NEW ENGLAND CEPAC
COMPARATIVE EFFECTIVENESS PUBLIC ADVISORY COUNCIL

AN ICER PROGRAM

Supervised Injection Facilities and Other Supervised Consumption Sites: Effectiveness and Value

Modeling Analysis Plan

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Institute for Clinical and Economic Review

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1. Approach

This analysis plan details our modeling approach and outcomes to be assessed for the economic evaluation of supervised injection facilities (SIFs) for people who inject drugs (PWID). Refer to the Research Protocol for details on the systematic review of the clinical evidence on this topic.

The primary aim of this analysis will be to estimate the cost-effectiveness of SIFs for injection drug use (IDU) among PWID using a cost-effectiveness analysis. The model will compare SIFs to syringe services programs (SSPs), which provide a multi-day or multi-week supply of clean needles and syringes to PWID either freely or as exchanges for contaminated products.[1] Because SIFs are not funded by the health care system or payers of health care, the base-case analysis will take a modified societal perspective and a one-year time horizon. We will also consider a health care payer perspective as a scenario analysis. The model will be developed in Microsoft® Excel® for Office 365 (Version 2005).

2. Methods: Long-Term Cost Effectiveness

2.1 Overview and Model Structure

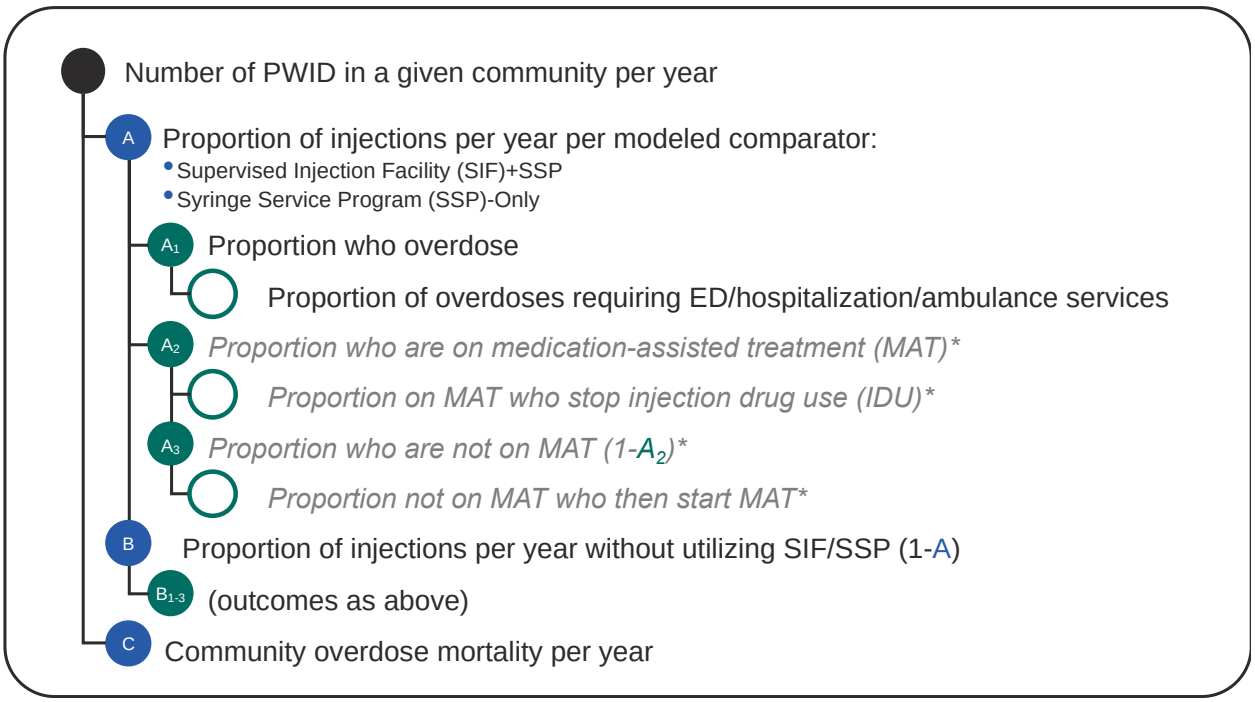
We will develop a decision analytic model for this evaluation, with outcome calculations adapted from prior relevant economic models of harm reduction for PWID[2-8] and informed by interviews among key staff and researchers of SIFs.

The model will focus on a community of PWID, specified by parameters for individual U.S. cities, who could potentially utilize SIFs in locations where SSPs already exist, i.e., SIF+SSP vs. SSP-only. We will calculate each setting's outcomes over one year, based on clinical data and observations in prior published economic models. The model will not track a single PWID cohort over time; rather, a population of PWID within a given community will be generated based on available data for each location and then outcomes for each community will be calculated per year. The costs and outcomes will be summed over the one-year time horizon. We plan to model up to six different U.S. cities, based on local parameters, in order to develop a tool that may be customized to provide cost effectiveness estimates for any U.S. city given the appropriate data.

PWID within a given community enter the model in either the SIF+SSP or SSP-only arm (Figure 2.1). Among the total population of PWID, the proportion of injections/month associated with each comparator will be calculated (A); the remainder of injections are assumed to occur without utilization of the SIF/SSP (B). Given the proportions of injections utilizing and not utilizing each comparator, conditional probabilities will be used to calculate proportions of (A_1) PWID who overdose, and (A_2) PWID who are on or (A_3) not on medication-assisted treatment (MAT). Among

PWID who are already on MAT, we will calculate the proportion per year who successfully stop IDU. Among PWID who are not on MAT, we will calculate the proportion per year who start it. For PWID who overdose, we will calculate the proportions that require emergency services such as ambulance utilization. MAT uptake and success rates are assumed to be equivalent between comparators in the base case, but increased MAT uptake and success rates due to a SIF will be explored in a scenario analysis. These same outcomes will be calculated for B_{1-3} and totals for a given community will be estimated. Community overdose mortality (C) will be estimated based on the proportion of injections in the SIF, applying a risk reduction estimate described below.

Figure 2.1. Model Schematic



*Base case assumes equivalence between comparators for A2, A3, B2, and B3

2.2 Key Model Choices and Assumptions

Below is a list of key model choices:

- The primary outcomes will be overall survival (stemming from overdose deaths prevented), and overall cost (comprised of costs for facility, staff, supplies, MAT, and emergency services utilization). We will then calculate the cost per life year for each comparator.
- We will not weight survival with health state utilities to calculate quality-adjusted life years given a lack of utility data for the US population of PWID and the proposed non-cohort model structure.
- We will utilize a modified societal perspective and a one-year time horizon.

Our model includes several assumptions, stated below.

Table 2.1. Key Model Assumptions

Assumption	Rationale
Hypothetical legally sactioned SIFs in US cities are comparable to Insite (Vancouver, BC, Canada) in terms of effectiveness, services offered, and cost of living-adjusted operating costs.	Insite is the first and most well-documented SIF in North America.
Rates of HIV/hepatitis C/other infections are equivalent between SIF+SSP and SSP-only.	We have no evidence that SIFs lower infection rates beyond the rates seen with SSPs.
We will assume that the rates of initiation and continuation of MAT are equivalent between clients using SIFs and SSPs.	There is a lack of comparative data between these two services; however, stakeholders have indicated that increased face-to-face time spent with PWID may lead to increased uptake of MAT. Therefore, we will explore the impacts of marginal increases in MAT initiation due to SIFs in a scenario analysis.

BC: British Columbia, MAT: medication-assisted treatment, PWID: person who injects drugs, SIF: supervised injection facility, SSP: syringe service program, US: United States

2.3 Locations

The populations of focus for the economic evaluation will include PWID at various locations in the US. Currently we plan on modeling Boston, Philadelphia, San Francisco, Austin, Baltimore, and Seattle. Table 2.2 will be refined from broad city-level characteristics to economic values for specific locations in each city where a SIF would be likely to be placed.

Table 2.2. Baseline Community Characteristics

City Characteristics	Boston	Philadelphia	San Francisco	Austin	Baltimore	Seattle	Vancouver
Population Density (people/square mile)[9,10]	13,943	11,692	18,581	3,182	7,594	8,391	13,595
Commercial Property Value/Cost per square foot[11-13]	$550	$207	$300	$486	$202	$414	$1,220
Commercial Mortgage Loan Rates[14,15]	5% - 9%	5% - 9%	5% - 9%	5% - 9%	5% - 9%	5% - 9%	3% - 6%
Commercial Space Availability[16,17]	8.0%	10.5%	7.0%	4.8%	15.3%	9.5%	4.7%
Cost of Living Ratio vs. Vancouver, BC[18]	1.24	1.05	1.47	1.00	0.95	1.18	Baseline
Number of PWID within city limits[19-24]	TBD	TBD	22,500 (year 2012)	TBD	19,000 (year 2017)	26,000 (year 2017)	42,200 (year 2016)

BC: British Columbia, PWID: person who injects drugs, TBD: to be decided

2.4 Interventions

The list of interventions was developed with input from community organizations, clinicians, researchers, government agencies, and payers on which interventions to include. The full list of interventions is as follows:

- Intervention of interest: SIF+SSP
- Comparator intervention: SSP-Only

2.5 Input Parameters

Outcome Inputs

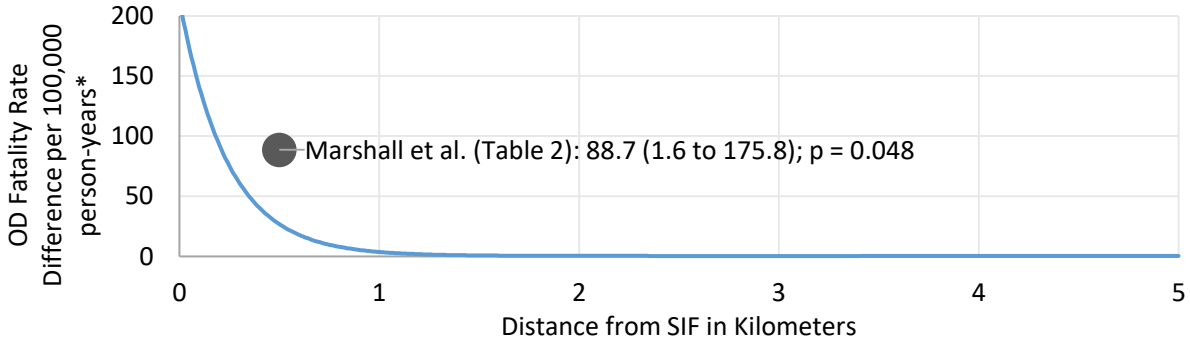
Overdoses

Utilizing estimates from the Canadian site, we will assume that 0.133% of injections result in an overdose.[25] If available, current community-level overdose rates will be extracted for each of the modeled cities and applied in each city.

Mortality

We plan to utilize overdose mortality risk reduction associated with SIFs based on Marshall et al.[26] We will apply the predicted rate difference to pre-SIF fatalities (and assume those apply to SSP-Only communities) to derive expected SIF fatalities per number of PWID by distance from the SIF.

Figure 2.2. Overdose Fatality Rate Difference by Distrance from SIF[26]



*Rate Difference in fatal OD (x) = 0.40 + 212.4 * e–4.17x

Emergency Services

Emergency services will include both ambulance services as well as hospital emergency department access, conditional on the occurrence of an overdose. We plan to utilize estimates from Irwin et al. to parameterize these services, with 0.79% of overdoses at a SIF versus 46% of overdoses outside a SIF resulting in an ambulance call, and 0.79% of overdoses at a SIF versus 33% of overdoses outside a SIF resulting in an emergency department visit. We will also explore data for other services associated with overdoses, such as police calls, coroner services, and hospital admissions.

Table 2.3. Emergency Services Parameters

Parameter	Base Case	Source
Total annual injections in the SIF	Variable	By location (Insite = 180,000)[25]
Percent of injections at SIF resulting in overdose	0.133%	Insite[25]
Ambulance Parameters		
Rate of non-SIF overdose resulting in ambulance call	46%	Irwin et al.,[6] Pollini et al.[27]
Rate of SIF overdose ambulance call	0.79%	Irwin et al.,[6] KPMG[28]
Cost of overdose ambulance call	Variable	By location[29]
Emergency Department Visit Parameters		
Rate of non-SIF overdose resulting in ED visit	33%	Irwin et al.,[6] Pollini et al.[27]
Rate of SIF overdose resulting in ED visit	0.79%	Irwin et al.,[6] KPMG[28]
Cost of overdose ED visit	Variable	By location[30]

ED: emergency department, SIF: supervised injection facility

Medication-Assisted Treatment

We will assume that SIFs provide equivalent benefit to SSPs in initiation of MAT. Currently, we will use the estimate of 5.78% of SIF clients accessing MAT due to a referral from the SIF and/or SSP.[31]

Cost Inputs

All costs used in the model will be updated to 2020 dollars.

SIF Costs

Facility and operations costs for SIFs and SSPs will be estimated based on the Irwin et. al. approach, adapting each community's estimate according to their individual characteristics.[6] We currently plan to apply start-up costs as well as marginal operating costs (Table 2.2, above). We will assume that these estimates include scalability for individual facilities, noting that the capacity of an individual SIF or SSP is balanced against the local population's size and willingness to travel to the location. These costs also require the assumption that the SIF's service offerings will match those of the source data (Insite, Vancouver, BC), as that site is also the source for the effectiveness parameters.

Emergency Services Costs

We will use Centers for Medicare and Medicaid Services (CMS) fee schedules with location-specific adjustments to calculate the costs of ambulance rides[29] and emergency department visits.[30]

2.6 Model Outcomes

Model outcomes will include total life years (LYs) gained and total costs for each intervention. The model outcomes will also include total overdose deaths prevented, total emergency services avoided, and total increase in MAT initiation. Due to the one-year time horizon, total costs and LY's will be reported as undiscounted values.

2.7 Model Analysis

Costs and cost effectiveness will be estimated using the incremental cost-effectiveness ratios, with incremental analyses comparing SIF+SSP to SSP-only. Because the health care system does not hold financial responsibility for funding SIFs, the base-case analysis will take a modified societal perspective. We will also consider a health care payer perspective analysis focused on direct health care costs, and the potential differences in those costs between the interventions.

Sensitivity Analyses

We will conduct one-way sensitivity analyses on each community estimate to identify the impact of parameter uncertainty and key drivers of model outcomes. Probabilistic sensitivity analyses will also be performed by jointly varying all model parameters over 1000 simulations, then calculating 95% credible range estimates for each model outcome based on the results.

Scenario Analyses

If data allow, we will consider conducting scenario analyses that include:

1. Health care payer perspective that focuses on direct health care costs, and the differences in health care resource utilization between the intervention and comparator.

2. Increased MAT uptake and success rates attributed to SIFs.

Model Validation

We will use several approaches to validate the model. First, we will provide preliminary model structure, methods and assumptions to patient groups and clinical experts. Based on feedback from these groups, we will refine data inputs used in the model, as needed. Second, we will vary model input parameters to evaluate face validity of changes in results. We will perform model

verification for model calculations using internal reviewers. Finally, we will compare results to other cost-effectiveness models in this therapy area. The outputs from the model will be validated against the trial/study data of the interventions and also any relevant observational datasets.

References

1. Des Jarlais DC, Nugent A, Solberg A, Feelemyer J, Mermin J, Holtzman D. Syringe Service Programs for Persons Who Inject Drugs in Urban, Suburban, and Rural Areas - United States, 2013. *MMWR Morb Mortal Wkly Rep.* 2015;64(48):1337-1341.
2. Behrends CN, Paone D, Nolan ML, et al. Estimated impact of supervised injection facilities on overdose fatalities and healthcare costs in New York City. *J Subst Abuse Treat.* 2019;106:79-88.
3. Hood JE, Behrends CN, Irwin A, et al. The projected costs and benefits of a supervised injection facility in Seattle, WA, USA. *Int J Drug Policy.* 2019;67:9-18.
4. Irvine MA, Kuo M, Buxton JA, et al. Modelling the combined impact of interventions in averting deaths during a synthetic-opioid overdose epidemic. *Addiction.* 2019;114(9):1602-1613.
5. Irwin A, Jozaghi E, Bluthenthal RN, Kral AH. A Cost-Benefit Analysis of a Potential Supervised Injection Facility in San Francisco, California, USA. *Journal of Drug Issues.* 2017;47(2):164-184.
6. Irwin A, Jozaghi E, Weir BW, Allen ST, Lindsay A, Sherman SG. Mitigating the heroin crisis in Baltimore, MD, USA: a cost-benefit analysis of a hypothetical supervised injection facility. *Harm Reduct J.* 2017;14(1):29.
7. Jozaghi E. A cost-benefit/cost-effectiveness analysis of an unsanctioned supervised smoking facility in the Downtown Eastside of Vancouver, Canada. *Harm Reduct J.* 2014;11(1):30.
8. Jozaghi E, Vancouver Area Network of Drug U. Exploring the role of an unsanctioned, supervised peer driven injection facility in reducing HIV and hepatitis C infections in people that require assistance during injection. *Health & Justice.* 2015;3(1):16.
9. Population Density for U.S. Cities Statistics. @governing. https://www.governing.com/gov-data/population-density-land-area-cities-map.html. Published 2020. Accessed 8/5/2020.
10. Canada S. Focus on Geography Series, 2011 Census: Census subdivision of Vancouver, CY - British Columbia. https://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-csd-eng.cfm?LANG=Eng&GK=CSD&GC=5915022. Published 2011. Accessed 8/5/2020.
11. Office prices per square foot in major U.S. cities 2017 | Statista. https://www.statista.com/statistics/789935/cost-of-office-space-in-selected-major-cities-usa/. Published 2020. Accessed.
12. Top 100 Most Expensive U.S. Office Submarkets in 2019. https://www.commercialcafe.com/blog/top-100-expensive-office-submarkets-2019/. Published 2020. Updated 2020-02-18. Accessed.
13. Vancouver Commercial Real Estate Market 2019 | Marcus & Millichap. https://marcusmillichap.ca/newsroom/2019/04/vancouver-commercial-real-estate-market-2019/. Published 2020. Accessed.
14. Average Commercial Real Estate Loan Rates for 2020. https://www.valuepenguin.com/average-commercial-real-estate-loan-rates. Published 2020. Accessed 8/5/2020.
15. British Columbia. @lowestrates_ca. https://www.lowestrates.ca/mortgage/british-columbia. Published 2016. Updated 2016-01-25. Accessed 8/5/2020.
16. Colliers International | 2019 Q1 U.S. Office Market Outlook Report. https://www2.colliers.com/en/research/2019-q1-us-office-market-outlook-report. Published 2020. Accessed 8/5/2020.
17. Office vacancy space drops to record low in downtown Vancouver | Urbanized. https://dailyhive.com/vancouver/office-space-metro-vancouver-cbre-2019.

https://dailyhive.com/vancouver/office-space-metro-vancouver-cbre-2019. Published 2020. Accessed 8/5/2020.
18. Cost of Living Comparisons, 2020 data. https://www.expatistan.com. Published 2020. Accessed 8/5/2020.
19. Safe Consumption Spaces: A Strategy for Baltimore. https://www.abell.org/publications/safe-consumption-spaces-strategy-baltimore. Published 2020. Accessed.
20. Washington KC. HIV/AIDS Fact Sheet: People Who Inject Drugs (PWID). https://www.kingcounty.gov/depts/health/~/media/depts/health/overdose/documents/people-who-inject-drugs-facts.ashx. Published 2020. Accessed.
21. Banta-Green C, Newman A, Kingston S. Washington State Syringe Exchange Health Survey: 2017 Results. https://adai.uw.edu/pubs/pdf/2017syringeexchangehealthsurvey.pdf. Published 2020. Accessed.
22. Manitoba TCfGPHUo. Estimation of Key Population Size of People who Use Injection Drugs (PWID), Men who Have Sex with Men (MSM) and Sex Workers (SW) who are At Risk of Acquiring HIV and Hepatitis C in the Five Health Regions of the Province of British Columbia. http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Statistics%20and%20Reports/STI/PSE%20Project%20Final%20Report.pdf. Published 2016. Accessed.
23. Chen YH, McFarland W, Raymond HF. Estimated Number of People Who Inject Drugs in San Francisco, 2005, 2009, and 2012. *AIDS Behav.* 2016;20(12):2914-2921.
24. Jacka B, Larney S, Degenhardt L, et al. Prevalence of Injecting Drug Use and Coverage of Interventions to Prevent HIV and Hepatitis C Virus Infection Among People Who Inject Drugs in Canada. *Am J Public Health.* 2020;110(1):45-50.
25. Milloy MJ, Kerr T, Tyndall M, Montaner J, Wood E. Estimated drug overdose deaths averted by North America's first medically-supervised safer injection facility. *PLoS One.* 2008;3(10):e3351.
26. Marshall BD, Milloy MJ, Wood E, Montaner JS, Kerr T. Reduction in overdose mortality after the opening of North America's first medically supervised safer injecting facility: a retrospective population-based study. *Lancet.* 2011;377(9775):1429-1437.
27. Pollini RA, McCall L, Mehta SH, Vlahov D, Strathdee SA. Non-fatal overdose and subsequent drug treatment among injection drug users. *Drug Alcohol Depend.* 2006;83(2):104-110.
28. KPMG. Further evaluation of the Medically Supervised Injecting Centre during its extended Trial period (2007-2011). 2020.
29. Centers for Medicare & Medicaid Services. Ambulance Fee Schedule Public Use Files. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AmbulanceFeeSchedule/afspuf. Published 2020. Accessed.
30. Centers for Medicare & Medicaid Services. Physician Fee Schedule Search Results: HCPCS 99285 (Emergency dept visit). https://www.cms.gov/apps/physician-fee-schedule/search/search-results.aspx?Y=0&T=0&HT=0&CT=3&H1=99285&M=5. Published 2020. Accessed.
31. MSIC Evaluation Committee. Final report of the evaluation of the Sydney Medically Supervised Injecting Centre. https://www.drugsandalcohol.ie/5706/1/MSIC_final_evaluation_report.pdf. Published 2020. Accessed.
32. Conover C. How Economists Calculate The Costs And Benefits Of COVID-19 Lockdowns. Forbes. https://www.forbes.com/sites/theapothecary/2020/03/27/how-economists-calculate-the-costs-and-benefits-of-covid-19-lockdowns/#6d266de46f63. Published 2020. Accessed 8/7/2020.