Adjusting the Baseline VSL for Income

We calculate the mean income ($\bar{X}_i$) for individuals that abuse opioids. We utilize a study conducted with data from the nationally representative National Survey on Drug Use and Health. This study found that low income populations make up a disproportionate share of those with prescription opioid use disorder (Han, Compton, Blanco, & Crane 2017). The population that abuses prescription opioids is only a subset of the wider universe of individuals that abuse opioids (our population of interest), we use it as a close proxy. We make the assumption that this population exhibits similar behavioral characteristics to the wider population of individuals that abuse opioids. Additionally, research shows that low-income individuals make up disproportionate shares of both of these populations (Song 2017; Han et al. 2017). The study by Han et al. on prescription opioid abusers also provides the level of detail needed to make our calculations. This study reports the percent of adults with prescription opioid use who have prescription opioid use disorder by income level.

Next, we use data from the U.S. Census Bureau, Current Population Survey to calculate mean income levels for the income groups used in the Han et al. study (U.S. Census Bureau 2015). While it would be preferable to utilize a median income for each of these income subgroups, we did not have the data necessary to make the calculation, so we rely on the mean. We then use the findings of the Han et al. study to create a weighted mean of incomes for adults with prescription opioid use disorder. Finally, we inflate the results to 2019 real dollars. The results of these calculations are in the table below.

Table 6: Calculations of Mean Income for Individuals that Abuse Opioids

2015 Household Income Range (Han et al.)	2015 Mean Household Income for Range (U.S. Census)	Percent of Adults using Prescription Opioids who Have Prescription Opioid Use Disorder in Each Income Level (Han et al.)	Percent of Adults with Prescription Opioid Use Disorder in Each Income level	Weighted Mean Calculation
<$20,000	$ 10,783	3.2	36.0	$ 3,877
$20,000-$49,999	$ 33,719	2.3	25.8	$ 8,714
$50,000-$74,999	$ 61,264	2.1	23.6	$ 14,456
$75,000+	$ 150,096	1.3	14.6	$ 21,924
2015 Mean Income for Adults with Prescription Opioid Use Disorder				$ 48,971
2015 Mean Income for Adults with Prescription Opioid Use Disorder (2019 Real Dollars)				**$ 52,744**

The median household income (m_i) for the U.S. population in 2015 is $55,775 (U.S. Census Bureau, 2015). We use the 2015 median household income for the U.S. population because the Han et al. study also looks at opioid abusers' incomes in 2015. Using the same year for the general population ensures an accurate comparison. We then inflate the 2015 median household income to 2019 real dollars, and this becomes $60,072. We utilize the median income, as opposed to mean income, so that the large outliers at the ends of the national income distribution do not skew the statistic. For the elasticity, we follow HHS guidelines and use an income elasticity (E_i) of 1.0 (U.S. Department of Health and Human Services 2016). Inputting all these numbers into the equation we solve for VSL_i.

$$central\ estimate: VSL_i = \$10.01\ million * \left(\frac{\$52{,}744}{\$60{,}072}\right)^1$$

$$central\ estimate: VSL_i = \$8.9 \text{ million}$$

Finally, like HHS, we use a wide range of values for the VSL. To calculate the high and low estimates, we use the HHS figures as baselines and again apply the same equation to adjust for income.

$$low\ estimate: VSL_i = \$4.73\ million * \left(\frac{\$52{,}744}{\$60{,}072}\right)^1$$

$$low\ estimate: VSL_i = \$\ 4.2 \text{ million}$$

$$high\ estimate: VSL_i = \$15.28\ million * \left(\frac{\$52{,}744}{\$60{,}072}\right)^1$$

$$high\ estimate: VSL_i = \$\ 13.4 \text{ million}$$

Due to the many uncertainties that could impact the VSL of those who die from fentanyl use, we utilize these parameters and a triangular distribution to set up a Monte Carlo simulation of VSL. We utilize the figures in Table 6 in our simulation. To calculate the total benefits from lives saved, we use these figures and multiply the VSL by the number of lives saved.

Table 7: VSL Levels Used in Benefits Calculations: 2019 Real Dollars (millions)

Low VSL Estimate	Central VSL Estimate	High VSL Estimate
$4.2	$8.9	$13.4

To calculate the total benefits from lives saved, we use these figures and multiply the VSL by the number of lives saved. Savings from reduced fatalities comprise the largest part of our benefits projections.

Table 8: Estimated Value of Lives Saved Over Five Years

Estimate	Savings
High	$78.6 billion
Best	**$16.2 billion**
Low	$1.1 billion

Appendix G: Calculating the Number of Fentanyl Consumers in the United States

We use drug seizure data compiled by the National Forensic Laboratory Information Service to project the total number of Americans abusing fentanyl. We use the ratio featuring both heroin reports and users to project the number of fentanyl consumers. We select heroin because the drug's epidemic immediately preceded fentanyl's emergence (Pardo et al. 2019 a).[3] Identifying the number of fentanyl consumers is critical to projecting total fentanyl-related healthcare and productivity costs (see Appendices H, I, and J for more information on health expenditures and productivity losses).

Identifying a Demand Indicator

In searching for a demand indicator proportional to the number of fentanyl consumers, we avoid consumption totals that are skewed by variations in potency between fentanyl and heroin. For instance, it might make sense that heroin users consume greater weights of heroin because it is less potent than fentanyl (Pardo et. al., 2019 a).

The National Forensic Laboratory Information System's (NFLIS) catalog of drug seizure reports is one such source. The DEA database collects information on seized drugs from American crime labs. However, the data only indicates the number of times that a drug has been seized by law enforcement officers and does not include the quantity consumed. Nevertheless, the drug report totals are useful in calculating the number of people who consume fentanyl. The reports are particularly helpful because seizures containing multiple drugs yield tallies for each illicit substance (NFLIS 2017). (For example, authorities who seized a bag containing fentanyl and heroin would report both drugs.) Our assumption is supported by CDC research that uses

[3] One study found that 70 percent of all fentanyl seizures in federal datasets were comprised entirely of fentanyl, while 25 percent also contained heroin (Pardo et. al. 2019 a). It is possible that some of the heroin RAND assumed to be consumed in 2016 was fentanyl because mixing is so common.

NFLIS seizure reports as a barometer for measuring the extent of the fentanyl crisis (Gladden et al. 2016; Zibbel et al. 2019).

Using a Ratio to Calculate the Number of Fentanyl Consumers

In a study released this year, the RAND Corporation projected the number of heroin users in the United States. From 2012 to 2016, the number of heroin users averaged 2.18 million people (Midgette et. al. 2019). The relative stability of the number allows us to extrapolate it to 2018. During that year, the National Forensic Laboratory Information System identified more than 155,000 reports of heroin and more than 75,000 reports of fentanyl and other synthetics (NFLIS 2018). In Equation 12, we use the demand-side seizure estimates (R_d) for heroin h and fentanyl f to project the total number of fentanyl consumers in the United States in 2018. We assume the number remains constant in 2020.

$$\frac{R_h}{U_h} = \frac{R_f}{U_f} \tag{12}$$

We insert information from Table 8 into Equation 12.

Table 9: National Estimates for Most Frequently Identified Drugs

Estimated number of total drug reports submitted to laboratories from January 1, 2017, through December 31, 2017, and analyzed by March 31, 2018. Calendar Year 2017 was the latest for which data was available.

Heroin	**157,055**
Fentanyl	56,530
Tramadol	6,498
Carfentanil	6,213
Furanyl fentanyl	4,970
Acetyl fentanyl	1,376
Cyclopropyl fentanyl	1,119
3-Methylfentanyl	788
Total Fentanyl and Other Synths.	**77,494**

Source: U.S. Drug Enforcement Administration National Forensic Laboratory Information System.

$$\frac{157{,}055}{2.18} = \frac{77{,}494}{U_f}$$

Solving for U_f we get:

$$Total\ Number\ of\ Fentanyl\ Consumers = 1{,}100{,}000\ individuals$$

We follow an identical process to determine the upper and lower bounds of fentanyl consumers based on the high and low estimates of heroin users projected by RAND (Midgette et al. 2019).

Table 10: Estimates for Projecting Fentanyl Consumers in 2020 (in millions)

Estimate	Heroin Users	Fentanyl Consumers
High	4.2	2.1
Best	**2.2**	**1.1**
Low	1	0.5

Source: Midgette et al. (2019) and the authors

Critical Assumptions

In both the productivity and healthcare analyses, we assume that the number of heroin reports per user is proportional to the number of reports of fentanyl per user. However, we use this approach because of the similarities between heroin and fentanyl, both of which are opioids. Emerging evidence indicates that drug dealers in the eastern United States began using fentanyl as a substitute for heroin during 2016 and 2017. In addition, heroin has long been a common carrier drug for fentanyl (Pardo et al. 2019a).

Appendix H: Calculating Annual Non-Fatality-Related Health Savings from Reduced Fentanyl Consumption in the United States

We calculate the average healthcare costs for an individual abusing fentanyl by relying upon previous authors' approaches and using our estimates of the total number of fentanyl consumers. Florence et. al. (2016) found that aggregate non-fatality-related health and treatment costs linked to prescription opioid abuse were $28.9 billion in 2013 dollars. After adjusting for inflation, the amount swells to $32.2 billion in 2019 dollars.[4] We then divide this total by the 1.9 million opioid prescription abusers Florence et al. identified for calendar year 2013. This yields an average healthcare cost ($\bar{X}_{health}$) of $17,000 per user. The total includes expenses related to both healthcare utilization and drug treatment. We are confident using costs related to prescription-opioid abuse as a proxy for fentanyl consumption because other researchers have replicated the approach. For instance, the White House Council of Economic Advisers used an identical approach in calculating total opioid costs (2017).

$$H_e = U_f * \bar{X}_{health} \tag{13}$$

We solve for the equation using our best estimate of fentanyl consumers to get annual non-fatality-related health costs (H_e).

$$\$18{,}700{,}000{,}000 = 1{,}100{,}000 * \$17{,}000$$

We followed an identical process to quantify the amounts for the upper and lower bounds of our fentanyl consumer estimates.

[4] Our inflation adjustment was performed using data from the federal Bureau of Labor Statistics' Consumer Price Index. It seems likely that fentanyl-related non-fatal health costs grew at a rate that exceeded the rate within the entire U.S. economy (Martin et al. 2019). For instance, experts have noted the dramatic price increases in Naloxone, a drug commonly used by paramedics to reverse overdoses (Gupta et al. 2016).

Table 11: Lower and Upper Bounds for Annual Non-Fatality-Related Health Expenditures Linked to Fentanyl

Estimate	Estimated Health Costs Per User[5]	Fentanyl Users	Expenditures
High	$17,000	2.1 million	$35.7 billion
Best	**$17,000**	**1.1 million**	**$18.7 billion**
Low	$17,000	0.5 million	$8.5 billion

We then multiply the total non-fatal health costs (H_e) by the total decrease in purity-adjusted consumption linked to bolstered interdiction by Customs and Border Protection. This gives us the savings to non-fatality-related health expenditures (H_{snf}) from increased fentanyl interdiction.

$$H_{snf} = H_e * \left(\frac{\Delta_{PAC}}{PAC_{2020}}\right) \tag{14}$$

We perform this technique on each year within the benefits period. In order to account for time, we apply the discount rate to calculate the net present value of benefits over the five-year period of the project.

Critical Assumptions

In our analysis of reduced healthcare costs linked to diminished fentanyl consumption, we assume that the rate of heroin reports per user is the same as the number of fentanyl reports per user. Nevertheless, we are confident because of the similarities between heroin and fentanyl, both of which are opioids (Pardo et al. 2019 a). We also assume that a reduction in fentanyl consumption will lead to a proportional reduction in health costs linked to the substance. There is little information within the academic literature regarding the extent to which this would occur.

[5] In their study, Florence et al. include upper and lower bounds for total health costs linked to prescription opioid addiction in 2013. However, these total expenditure amounts only vary based on the number of users the researchers project – the average cost per user does not change in their estimates (Florence et al. 2016, Supplement 3).

Nevertheless, we believe that reducing the total amount of fentanyl consumption in the United States would diminish health expenditures. For instance, we note that the total amount of fentanyl or its analogues needed to kill a human is infinitesimally small. For example, tens of micrograms (one-thousandths of a gram) of fentanyl or its analogues can trigger overdoses among those who do not have a prior tolerance (Suzuki and El-Hadad 2017). Carfentanil is one of the most lethal fentanyl analogues and is 10,000 times stronger than morphine. By reducing exposure to fentanyl, we expect economic health savings proportionate to the reduction in pure fentanyl pounds.

Table 12: Estimates for Non-Fatality-Related Health Savings Linked to Fentanyl Interdiction Over Five Years

Estimate	Savings
High	$5.23 billion
Best	**$986 million**
Low	$62 million

Appendix I: Health Savings from Diminished Fatalities Linked to Fentanyl Consumption

Florence et al. (2016) estimated there were 16,000 deaths linked to prescription opioid overdoses in 2013. The researchers estimated that fatality-related health expenditures totaled $84 million that year. We adjust their cost estimate to 2019 dollars and find that the expenditure inflates to $93.66 million. Similar to our technique for non-fatality-related health expenditures, we project average costs by dividing total costs by the number of deaths. We find that the average prescription overdose death in 2013 would cost $6,000 in 2019 dollars. Our calculations assume that the costs would be similar between prescription overdose and fentanyl deaths. Nevertheless, we feel confident in our approach since other researchers have used Florence et al.'s data in a similar manner (Council of Economic Advisers 2017; Rembert et al. 2017).

Calculating Health Savings from Diminished Fentanyl-Related Fatalities

We then multiply $6,000 average cost per fentanyl death ($\bar{X}_{healthD}$) by the projected number of deaths avoided from EFI (D_a).

$$H_{sf} = \bar{X}_{healthD} * D_a \tag{15}$$

We calculate upper and lower bounds using our estimates of the number of the number of fatalities avoided.

Table 13: Estimates for Fatality-Related Health Savings Linked to Fentanyl Interdiction Over Five Years

Estimate	Savings
High	$39.4 million
Best	**$11.2 million**
Low	$1 million

Appendix J: Calculating Productivity Losses Caused by Non-Fatal Fentanyl Consumption in the United States

We calculate productivity lost from non-fatal fentanyl addiction using an approach like the one used for healthcare expenditures in Appendices H and I. (Productivity losses linked to fatalities are included within our value of statistical life estimate. See Appendix F for more information.) Florence et. al. (2016) suggest that lost productivity due to disability caused by prescription drug abuse was $16.26 billion in 2013. When adjusted for inflation the amount is $18.13 billion in 2019. The authors projected that there were 1.9 million prescription drug abusers in 2013. Therefore, we divide $18.13 billion by 1.9 million and find the average lost productivity per user to be $9,500. We use the prescription drug overdose figure because it mirrors the strategy used by the Council of Economic Advisers in its estimate of total costs from the opioid crisis (2017). We multiply the number of fentanyl users calculated in Appendix D by the average productivity costs per user (P_f) outlined below.

$$P_{cf} = U_f * P_f \tag{16}$$

We solve for total non-fatal productivity costs to produce our best estimate.

$$\$10{,}500{,}000{,}000 = 1{,}100{,}000 \times \$9{,}500$$

We then multiply $9,500 in averaged productivity losses by the smallest projected number of fentanyl consumers and $9,500 by the largest projected number of fentanyl consumers. This produces our upper and lower bounds.

Table 14: Estimates for Annual Non-Fatality-Related Productivity Losses Linked to Fentanyl

Estimate	Estimated Productivity Losses Per Consumer[6]	Fentanyl Consumers	Expenditures
High	$9,500	2.1 million	$20.0 billion
Best	**$9,500**	**1.1 million**	**$10.5 billion**
Low	$9,500	0.5 million	$4.8 billion

Source: Estimated productivity losses per user derived from Florence et al. (2016).

We then multiply the total non-fatal productivity costs by the total decrease in purity-adjusted consumption linked to bolstered interdiction by Customs and Border Protection.

$$P_{la} = P_a * \left(\frac{\Delta_{PAC}}{PAC_{2020}}\right) \tag{17}$$

We can alter Δ_{PAC} based on varying estimates of EFI's improved effectiveness. Using our expenditure estimates from Table 13 we can calculate the total annual productivity losses avoided from increased interdiction (P_{la}). We then sum the total productivity losses avoided from increased interdiction over the five-year period from which we project benefits and apply the discount rate to achieve the net present value of benefits.

Table 15: Estimates for Non-Fatality-Related Productivity Gains Linked to Fentanyl Interdiction Over Five Years

Estimate	Savings
High	$2.9 billion
Best	**$548 million**
Low	$31.1 million

[6] Similar to the case of healthcare, Florence et al. included upper and lower bounds for total productivity costs linked to prescription opioid addiction in 2013. However, these total expenditure amounts only vary based on the number of users the researchers project – the average cost per user does not change in their estimates (Florence et al. 2016, Supplement 3).

Appendix K: Calculating Foster Care Savings from Reduced Fentanyl Consumption in the United States

We calculate our estimates of foster care savings by considering the relationship between foster care entries (FCE_y) and overdose deaths (OD_y) as an elasticity (E_{fc}). We first calculate the rate of change in overdose deaths and foster care entries (R_{OD} and R_{fc}, respectively). We choose 2012 as a starting point because it represents the trough of a multi-year decline in FCEs (Children's Bureau 2015).

$$R_{OD} = \frac{OD_{2018} - OD_{2012}}{OD_{2012}} \tag{18}$$

$$R_{fc} = \frac{FCE_{2018} - FCE_{2012}}{FCE_{2012}} \tag{19}$$

$$E_{fc} = \frac{R_{fc}}{R_{OD}} \tag{20}$$

Under this model, we multiply the elasticity by the percentage reduction in opioid deaths linked to increased interdiction (Δ_D). We also multiply by the average annual cost per child (AC) and median length of stay for a child in foster care (m_s).

$$FC_s = E_{fc} * \Delta_D * FCE_{2020} * (AC * m_s) \tag{21}$$

Entering known values into Equation 20 we get:

$$\frac{\frac{263{,}000-251{,}000}{251{,}000}}{\frac{69{,}000-41{,}500}{41{,}500}} = 0.07$$

For every 1 percent increase in drug overdoses between 2012 and 2018, there is a 0.07 percent increase in foster care entries. We then use that as our elasticity in Equation 21 to calculate the total annual foster care savings from reduced fentanyl consumption. We apply the same approach to each of the years in our benefit period, applying the standard discount rate to obtain our net present value over the life of EFI.

Table 16: Estimates of Foster Care Savings Linked to Increased Fentanyl Interdiction Over Five Years

Estimate	Foster Care Savings
High	$115 million
Best	**$32.8 million**
Low	$3 million

Our calculation is like the one used by Ghertner et al. (2018) in their analysis. However, their study was based on aggregated county-level data. It appears our calculation is the first to use an elasticity formula to determine the relationship between foster care entries and opioid overdose deaths at the national level. Nevertheless, we are confident in the measure because a broad literature indicates that there is an inherent correlation between the two variables over the period analyzed (Ghertner et al. 2018; Lynch et al. 2018; Quast et al. 2018). Moreover, we control for uncertainty using upper and lower bounds.

Appendix L: Need for Personnel and Cost of Port Entry Officers

Need for Personnel

There is a growing need for staff in CBP international mail centers to combat the opioid crisis. Former Senator Heidi Heitkamp argued that the United States is failing to interdict opioids in mail because CBP is understaffed (McCaskill 2018). Furthermore, the Office of Inspector General also released a report outlining the need for additional staff due to the current conditions at JFK international mail facilities. Currently, CBP employs fewer than 400 Port Officers at International Service Centers (ISCs) in the United States; therefore, CBP officers are not able to physically search each targeted piece of mail (McCaskill 2018). We want to increase the number of employees at the five ISCs (and our off-site facility) to process packages more efficiently due to our belief that increasing personnel will make a crucial difference in the volume of mail being inspected daily.

CBP Pay and Benefits

Our estimates for the cost of personnel were calculated from the grade level compensation, which include base salary, average locality, overtime, and night differential. CBP officers have a grade-level pay progression of GS-5, GS-7, GS-9, GS-11, and GS-12. The agency indicates that officers are offered a promotion to the next highest-grade level once they successfully complete one year in each grade level (CBP 2019 b). We use these average compensations to account for the costs of hiring more personnel to help inspect and screen pieces of mail. We keep in mind that after each year CBP officers have the opportunity to rise to the next salary grade.

Table 17: Customs and Border Protection Annual Benefits Package by GS Position

Grade	Average Compensation	Base Salary	Average FY19 Locality, Overtime, and Night Differential
GS-5	$41,380	$29,350	$12,480
GS-7	$57,519	$36,356	$21,163
GS-9	$74,222	$44,471	$29,751
GS-11	$94,314	$53,805	$40,509
GS-12	$104,516	$64,490	$40,026

Source: Customs and Border Protection (2019)

Calculation of Staff Needed

To calculate the number of additional CBP personnel needed under EFI we use the optimal port officer staffing level (CBP_o) as reported by the HSGAC (McCaskill 2018). Using current CBP staffing level at ISCs (CBP_c) and the total number of port officers (IPO_t) working at all ports of entry we calculate the current proportion ($\propto_c$) of CBP officers assigned to ISCs.

$$\propto_c = \frac{CBP_c}{IPO_t} \tag{22}$$

This provides our base assumption which we then increase as part of EFI. We multiply this increased proportion ($\propto_{EFI}$) by the optimal staffing level to calculate the total number of CBP officers (CBP_t) working at ISCs under EFI.

$$CBP_t = CBP_o * \propto_{EFI} \tag{23}$$

We then subtract the current ISC staffing level from this figure to calculate the number of additional CBP officers employed under EFI.

$$CBP_n = CBP_t - CBP_c \tag{24}$$

As previously noted, CBP employs approximately 400 port officers at the five International Service Centers. For 2018, the optimal port officer staffing level was 27,187 to adequately fulfill all duties (McCaskill 2018). According to CBP's updated analytic working staffing model, CBP is 3,500 officers short of meeting the current need (Reardon 2018). We use these figures in Equations 22, 23, and 24 to calculate the number of additional officers needed to help process a higher volume of packages.

$$0.017 = \frac{400}{23{,}147}$$

Increase to 5 percent:

$$1359 = 27{,}187 * 0.05$$

Subtract current CBP staffing level:

$$959 = 1359 - 400$$

Our calculations indicate the need to hire roughly 960 new CBP officers. To calculate the net present value of costs (C_{cbp}) over the five-year life of EFI, we multiply CBP_n by the average compensation ($\bar{X}_c$) at graduated GS levels to account for salary changes over time.

$$C_{cbp} = CBP_n * \bar{X}_c \tag{25}$$

Our estimate for the total cost of hiring additional CBP officers, using the standard discount rate, is $323 million over five years.

Appendix M: Contribution of New Equipment and Cost

Support for Technology Advancement

In a hearing for combatting the opioid crisis, witnesses from the DHS and USPS argued how crucial technology is to detect illicit drugs. CBP is currently testing new technology that could be utilized in international mail facilities to detect synthetic opioids if they receive funding (McCaskill 2018). CBP would benefit from expanding the use of various testing equipment for all ports of entry. CBP staff expressed the importance of using the latest advances in technology "as part of CBP's screening processes and expressed a desire for certain key pieces of equipment" (McCaskill 2018). Many witnesses argued that CBP officers should have technology available to them to quickly and safely identify illicit drugs as they can be exposed to chemicals. Our country has more pressure now than before to invest in new technology to address the fentanyl crisis.

CBP is seeking new technology to help it more easily identify fentanyl in packages. In a recent report, CBP mentioned how current technology was developed decades ago when there was no presence of fentanyl (CBP 2019b). Therefore, CBP is seeking new non-intrusive inspection technology (NII) that can be used to identify fentanyl in the package without opening it (CBP 2019b). It continues to explore new technology innovations to make them more accessible to all CBP officers. Our analysis takes this need into account by assuming the purchase a large amount of new equipment. This will allow for CBP officers to be more efficient and inspect more flagged packages per day.

Calculation for New Equipment

To calculate the cost of buying new technology, we use 908 Devices estimated costs for new miniature mass-spectrometers. These devices increase detection power for responders in chemical and drug scenarios. Able to detect trace amounts of substances within seconds, miniature mass-spectrometers like the MX908 allow CBP offers to quickly and efficiently inspect packages (908 Devices). The average upfront cost of these devices is $65,000 and maintenance cost of $95 for 100 TD swabs. New x-ray machines that are more advanced and able to screen bigger packages would also be required. One x-ray machine will cost between $48,777 to $90,344 (AS&E 2016)

Currently, CBP uses over 326 large-scale ($XRAY_L$) and 4,500 small-scale ($XRAY_S$) NII x-ray and gamma ray imaging systems to detect the illegal transit of narcotics (Overacker 2019). In total, CBP reports having 328 ports of entry (POE_t) (including facilities where international mail is processed) to screen individuals, cargo, and mail coming into the United States (CBP 2019d). We divided the total amount of x-ray machines by the number of ports of entry to calculate the number of x-ray machines per port ($XRAY_{pp}$).

$$XRAY_{pp} = \frac{XRAY_L + XRAY_S}{POE_t} \tag{26}$$

Entering in known values we get:

$$15 = \frac{326 + 4{,}500}{328}$$

In order to increase the efficiency with which packages are inspected, so we increase the number of x-ray machines at our new processing facilities. We chose to be more aggressive and double the number of machines in the five ISCs. Therefore, we calculate the need for 30 x-ray machines at the off-site facility at JFK Airport and 75 for the remaining four international mail facilities.

We decided to provide half of all new personnel with the MX908 spectrometers. Based on our calculation, we estimate needing 480 MX908s to help inspect the current amount of mail received. Associated ongoing costs include the cost of purchasing additional swabs which are sold in packs of 100 swabs for $95 (AS&E 2016). We calculate the necessary annual swab total ($SWAB_t$) based on volume of mail targeted for inspection (MV_{2019}) (see Appendix P for more information on calculating mail volume). We also estimate needing a total 105 new x-ray machines in the new facility and other five international mail facilities to help with identifying fentanyl.

$$Cost\ of\ 908\ Devices = 480 \times \$65{,}000 = \$31{,}200{,}000$$

$$Annual\ Cost\ of\ 908\ Maintenance = \$95 \times 5{,}000 = \$475{,}000$$

$$Cost\ of\ new\ x - ray\ machines = 105 \times \$90{,}344 = \$9{,}486{,}120$$

$$SWAB_t = \frac{MV_{2019}}{SWAB_{pp}} \tag{27}$$

$$5{,}000 = \frac{50{,}000}{100}$$

As a result, the net present cost of buying and maintaining new equipment over the five-year period is $33.4 million using the standard discount rate.

Appendix N: Accessory and Protective Equipment for Off-Site Warehouse

In order to outfit the warehouses with accessory and protective equipment for employees, we calculate the total cost (TC_e) use the following calculations:

Conveyor Belts

Based on the size and necessary screening capacity we estimate the need for roughly 100 standard 17ft x 3ft conveyor belts (CB_t). We use the cost estimate (C_{cb}) of $5,139 per belt to calculate the cost of this equipment (Global Industrial). These conveyor belts also require the purchase of two accompanying floor supports (FS_t) per belt, which we also include in our calculation of total cost.

$$TC_{cb} = (CB_t * C_{cb}) + \left(FS_t * C_{fs}\right) \tag{28}$$

Entering in known values we get the upfront cost of purchasing conveyor belts and floor supports for the new warehouse space.

$$\$532{,}300 = (100 * \$5{,}139) + (200 * \$92)$$

Tables

We use the average cost of a 48in W x 24in D x 36in H industrial table to calculate the cost of outfitting the new space with tables on which to inspect flagged packages (Global Industrial). We estimate needing 500 tables (T_t) to meet the needs of package inspection by CBP.

$$TC_t = T_t * C_t \tag{29}$$

Entering in known values we get the upfront cost of purchasing industrial tables.

$$\$79{,}000 = 500 * \$158$$

Carts

Bushel vinyl carts are used by CBP officers to move mail throughout the inspection facility. These carts have a capacity of 2000 lbs and cost $207.95 per cart ($C_c$) (Global Industrial). We estimate the need for 100 carts (C_t) to equip facilities.

$$TC_c = T_c * C_c \tag{30}$$

Entering known values, we get the upfront cost of purchasing vinyl carts for the transportation of packages throughout the facility.

$$\$20{,}800 = 100 * \$207.95$$

Protective Equipment

The National Institute for Occupational Safety and Health (NIOSH) and CDC issued guidelines for the safe handling of fentanyl and its analogs. NIOSH recommends that employees wear an approved half-mask filtering facepiece respirator rated P100 or a tight-fitting, full-face air-purifying respirator (FM_t) with multi-purpose P100 cartridges/canisters (F_t), nitrile gloves (G_t), and safety glasses (SG_t) (CDC 2017). Furthermore, we equip the facility with annual doses of Naloxone (N_t), an emergency treatment for narcotic overdoses. This is a safety precaution in case an employee is exposed to dangerous levels of fentanyl.

We calculate the number of P100 reusable half-face respirator masks by multiplying the cost per mask (C_m) by total number of additional CBP officers (Amazon). We round up to 1000 employees to allow for extra masks in case of malfunction or emergency. These masks also require the purchase of accompanying filters which cost \$19 per 4 filters (C_f) (Amazon).

$$TC_m = (FM_t * C_m) + (F_t * C_f) \tag{31}$$

Similarly, we allow for the purchase of extra safety glasses and a cost of \$2 per pair (C_g).

$$TC_{sg} = SG_t * C_{sg} \tag{32}$$

Entering in known values, we get an estimate of total upfront costs of accessory and safety equipment of \$674,000.

Ongoing Costs

Both protective nitrile gloves and Naloxone doses need to be purchased per year. We calculate these costs based on estimated annual quantities required for employees. We utilize an average cost per dose (C_n) for Naloxone of $30 (Abrams 2018).

$$TC_n = N_t * C_n \tag{33}$$

$$TC_g = G_t * C_g \tag{34}$$

Entering in known values and summing the ongoing costs over the five-year period, using the standard discount rate, we get a net present cost of accessory and safety equipment of $260,000.

Appendix O: Usefulness and Cost of New Canine Teams

Research on Canine Teams

Research has shown how trained dogs are useful even if their effectiveness may not be 100 percent. In a recent study, dogs were successful in identifying drugs in 70 to 91 percent of cases where drugs are present (Jezierski 2013). There are factors that contribute to the maximum effectiveness such as breed of the detection dog, type of drug, and type of searching environment (Jezierski 2013). There has been more literature supporting how narcotics dogs have been an essential tool in fighting the war on drugs. The Office of Inspector General of CBP conducted a review of CBP canines, where they found that canine teams are an essential tool for CBP officers. They observed the work of canine teams at Ports of Entry in El Paso and Laredo, Texas, and John F. Kennedy International and Newark Liberty International Airports (Skinner 2008). At all locations, auditors learned that OFO officers and OBP agents valued canine for efficiently being able to clear vehicles with minimum wait times. Most canine team dogs are trained to detect and interdict narcotics in seconds while personnel can take more than 20 minutes.

Canine teams have helped capture a substantial number of drugs coming into the United States. In five months of service, canine teams accounted for over $150,000,000 in seized narcotics (Harvey 2017). During 2016, canine teams assisted in the seizure of over 419,000 pounds of narcotics (Harvey 2017). Trained canine teams continue to have a substantial impact on the number of illicit drugs being confiscated at ports of entry. Using canine teams offers distinctive benefits in drug detection as dogs have unique capabilities and can be easily moved from one package to another (Harvey 2017). We believe that increasing the number of canine teams can help CBP officers better detect whether fentanyl is present in a package. Canine teams will help CBP inspect more packages at a faster rate than before.

Calculation of Cost for Canine Teams

Currently, the CBP Canine Program is headquartered in the El Paso, Texas and oversees two training facilities. Canine Center El Paso and Canine Center Front Royal, Virginia train all canine teams for the Office of Field Operations (Skinner 2008). CBP has the capability to train 400 canine teams per year; however, the agency is not meeting its capacity (Skinner 2008). In 2008, CBP maintained approximately 1,100 canine teams in the Office of Field Operation and Office of Border Patrol. Still, CBP only has approximately 1,500 canine teams available today for CBP Officers (CBP 2019e). We must assure that both centers are training at full capacity every year to help inspect mail. Based on this assumption, we estimate needing 400 more dogs ($K9_t$) based on the capacity of both canine programs. We plan to only train for the first year since dogs tend to work for many years in CBP before retiring (DHS 2016). The average cost of a trained canine unit (C_{K9}) is $21,000 (Skinner 2008). We also include the cost of employing handlers (H_t) which is $41,830 per year ($C_H$) (CBP 2019a). Based on the number of additional canine teams needed, we calculate the total cost (TC_{K9}) using the following equation:

$$TC_{K9} = (K9_t * C_{K9}) + (H_t * C_H) \tag{35}$$

Using the values we have laid out in this appendix, and discounting at the standard rate, we calculate the net present cost of hiring additional canine teams to be between $175 million and $306 million. Our best estimate indicates a cost of $241 million.

Appendix P: International Mail Quantity and Screening

The U.S. Postal Service (USPS) processes international mail at five International Service Centers (ISC): San Francisco, New York, Los Angeles, Miami, and Chicago (Office of the Inspector General 2017). In FY 2019, 855 million pieces of international mail (TMV_{2019}) entered the United States from foreign countries through these International Service Centers (U.S. Postal Regulatory Commission 2019). Over half of all of the volume of international mail enters at JFK airport (MV_{JFK}) (Committee on Homeland Security 2018). We will use JFK Airport as our base case, as it will have to process the largest volume of mail. CBP screened .01 percent of international mail for fentanyl in a pilot study at JFK Airport (McCauley 2019); presumably this is an increase in their previous screening rate. The average weight of fentanyl interdicted was 1.5 pounds ($\overline{W}_{pp}$); we use this to estimate the weight of packages (TW_s) to be selected and screened (W_{pp}) (U.S. Congress 2018).

To find a volume of mail per month (mpm) at the ISC at JFK Airport, we calculate:

$$MV_{JFK} = \frac{MV_{2019}}{2} \tag{36}$$

$$mpm = \frac{MV_{JFK}}{(12\ mo. * 30\ days)} \tag{37}$$

We then calculate the amount of mail flagged for screening (MV_f) through EFI. We plan to increase the rate from 0.01 percent to 1 percent of all international mail.

$$MV_f = mpm * 0.01 \tag{38}$$

Finally, we calculate the total weight of packages being screened through EFI. We use this estimate to calculate weight per truckload (W_{pr}) (see Appendix Q for more information).

$$TW_s = MV_s * \overline{W}_{pp} \tag{39}$$

$$W_{pr} = \frac{TW_s}{rpd} \tag{40}$$

Using known values in Equations 36 through 40, we calculate roughly 3,000 pounds of mail per truckload, with 12,000 pieces of mail being flagged daily for screening.

As the amount of international mail being interdicted at the four other ISC is not publicly available information, we assume if EFI were implemented, the other six trucks that transport mail from the airport to the off-site warehouse would be distributed efficiently based on volume of international mail being processed at each ISC.

Appendix Q: Off-Site Warehouse and Transportation

Once Customs and Border Patrol have identified suspicious packages to be screened, these packages will be transported to an off-site warehouse for further investigating. Determining the cost of transportation to the warehouse includes the cost of trucks (T_t), gas (G_t), and truck driver wages (TD_t). A current survey of industrial warehouse space rental rates within 10 miles of JFK Airport indicates a range of $35 to $25 per square foot (cityfeet.com 2019). We will use an average $30 per square foot of warehouse space. A survey of the other four ISC locations (Miami, Los Angeles, San Francisco, Chicago) indicates that industrial warehouse rental rates within 10 miles from the respective airports range from $5 to $20 per square foot. We keep our rental rate at $30 per square foot to give a conservative estimate of the cost. Also, it allows for the costs of preparing the space for use.

Transportation

We calculate the total cost of transportation (TC_t) by first calculating the cost of purchasing trucks. We use the cost of purchasing a 2015 International 4400 truck, which is $35,000 ($C_t$). The 2015 International 4400 truck features 1,700 cubic feet and has a max load of 10,000 pounds (commercialtrucktrader.com 2019). Six of these trucks are more than capable of handling the daily load calculated in Appendix P.

$$T_t = 6 * C_t \tag{41}$$

Our ongoing transportation costs (OG_t) include the cost of gas and the cost of employing USPS truck drivers. We calculate the annual cost of gas for these trucks using a uniform distribution of gas prices (C_g) in New York City from November 2015 to November 2019 and the listed gas mileage (mpg) for 2015 International 4400 trucks (commercialtrucktrader.com 2019). The six trucks each make one roundtrip a day for a total of 240 miles traveled per day

(mpd). Our calculation is based on 260 working days per year (D). Finally, we factor in yearly wages for USPS truck drivers ($20/hour working 8-hour shifts) (TD_t) (Glassdoor.com 2019).

$$Gas = \left(C_g * \frac{mpd}{mpg}\right) * 6 * D \tag{42}$$

$$Drivers = TD_t * D \tag{43}$$

$$OG_t = Gas + Drivers \tag{44}$$

Plugging in the values we have outlined, our best estimate for the net present cost of transportation is $2.1 million with a low estimate of $2.05 million and high estimate of $2.15 million. These estimates are for one program at JFK, which handles at least 50 percent of all international mail. To account for the other four ISCs we multiply this estimate by two giving us an estimate of $4.2 million with a low estimate of $4.1 million and high estimate of $4.3 million. These values represent the cost over a five-year period, discounted at the standard rate.

Real Estate

To calculate the cost of renting industrial warehouse space (TC_{wh}) we use the midpoint estimate of $30 per square foot ($C_{sqft}$) and multiply by 50,000 ($sqft$) which is the proposed square footage of the off-site location (Loopnet.com 2019). Again, we multiply this by two to calculate the cost of EFI across all ISCs.

$$TC_{wh} = C_{sqft} * sqft \tag{45}$$

We calculate the net present cost of renting industrial warehouse space to be $13.8 million over a five-year period, discounted at the standard rate.

Appendix R: Net Present Value of Cost and Benefit Categories, Using a 3.5 Percent Discount Rate

Table 18: NPV of Costs and Benefits at 5 Percent Interdiction Rate

5 percent interdiction	**Best**	**Low**	**High**
Reduced fentanyl deaths	$6.55 billion	$1.1 billion	$22.9 billion
Non-fatal health benefits	$399 million	$62 million	$1.46 billion
Avoided fatal health cost	$4,574,316	$1,056,741	$11.7 million
Non-fatal productivity benefits	$222 million	$31.1 million	$803 million
Reduced foster care utilization	$13.3 million	$3 million	$34.2 million
Hiring additional canine teams	-$241 million	-$175 million	-$306 million
Hiring additional CBP officers	-$323 million	--	--
Renting warehouse	-$13.8 million	--	--
X-ray & accessory/safety equipment	-$8.2 million	-$6.1 million	-$10.4 million
Transportation	-$4.2 million	-$4.1 million	-$4.3 million
Mini Mass-spectrometer	-$33.4 million	--	--
Total	**$6.6 billion**	**$692 million**	**$23.7 billion**

Table 19: NPV of Costs and Benefits at 10 Percent Interdiction Rate

10 percent interdiction	**Best**	**Low**	**High**
Reduced fentanyl deaths	$16.2 billion	$3.35 billion	$50.5 billion
Non-fatal health benefits	$986 million	$206 million	$3.29 billion
Avoided fatal health cost	$11.2 million	$3,846,654	$25.6 million
Non-fatal productivity benefits	$548 million	$108 million	$1.84 billion
Reduced foster care utilization	$32.8 million	$11.2 million	$74.6 million

10 percent interdiction	Best	Low	High
Hiring additional canine teams	-$241 million	-$175 million	-$306 million
Hiring additional CBP officers	-$323 million	--	--
Renting warehouse	-$13.8 million	--	--
X-ray & accessory/safety equipment	-$8.2 million	-$6.1 million	-$10.4 million
Transportation	-$4.2 million	-$4.1 million	-$4.3 million
Mini Mass-spectrometer	-$33.4 million	--	--
Total	**$17.2 billion**	**$3.4 million**	**$53.6 billion**

Table 20: NPV of Costs and Benefits at 15 Percent Interdiction Rate

15 percent interdiction	Best	Low	High
Reduced fentanyl deaths	$25.9 billion	$5.6 billion	$78.6 billion
Non-fatal health benefits	$1.57 billion	$347 million	$5.23 billion
Avoided fatal health cost	$17.9 million	$6.6 million	$39.4 million
Non-fatal productivity benefits	$877 million	$185 million	$2.9 billion
Reduced foster care utilization	$52.2 million	$19.4 million	$115 million
Hiring additional canine teams	-$241 million	-$175 million	-$306 million
Hiring additional CBP officers	-$323 million	--	--
Renting warehouse	-$13.8 million	--	--
X-ray & accessory/safety equipment	-$8.2 million	-$6.1 million	-$10.4 million
Transportation	-$4.2 million	-$4.1 million	-$4.3 million
Mini Mass-spectrometer	-$33.4 million	--	--
Total	**$27.9 billion**	**$6 billion**	**$83.8 billion**

Appendix S: Year-by-Year Median Benefits and Costs at 5 Percent Interdiction Rate, Discounted at 3.5%

Table 21: Year-by-Year Median Benefits and Costs

Benefits					
	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*
Reduced Fentanyl Deaths	$1,560	$1,290	$1,250	$1,210	$1,170
Non-Fatal Health Benefits	$94.8	$77.9	$75.3	$72.7	$70.3
Fatal Health Benefits	$1.1	$0.9	$0.9	$0.9	$0.8
Non-Fatal Productivity Benefits	$52.8	$43.5	$42	$40.6	$39.2
Reduced Foster Care Utilization	$3.2	$2.7	$2.6	$2.5	$2.4
Costs					
Hiring Additional Canine Teams	$51.7	$49.9	$48.2	$46.6	$45.0
Hiring Additional CBP Personnel	$39.4	$52.4	$65.3	$80.0	$85.9
Renting Warehouse	$2.9	$2.8	$2.8	$2.7	$2.6
Transportation	$0.8	$0.7	$0.7	$0.7	$0.7
Mini Mass-Spectrometers	$26.5	$0.5	$0.4	$0.4	$0.4
Tech Maintenance	$0.3	$0.3	$0.3	$0.3	$0.3
Accessory Equipment	$0.7	$0.7	$0.7	$0.6	$0.6
X-Ray Machines	$11.5	-	-	-	-
Trucks	$0.2	-	-	-	-

Appendix T: All Quantified Values

Table 22: All Quantified Values

Variable and Distribution	Value	Source
Non-fatality-related health expenditures over five-year period (triangular distribution)	High: $35.7 billion	We obtained estimates for the cost per opioid user from Florence et al. (2016). We adjusted the average cost per opioid user for inflation and then multiplied by estimated number of fentanyl consumers
	Best: $18.7 billion	
	Low: $8.5 billion	
Average health costs per fentanyl-related death	$6,000	Adjusted for inflation from the estimate provided by Florence et al. (2016).
Fatality-related health savings over five-year period	High: $17.9 million	We looked to Florence et al. (2016) for estimates of average fatality-related health costs per death and adjusted for inflation. We then multiplied by the number of lives saved.
	Best: $11.2 million	
	Low: $4.6 million	
Non-fatality-related productivity losses (triangular)	High: $20 billion	We looked to Florence et al. (2016) for estimates of average productivity losses per user and adjusted for inflation. We then multiplied by the estimated number of fentanyl consumers.
	Best: $10.5 billion	
	Low: $4.8 billion	
Non-fatality-related productivity gains	High: $4.2 billion	We multiplied estimated productivity losses by the percentage reduction in PAC.
	Best: $730 million	
	Low: $36 million	
Nationwide relationship between foster care entries and opioid deaths	0.07 percent increase in foster care entries for every 1 percent increase in opioid deaths.	Ahmad et al. (2019) and Children's Bureau (2015; 2019)
Foster care entries	2018: 263,000	Ahmad et al. (2019) and Children's Bureau (2015; 2019)
	2012: 251,000	

Variable and Distribution	Value	Source
Opioid overdose deaths	2018: 69,000 2012: 41,500	Ahmad et al. (2019) and Children's Bureau (2015; 2019)
Projected 2020 foster care entries	259,000	Average of previous years using data from Children's Bureau (2019)
Average cost per year of foster care	$34,500	Ghertner et al. (2018)
Median stay in foster care	13 months	Children's Bureau (2019)
Foster care savings over five-year period	High: $115 million Best: $32.8 million Low: $3 million	We multiplied the relationship between foster care entries and opioid overdoses by the percentage reduction in deaths, projected number of foster care entries, average cost per year and median stay.
Current staffing for CBP international port officers	400	McCaskill (2018)
Optimal staffing for CBP officers	27,187	Reardon (2019)
Optimal staffing for CBP international port officers	959	5 percent of the optimal number of CBP officers
Personnel costs per officer by GS-level (uniform between $41,830 and $104,516)	GS-12: $104,516 GS-11: $94,134 GS-9: $74,222 GS-7: $57,519 GS-5: $41,830	CBP (2019 c)
Personnel costs over five-year period	$323 million	We calculated annual costs for hiring 959 new CBP officers over five years.
Purchase price per MX908 miniature mass-spectrometers	$65,000	908 Devices (2019)
Number of MX908 miniature mass-spectrometers.	480	Estimation from providing approximately half of all new personnel with miniature mass-spectrometers.

Variable and Distribution	Value	Source
Purchase price of MX908 devices	$26,520,000	908 Devices (2019)
Maintenance of MX908 devices	$475,000	Per year, non-discounted
Total costs of MX908 devices	$33.4 million	Authors' estimates informed by 908 Devices (2019)
Cost of x-ray machine (uniform distribution)	High: $90,344	AS&E (2016)
	Low: $48,777	
Projected number of additional x-ray machines needed	105	Estimate by authors.
Purchase price of 100 conveyer belts	$513,900	Global Industrial (2019)
Purchase price of 200 floor supports	$18,400	Global Industrial (2019)
Purchase price of 500 tables	$79,000	Global Industrial (2019)
Purchase price of 100 carts	$20,800	Global Industrial (2019)
Purchase price of 1,000 respirators	$20,000	Amazon (2019)
Purchase price of 1,000 air filters	$19,000	Amazon (2019)
Purchase price of 1,500 safety glasses	$3,000	Global Industrial (2019)
Purchase price of gloves for one year	$41,600	Amazon (2019)
500 emergency doses of naloxone	$15,000	(Abrams 2018)
Total Accessory and Protective Equipment Costs for Off-Site Warehouse	$731,000	Amazon (2019); Global Industrial (2019); Abrams (2018)
Additional trained dogs	400	Skinner (2008)
Total cost of a trained dog	$21,040	CBP (2019 e)
Additional trained handlers	400	CBP (2019 e)
Annual compensation per trained handler	$41,830	CBP (2019 e)

Variable and Distribution	Value	Source
Total costs of additional canine inspection teams	High: $306 million	Authors' estimates based on CBP (2019 e)
	Best: $241 million	
	Low: $175 million	
Pieces of mail processed per day at JFK	1.2 million pieces of mail per day	House Committee on Homeland Security (2018)
Estimated number of items currently flagged for screening daily at JFK	120 pieces of mail	Authors' estimates based off McCauley (2019)
Estimated number of items screened at 1 percent screening rate at JFK.	12,000 pieces of mail	Authors' estimates based off McCauley (2019)
Estimated weight of mail inspected daily under EFI.	18,000 pounds of mail	Authors' estimates based off McCauley (2019)
Diesel costs	High: $2.77	New York State Energy Research Development Authority (2019)
	Low: $2.49	
Estimated transportation costs over five-year period	$4.3 million	Authors estimates based off Commercial Truck Trader (2019), Glassdoor (2019),
	$4.2 million	
	$4.1 million	
Warehouse rents over five-year period	$13.8 million	Loopnet.com (2019)
Net Present Value of EFI over five-year period, 5 percent interdiction rate	**High: $23.7 billion**	**Authors' estimates.**
	Best: $6.6 billion	
	Low: $692 million	
Net Present Value of EFI over five-year period, 10 percent interdiction rate	**High: $53.6 billion**	**Authors' estimates.**
	Best: $17.2 billion	
	Low: $3.4 billion	
Net Present Value of EFI over five-year period, 15 percent interdiction rate	**High: $83.8 billion**	**Authors' estimates.**
	Best: $27.9 billion	
	Low: $6 billion	

Appendix U: STATA Code

```
clear
set more off
capture log close

log using
"/Users/lucypepin/Documents/CBA/fentanylmontecarlo.log", replace

clear all
ssc install blindschemes
set seed 04081994
set obs 10000

*Program to generate triangular distributions
     quietly: capture program drop Triangular
     quietly: program define Triangular
     local min = `1'
     local mode = `2'
     local max = `3'
     local variable = "`4'"
     local cutoff=(`mode'-`min')/(`max'-`min')
     generate Tri_temp = uniform()

     generate `variable' = `min' +      ///
     sqrt(Tri_temp*(`mode'-`min')*(`max'-`min')) if
Tri_temp<`cutoff'

     replace `variable' = `max' -  ///
     sqrt((1-Tri_temp)*(`max'-`mode')*(`max'-`min')) if
Tri_temp>=`cutoff'

     drop Tri_temp
     end

*BENEFITS

     *Discount Rate
     gen d = .035

     *Value of Statistical Life
     Triangular 4200000 8900000 13400000 VSL

     *Fentanyl Consumption

     Triangular 4.6 6.2 29.7 consump_triangular
```

```
     lab var consump_triangular "Total consumption in metric
tons, drawn from triangular distribution"

     gen mail_fentanyl_proportion = runiform(0.6, 0.9)
     gen mailproportion_reduction= runiform(0.1, 0.5)
     gen mailproportion_future = mail_fentanyl_proportion *
mailproportion_reduction

     gen mail_fentanyl_base = consump_triangular *
mail_fentanyl_proportion
     lab var mail_fentanyl_base "Total estimated fentanyl
distributed through U.S. Mail in metric tons"

     gen base_deaths = 38582
     lab var base_deaths "Total projected deaths from fentanyl
overdose in year 2020"


     *Interdiction Rate and Elasticity
     gen interdict_rate_base = runiform(0.02, 0.045)
     lab var interdict_rate_base "Percent of total U.S. fentanyl
supply interdicted through the USPS"

     gen interdiction_rate_yr1 =
(mail_fentanyl_proportion*0.05)-
(mail_fentanyl_proportion*interdict_rate_base)
     gen interdiction_rate_yr2 = (mailproportion_future*0.05)
     gen interdiction_rate_yr3 = (mailproportion_future*0.05)
     gen interdiction_rate_yr4 = (mailproportion_future*0.05)
     gen interdiction_rate_yr5 = (mailproportion_future*0.05)
//This is for the 5% interdiction rate

     *code for 10% and 15% interdiction
     /*
     gen interdiction_rate_yr1 = (mail_fentanyl_proportion*0.1)-
(mail_fentanyl_proportion*interdict_rate_base)
     gen interdiction_rate_yr2 = (mailproportion_future*0.1)
     gen interdiction_rate_yr3 = (mailproportion_future*0.1)
     gen interdiction_rate_yr4 = (mailproportion_future*0.1)
     gen interdiction_rate_yr5 = (mailproportion_future*0.1)

     gen interdiction_rate_yr1 =
(mail_fentanyl_proportion*0.15)-
(mail_fentanyl_proportion*interdict_rate_base)
     gen interdiction_rate_yr2 = (mailproportion_future*0.15)
     gen interdiction_rate_yr3 = (mailproportion_future*0.15)
     gen interdiction_rate_yr4 = (mailproportion_future*0.15)
```

```
	gen interdiction_rate_yr5 = (mailproportion_future*0.15)*/

	*Change in Consumption
	*Yr1
	gen elasticity = runiform(0.27, 0.5)
	lab var elasticity "Elasticity of demand for fentanyl"
	gen delta_price1 = interdiction_rate_yr1
	gen delta_consump_yr1= consump_triangular * elasticity * 
delta_price1
	lab var delta_consump_yr1 "change in consumption after 
first year of interdiction"
	gen consump_yr1= consump_triangular - delta_consump_yr1

	*Yr2
	gen delta_price2 = interdiction_rate_yr2
	gen delta_consump_yr2= consump_triangular * elasticity * 
delta_price2
	lab var delta_consump_yr2 "change in consumption after 
second year of interdiction"
	gen consump_yr2= consump_triangular - delta_consump_yr2

	*Yr3
	gen delta_price3 = interdiction_rate_yr3
	gen delta_consump_yr3= consump_triangular * elasticity * 
delta_price3
	lab var delta_consump_yr3 "change in consumption after 
third year of interdiction"
	gen consump_yr3= consump_triangular - delta_consump_yr3

	*Yr4
	gen delta_price4 = interdiction_rate_yr4
	gen delta_consump_yr4= consump_triangular * elasticity * 
delta_price4
	lab var delta_consump_yr1 "change in consumption after 
fourth year of interdiction"
	gen consump_yr4= consump_triangular - delta_consump_yr4

	*Yr5
	gen delta_price5 = interdiction_rate_yr5
	gen delta_consump_yr5= consump_triangular * elasticity * 
delta_price5
	lab var delta_consump_yr5 "change in consumption after 
fifth year of interdiction"
	gen consump_yr5= consump_triangular - delta_consump_yr5

	*Lives Saved
```

```
     gen deaths_yr1= consump_yr1 * (base_deaths /
consump_triangular)
     gen deaths_yr2= consump_yr2 * (base_deaths /
consump_triangular)
     gen deaths_yr3= consump_yr3 * (base_deaths /
consump_triangular)
     gen deaths_yr4= consump_yr4 * (base_deaths /
consump_triangular)
     gen deaths_yr5= consump_yr5 * (base_deaths /
consump_triangular)
     gen delta_deaths1 = base_deaths - deaths_yr1
     gen delta_deaths2 = base_deaths - deaths_yr2
     gen delta_deaths3 = base_deaths - deaths_yr3
     gen delta_deaths4 = base_deaths - deaths_yr4
     gen delta_deaths5 = base_deaths - deaths_yr5

     gen deaths_benefit1 = delta_deaths1 * VSL
     gen deaths_benefit2 = delta_deaths2 * VSL
     gen deaths_benefit3 = delta_deaths3 * VSL
     gen deaths_benefit4 = delta_deaths4 * VSL
     gen deaths_benefit5 = delta_deaths5 * VSL

     *NonFatal Health Costs
     Triangular 8500000000 18700000000 35700000000
healthcost_triangular
     lab var healthcost_triangular "Fentanyl-related healthcare
costs, drawn from triangular distribution"
     gen nonfatal_health_benefit1 =
(delta_consump_yr1/consump_triangular) * healthcost_triangular
     gen nonfatal_health_benefit2 =
(delta_consump_yr2/consump_triangular) * healthcost_triangular
     gen nonfatal_health_benefit3 =
(delta_consump_yr3/consump_triangular) * healthcost_triangular
     gen nonfatal_health_benefit4 =
(delta_consump_yr4/consump_triangular) * healthcost_triangular
     gen nonfatal_health_benefit5 =
(delta_consump_yr5/consump_triangular) * healthcost_triangular

     *Fatal Health Costs
     gen fatal_health_cost=6000
     gen fatal_health_benefit1 = delta_deaths1 *
fatal_health_cost
     gen fatal_health_benefit2 = delta_deaths2 *
fatal_health_cost
     gen fatal_health_benefit3 = delta_deaths3 *
fatal_health_cost
```

```
     gen fatal_health_benefit4 = delta_deaths4 *
fatal_health_cost
     gen fatal_health_benefit5 = delta_deaths5 *
fatal_health_cost

     *Productivity
     Triangular 4800000000 10500000000 20000000000
prodcost_triangular
     lab var prodcost_triangular "Productivity loss due to
fentanyl use in billions, drawn from triangular distribution"
     gen nonfatal_prod_benefit1 =
(delta_consump_yr1/consump_triangular) * prodcost_triangular
     gen nonfatal_prod_benefit2 =
(delta_consump_yr2/consump_triangular) * prodcost_triangular
     gen nonfatal_prod_benefit3 =
(delta_consump_yr3/consump_triangular) * prodcost_triangular
     gen nonfatal_prod_benefit4 =
(delta_consump_yr4/consump_triangular) * prodcost_triangular
     gen nonfatal_prod_benefit5 =
(delta_consump_yr5/consump_triangular) * prodcost_triangular

     *Foster Care
     gen fostercare_benefit1 = (0.07 *
(delta_deaths1/base_deaths) * 259000 * 34500)*1.08
     gen fostercare_benefit2 = (0.07 *
(delta_deaths2/base_deaths) * 259000 * 34500)*1.08
     gen fostercare_benefit3 = (0.07 *
(delta_deaths3/base_deaths) * 259000 * 34500)*1.08
     gen fostercare_benefit4 = (0.07 *
(delta_deaths4/base_deaths) * 259000 * 34500)*1.08
     gen fostercare_benefit5 = (0.07 *
(delta_deaths5/base_deaths) * 259000 * 34500)*1.08

     *Benefits Summation
     gen benefits1 = deaths_benefit1 + nonfatal_health_benefit1
+ fatal_health_benefit1 + nonfatal_prod_benefit1 +
fostercare_benefit1
     gen benefits2 = deaths_benefit2 + nonfatal_health_benefit2
+ fatal_health_benefit2 + nonfatal_prod_benefit2 +
fostercare_benefit2
     gen benefits3 = deaths_benefit3 + nonfatal_health_benefit3
+ fatal_health_benefit3 + nonfatal_prod_benefit3 +
fostercare_benefit3
     gen benefits4 = deaths_benefit4 + nonfatal_health_benefit4
+ fatal_health_benefit4 + nonfatal_prod_benefit4 +
fostercare_benefit4
```

```
     gen benefits5 = deaths_benefit5 + nonfatal_health_benefit5
+ fatal_health_benefit5 + nonfatal_prod_benefit5 +
fostercare_benefit5

     gen benefits = (benefits1 / (1 + d)^0.5) + (benefits2 / (1
+ d)^1.5) + (benefits3 / (1 + d)^2.5) + (benefits4 / (1 +
d)^3.5) + (benefits5 / (1 + d)^4.5)

*COSTS
     *K9 detection units
     gen canine_uniform = 95262 + 71405*runiform()
     lab var canine_uniform "Cost of hiring a K9 team in
thousands, drawn from uniform"

     gen canine_yr1 = canine_uniform * 400 // x = # of
additional K9 teams
     gen canine_yr2 = canine_uniform * 400
     gen canine_yr3 = canine_uniform * 400
     gen canine_yr4 = canine_uniform * 400
     gen canine_yr5 = canine_uniform * 400

     forval i = 1/5 {
     lab var canine_yr`i' "Cost of employing 400 K9 units, year
`i'"
     }

     *Hiring CBP Officers
     /*gen CBP_uniform = 41830 + 62686*runiform()
     lab var CBP_uniform "Cost of hiring a CBP officer in
thousands, drawn from uniform"*/

     gen CBP_employ = 959
     gen GS_5 = 41830
     gen GS_7 = 57519
     gen GS_9 = 74222
     gen GS_11 = 94134
     gen GS_12 = 104516

     lab var CBP_employ "Number of additional CBP officers
hired"
     foreach i in 5 7 9 11 12 {
     lab var GS_`i' "Average yearly compensation at level GS`i',
in dollars"
     }

     gen CBP_yr1 = CBP_employ*GS_5 //Cost of hiring 959
additional CBP officers
```

```
	gen CBP_yr2 = CBP_employ*GS_7
	gen CBP_yr3 = CBP_employ*GS_9
	gen CBP_yr4 = CBP_employ*GS_11
	gen CBP_yr5 = CBP_employ*GS_12

	forval i = 1/5 {
	lab var CBP_yr`i' "Cost of employing 959 additional CBP
officers, year `i'"
	}

	*Renting warehouse space

		*Upfront Costs

		gen accessory_equip = 674000
		lab var accessory_equip "Upfront cost of Accessory and
Protective Equipment in dollars"

		*Ongoing Costs
		gen warehouse_per_sqft = 30
		lab var warehouse_per_sqft "Cost per square foot of
renting warehouse space near JFK"

		gen sqft = 50000
		lab var sqft "Size of mail inspection facility, in
square feet"

		gen warehouse_yr1 = warehouse_per_sqft * sqft
		gen warehouse_yr2 = warehouse_per_sqft * sqft
		gen warehouse_yr3 = warehouse_per_sqft * sqft
		gen warehouse_yr4 = warehouse_per_sqft * sqft
		gen warehouse_yr5 = warehouse_per_sqft * sqft

		forval i = 1/5 {
		lab var warehouse_yr`i' "Cost of renting warehouse
space, year `i'"
		}

		gen gloves = 41600
		lab var gloves "Cost of purchasing safety gloves per
year"

		gen nalaxone = 15000
		lab var nalaxone "Cost of purchasing Nalaxone per
year"

	*Technology
```

```
		*Upfront Costs

		gen mini_mass_spec = 65000 * 480 //
		lab var mini_mass_spec "Cost of purchasing 480
miniature mass spectrometers, in dollars"

		gen xray_uniform = 48777 + 41567*runiform()
		lab var xray_uniform "Cost of purchasing an x-ray
machine in thousands of dollars, drawn from uniform"

		gen xray = xray_uniform*105
		lab var xray "Cost of purchasing 105 x-ray machines in
dollars"

		*Ongoing Costs
		forval i = 1/5 {
		gen mini_mass_spec_yr`i' = (95 * 5000) // 5000
packages of swabs per year
		}

		gen maintenance = 300000 //need an estimate of yearly
x-ray maintenance costs

	*Transportation

		*Upfront Costs

		gen trucks = 35000 * 6 //price of trucks * number of
trucks
		lab var trucks "Cost of purchasing 6 trucks, in
dollars"

		*Ongoing Costs

		gen mpd = 12 * 20 //12 trips * 20 roundtrip miles
		gen gas = runiform(2.49, 2.77) //average range in NYC,
November 2015-2019
		gen workdays = 260

		gen driving = mpd*gas*workdays
		gen drivers = 20 * 8 * 6 * workdays

		gen transportation_yr1 = driving + drivers
		gen transportation_yr2 = driving + drivers
		gen transportation_yr3 = driving + drivers
		gen transportation_yr4 = driving + drivers
```

```
          gen transportation_yr5 = driving + drivers

*Calculate Present Value of Net Benefits, and Distribution of
Benefits

     *Present Value of Net Costs

     forval i = 1/5 {
     gen totalcost_yr`i' = canine_yr`i' + CBP_yr`i' +
2*warehouse_yr`i' + mini_mass_spec_yr`i' + maintenance ///
     + 2*transportation_yr`i' + gloves + nalaxone
     }

     *Upfront Costs not discounted,
     gen pvnc = mini_mass_spec + xray + trucks + accessory_equip
+ totalcost_yr1/(1+d)^0.5 + totalcost_yr2/(1+d)^1.5 ///
     + totalcost_yr3/(1+d)^2.5 + totalcost_yr4/(1+d)^3.5 +
totalcost_yr5/(1+d)^4.5

     *Present Value of Net Benefits

     gen pvnb = (benefits - pvnc)/1000000000

     gen sign = 1 if pvnb > 0
     replace sign = 0 if pvnb < 0

     sum pvnb, detail
     lab var pvnb "Present Value of Net Benefits, in billions"

     hist pvnb, percent fcolor(bluishgray) lcolor(black)
ytitle(Percent of Observations) ///
     xtitle(Net present value in billions of dollars) title(Net
Present Value of Interdicting 5 Percent of Fentanyl)
     //title changed for 10 and 15 percent interdiction

*Generating Values for Tables

     gen pvdeathben = deaths_benefit1/(1+d)^0.5 +
deaths_benefit2/(1+d)^1.5 + deaths_benefit3/(1+d)^2.5 ///
          + deaths_benefit4/(1+d)^3.5 +
deaths_benefit5/(1+d)^4.5

     gen pvnfhealthben = nonfatal_health_benefit1/(1+d)^0.5 +
nonfatal_health_benefit2/(1+d)^1.5 ///
          + nonfatal_health_benefit3/(1+d)^2.5 +
nonfatal_health_benefit4/(1+d)^3.5 +
nonfatal_health_benefit5/(1+d)^4.5
```

```
     gen pvfatalhealthben = fatal_health_benefit1/(1+d)^0.5 +
fatal_health_benefit2/(1+d)^1.5 ///
          + fatal_health_benefit3/(1+d)^2.5 +
fatal_health_benefit4/(1+d)^3.5 +
fatal_health_benefit5/(1+d)^4.5

     gen pvnfprodben = nonfatal_prod_benefit1/(1+d)^0.5 +
nonfatal_prod_benefit2/(1+d)^1.5 +
nonfatal_prod_benefit3/(1+d)^2.5 ///
          + nonfatal_prod_benefit4/(1+d)^3.5 +
nonfatal_prod_benefit5/(1+d)^4.5

     gen pvfostcareben = fostercare_benefit1/(1+d)^0.5 +
fostercare_benefit2/(1+d)^1.5 + fostercare_benefit3/(1+d)^2.5
///
          + fostercare_benefit4/(1+d)^3.5 +
fostercare_benefit5/(1+d)^4.5

     gen pvk9cost = canine_yr1/(1+d)^0.5 + canine_yr2/(1+d)^1.5
+ canine_yr3/(1+d)^2.5 + canine_yr4/(1+d)^3.5 +
canine_yr5/(1+d)^4.5

     gen pvCBPcost = CBP_yr1/(1+d)^0.5 + CBP_yr2/(1+d)^1.5 +
CBP_yr3/(1+d)^2.5 + CBP_yr4/(1+d)^3.5 + CBP_yr5/(1+d)^4.5

     gen pvwhcost = (warehouse_yr1/(1+d)^0.5 +
warehouse_yr2/(1+d)^1.5 + warehouse_yr3/(1+d)^2.5 ///
          + warehouse_yr4/(1+d)^3.5 + warehouse_yr5/(1+d)^4.5)*2

     gen pvtranscost = (trucks + transportation_yr1/(1+d)^0.5 +
transportation_yr2/(1+d)^1.5 + transportation_yr3/(1+d)^2.5 ///
          + transportation_yr4/(1+d)^3.5 +
transportation_yr5/(1+d)^4.5)*2

     gen pvminispeccost = mini_mass_spec +
mini_mass_spec_yr1/(1+d)^0.5 + mini_mass_spec_yr2/(1+d)^1.5 +
mini_mass_spec_yr3/(1+d)^2.5 ///
          + mini_mass_spec_yr4/(1+d)^3.5 +
mini_mass_spec_yr5/(1+d)^4.5

     gen pvaccessoryequipcost = (nalaxone + gloves)/(1+d)^0.5 +
(nalaxone + gloves)/(1+d)^1.5 + (nalaxone + gloves)/(1+d)^2.5
///
          + (nalaxone + gloves)/(1+d)^3.5 + (nalaxone +
gloves)/(1+d)^4.5
```

```
	foreach i in pvdeathben pvnfhealthben pvfatalhealthben
pvnfprodben pvfostcareben pvk9cost pvCBPcost pvwhcost
pvtranscost ///
		pvminispeccost pvaccessoryequipcost {
		sum `i', detail
	}
```

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