

THE IMPACT OF SYRINGE AND NEEDLE EXCHANGE PROGRAMS ON DRUG USE
RATES IN THE UNITED STATES

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By

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ABSTRACT

Despite a wealth of research evidence indicating the benefits of syringe and needle exchange programs (SNEPs) in reducing the transmission of blood-borne disease and drug use, the decades-old ban on the use of federal funding for these programs currently remains in place. This study utilizes data from the 1992-2010 Treatment Episode Data Set for annual admissions to substance abuse treatment facilities (TEDS-A) and the U.S. Department of Health and Human Services' Area Resource File to analyze the relationship between drug use and access to SNEPs at the Core Based Statistical Area (CBSA) level. After controlling for fixed effects for CBSAs and years; CBSA characteristics such as income, age, education, gender, race and poverty and unemployment rates; and substance abuse treatment client characteristics such as mental illness diagnoses, the models indicate that additional years of SNEP operation are associated with decreases in the rates of injection drug use among drug users and the general population, as well as decreases in overall drug use.

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Introduction

Since the institution of the federal funding ban on syringe and needle exchange programs (SNEPs) in the late 1980s, advocates of the harm reduction approach to injection drug use have sought to demonstrate the positive role that these programs may play in a comprehensive national drug policy. A recent surge in the discussion of injection drug use in the policy realm lends a sense of urgency to determining whether SNEPs are safe and effective measures for combatting the threats to public health that are associated with the use and abuse of illicit substances. In his January 2014 State of the State address, Vermont Governor Peter Schumlin devoted the majority of his speech to addressing the state's worsening heroin epidemic. The Governor stated that over the past 15 years, treatment admissions for opiates in Vermont have increased by 770 percent, and treatment admission rates for the use of heroin have risen nearly 40 percent in the past year alone (Schumlin, 2014). Far from an isolated issue in only one state, heroin use rates have continued to rise steadily nationwide since 2005 (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013, p.16). There is a clear and present need for research and policy change targeting the use of heroin and other illicit drugs administered through injection.

Syringe and needle exchange programs provide injection drug users with sterile hypodermic needles and, often, other supportive services. Despite a robust body of research supporting the effectiveness of these programs in reducing rates of blood-borne illness transmission and containing health costs among injection drug users, opponents of the programs assert that syringe and needle exchanges condone or promote substance abuse. Policymakers have communicated mixed messages about SNEPs since the inception of the original federal funding ban on these programs in 1988. In December 2009, President Obama signed a law to lift

the funding ban after it had been in place for 21 years. Two years later, Congress quietly reinstated the ban, and it remains in place at the time of this report (Office of National Drug Control Policy, 2012).

This study investigates the relationship between access to SNEPs and drug use rates at the Core Based Statistical Area (CBSA) level using the concatenated 1992-2010 Treatment Episode Data Set for annual admissions to substance abuse treatment facilities (TEDS-A) as well as a selection of population variables from the U.S. Department of Health and Human Services' Area Resource File (ARF). TEDS-A consists of data from a reporting system that was originally created to provide the federal government with data on individuals admitted to public and private substance abuse treatment facilities in the United States that receive public funding. The dataset is uniquely suited to the scope of this study, as it provides client-level data on drug use and the geographically-identifying characteristics (e.g., city and state) of individuals admitted to treatment. I utilize several difference-in-differences regression models to estimate the effects of syringe and needle exchange program operation on CBSA-level drug use rates over time. The hypothesis of this study is that providing access to SNEPs reduces the rate of injection drug use among drug users and the general population, which is reflected through a decrease in substance abuse treatment admissions over time in CBSAs with at least one SNEP. This study will also seek to determine whether SNEPs are associated with reductions in overall drug use over time beyond the use of injectable substances.

Background

Results from the National Survey on Drug Use and Health (NSDUH) indicate that approximately 23.9 million Americans aged 12 or older were current illicit drug users in 2012 (SAMHSA, 2013, p. 13). Although the number of current heroin users reported in the 2012 NSDUH results (335,000) comprised a relatively small portion of the American population (approximately 0.1 percent), the number of heroin users has increased nearly *threefold* since 2005, when NSDUH reported only 136,000 current heroin users nationwide (SAMHSA, 2013, p. 16). As heroin is only one example of illicit substances that may be administered through injection, the increasing rates of heroin use indicate only a portion of the nationwide injection drug use crisis.

Despite the rising rates of heroin use and the publication of federally-sponsored research findings that injection drug use “is associated with a high risk for transmission of blood-borne infections, including human immunodeficiency virus (HIV) and hepatitis B and C” (Centers for Disease Control and Prevention, 2001, p.378), the United States Congress reaffirmed its stance against harm reduction public health approaches in 2011 by reinstating the federal funding ban on SNEPs after a two-year reprieve. The original federal funding ban on SNEPs was codified into law in 1988 through Section 300ee-5 of the Public Health and Welfare Act, which states that no public health funds “shall be used to provide individuals with hypodermic needles or syringes so that such individuals may use illegal drugs, unless the Surgeon General of the Public Health Service determines that a demonstration needle exchange program would be effective in reducing drug abuse and the risk that the public will become infected with the etiologic agent for acquired immune deficiency syndrome” (Government Printing Office, 2009). In 1995, a panel convened by the Institute of Medicine published a recommendation that the U.S. government lift the funding ban in light of the role that SNEPs may play in reducing HIV rates (National

Research Council, 1995). However, the ban remained in place until Congress lifted the funding prohibition in 2009. The ban was reinstated in 2011 amid turbulent, partisan Congressional budget negotiations (J. Kaiser Family Foundation, 2011).

Despite the existence of a strong research base demonstrating the effectiveness of SNEPs as a component of a public health strategy, opponents argue that these programs are an irresponsible approach to dealing with illicit drug use. The literature indicates that one commonly shared belief among SNEP opponents is that these programs enable injection drug users to continue to break the law while minimizing the personal consequences of such actions. The National District Attorneys Association published an outright condemnation of SNEPs in 2005, stating that individuals “who spread the ills of illicit drug use and abuse should suffer appropriate sanctions under both the criminal and civil law for the injury they cause to their fellow citizens” (National District Attorneys Association, 2005). However, there is little published research which lends any credence to the belief that SNEPS do harm to the general population through enabling injection drug use. Further, this study’s review of the literature found that SNEPs have generally met the criteria set out in Section 300ee-5 of the Public Health and Welfare Act to warrant the Surgeon General’s endorsement of a federally-funded demonstration needle exchange program. Overall, the research aligns with this study’s hypothesis that SNEPs reduce the transmission of blood-borne disease and reduce injection and other drug use.

Review of the Literature

Summary

A central issue in crafting a cohesive review of the literature on the effectiveness of publicly-funded syringe and needle exchange programs lies in the fact that there is no general consensus on the primary goal of these programs, whether decreasing the transmission of blood-borne disease among injection drug users or decreasing drug use, or both. Three papers included in this literature review indicated the effectiveness of needle exchange programs in reducing rates of HIV transmission (Martin, 2009; Iversen et al., 2013; Hurley et al., 1997). One study evaluated the cost effectiveness of SNEPs in reducing HIV transmission (Belani et al, 2008), and one study found that needle exchange programs are effective in reducing the spread of HIV among injection drug users without negatively affecting injection drug use rates (Wodak & Cooney, 2004). Importantly, four studies discussed the positive effect of syringe and needle exchange programs on the incidence of injection drug cessation (Huo et al., 2006; DeSimone, 2005; Hagan et al., 2000; Brooner et al., 1998).

For contextual information on the position of American medical providers regarding syringe and needle exchange programs, this review also examined the position paper on SNEPs issued by the American College of Preventative Medicine (Ferrini, 2000). Although there is little agreement on the overall purpose of policies supporting the funding of SNEPs, the research generally shows that these programs are effective in the reduction of blood-borne disease transmission and improve drug use rates, which would meet the standard set forth in Section 300ee-5 of the Public Health and Welfare Act for the Surgeon General's endorsement of a federally-funded syringe and needle exchange program.

The Effectiveness of Syringe and Needle Exchange Programs on Reducing the Transmission of Blood-Borne Disease Among Injection Drug Users

Three studies reviewed in this paper focused on the effectiveness of needle exchange programs on HIV and other blood-borne disease transmission rates. Martin (2009) wrote that in 2002, 36 percent of AIDS cases in the United States occurred among injection drug users, their sexual partners and/or their children, which is a powerful synthesis of the statement of the problem regarding blood-borne diseases and injection drug use (Martin, 2009, p.3). Martin argued for cost-effectiveness, stating that the estimated savings from preventing HIV transmission is \$303,100 per case prevented (p. 4). He provided an overview of the history of syringe and needle exchange programs in the Netherlands and Australia, primarily assessing the return on investment in each nation's programs. Martin also discussed the history of closely-studied SNEPs in New Haven, Connecticut, which boasted a reduction of approximately 33 percent in the HIV transmission and/or new infection rate among injection drug users who utilized the SNEPs (p.7).

Recently published research from investigators in Australia (Iversen et al., 2013) concurred with Martin's characterization of the impact of syringe and needle exchange programs. The investigators examined HIV infection rates among injection drug users in Australia between 1995 and 2010 and created a retrospective cohort of injection drug users who were HIV-negative. The researchers found a general decrease in HIV incidence among Australian injection drug users who were involved in SNEPs and a "likely" reduction in the number of injection drug users overall.

Hurley et al. (1997) also examined the effectiveness of syringe and needle exchange programs on the prevention of HIV transmission. Using both published and unpublished reports of HIV seroprevalence among injection drug users in treatment in the United States between

1988 and 1993, the researchers constructed a regression analysis to estimate the rates of change of seroprevalence for each city in the study.

The investigators found that on average, “seroprevalence increased by 5.9 percent per year in the 52 cities without [SNEPs], and decreased by 5.8 percent per year in the 29 cities with [syringe and needle exchange programs] (Hurley et al., 1997, p. 1797). Further, cities with SNEPs reported lower annual changes in seroprevalence ($p=0.004$). The results can be interpreted as highly favorable for SNEPs, as the presence of syringe and exchange resources resulted in a significant impact on HIV transmission rates.

Cost Effectiveness of Syringe and Needle Exchange Programs for HIV Prevention

Belani and Muennig (2008) examined the cost effectiveness of syringe and needle exchange programs in New York City. The researchers defined the purpose of the exchange programs as the prevention of HIV transmission and infection. They compared the cost of operating syringe and needle exchange programs (using data obtained from a SNEP in New York City) with the cost of health care associated with HIV treatment for patients enrolled in Medicaid. The researchers found that the needle exchange programs were, on average, cost effective in their HIV prevention efforts.

Support for Syringe and Needle Exchange Programs Among Clinicians

In 2000, the American College of Preventative Medicine (ACPM) issued a public policy statement supporting syringe and needle exchange programs for the prevention of blood-borne disease. Ferrini, the statement’s author, provided background information on the depth of the relationship between injection drug use and HIV transmission. The author also stated that proven benefits of syringe and needle exchange programs include “reduction in risk behaviors, possible reduced transmission of HIV and hepatitis B and C, and increased referral to drug treatment”

(Ferrini, 2000, p. 173). Ferrini noted that “no significant harm, such as increasing drug use initiation, crime in surrounding sites, increased needles on street or increased use of drugs among users” has been found in existing studies on needle exchange programs (p. 173).

Ferrini stated that needle exchange programs face significant legal and financial roadblocks to implementation and that much public opposition to the programs stems from beliefs that syringe and needle exchanges “imply societal condoning of illicit drug use” (Ferrini, 2000, p. 174). Some programs operate “in technical violation of state drug paraphernalia laws” (p.174). However, she argues that despite the federal funding ban on syringe and needle exchange programs resulting in state and local governments and organizations bearing the brunt of the cost of program operation, research has shown the most programs are cost-effective. Additionally, programs are of greatest benefit to the public when syringe and needle exchanges offer additional services such as health education and referrals to drug treatment programs (p. 174).

The Effectiveness of Syringe and Needle Exchange Programs on the Cessation of Drug Use

The vast majority of the research on syringe and needle exchange programs concerns the effectiveness of these programs in reducing the transmission of blood-borne illnesses among injection drug users. However, several studies that were reviewed directly addressed the relationship between SNEPs and the frequency of injection drug use and cessation. Between 1997 and 2001, Huo et al. (2006) studied injection drug users in Chicago, Illinois. One group of participants comprised individuals who utilized a syringe and needle exchange program, and the other group of participants did not have access to any SNEP. The SNEP which was examined in this study was funded through a public-private partnership between the Chicago Department of Public Health and the AIDS Foundation of Chicago. Covariates examined as potential

confounders/predictors of injection drug use included age, gender, race/ethnicity, education, marital status, income, incarceration status/history, HIV status, age at initiation to drug use and injection drug use, injection duration, history of overdose and injection drug of choice.

The researchers defined “injection cessation” as no injection drug use from one interview session to the next. They found that 16 percent of participants reported injection cessation during the course of the study. Importantly, most participants who reported injection cessation also reported cessation from all other drug use. Individuals who continued to inject drugs reduced their use frequency by 12 percent annually. In this study, researchers found that the utilization of syringe and needle exchange programs was not associated with the cessation of injection drug use or a change in the frequency of injection drug use. Overall, the study found no significant relationship between exposure to SNEPs and drug use cessation or drug use frequency reduction.

However, multiple studies have indicated that access to syringe and needle exchange programs is associated with reduced frequency of injection drug use, increased frequency of entry into drug treatment and increased overall cessation of drug use. Brooner et al. (1998) conducted a study of participants in a SNEP in Baltimore, MD and found that these programs may play a legitimate role in the referral pipeline for substance abuse treatment. Specifically, the authors indicated advocated for the “feasibility and merits of creating strong linkages between [SNEPs] and comprehensive drug abuse treatment clinics” (1998, p. 133). Hagan et al. (2000) studied the outcomes of injection drug users in a SNEP in Seattle, Washington. The researchers found that those who utilized a SNEP were more likely to report a “substantial ($\geq 75\%$) reduction in injection and to remain in drug treatment” compared to individuals who had not utilized SNEP services (p. 247). DeSimone (2005) engaged in a broader study of nine SNEPs which began operating between 1989 and 1995 and found that the presence of a SNEP “is associated with

declines of 13 percent in drug injection and 20 percent in needle sharing among drug injectors” (p. 559).

The Effectiveness of Syringe and Needle Exchange Programs in Reducing the Transmission of Blood-Borne Disease and Drug Use Among Injection Drug Users

One study examined as a part of this review addressed *both* the transmission of blood-borne disease and the prevalence of drug use among injection drug users with exposure to syringe and needle exchange programs. Wodak and Cooney (2006) first examined the relationship between the availability of syringe and needle exchange programs and the spread of HIV among injection drug users. Overall, the researchers found evidence that SNEPs are statistically, causally associated with reducing HIV infection among injection drug users, and that these programs are cost-effective. The authors also found no evidence of “any major, unintended negative consequences” that syringe and needle exchanges effect on the initiation, duration and/or frequency of drug use and/or injection drug use. The findings indicated that syringe and needle exchange programs both reduce HIV infection rates among injection drug users and increase the rate of entry into treatment and recovery programs for illicit drug use, and also possibly into integrated primary care facilities. The research has interesting ramifications for public policy, as investigators found that legal barriers to obtaining injection drug paraphernalia serves as a stumbling block for controlling HIV infection among injection drug users.

Conclusions from the Literature

This literature review identified three specific purposes for funding and operating syringe and needle exchange programs in the United States: reducing blood-borne disease transmission among injection drug users, reducing injection drug use rates and reducing the financial burden of injection drug users’ medical cost for the public. The research has indicated that syringe and needle exchange programs are cost-effective and contribute positively to the reduction of blood-

borne disease transmission among injection drug users. Critics' assertions that the programs condone drug use are not supported by any research evidence suggesting increased drug use among individuals who have contact with the programs. There is a relatively robust research base concerning syringe and needle exchange programs' cost effectiveness and effectiveness in reducing blood-borne disease transmission among injection drug users, and there is mounting research that suggests the reduction of drug use rates through these programs.

Conceptual Framework

The relationship between access to SNEPs and overall drug use rates is complex. SNEPs may serve as a point of intervention in the lives of drug users by supplying sterile injection materials and/or by providing clinical substance use disorder referrals and/or treatment. Due to the lack of standardized operational protocols and purposes across SNEPs in the United States, this study found no currently available data on the characteristics of individual SNEPs which would assist in determining whether certain program goals (e.g., guiding injection drug users into substance use disorder treatment) and methods (e.g., offering on-site counseling) are more effective than others at decreasing blood-borne disease transmission and/or overall drug use. This study focuses on the availability of SNEPs within an immediate geographic area (defined here as a core base statistical area [CBSA]) and the effect that this availability has on drug use rates. It should be noted that even in circumstances in which a SNEP is available in an individual's CBSA, participation in such programs is entirely voluntary, and individuals who choose to utilize SNEPs are a self-selected group who may already be interested in pursuing a form of treatment.

In developing an analytical approach for this study, I noted that the rate of current illicit drug use and the rate of heroin use have both increased over the past 10 years (SAMHSA, 2013, p. 1). Thus one would expect to observe in the data an overall nationwide increase in drug use and potentially an increase in the number of individuals admitted to substance use treatment facilities over time. Given the documented knowledge based on the effectiveness of syringe and needle exchange programs in reducing drug use, this study hypothesizes a reduction in substance use treatment admissions and overall drug use over time among populations that have access to SNEPs compared to populations that do not have access to these programs.

Individuals who elect to receive services from these programs may continue, increase or decrease their current rate of injection drug use while choosing to pursue or opt out of substance use disorder treatment. The data examined in this study comprises all individuals who either chose or were non-consensually admitted to substance use treatment facilities that report admissions data to SAMHSA. This limited data reduces the conceptual framework of the study to individuals who are admitted to substance use disorder treatment and either do or do not have access to SNEPs in their metropolitan areas. Thus this study uses treatment admission as a conservative proxy for drug use, as (arguably) all individuals admitted to treatment are drug users, but not all drug users are admitted to treatment. In this context, the results of this study may under-predict the true effect of SNEPs on drug use, as individuals may cease drug use without pursuing treatment, and those individuals would not be captured in my model.

Data

In order to estimate the effect of access to SNEPs on drug use among drug users and the general population, this study utilizes eighteen years of data (1992-2010) from the Substance Abuse and Mental Health Service Administration (SAMHSA)'s Treatment Episode Data Set for annual admissions to substance abuse treatment facilities (TEDS-A) in the 50 U.S. states, the District of Columbia and Puerto Rico. The TEDS-A is the product of a legally-mandated reporting system that was originally created to provide the federal government with data on individuals admitted to public and private substance abuse treatment facilities in the United States that receive public funding (SAMHSA, 2014). The concatenated 1992-2010 dataset comprises the vast majority of individuals who were admitted to a substance abuse treatment programs that report admission data to SAMHSA, but it should be noted that the dataset does not include every individual admission to treatment in the United States. Reports that are conspicuously absent from the dataset include Arizona's admissions data from 1992 to 1996, Kentucky's admissions data from 1992 to 1997, Puerto Rico's admissions data from 1997 to 2002, the District of Columbia's admissions data from 2004 to 2010, and West Virginia's admissions data from 1994, 1997, 1998, and 2000-2002. TEDS-A thus serves primarily as a robust sample of national substance abuse treatment admissions data. While much of the previous research on the effects of SNEPs on drug use rates has involved the evaluation of individual syringe and needle exchange programs and/or small cohorts of such programs, this study makes use of a wealth of data on drug use and SNEPs from across the United States, examining a total of 301 CBSAs and 68 SNEPs.

To address this study's desire to examine injection drug use rates among both drug users and the general American population, I also utilize the U.S. Department of Health and Human

Services' Area Resource File (ARF), which contains data on over 6,000 health, socioeconomic and environmental variables at the county level (Health Resources and Services Administration, 2014). The ARF and the TEDS-A were merged and collapsed to the CBSA level to facilitate the manipulation and use of such massive data resources. Additionally, this study uses a variable to represent citizen political ideology (0 being conservative, 1 being liberal) from Berry et al. (2007).

Dependent Variables

This study involved three separate regressions, each with a separate dependent variable of interest. The dependent variables that are utilized in the my regression models were constructed from a combination of variables from the TEDS-A and the ARF, and they are meant to represent the rate of injection drug use among drug users (labeled Y1 in the dataset), the rate of injection drug use among the general population (Y2), and the rate of overall drug use among the general population (Y3). The Y1 variable representing the injection drug use rate among drug users was generated by dividing the mean number of injection drug users per CBSA reported in TEDS by the mean number of individuals admitted to substance use disorder treatment (i.e., the mean number of observations in TEDS) per CBSA, and time-lagging this quotient to assist in predicting the injection drug use rate for the next year. The Y2 variable representing the population injection drug use rate was generated by dividing the mean number of injection drug users per CBSA reported in TEDS by the mean population per CBSA reported in the ARF, time-lagging this quotient, and taking the log of the created variable to facilitate interpretation. The Y3 variable representing the population drug use rate was similarly generated by dividing the mean number of individuals admitted to substance use disorder treatment (i.e., the mean number

of observations in TEDS) per CBSA by the mean population per CBSA reported in the ARF, time-lagging the quotient and taking the log.

Syringe and Needle Exchange Program Independent Variable

Neither the TEDS-A nor the ARF dataset contains variables related to the existence and operation of syringe and needle exchange programs. In order to control for the presence of a SNEP, I constructed an indicator variable for syringe and needle exchange program operation in accordance with the North American Syringe Exchange Network (NASEN)'s U.S. Syringe Exchange Program Database. NASEN notes that the database does not contain data on every existing SNEP in the United States, as some programs have not provided NASEN with permission to publicly release their information (NASEN 2014). Previous research on SNEPs relied on personal communication with NASEN staff to confirm approximate program start dates (DeSimone, 2005). However, this study utilizes a combination of publicly-available information from program websites and online newspaper publications to compile a list of program start years for every SNEP located in a CBSA that reported TEDS data. The SNEP independent variable is coded such that it signifies the number of years that active SNEPs have been in operation. It should be noted that the 68 SNEPs represented by this SNEP variable all began operating after 1992, as I consciously omitted programs from this study which were established prior to the earliest year for which TEDS data is available.

As was previously mentioned, no variables were available to distinguish program-level characteristics among SNEPs (e.g., on-site drug counseling and referrals, number of clients served annually). In order to evaluate the effectiveness of SNEP programs in providing and

referring individuals to substance use disorder treatment, it is essential that SNEPs make such program-level characteristics available for future research.

Other Independent Variables

Additional independent variables included in the regression models for this study align with the research precedents outlined in the review of the literature. Due to the availability of both general population data from the Area Resource File and substance abuse treatment population-specific data from the TEDS-A, this study was able to include variables in the regression models to control for mean income, age, education, poverty and unemployment rates and population percentages of individuals identifying as African American and/or female at the CBSA level. This study also utilized control variables for mental illness diagnoses, as well as a binary variable representing the average citizen's political ideology (liberal versus conservative).

Analysis Methods

Descriptive statistics from the data for CBSAs with and without operational SNEPs are presented in Table 1 below.

Table 1: Descriptive Statistics for Select Individual Characteristic Variables by Presence of SNEPs, 1992-2010 TEDS-A/Area Resource File

Policy Variable:	CBSAs with SNEPs	CBSAs without SNEPs
Basic Demographic Information		
Population	1,941,234*** (2,486,695)	592,879 (1,385,216)
Percentage Female	50.71 (0.01)	50.73 (0.01)
Percentage Black	6.47*** (0.07)	10.66 (0.12)
Economic Information		
Individual income (dollars)	39,483.74*** (18,877.48)	29,828.97 (14,225.52)
Percentage Unemployed	9.82 (8.33)	9.73 (8.32)
Percentage in Poverty	9.00*** (0.04)	10.06 (0.06)
Information on Individuals in Substance Abuse Treatment		
Percentage of Injection Drug Users	17.57*** (0.12)	13.94 (0.12)
Number of Substances Reported	1.94* (0.36)	1.97 (0.32)
Percentage of Clients with a Co-occurring Psychiatric Diagnosis	13.34*** (0.15)	15.95 (0.21)
N=	658	3,834

*The variable mean is statistically significant from the CBSAs without SNEPs at the ***1%, **5%, or *10% level. The quantities in parentheses are the standard errors.*

The data indicates that CBSAs with SNEPs are systematically different from CBSAs without SNEPs. CBSAs with SNEPs have significantly larger populations but significantly lower percentages of individuals who identify as Black. CBSAs with SNEPs also have higher mean income levels and lower poverty rates. Individuals who were admitted to substance abuse treatment facilities from CBSAs with SNEPs have higher rates of injection drug use and lower rates of co-occurring mental illness than treatment clients in CBSAs without SNEPs. The fact that injection drug use rates are significantly higher in CBSAs with SNEPs does not necessarily mean that the presence of the SNEPs is driving up these rates. However, as DeSimone (2005) notes, “it does imply that [SNEP] openings are more likely to occur” in cities where injection is a more common route of drug administration (p. 567).

In order to control for these baseline differences between CBSAs with and without SNEPs, as well as other unobserved differences and CBSA-specific trends, it is imperative to control for CBSA-specific fixed effects in each regression model. The specific research question addressed by this study is whether injection drug use and other drug use rates decreased in CBSAs with SNEPs compared to CBSAs without SNEPs, and difference-in-differences models with CBSA and year fixed effects are fit these specification needs. My regression models also control for income, poverty and unemployment rates, and age, race, mental illness and political ideology in order to account for the systematic differences between CBSAs with and without SNEPs that are demonstrated in Table 1.

To test the hypothesis that access to a SNEP reduces injection and overall drug use among those admitted to substance abuse treatment over time, this study uses difference-in-differences regression models to predict the effect of an additional year of SNEP operation on the rate of admission of injection drug users and/or other drug users to substance abuse treatment

compared to the overall population by CBSA. This hypothesis assumes that if no other programmatic specifications are known regarding the operation of individual SNEPs, the programs provide materials specifically related to injection drug use, and this outreach effort targets a type of drug user who utilizes a specific route of drug administration.

Another interesting trend observed in the raw data, which is slightly beyond the scope of this study but warrants a brief discussion, is the disproportionate representation of individuals identifying as black within the population in substance abuse treatment facilities. Table 2 below presents a snapshot of these findings. Although the health disparities gap appears to grow smaller over time between 1994 and 2010, there seems to be a substantial difference between the percentage of the population in treatment who identify as black and the percentage of the general population who identify as black, regardless of whether or not the CBSA has a syringe and needle exchange program. These observations may indicate a need for further research in this area.

Table 2: Mean Percentage of Individuals in Substance Abuse Treatment Facilities and the General Population Identifying as Black for Core Base Statistical Areas (CBSAs) with and without Syringe and Needle Exchange Programs (SNEPs), by Year

	<u>1994</u>		<u>2002</u>		<u>2010</u>	
	<u>In Treatment</u>	<u>Population</u>	<u>In Treatment</u>	<u>Population</u>	<u>In Treatment</u>	<u>Population</u>
CBSAs with SNEPs	27.43%	6.44%	21.56%	5.61%	18.67%	7.63%
CBSAs without SNEPs	27.98%	10.02%	22.75%	11.15%	17.94%	11.10%

Results

The results of this study ultimately align with the general knowledge base of the literature which has found a negative relationship between access to syringe and needle exchange programs and rates of injection and other drug use. Table 3 on the following page presents the results of the fully-specified regression models for each of the dependent variables of interest. Initial specifications of the regression models utilized in this study controlled for the existence of at least one SNEP within a CBSA with a SNEP dummy variable limited to the years of each program's operation. However, this model specification yielded coefficient values that largely contradicted the published research cited in my literature review as well as the hypotheses of this study, but none of the coefficients were remotely statistically significant. Table 4 presents the results of the regression models with this initial specification issue for comparison.

This study found its compelling results when examining the relationship between the number of years that a SNEP has operated within a CBSA and injection and overall drug use rates among drug users and the general CBSA population. My findings indicate that there is a statistically significant reduction in injection drug use among drug users, injection drug use in the general population and overall drug use in the general population for each additional year that a syringe and needle exchange programs operates within a CBSA.

Table 3: Results from Fully-Specified Difference-in-Differences Regression Models with CBSA and Year Fixed Effects by Dependent Variable

	Dependent Variable		
	(1) Injection Drug Use Rate for Drug Users	(2) Injection Drug Use Rate for CBSA Population per 100,000 Individuals	(3) Drug Use Rate for CBSA Population per 100,000 Individuals
Years of SNEP Operation	-0.0030* (0.0017)	-0.0516*** (0.0168)	-0.0512*** (0.0158)
Log(population)	0.0025 (0.0134)	0.3668*** (0.1294)	0.1450 (0.1242)
Log(income)	0.0027 (0.0047)	0.0946 (0.0592)	0.0504 (0.0585)
Age (years)	-0.0231 (0.0149)	0.1543 (0.2430)	-0.3709** (0.1806)
Age squared	0.0013 (0.0012)	-0.0124 (0.0197)	0.0299** (0.0150)
Percentage in Poverty	-0.0510 (0.0484)	0.5892 (0.6140)	0.3627 (0.5976)
Percentage Unemployed	0.0007 (0.0006)	0.0033 (0.0074)	-0.0020 (0.0073)
Percentage with a high school education	-0.1983*** (0.0502)	-1.2836** (0.6149)	0.9114 (0.5982)
Percentage CBSA Population Black	-0.3287 (0.0942)	-4.5045*** (1.0081)	-2.1828** (0.9711)
Percentage CBSA Population Female	0.2631 (0.5977)	10.8081 (7.1862)	1.1248 (6.9979)
Citizen Political Ideology (0=conservative, 1=liberal)	0.0007 (0.0002)	-0.0042 (0.0029)	-0.0056** (0.0028)
Percentage of Treatment Population Black	-0.0336* (0.0185)	-0.0269 (0.2519)	1.0217*** (0.2202)
Percentage of Treatment Population Multiracial	-0.1280 (0.0873)	1.5217 (1.0548)	2.0631** (1.0323)
Percentage of Clients with a Co-occurring Psychiatric Diagnosis	0.0048 (0.0085)	-0.2342** (0.1045)	-0.1743* (0.1003)
N=	3,795	3,704	3,795

*The variable mean is statistically significant from zero at the ***1%, **5%, or *10% level. The quantities in parentheses are the standard errors.*

Table 4: Results from Initial Specification (Binary SNEP Variable) Difference-in-Differences Regression Models with CBSA and Year Fixed Effects by Dependent Variable

	Dependent Variable		
	(1) Injection Drug Use Rate for Drug Users	(2) Injection Drug Use Rate for CBSA Population per 100,000 Individuals	(3) Drug Use Rate for CBSA Population per 100,000 Individuals
Presence of SNEP	-0.0038 (0.0075)	0.0755 (0.0895)	-0.1043 (0.0865)
Log(population)	0.0078 (0.0131)	0.4278*** (0.1285)	0.2176* (0.1226)
Log(income)	0.00259 (0.0047)	0.0920 (0.0592)	0.0478 (0.0586)
Age (years)	-0.0233 (0.0149)	0.1370 (0.2433)	-0.3702** (0.1808)
Age squared	0.0013 (0.0012)	-0.0111 (0.0197)	0.0298** (0.0151)
Percentage in Poverty	-0.0535 (0.0484)	0.5709 (0.6145)	0.358 (0.5982)
Percentage Unemployed	0.0007 (0.0006)	0.0031 (0.0074)	-0.0023 (0.0073)
Percentage with a high school education	-0.1980*** (0.0502)	-1.2638** (0.6158)	0.9215 (0.5991)
Percentage CBSA Population Black	-0.3400*** (0.0940)	-4.6530*** (1.0112)	-2.3733** (0.9728)
Percentage CBSA Population Female	0.3063 (0.5974)	11.7341 (7.1922)	2.1082 (7.0021)
Citizen Political Ideology (0=conservative, 1=liberal)	0.0007*** (0.0002)	-0.0043 (0.0029)	-0.0057** (0.0028)
Percentage of Treatment Population Black	-0.0344* (0.0185)	-0.0514 (0.2524)	0.9949*** (0.2205)
Percentage of Treatment Population Multiracial	-0.1307 (0.0874)	1.378 (1.0568)	1.9074* (1.0346)
Percentage of Clients with a Co-occurring Psychiatric Diagnosis	0.0049 (0.0085)	-0.2251** (0.1047)	-0.1667* (0.1005)
N=	3,795	3,704	3,795

*The variable mean is statistically significant from zero at the ***1%, **5%, or *10% level. The quantities in parentheses are the standard errors.*

Injection Drug Use Among Drug Users

In the fully-specified difference-in-differences regression model designed to predict injection drug use rates among drug users, this study found a statistically significant, negative relationship between the number of years a SNEP has been in operation in a CBSA and injection rates among drug users within that CBSA over time ($p=0.081$, see Table 3, col. 1).

One may interpret these results as disproving notions of substance displacement effects among drug users; that is, my findings indicate that having access to injection materials via SNEPs does not result in users of other illicit substances and/or modes of drug consumption initiating or increasing consumption of injectable illicit substances. One caveat of these findings is that this data is garnered from a sample population comprised completely of drug users in substance abuse treatment programs. As such, there may be issues with the external validity of these findings, as I would hypothesize that substance users have systematically different person-level characteristics compared to the broader population, and thus these results may not be widely generalizable.

An additional point of interest in the results from this regression is the variable that controls for the percentage of the population in substance abuse treatment that identifies as Black. I found a statistically significant, negative relationship between Black population rates and injection drug use rates in the population in treatment, which seems to indicate that when controlling for other variables (including the number of years of SNEP operation), higher rates of Black individuals in a CBSA population are associated with lower rates of injection drug use.

Injection Drug Use in CBSA Population

In order to address the external validity concerns raised by the results of the model discussed above, a second difference-in-differences regression model was developed using nearly identical specifications, save for the dependent variable. As was discussed earlier in this paper, I created a variable utilizing injection drug use data from TEDS and population data from the ARF. I again found a negative relationship between the number of years that a SNEP operates and injection drug use over time, and the variable coefficient was highly statistically significant ($p=0.002$).

These results indicate that for each additional year that a SNEP operates in a CBSA, the rate of individuals admitted to substance abuse treatment programs for injection drug use decreases. Interestingly, in addition to being much more highly statistically significant, the coefficient on the SNEP variable in this model is much more substantively significant than the coefficient on the SNEP variable in the model above, indicating that the estimated effect of SNEPs on injection drug use in the general population is more than 17 times larger than the estimated effect of SNEPs on injection drug use in the population of drug users in substance abuse treatment.

Despite these positive findings, this model specification still presents lingering concerns regarding external validity. Although there appears to be a statistically significant reduction in injection drug use in CBSAs with SNEPs, it would certainly be plausible to argue from a policy perspective that these programs only help a small portion of drug users. A more powerful argument could be made to fund these programs if there were evidence that SNEPs affect overall drug use rates beyond the rates of injection drug use.

Drug Use in CBSA Population

A third regression was run with a dependent variable for overall CBSA population drug use rates. The estimated effect was again highly statistically significant ($p=0.001$) and negative, which indicates with a high degree of confidence that the longer a SNEP operates in a CBSA, the lower the rates of drug use that results in treatment admission over time. The coefficient on the SNEP variable in this model was nearly equal in statistical and substantive significance to the coefficient on the SNEP variable in the population injection drug use model above. Thus my results indicate that at the mean number of years of SNEP operation (2.5 years, weighted by population), injection drug use rates in the overall CBSA population would fall by approximately 5 percent¹ during the next year. That is, after about 2.5 years of SNEP operation, one would expect to see a 5 percent decline in population drug use the following year.

Falsification Tests

In the interest of testing the validity of my results, I developed two additional regression models to run as falsification tests which use the SNEP independent variable to predict alcohol abuse treatment rates. The results of both falsification tests are presented in Table 5 on the following page.

¹ The 5 percent approximation was calculated using the formula $(\exp[\beta_{\text{yearsneedle}}]-1)$.

Table 5: Results from Falsification Test Difference-in-Differences Regression Models with CBSA and Year Fixed Effects by Dependent Variable

	Dependent Variable	
	(1) Alcohol Abuse Rate for Individuals in Substance Abuse Treatment	(2) Alcohol Abuse Rate for CBSA Population per 100,000 Citizens
Years of SNEP operation	0.0004 (0.0066)	0.0051 (0.0171)
Log(population)	-0.1882*** (0.0518)	-0.1082 (0.1346)
Log(income)	0.0052 (0.0235)	0.0760 (0.0627)
Age (years)	0.0032 (0.0847)	0.3835 (0.2250)
Age squared	0.0001 (0.0069)	-0.0233 (0.0184)
Percentage in Poverty	0.0422 (0.2406)	0.8649 (0.6414)
Percentage Unemployed	-0.0037 (0.0029)	-0.0066 (0.0078)
Percentage with a high school education	-0.0821 (0.2423)	0.4364 (0.6430)
Percentage CBSA Population Black	0.1404 (0.4047)	-2.2504** (1.0603)
Percentage CBSA Population Female	-3.7601 (2.840)	-5.0381 (7.5289)
Citizen Political Ideology (0=conservative, 1=liberal)	0.0006 (0.0011)	-0.0043 (0.0030)
Percentage of Treatment Population Black	0.0233 (0.0984)	-0.0514*** (0.2610)
Percentage of Treatment Population Multiracial	0.3457 (0.4195)	2.9656*** (1.1122)
Percentage of Clients with a Co-occurring Psychiatric Diagnosis	-0.0413 (0.0410)	-0.3186*** (0.1087)
N=	3,770	3,770

*The variable mean is statistically significant from zero at the ***1%, **5%, or *10% level. The quantities in parentheses are the standard errors.*

If the results of these models indicated a statistically significant relationship between SNEP operation and alcohol abuse treatment admission, this would suggest a number of concerns with my drug use rate findings. First, a positive relationship between access to SNEPs and alcohol abuse treatment rates may indicate that alcohol abuse is supplanting part of the drug use that the SNEPs are reducing (i.e., drug users are replacing the abuse of illicit substances with the abuse of alcohol). This is not an inconceivable situation, as incidences of substance substitution are documented in the research (Kadden et al., 2009). An additional concern is that the presence of SNEPs may be an indicator of overall attitudes in a community toward substance abuse, and SNEPs may be just one component of an available system of community resources that are the true variables impacting both illicit drug use and alcohol abuse.

I found no statistically significant relationships between SNEPs and alcohol abuse rates, either among the population in substance abuse treatment or the general CBSA populations. These results increase the confidence of my assertions that it is the presence of SNEPs rather than overall community attitudes and/or other CBSA unobservables that are affecting the decrease in substance abuse treatment admission rates for both injection drug use and overall drug use.

Additional Findings

The results of several of my fully-specified regression models indicate statistically and substantively significant relationships between the percentage of the overall CBSA population that identifies as Black and the rate of injection drug use in the CBSA. From the perspective of addressing racial health disparities, these findings may be a disappointment. Despite the positive effects that SNEPs seem to have on injection and overall drug use rates, there are some indications that injection drug use is an issue that affects non-Black populations more significantly than Black populations. In this sense, SNEPs may not zeroing in on the specific

issues that lead to the disproportionate representation of Black Americans in substance abuse treatment programs. Although it is not the primary focus of this study, my data has indicated that substance abuse health disparities exist among individuals who identify as Black, and future research should seek to identify the causes of and remedies for these disparities.

Discussion

The results of this study suggest that access to syringe and needle exchange programs decreases the rate of injection drug use among drug users in substance abuse treatment as well as among the general population. Additionally, my results indicate that access to SNEPs is associated with a statistically significant reduction in overall population drug use rates over time, which aligns with the findings of previous research and my hypothesis.

There are a number of caveats that must be addressed in the discussion of these findings. One of the most obvious shortcomings my study is that I have used admission to substance abuse treatment as a proxy for drug use. One may argue that this research decision is sound, as individuals admitted to substance abuse treatment may be safely assumed to be drug users in almost all circumstances. One may also argue that the rate of substance use cessation is potentially higher than the rate captured by my data, as there are likely individuals who cease substance use without pursuing treatment at the facilities that submit reporting data to TEDS. However, concerns may arise when one considers the fact that my models predict decreases in the rate of individuals entering treatment facilities, which individuals engaged in public health policy may not find ideal, particularly given the fact that there is a high level of unmet treatment need among individuals with substance use disorders in the United States (SAMHSA, 2013). These concerns indicate a need for further research to determine whether the effects that I estimate have a positive or negative overall effect on public health.

DeSimone (2005) noted his surprise at findings that SNEPs reduce injection drug use given the fact that the programs seemingly reduce the barriers between drug users and illicit substances through the provision of free drug paraphernalia (e.g., syringes and needles) (p. 570). He hypothesizes that some SNEPs may have substance abuse treatment referral practices incorporated into the programs, but my findings directly contradict the notion that SNEPs

increase rates of admission to substance abuse treatment. Lacking widespread standardization of program elements across SNEPs and without access to data to tease out what program elements are most effective in generating positive outcomes among SNEP clients, there is a need for further research to pinpoint the precise mechanism through which SNEPs affect injection and other drug use rates.

References

- Belani, H. K., & Muennig, P. A. (2008). Cost-effectiveness of needle and syringe exchange for the prevention of HIV in New York City. *Journal of HIV/AIDS & Social Services*, 7(3), 229-240.
- Berry, W.D., Evan, J., Ringquist, E.J., Fording, R.C. & Hanson, R. (2007). Replication data for: Measuring Citizen and Government Ideology in the American States, 1960-93.
- Broner, J., Kidorf, M., King, V., Beilsenson, P., Svikis, D., & Vlahow, D. (1998). Drug abuse treatment success among needle exchange participants. *Public Health Reports*. 113 (1). 129-139.
- Centers for Disease Control and Prevention. (2001). Morbidity and mortality weekly report. 50(19): 378-400. Washington, DC: U.S. Government Printing Office.
- DeSimone, J. (2005). Needle exchange programs and drug injection behavior. *Journal of Policy Analysis and Management*. 24 (3). 559-577.
- Ferrini, R. (2000). American College of Preventive Medicine: Public policy on needle-exchange programs to reduce drug-associated morbidity and mortality. *American Journal of Preventative Medicine*. 18(2):173-175.
- Hagen, H., McGough, J., Hanne, T., Hopkins, S., Duchin, J., & Alexander, E. (2000). Reduced injection frequency and increase entry and retention in drug treatment associated with needle-exchange participation in Seattle drug injectors. *Journal of Substance Abuse Treatment* (19), 247-252.
- Health Resources and Services Administration. (2014). Area Health Resource Files. Washington, DC: U.S. Department of Health and Human Services.
- Huo, D., Bailey, S. L., & Ouellet, L. J. (2006). Cessation of injection drug use and change in injection frequency: The Chicago needle exchange evaluation study. *Addiction*, 101(1), 1606-1613.
- Hurley, S., Jolley, D. and Kaldor, J. (1997). Effectiveness of needle-exchange programmes for prevention of HIV infection. *The Lancet*, 349(9068), 1797 – 1800.
- Iversen J, Wand H, Topp L, Kaldor J, Maher L. (2013). Reduction in HCV incidence among injection drug users attending needle and syringe programs in Australia: A linkage study. *American Journal Public Health*. 103(8):1436-44.
- J. Kaiser Family Foundation. (2011). Needle-exchange programs face new federal funding ban. Retrieved March 6, 2014 from <http://www.kaiserhealthnews.org/stories/2011/december/21/needle-exchange-federal-funding.aspx>

- Kadden, R., Litt, M., Kabela-Cormier, E. & Petry, N. (2009). Increased drinking in a trial of treatments for marijuana dependence: Substance substitution? *Articles - Research.Paper 46*. Retrieved March 15, 2014 from http://digitalcommons.uconn.edu/cgi/viewcontent.cgi?article=1044&context=uchcres_articles
- Martin, W. (2009). *Needle exchange programs: Sending the right message*. James A. Baker III Institute for Public Policy, Rice University.
- National District Attorneys Association. (2005). Policy positions on drug control and enforcement. Alexandria, VA: National District Attorneys Association. Retrieved March 18, 2014 from http://www.ndaa.org/pdf/policy_position_drug_control_enforcement_july_17_05.pdf
- National Research Council. Preventing HIV transmission: The role of sterile needles and bleach. Washington, DC: The National Academies Press, 1995.
- North American Syringe and Needle Exchange Network. *US Syringe Exchange Program Database*. Retrieved February 9, 2014 from <http://nasen.org/programs/>
- Office of National Drug Control Policy. (2012). Retrieved March 28, 2014 from <http://www.whitehouse.gov/blog/2012/01/05/federal-funding-ban-needle-exchange-programs>
- Schumlin, P. (2014). State of the State Address. Retrieved March 27, 2014 from <http://governor.vermont.gov/newsroom-state-of-state-speech-2013>
- Substance Abuse and Mental Health Services Administration. (2013). Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-46, HHS Publication No. (SMA) 13-4795. Rockville, MD: Substance Abuse and Mental Health Services Administration
- Substance Abuse and Mental Health Services Administration. (2014). Treatment Episode Data Set – Admissions (TEDS-A) Series. Substance Abuse and Mental Health Data Archive. Ann Arbor: Inter-university Consortium for Political and Social Research. Retrieved March 3, 2014 from <http://www.icpsr.umich.edu/icpsrweb/SAMHDA/series/56>
- U.S. Government Printing Office. (2009). Use of funds to supply hypodermic needles or syringes for illegal drug use; prohibition.” Title 42 U.S. Code, Sec. 300ee-5. 2006 ed. Supp. III. Retrieved April 1, 2014 from <http://www.gpo.gov/fdsys/pkg/USCODE-2009-title42/pdf/USCODE-2009-title42-chap6A-subchapXXIII-partA-sec300ee-11.pdf>
- Wodak, A. & Cooney, A. (2004). Effectiveness of sterile needle and syringe programming in reducing HIV/AIDS among injecting drug users. World Health Organization.