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Examining the Effect of a Hypothetical Safe Injection Facility on
HIV and HCV Transmission Rates in Kent County, Michigan

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Abstract

Previous literature has established that increases in prescription opioid misuse has resulted in similar increases in injection drug use (IDU), collectively referred to as the “opioid epidemic” in the US. Due to this surge in IDU, incidence of Hepatitis C (HCV) and Human Immunodeficiency Virus (HIV) are on the rise in many regions. Research conducted in Canada and elsewhere has supported the use of Safe Injection Facilities (SIFs) and Needle Syringe Programs (NSPs) to mollify disease incidence, but only NSPs are operating in the US despite SIFs having been in use in Canada for several decades. As little research has been conducted in the US about where SIFs could be of benefit, we employ an analytical model to estimate the value of a hypothetical SIF in Kent County, Michigan (MI) using local surveillance data. Addition of such a facility was found to reduce HCV incidence by 7 cases / year, in addition to decreasing HIV incidence by 5%.

Background

Treatment for opioid use disorder occupies a precarious space within the American legal, medical, and cultural frameworks. In 1971, the “War on Drugs” began in earnest, although another three years had passed before the Narcotic Addict Treatment Act was signed into law, which established the legality of methadone clinics. Methadone (although commonly mistaken for the street drug “meth”, which is an entirely different substance whose full name is methamphetamine) is in many ways an ideal drug from treating opioid addiction, as its properties allow for the abatement of withdrawal symptoms without the euphoric effects of heroin or morphine, which can allow users to maintain steady employment and begin rebuilding the social damages caused by addiction. Results of this approach were encouraging, but less than two decades later, an unrelated report by the American Pain Society advocated that pain was determined to be the “fifth vital sign” in medicine. This report argued that physicians to minimize patient suffering as much as possible— often relying on opioids to do so¹. This effort was well-

¹ “The 5th Vital Sign and America’s Painkiller Epidemic.” 2016. The University of Arizona Health Sciences. April 1, 2016. <https://uahs.arizona.edu/blog/2016-04-02/5th-vital-sign-and-america%E2%80%99s-painkiller-epidemic>.

intentioned but had side effect of vastly increasing the number of opioids in circulation, becoming what many consider to be a prominent cause for today's current opioid epidemic.

Because of the variance in patient needs and circumstances, it stands to reason that a wider array of therapeutic options can result in better individualized treatment and outcomes; and indeed congress and the U.S. Food and Drug Administration (FDA) has since approved other drugs for therapeutic use: two such being Buprenorphine and Naltrexone. Buprenorphine can only be prescribed in a primary care setting, and while as an "agonist-antagonist" it has proven effective in achieving abstinence in a short period of time, there remain concerns about longer term mortality rates that may be due to patient tolerance discrepancies². Naltrexone, on the other hand, is available as a depot injection and as such isn't subject to the adherence or overdose concerns of oral tablets, but has limited effectiveness otherwise³.

While it is true that these drugs have unique profiles and can be tailored to fit specific patient needs, the limitations of an incongruent approach to the broader social, economic, and legal context of the opioid crisis has been exacerbated by the alarming growth of the epidemic. This calls for stronger efforts to destigmatize addiction in both a social and clinical context in order to improve patient retention and adherence to all intervention methods. It is for this reason that safe injection facilities (SIFs) have great potential. Put plainly, SIFs are clinics that are staffed by licensed physicians and nursing staff where opioid users can go, without legal consequence, to inject the drugs they have pre-obtained prior to visiting the SIF. The benefit of this arrangement is derived from the provision of clean injection materials, best-practices education from the clinical staff on site, emergency care that is immediately available as needed, as well as stigma-free patient access. In addition, these facilities provide an access point to more robust cessation programs that is favorable to many patients because they are already typically

² Luis Sordo et al., "Mortality Risk during and after Opioid Substitution Treatment: Systematic Review and Meta-Analysis of Cohort Studies," *The BMJ* 357 (April 26, 2017), <https://doi.org/10.1136/bmj.j1550>.

³ Tanum L et al., "Effectiveness of Injectable Extended-Release Naltrexone vs Daily Buprenorphine-Naloxone for Opioid Dependence: A Randomized Clinical Noninferiority Trial," *JAMA Psychiatry* 74, no. 12 (December 1, 2017): 1197–1205, <https://doi.org/10.1001/jamapsychiatry.2017.3206>.

familiar with the facility and care experience at that SIF. Although legally no such facilities currently exist in the United States, current data from the Insite (SIF) facility in Vancouver, British Columbia suggests 88 fewer deaths per 100,000 person years, as well as a net public savings in spending⁴. Analytical models for Insite have determined that similar benefits are feasible with a facility in the US: hypothetical facilities in Baltimore, San Francisco, and elsewhere have proven to improve patient outcomes while remaining financially solvent. Results such as these provide the basis to argue that SIFs give physicians an additional degree of control in the overall treatment pathway, allowing for various risk factors to be mitigated via proactive efforts that compliment existing cessation efforts.

Significance

Although the benefit of SIFs have been established in some major metropolitan areas, much less research has been conducted in less densely populated regions where the need is either not as great or otherwise not as concentrated geospatially, especially in the United States where there are legal barriers obstructing the short term value of this information. As such, the estimated impact of a SIF in an area like the Kent County is largely an unknown. However, the broader opioid epidemic in the US is that the problem is still worsening. In 2017 67.8% of 70,237 overdose deaths were due to opioids. About 15,000 were due to drug overdoses involving heroin— with current information from the Centers for Disease Control (CDC) showing some 400,000 deaths due to opioid overdose from 1999-2017, making it the number one form of accidental death in the country⁵. Figures as dire as these call for greater investment within existing healthcare structures, but also merit the consideration of feasible alternatives.

To this end, although epidemiological methods of measuring needle / syringe programs (NSPs) have been around for a few decades, more recent studies have built

⁴ Jennifer Ng, Christy Sutherland, and Michael R. Kolber, “Does Evidence Support Supervised Injection Sites?,” *Canadian Family Physician* 63, no. 11 (November 2017): 866.

⁵ Lawrence Scholl, “Drug and Opioid-Involved Overdose Deaths — United States, 2013–2017,” *MMWR. Morbidity and Mortality Weekly Report* 67 (2019), <https://doi.org/10.15585/mmwr.mm6751521e1>.

upon Kaplan's "Circulation Theory of Needle Exchange" in order to assess the effect of SIFs in a manner that also takes into consideration the impact of NSPs operating within the same communities⁶⁷. Although the primary objective of this research is to determine the impact of a SIF in Kent County, MI based on a defined set of variables, a secondary objective will include examination of the model itself with an intent to identify potential modifications to the model itself, or via localized data collection methods in order to contribute to the discussion of how this model is applied in future research.

In addition, data necessary for this model to be generalizable to a local area is not readily available at an individual location, municipal or county level, and collating data from state or national health agencies, and existing needle exchange facilities would help to better estimate the severity of the problem in this specific region. In the same way, investigation in this sector would highlight what information is not commonly collected but could be in order to improve future research on health outcomes that would also likely be impacted by a SIF or other similar interventions.

While mitigating negative health outcomes is of great value to the patient demographic in question, it bears reminding that the treatment of these conditions are also associated with significant economic costs, which are at least in part borne by the general taxbase. The calculated impacts can be weighed against the estimated costs of constructing and operating this sort of facility to provide predictive and tangible information that may help inform future policy decisions. This information would help illuminate the conditions under which opening a SIF is economically solvent and a viable taxpayer investment using commonly collected health statistics.

Methods

As stated, Kaplan's "circulation theory of needle exchange" takes into consideration a variety of behaviors common amongst people who use drugs (PWID) which are then employed to estimate a change in incidence within the at-risk

⁶ E. H. Kaplan and R. Heimer, "A Circulation Theory of Needle Exchange," *AIDS (London, England)* 8, no. 5 (May 1994): 567–74.

⁷ Steven D. Pinkerton, "Is Vancouver Canada's Supervised Injection Facility Cost-Saving?," *Addiction* 105, no. 8 (2010): 1429–36, <https://doi.org/10.1111/j.1360-0443.2010.02977.x>.

subpopulation of PWID. Collecting and analyzing reliable information on each contributing variable presents numerous challenges in and of itself— while many of these variables are ascertained or extrapolated via localized health statistics, others can only be derived through direct communication within the PWID community itself, thus encouraging the use of large scale statistics collecting from the CDC and others. The illegal status of PWID is a significant driver in behavior for obvious reasons, but also adds a great deal of ethical concerns that must be adhered to for the sake of anonymity and privacy as well as to obtain responses demonstrating limited bias, or are reflective of real life. The model is given as:

Disease Incidence Associated with Needle Sharing at a Given Rate:

$$I_{CV} / I_{CV} = I - (I - I) \cdot M$$

Variable	Value	Description
i	HIV - 93.6093% HCV - 38.2%	Proportion of PWID HIV(-) / HCV(-)
N	978,621	Number of needles in circulation
s	8%	Rate of needle sharing
d	17%	Percentage of unclean needles
q	HIV - 6.39075% HCV - 61.8%	Proportion of PWID HIV(+) / HCV(+)
t	HIV - 0.63% HCV - 0.57%	Probability of HIV / HCV infection from a single injection
M	1.3125	Number of sharing partners

The “rate of needle sharing” is calculated as a “before or after intervention” by a separate sub equation given below:

Change in the Rate of Needle Sharing:

$$\frac{I - B}{N} = \frac{(I - B) + (I - B) \cdot n}{T}$$

Variable	Value	Description
n	70%	SIF client reduction in needle sharing
N	7,301	Number of unique, annual SIF clients
T	16,863	PWID Population (lifetime)

PWID Population

Definition : Estimated size of the PWID community in Kent County, Michigan

Selected Figure : 16,863 lifetime / 1945 prior-year

Given the legal status of PWID, it is undeniably difficult to estimate the size of the PWID population. Methods used in the past include “capture-and-release”, the multiplier method, and survey meta-analysis. Previous research employing the multiplier method averaged several estimates of PWID numbers to determine a possible number of PWID in metropolitan regions⁸. While using additional sets of information or longer sampling periods can improve the accuracy of this approach, multiplier methods are

⁸ Barbara Tempalski et al., “Trends in the Population Prevalence of People Who Inject Drugs in US Metropolitan Areas 1992–2007,” *PLOS ONE* 8, no. 6 (June 5, 2013): e64789, <https://doi.org/10.1371/journal.pone.0064789>.

typically subject to a large degree of variability. This is similarly true of capture-and-release, although it should also be noted that more recent attempts using this approach, while considered highly accurate, were used to calculate areas hit particularly hard by the opioid epidemic and would not be generalizable in other settings⁹.

Emulating a method employed by the CDC to estimate the STI disease burden amongst men who have sex with men (MSM), Lansky, et al. set about a multi-phase process to collect usable survey data with strict exclusion criterion. Those sufficiently homogenous for comparison generated estimates for the amount of individuals that have injected drugs in the previous year as well as some point in their lives. 2.6% of the US population (6,612,488 individuals) are estimated to have used injection drugs at some point in their lives. For the past year usage was 0.30%, or 774,434 individuals— both estimates apply to the year 2011¹⁰. Contrasted to other studies, the previous year finding was roughly half of Tempalski’s multiplier method estimate. It should be noted that as there is no accepted standard for this estimate, it could be that either study is either underestimating or overestimating the size of the PWID population respectively. That said, conservative estimates for the lifetime PWID population size of Kent County at a population of 648,594 stands at approximately 16,863 individuals using 2018 population sizes according to this approach.

Proportion of PWID that are HIV+ / HCV+

Definition : The percentage of the Kent County PWID population that is HIV+ / HCV+

Selected Figure :

6.39075% HIV+

61.8% HCV+

⁹ Lawrence Scholl, “Drug and Opioid-Involved Overdose Deaths — United States, 2013–2017,” *MMWR. Morbidity and Mortality Weekly Report* 67 (2019), <https://doi.org/10.15585/mmwr.mm6751521e1>.

¹⁰ Amy Lansky et al., “Estimating the Number of Persons Who Inject Drugs in the United States by Meta-Analysis to Calculate National Rates of HIV and Hepatitis C Virus Infections,” *PLoS ONE* 9, no. 5 (May 19, 2014), <https://doi.org/10.1371/journal.pone.0097596>.

Using 2016 data, the CDC reports that roughly 6.6% of HIV diagnoses were attributable to IDU at a national level¹¹. Including both MSM/PWID and PWID only, the Michigan Department of Health and Human Services (MDHHS) reported that 11% of HIV prevalence in Michigan attributable to IDU (including IDU/MSM), or 7% of HIV prevalence attributable to IDU alone¹². Applied to our estimate of the broader PWID population, we estimate that roughly 6.39% (~1945 individuals) of the PWID population in Kent County is living with HIV. A necessary caveat here is that the CDC estimates that one in seven individuals infected with HIV are unaware, and as such this may be underreported by roughly 15%.

With regards to HCV, the CDC reports roughly 53.1% (range: 38.1%-68.0%, 95% CI) prevalence of HCV amongst PWID using global meta-analysis¹³. This rate does vary by report, as the CDC also reported 68.6% acute cases attributable to IDU in 2016, and 67% globally¹⁴. At a more localized level, this seems to coincide with survey data collected by the MDHHS in which 62% of those diagnosed with chronic HCV also reported recent injection drug usage, as well as 56% of diagnosed acute cases of HCV¹⁵. Applying this information to the total number of cases in Kent County allows us to estimate the number of HIV+ / HCV+ whom are PWID as follows:

¹¹ "Statistics Overview | Statistics Center | HIV/AIDS | CDC." 2019. April 12, 2019. <https://www.cdc.gov/hiv/statistics/overview/index.html>.

¹² Michigan Dept. of Health and Human Services, "Epidemiologic Profile of HIV in Michigan", 2018.

¹³ Louisa Degenhardt et al., "Global Prevalence of Injecting Drug Use and Sociodemographic Characteristics and Prevalence of HIV, HBV, and HCV in People Who Inject Drugs: A Multistage Systematic Review," *The Lancet. Global Health* 5, no. 12 (October 23, 2017): e1192-1207, [https://doi.org/10.1016/S2214-109X\(17\)30375-3](https://doi.org/10.1016/S2214-109X(17)30375-3).

¹⁴ Kimberly Page et al., "Injection Drug Use and Hepatitis C Virus Infection in Young Adult Injectors: Using Evidence to Inform Comprehensive Prevention," *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America* 57, no. Suppl 2 (August 15, 2013): S32-38, <https://doi.org/10.1093/cid/cit300>.

¹⁵ Michigan Dept. of Health and Human Services, "Hepatitis B and C Annual Surveillance Report", 2018

Kent County HIV+ / HCV+ Total Reported (2018)			
Condition	No.	% Attributable to PWID (Statewide)	Amount due to PWID
<i>HIV+</i>	1130	11%	124.3
<i>Chronic HCV+</i>	454	62%	281.48
<i>Acute HCV+</i>	11	56%	6.16
<i>Seropositive HCV</i>	465	61.8%	287.64

While these numbers are reliant on mathematical estimations and are therefore inherently inexact, there is evidence that the rate of reported HCV is significantly smaller than the true incidence when unreported cases are also considered. Reports demonstrate anywhere from 12.30 actual cases per each single reported case up to 23 cases per every reported, as posted by the CDC and others¹⁶¹⁷. This is partially due to the infection being effectively asymptomatic throughout the most stages of infection up until hepatic function is severely impaired but also because it stands to reason that PWID would be less likely to voluntarily seek testing for legal and social reasons, increasing rates of infection within that community.

Proportion of PWID that are HIV- / HCV-

Definition : The percentage of the Kent County PWID population that is HIV- / HCV-

Selected Figure :

¹⁶ R. Monina Kleven et al., "Estimating Acute Viral Hepatitis Infections From Nationally Reported Cases," *American Journal of Public Health; Washington* 104, no. 3 (March 2014): 482-87.

¹⁷ Brian R. Edlin et al., "Toward a More Accurate Estimate of the Prevalence of Hepatitis C in the United States," *Hepatology (Baltimore, Md.)* 62, no. 5 (November 2015): 1353-63, <https://doi.org/10.1002/hep.27978>.

93.6093% HIV-

38.1419% HCV-

As specific knowledge of the number of HIV- or HCV- individuals is dependent on the total PWID population, an exact estimate of this value is subject to the same assumptions as those those given above. With that said, using our estimated PWID population sizes and the calculated rates of HIV+ / HCV+ individuals, the remainder (HIV- / HCV-) can be similarly estimated.

Kent County HIV- / HCV- (2017)	
Outcome	% of Total
<i>HIV-</i>	93.6093
<i>Seronegative HCV-</i>	38.1419

Per-Act HIV Risk

Definition : The risk of viral transmission from a single use of a needle or syringe previously used by another individual infected with HIV

Selected Figure : 0.63%

_____ Given the differing biochemical characteristics of each virus, the rate of transmission is specific to the virus itself. In addition, the specific subtype of the HIV preminent within any particular geographic area need also be considered for the same reason. Reported statistics range from 0.63%-2.4%¹⁸. On the more conservative side a

¹⁸ Rebecca F Baggaley et al., "Risk of HIV-1 Transmission for Parenteral Exposure and Blood Transfusion: A Systematic Review and Meta-Analysis," *AIDS* 20, no. 6 (April 2006): 805-12, <https://doi.org/10.1097/01.aids.0000218543.46963.6d>.

large study specific to the B-subtype was conducted in Thailand and found a per-act risk rate of 0.63%, or roughly a 1/158 chance per needle sharing event¹⁹. This figure is also supported by meta-analysis and has been adopted as the currently accepted CDC rate²⁰. Given that this 0.63% figure is sufficiently sampled, of the subtype predominant in North America, conservative compared to other measures, and is accepted as the current standard, it is the preferred number to use for this analysis short of having highly localized data available or otherwise conducting a test using weighted prevalences of each subtype.

Per-Act HCV Risk

Definition : The risk of viral transmission from a single use of a needle or syringe previously used by another individual infected with HCV

Selected Figure : 0.57%

Accidental needlestick injuries are commonly recorded in clinical environments as workplace accidents, and thus might act as reliable data on HCV transmission. Available data from the CDC provides a cumulative risk of roughly 1.8% per act via needlestick injury to health care workers. However, it should be noted that there are notable differences in how and where those injections occurred (predominantly the hand, neck, or face in that setting), and thus it may not accurately reflect the risk to sharing injection equipment^{21,22}. Current literature specific to transmission among PWID suggests some conjecture over this figure, likely due to the wide variance in reporting methods

¹⁹ Michael G. Hudgens et al., "Estimating the Transmission Probability of Human Immunodeficiency Virus in Injecting Drug Users in Thailand," *Journal of the Royal Statistical Society: Series C (Applied Statistics)* 50, no. 1 (2001): 1–14, <https://doi.org/10.1111/1467-9876.00216>.

²⁰ Pragna Patel et al., "Estimating Per-Act HIV Transmission Risk: A Systematic Review," *AIDS* 28, no. 10 (June 2014): 1509–19, <https://doi.org/10.1097/QAD.000000000000298>.

²¹ Francesco M. Egro et al., "Seroconversion Rates among Health Care Workers Exposed to Hepatitis C Virus–Contaminated Body Fluids: The University of Pittsburgh 13-Year Experience," *American Journal of Infection Control* 45, no. 9 (September 1, 2017): 1001–5, <https://doi.org/10.1016/j.ajic.2017.03.011>.

²² Fenton M. O’Leary and Timothy C. Green, "Community Acquired Needlestick Injuries in Non-Health Care Workers Presenting to an Urban Emergency Department," *Emergency Medicine* 15, no. 5–6 (2003): 434–40, <https://doi.org/10.1046/j.1442-2026.2003.00498.x>.

amongst users. Boelen, et al. found a rate of roughly 0.57%, or 1/175, admitting that the risk may be as high as 6% per act²³. Given the asymptomatic nature of HCV, it stands to reason that a transmission rate lower than HIV could still result in a far greater number of total infections and so a conservative estimate may not be as unrealistic as it would initially appear.

Percent Needles Uncleaned

Definition : The probability that a used needle or syringe was not disinfected bleached before reuse by a secondary party

Selected Figure : 17%

Bleach has proven to be an effective disinfection measure for injection equipment and is thus employed regularly for disinfection by PWID²⁴. The low cost and high effectiveness of bleach led to the mass distribution of “bleach kit” programs long before more modern needle exchange services were created, which fill of distributing these kits in many locations across the US. Despite ease of availability, the frequency of effective disinfection of injection materials is not 100%. While it is reasonable to suggest that SIF users would likely have a heightened rate of bleaching, it likely be similar to rate among users of existing NSPs because there would be a large overlap in the types of materials distributed as well as risk-mitigation education efforts by these respective services. Previous studies have estimated a percentage of unclean needles used via survey data to be roughly 17%, or that 83% of the time needles are adequately bleached prior to reuse.²⁵

²³ Lies Boelen et al., “Per-Event Probability of Hepatitis C Infection during Sharing of Injecting Equipment,” *PLoS ONE* 9, no. 7 (July 7, 2014): e100749, <https://doi.org/10.1371/journal.pone.0100749>.

²⁴ Holly Hagan, Enrique R. Pouget, and Don C. Des Jarlais, “A Systematic Review and Meta-Analysis of Interventions to Prevent Hepatitis C Virus Infection in People Who Inject Drugs,” *The Journal of Infectious Diseases* 204, no. 1 (July 1, 2011): 74–83, <https://doi.org/10.1093/infdis/jir196>.

²⁵ Martin A. Andresen and Neil Boyd, “A Cost-Benefit and Cost-Effectiveness Analysis of Vancouver’s Supervised Injection Facility,” *International Journal of Drug Policy* 21, no. 1 (January 1, 2010): 70–76, <https://doi.org/10.1016/j.drugpo.2009.03.004>.

Needles in Circulation

Definition : The number of needles or syringes in circulation amongst the PWID community, distributed by NSP's or other available services

Selected Figure : 978,621

Alongside many other states, Michigan has legal provisions supporting the sale of syringes without prescription at pharmacies and other facilities selling medical supplies, and as such there is no method of accurately determining whether any syringe sale is intended for medical or illicit use. This being the case, it's difficult to ascertain just how many syringes are in circulation across the entire the PWID community. However this can be estimated using local NSP data because it can be assumed that procurement behavior amongst PWID via NSPs and SIFs would be similar, and that their geospatial reach in terms of needle distribution would be similar.

“Clean Works”, the only NSP operating within Kent County, operates in various spots surrounding Grand Rapids, Michigan. Clean Works reports roughly 300,000 syringes distributed annually, or roughly 1.501 syringes per person, per year²⁶. Applying a similar rate to Kent County with regards to the difference in population yields an approximate estimate of 978,621 syringes distributed across the county. It should be noted that Clean Works has adopted a system of operating a model unit with a rotating schedule of locations based on relative PWID demand across different locations within the city and so while a SIF would provide a similar service, it would presumably be limited to a static location. In addition, it is assumed that broader Kent County has roughly the same per capita PWID as the more urban Grand Rapids area, which is a query that ought be subject to further investigation.

Frequency of Share Events

Definition : The percent likelihood that any instance of injection drug use is a shared (receptive) injection

²⁶ “Red Project, “*Syringe Access, HIV Test, Overdose Prevention*”, accessed 23 July, 2019.)

Selected Figure : 8.00%

Given the high correlation between IDU and communicable diseases, various social behaviors amongst PWID play a unique and prominent role in viral transmission. As such, a great deal of data is collected on the frequency of needle-sharing, although this rate varies amongst study groups and is also notably dependent on the duration any particular cohort was surveyed. Analysis from interviews of >12,000 individual PWID yielded a sharing rate of roughly 31.9% in the last thirty days, or up to 64.5% within the previous six months²⁷²⁸. While it is obvious that the likelihood sharing may have occurred increases with time, Nguyen et al. worked in conjunction with the CDC to extrapolate an estimated rate of 8-13% share rate per injection by way of incorporating reported daily injection averages and share rates across multiple groups across 19 US cities²⁹.

Number of Sharing Partners

Definition : The average number of individuals injecting in a single assembly or session

Selected Figure : 1.3125

In order to fully characterize patterns of behavior in injection drug use, it is necessary to consider the number of partners included in any particular session. To illustrate the relevance of this variable, consider a situation where four individuals in one setting might share the same set of injection equipment, and the added risk to the fourth individual to use that set equipment as compared to the second individual (or first, if the equipment used is not sterile to begin with).

²⁷ Trang Quynh Nguyen et al., "Syringe Exchange in the United States: A National Level Economic Evaluation of Hypothetical Increases in Investment," *AIDS and Behavior* 18, no. 11 (November 2014): 2144–55, <https://doi.org/10.1007/s10461-014-0789-9>.

²⁸ Shruti H. Mehta et al., "Changes in Blood-Borne Infection Risk Among Injection Drug Users," *The Journal of Infectious Diseases* 203, no. 5 (2011): 587–94.

²⁹ Trang Quynh Nguyen et al., "Syringe Exchange in the United States: A National Level Economic Evaluation of Hypothetical Increases in Investment," *AIDS and Behavior* 18, no. 11 (November 2014): 2144–55, <https://doi.org/10.1007/s10461-014-0789-9>.

The amount of information on this particular topic is very thin— while there is a wealth of data supporting the rate of receptive sharing (both over the course of a lifetime and in say, the last month), this is inadequate to describe the number of individuals participating in a single exchange. One study found a ratio of roughly 1.3125 receiving to giving injection equipment in Montreal, Quebec³⁰. This population would have some overlap with Insite’s clientele base, and represents the more conservative number than other studies surveying smaller populations or at earlier points in time³¹. It should be noted that all known material published on this subject has been collected from NSP’s, so it is currently unknown whether SIF usage may impact this behavior differently.

Number of SIF Clients

Definition : The annual number of unique visitors to an existing SIF

Selected Figure : 7301 unique, annual clients

In other modeling studies, this figure has been reported as a monthly total of unique visitors^{32,33}. However, there are several issues with this approach. First, any change in the incidence of HIV or HCV is being reported as cases prevented annually, so it is more consistent to not convert between differing units of time unnecessarily. In addition, Vancouver Coastal Health (VCH; the regional state health authority that includes Vancouver’s DTES and Insite) reported an annual total of 7,301 unique visitors

³⁰ Prithwish De et al., “HIV and HCV Discordant Injecting Partners and Their Association to Drug Equipment Sharing,” *Scandinavian Journal of Infectious Diseases* 41, no. 3 (2009): 206–14, <https://doi.org/10.1080/00365540902721376>.

³¹ Amos Irwin et al., “A Cost-Benefit Analysis of a Potential Supervised Injection Facility in San Francisco, California, USA,” *Journal of Drug Issues* 47, no. 2 (April 2017): 164–84, <https://doi.org/10.1177/0022042616679829>.

³² Amos Irwin et al., “Mitigating the Heroin Crisis in Baltimore, MD, USA: A Cost-Benefit Analysis of a Hypothetical Supervised Injection Facility,” *Harm Reduction Journal* 14, no. 1 (12 2017): 29, <https://doi.org/10.1186/s12954-017-0153-2>.

³³ Amos Irwin et al., “A Cost-Benefit Analysis of a Potential Supervised Injection Facility in San Francisco, California, USA,” *Journal of Drug Issues* 47, no. 2 (April 2017): 164–84, <https://doi.org/10.1177/0022042616679829>.

(2017)³⁴. Because some percentage of the first month's visitors likely returned and are thus contained within VCH's reported 7,301 annual unique clients, using one month for calculation and then converting to an annual unit value is effectively inflating the benefit of the SIF artificially due to the fact that it is seemingly unlikely that Insite or another SIF would maintain a consistent standard of roughly 1,700-2,100 unique visitors throughout the remainder of the year.

SIF Client Reduction in Needle Sharing

Definition : The PWID-reported decrease in injection equipment sharing as a result of SIF usage or SIF-mediated education initiatives

Selected Figure : 70% reported decrease in needle / syringe sharing

At the heart of any hypothetical model such as this lie some core assumptions that must be made due to the inherent lack of comparative information. As there are no legally sanctioned SIFs in the US at this time (much less in the West Michigan area), it is impossible to say whether a SIF in this area would have a similar impact on individual behavior as Vancouver's Insite, or whether that facility would be as well-regarded within the PWID population in that area. Kerr et al. reported a 70% reduction in sharing at the Insite facility, a figure that has been reused in modeling for a number of other SIFs³⁵. This information was subsequently reviewed independently in meta-analysis, and is thus accurately representative of Insite's role³⁶.

³⁴ "Insite User Statistics - Vancouver Coastal Health." n.d. Accessed June 25, 2019.

<http://www.vch.ca/public-health/harm-reduction/supervised-consumption-sites/insite-user-statistics>.

³⁵ Thomas Kerr et al., "Safer Injection Facility Use and Syringe Sharing in Injection Drug Users," *The Lancet* 366, no. 9482 (July 2005): 316–18, [https://doi.org/10.1016/S0140-6736\(05\)66475-6](https://doi.org/10.1016/S0140-6736(05)66475-6).

³⁶ Chloé Potier et al., "Supervised Injection Services: What Has Been Demonstrated? A Systematic Literature Review," *Drug and Alcohol Dependence* 145 (December 1, 2014): 48–68, <https://doi.org/10.1016/j.drugalcdep.2014.10.012>.

Results

Implementation of a SIF in the Kent County area was found to reduce the frequency of sharing events by roughly 2.5%. The decrease in sharing, subsequently, would result in a decrease of HCV and HIV incidence attributable to IDU by approximately 30%. For clarity, as MDHHS report 47 total incident HIV diagnoses were made in 2017 and only a small percentage of those were due to IDU, this represents a roughly 5% decrease in HIV diagnoses. With roughly 60% of HCV diagnoses being associated with IDU, calculations show a flat decrease in 7 incident cases, but the actual impact of this could vary much more widely due to high transmission of HCV as well as heightened rates of education and testing services that a SIF could provide to the PWID community that are difficult to administer currently due to legal and social concerns of that population. Perhaps most importantly, results here are purely analytical in nature and would have limited predictability. One especially noteworthy reason for this is that that drug policy in the US differs significantly from Canada, and developing trust between an SIF and local PWID is a relationship that would take some time to nurture and mature.

Discussion

While a handful of studies modeling SIFs in the US have been published, there is still a great deal of work to do with regard to determining best practices. Such studies have inherent blind spots, and while that is acceptable in the sense that more comprehensive data is as of yet unavailable, it simultaneously highlights the need for increased time and resource investment, given the relative success of SIFs north of the border. At this time, most existing data comes via major metropolitan areas, and the demand for a broadened tool kit is likely felt most acutely in dense urban environments, it remains true that lower boundaries of the positive impact of SIFs provides valuable information to policymakers and a wide assortment of local stakeholders. As such, future studies would do well to consider the broader implications of SIFs, including impacts on PWID behavior and third party effects, including those on local health providers, first responders, and other associated parties.

Limitations

Given the limited local data available, the results of this test should be considered subjective and preliminary in nature. While Kent County and Vancouver have similar population sizes, there is a great difference in population density and this would likely have a strong impact on PWID attendance and retention with any SIF, which would ideally be built in the highest concentrated area of need to provide the greatest impact. Similarly, as Kent County is made of urban, suburban, and rural areas, the per capita PWID within each geographic subregion is not likely to be consistent and should be studied more in depth to help define those areas of greatest need. Finally, it is questionable whether a Kent County SIF would result in a similar reduction on injection equipment sharing.

On the opposing side, this study also does not detail a comprehensive list of changes that may occur with the addition of a SIF. Most notably, SIFs have also shown to decrease drug overdoses, and soft skin and tissue infections that are also extremely common amongst injection drug users. Other benefits may also include decreases in hospital bed stay and first responder expenses, both of which are also often absorbed by the general tax base. SIFs and NSPs would also impact biohazard waste, decreasing the amount of used drug supplies discarded in public areas, decreasing risk to others and helping maintain clean urban environments.

In addition to those mentioned above, future studies could improve this test with further localization of data. The rate of equipment sharing, number of sharing partners, likelihood of bleaching shared equipment, and number of needles in circulation are all specific to differing populations and are impacted by outside confounders (such as the local economy or job market), and with significant ethical considerations in place this information could be surveyed anonymously via local NSPs. Ideally, surveys would be completed at multiple points in time or over long periods in order to produce large averages or detect changes in behavioral patterns over time within a given survey area.