

The Costs and Benefits of a Supervised Use Site in Denver, Colorado

A supervised consumption services / supervised use site in Denver, Colorado could generate annual net savings of \$6.9 million.



Prepared By:

Drug Policy Alliance

1839 York Street, #1
Denver, CO 80206

303.388.8950 voice
303.388.8859 fax

www.drugpolicy.org

Amos Irwin

Program Director
Law Enforcement Action
Partnership

Thamanna Vasan

Economic Policy Analyst
Colorado Fiscal Institute

Lisa Raville

Executive Director
Harm Reduction Action Center

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In recent years, Colorado has made strides in establishing and improving vital harm reduction services like sterile syringe access programs and naloxone distribution, but our communities still experience far too many needless overdose deaths. Multiple counties in Colorado, including Denver, have had overdose rates among the highest in the nation.¹ Public injecting is also an ongoing concern. Just in Denver in 2018 alone, at least 25 people passed away from overdose in public locations such as parks, alleys, parking lots, and business restrooms.² These deaths were unnecessary and preventable.

Along with the risk of overdose, unsafe injection practices are associated with blood-borne disease transmission and skin and soft tissue infection (SSTI)—also extremely costly, yet preventable, concerns. Injection drug use is the primary cause of new hepatitis C virus (HCV) infections in Colorado, with half of all reported cases occurring among people who inject drugs (PWID).³ In the past year, more than half of all PWID in the city of Denver experienced a skin or soft tissue infection, requiring them to utilize emergency rooms and hospital beds.⁴

Prevention and treatment are important aspects of our public health infrastructure, but they are not enough. By enhancing harm reduction services that directly address the risks associated with *continued* drug use, we can better mitigate some of the most costly problems and improve access to effective public health resources that would better protect our communities.

What are supervised consumption services?

Supervised consumption services (SCS), also known as supervised use sites (SUSs) and safer or supervised injection facilities (SIFs), are legally sanctioned facilities designed to reduce the health and public order issues often associated with public injection.⁵ These facilities provide a space for people to consume pre-obtained drugs in controlled settings under the supervision of trained staff and with access to sterile injecting equipment. Participants can also receive health care, counseling, and referrals to health and social services, including drug treatment. The impacts of SCS/SUSs/SIFs have been thoroughly evaluated by researchers studying the over 100 facilities now operating in more than 60 cities and twelve countries worldwide.⁶ These sites are empirically proven to:

- Reduce blood-borne disease transmission by providing sterile syringes and injection education.⁷
- Reduce SSTIs by cleaning wounds and identifying serious infections early.⁸
- Prevent overdose emergencies and deaths—these facilities are designed to reduce risk behaviors that contribute to accidental overdose and staff intervene promptly to reverse overdoses if they do occur. As a result, even though tens of thousands of people have used SCS worldwide, there have not been any overdose deaths.⁹
- Build relationships between staff and hard-to-reach PWID, supporting participants into social services, substance use disorder treatment and other successful harm reduction outcomes. Enrolling more PWID in treatment means fewer associated medical issues and less crime.¹⁰

While delivering these benefits, there is no evidence that existing SCS facilities increase or initiate drug use or drug-related crime.¹¹

We have yet to establish any SCS facilities in the U.S. despite the alarming fact that one quarter of all global drug-related deaths, including overdose deaths, occur here.¹² Legislatures across the country have moved bills to pave the way for SCS in states including New York, Vermont, Massachusetts, Maryland, California and New Jersey while local campaigns are continuously evolving in cities such as Seattle, San Francisco, Ithaca, Baltimore, Boston, New York City and Philadelphia. Here in Colorado, a broad coalition of individuals, organizations, and businesses—including the Colorado Medical Society and Denver Medical Society—is calling for the timely establishment of SCS. In November of 2018, Denver City Council passed an ordinance¹³ authorizing establishment of a supervised use site pilot program contingent upon approval of corresponding legislation that is pending introduction in the General Assembly.

Organizational and business support for a supervised use site is echoed by community members in Denver who inject drugs. A recent local survey found that most of them reported doing so in a public or semi-public place in the last six months, commonly in public bathrooms and streets or alleys.¹⁴ Eighty-five percent of those same respondents stated that they would utilize a SCS site without reservation if it were available.¹⁵

Research also shows that SCS sites generate several other benefits that have not been quantified in the cost-benefit analysis below. They reduce syringe littering and injection in public places and private businesses, physical and sexual violence against PWID, and drug use-related public disturbances.¹⁶ They also reduce overdose emergencies, which means fewer ambulance calls, emergency room visits and hospital stays for overdose complications in addition to fewer overdose deaths.¹⁷ SCS sites facilitate high-quality research on the notoriously hard-to-reach PWID population. Finally, they provide easy access for medical and social service programs to serve PWID.¹⁸ They accomplish all of this without increasing drug use, initiating new users, or fostering drug-related crime.¹⁹

As demonstrated in the cost-benefit analysis below, SCS/SUSs are a fiscally responsible component of a comprehensive public health response to the challenges associated with injection drug use in Denver.

While SUSs and other public health programs should never be judged solely on financial savings, it is important for city and state officials to be aware of such a facility's expected financial impact. We marshal the best available data on PWID in Denver and on the impact of existing SCS/SUSs/SIFs elsewhere to answer the question: ***Would a supervised use site in Denver be an effective and efficient use of financial resources?***

Results

Insite, located in Vancouver, British Columbia, was the first legally-sanctioned SCS facility in North America. It is a well-established, extensively-studied program that has been operating since 2003. Using it as a model, we are estimating the impact of establishing a facility in Denver at similar scale—1,000 square feet (about the size of a large hair salon) serving 13 PWID at a time, and operating 18 hours per day.¹

We estimate that an Insite-sized SUS in Denver would cost under \$1.8 million per year while generating roughly \$8.6 million in health benefits, for a net savings of \$6.9 million per year. The financial cost and benefits, along with the underlying health impacts, are listed in Table 1.

Table 1: Estimated annual financial and health impact of a SUS in Denver

Costs		\$1,761,752
Annual Operating Cost	\$1,596,500	
Annualized Upfront Cost	\$165,252	
Savings		\$8,612,216
HIV	\$345,117	0.8 new infections prevented
Hepatitis C	\$3,802,741	55.8 new infections prevented
Skin and Soft Tissue Infections	\$2,815,332	462.3 hospital days prevented
Overdose Deaths	\$1,330,403	2.8 deaths prevented
Medication-Assisted Treatment	\$318,623	40.5 additional people entering treatment
Summary		
Cost-Benefit Ratio	\$4.89	in savings for each \$1 spent
Net savings	\$6,850,464	

¹ It should be noted that our study evaluates an Insite-sized facility while a smaller SUS is likely to be implemented as an initial pilot in Denver. Both the benefits and costs of a smaller facility will be reduced compared with a larger counterpart. Since a pilot program is meant to

establish baseline efficacy and provide the basis for expanding capacity if outcomes are successful, we have every reason to believe that the benefits and associated savings of a Denver-based SUS can eventually be maximized to the scale projected here.

Discussionⁱⁱ

This analysis suggests that establishing a single SUS in Denver at the capacity of the counterpart facility, Insite, would be highly cost-effective; **each dollar spent on the facility would return an estimated \$4.89 in savings**. A single SUS would also have a large impact city-wide—**the net savings of \$6.9 million are equivalent to 13% of Denver County’s entire budget for Environmental Health**.²⁰

The savings could free up local and federal tax dollars, reduce costs across the health system, and potentially increase business profits by reducing crime while raising productivity and sales.

Health benefits and associated fiscal savings projected for a Denver-based SUS

- Each dollar spent on the facility would return an estimated \$4.89 in savings
- Net annual savings of \$6.9 million
- \$300,000 in annual savings through HIV prevention
- \$3.8 million in annual savings through HCV prevention
- \$2.8 million in annual savings through SSTI prevention
- Multiple lives saved each year through overdose prevention
- \$320,000 in reduced annual drug-related health care and crime costs

Our \$1.8 million cost estimate includes \$1.6 million in annual operating costs and an annual payment of roughly \$200,000 to account for a conservative upfront cost estimate of \$2 million. Our analysis suggests that given the long lifetime of the facility, the operating cost makes up a far greater share of the total cost than the upfront cost. While actual cost figures could diverge widely from this estimate based on decisions around neighborhood, size of medical staff, and additional services, we believe that this figure represents a conservative cost estimate for an Insite-sized facility.ⁱⁱⁱ

In the first category of savings, **a SUS would prevent about one new HIV infection every year, saving over \$300,000 annually**, by educating PWID about the risks of infection and ensuring that they do not share injection equipment.

We find that the greatest financial benefits would come through reduced syringe-sharing—lowering HCV transmission, which we estimate would prevent 56 infections per year.^{iv} Savings from HCV prevention would be even higher than HIV because a greater share of PWID have HCV and because it is much more easily transmitted. **Since a single new case of HCV carries a lifetime treatment cost of over \$60,000, preventing 56 infections would save roughly \$3.8 million**. With respect to SSTI, we estimate that **a SUS would reduce the amount of time that PWID spend in the hospital each year by about 462 days, saving \$2.8 million**.^v Research suggests that Insite reduces SSTI hospital stays 67 percent by providing sterile equipment, risk education, wound treatment, and preventative referrals.

ⁱⁱ Appendix I details the methodology, assumptions, uncertainties, and limitations of our models and data. While we base our financial estimates on the best available data, it should be noted that gathering health data on the population of PWID is notoriously difficult. This limitation also points to the need for SCS, since establishing them is the best means of acquiring reliable health data on PWID and researching their response to health interventions. To date Insite has served as a recruitment center for dozens of high-quality PWID studies and a Denver-based facility would become a similar invaluable resource. For all comparative references to similar cost-benefit analyses for San Francisco and Baltimore, see Irwin et al. 2017.

ⁱⁱⁱ As previously mentioned, current proposals for a smaller Denver facility would be significantly less expensive.

^{iv} This prediction of 56 infections greatly exceeds the prevention estimates in similar studies for San Francisco and Baltimore—19 and 21 cases, respectively. While Denver has a lower total number of PWID, this does not reduce the SCS site’s impact, because there are still far more PWID than would be able to use a single facility. The difference in HCV impact stems from two numbers—first, Denver has a

higher rate of syringe-sharing, with over 35 percent of PWID reporting syringe-sharing in the past year (Denver Public Health (2014), *Report: HIV Behavioral Surveillance in the Denver Metro Area*). Second, half of Denver’s PWID already have HCV—compared to over 75 percent in San Francisco and Baltimore—meaning that Denver has a greater share of HCV-negative PWID who are at risk of contracting HCV every day.

^v While the 462 hospital days figure is only slightly higher than the estimate of 415 days in San Francisco, Denver’s financial savings are far higher—\$2.8 million versus \$1.7 million. This difference stems from new data in the Denver study, which was not available for San Francisco. While the San Francisco study used generic hospital costs of \$4,000 per day, data from the Colorado Hospital Association shows that PWID hospital stays in Denver for SSTI cost a much higher average of \$6,000 per day. Since San Francisco has higher hospital costs in general, this new data suggests that San Francisco’s SSTI savings would greatly exceed a previous \$1.7 million prediction by Irwin et al (2017).

Our study predicts that *SUS staff would prevent about three overdose deaths every year.*^{vi} Saving three lives is an enormous achievement in a city that loses 50 people to heroin overdose each year. Since overdoses can be stopped using the reversal drug naloxone, these deaths can be prevented simply by moving injection drug use from public places into this monitored facility.

Finally, because SUS staff build trust with those PWID who might not otherwise be connected to treatment or other services, we estimate that the SUS would usher dozens of additional PWID into the treatment system every year.^{vii} Medication-assisted treatment (MAT) using methadone or Suboxone has been shown to save society more than four times its cost by reducing health care spending and crime losses.

We calculate that by bringing 40 new PWID into MAT, the SUS would reduce drug-related health care and crime costs by roughly \$320,000 per year.

Appendix: Study Methodology, Data, Limitations, and Sources

Cost of Operating the Facility

For a very rough estimate of annual SCS facility cost, we combine the estimated annual operating cost with an annualized equivalent of the upfront cost. We approximate the operating cost by adjusting the Insite SCS' reported operating cost to account for the cost of living in Denver. We annualize the upfront cost with the levelized annual payment model that Irwin et al. (2017) used for a Baltimore facility in the *Harm Reduction Journal*.²¹

$$C = \frac{i(P)}{1 - (1 + i)^{-N}}$$

For the variable definitions and Denver data, see Table 2 below. While there cannot be any accurate cost estimates without concrete plans for a SUS facility in Denver, we believe that our cost estimate is conservatively high.

Table 2. Values, notes, and sources for variables used to predict facility cost

Variable	Value	Note	Source
Insite operating cost	\$1.55 million	CAD 1.53m in 2013 converted to USD and adjusted for inflation	Jozaghi et al. (2015) ²²
Cost of living adjustment	3%		Expatistan (2017) ²³
Upfront cost (<i>P</i>)	\$1.5 million	Conservative estimate	Rider Levett Bucknall (2017) ²⁴
Loan interest rate (<i>i</i>)	10%	Conservative estimate	Standard assumption
Lifetime of facility, in years (<i>N</i>)	25	Conservative estimate	Standard assumption

For a discussion of the limitations and uncertainties with this model, see Irwin et al. 2017.

^{vi} The three overdose deaths figure is half of the prediction for Baltimore, which has a significantly higher overdose death rate, but significantly higher than for San Francisco, where PWID overdose death has been practically eliminated by naloxone availability and education, as well as Good Samaritan Laws. SCS sites also prevent medical complications from nonfatal overdose, which carry enormous

ambulance, emergency room, and hospital costs that were not included in this analysis.

^{vii} While we predict that a single SCS facility could bring about 120 people into treatment per year, currently Denver's treatment infrastructure does not have the capacity to intake such a large number of people.

Benefits of Operating the Facility

HIV and HCV savings

We base our HIV and HCV prevention estimates on the finding that Insite reduced SCS client syringe-sharing by 70 percent.²⁵ We use an epidemiological “circulation theory” model, developed to assess the impact of syringe exchange, to evaluate how the 70 percent syringe-sharing reduction would reduce HIV and HCV transmission. Our approach uses the same model as Irwin et al. (2017)’s cost-benefit analysis of a potential SCS facility in Baltimore:²⁶

$$I_{HIV} = iNsd[1 - (1 - qt)^M]$$

and

$$s_{post} = s_{pre} \frac{(T - N) + (1 - n)N}{T}$$

For the variable definitions and Denver data, see Tables 3 and 4 below.

Table 3. Values, notes and sources for variables used to predict HIV infection reduction savings

Variable	Value	Note	Source
Proportion of PWID HIV- (<i>I</i>)	94%		Denver Public Health (2014) ²⁷
Number of syringes in circulation (<i>N</i>)	1,052,903		Raville (2017) ²⁸
Percent PWID shared syringes in past year	35.5%	Converted to per-injection value (<i>s</i>) by comparing to 15.1% in San Francisco	Denver Public Health (2014) ²⁹
Rate of syringe sharing (<i>s</i>)	2.58%	Percent of injections with a syringe already used by another person	Calculated using SF data from Bluthenthal et al (2015) ³⁰
Percentage of syringes not bleached (<i>d</i>)	100%		Bluthenthal et al. (2015) ³¹
Proportion of PWID HIV+ and infectious (<i>q</i>)	1.8%	70% of HIV+ PWID are virally suppressed	Rowan (2017) ³²
Probability of HIV infections from a single injection (<i>l</i>)	0.67%		Kaplan and O’Keefe (1993) ³³ ; Kwon et al. (2012) ³⁴
Number of sharing partners (<i>m</i>)	1.4	HRAC Intake data	Raville (2017) ³⁵
SIF client reduction in syringe-sharing (<i>n</i>)	70%	From Insite	Kerr et al. (2005) ³⁶
Number of SIF clients (<i>N</i>)	2,100	Approximate monthly unique Insite injection room clients	Maynard (2017) ³⁷
PWID population (<i>T</i>)	7,500	Estimated using HRAC registration, Denver metro area estimate	Raville (2017) ³⁸ ; Tempalski et al. (2008) ³⁹
Lifetime HIV treatment cost	\$408,000	National data	CDC (2015) ⁴⁰
Cross-check: New HIV infections among PWID	16	Excluding MSM-IDU	Raville (2017) ⁴¹

Table 4. Values, notes and sources for variables used to predict HCV infection reduction

Variable	Value	Note	Source
Proportion of PWID HCV- (<i>I</i>)	49%		CDPHE (2017) ⁴²
Number of syringes in circulation (<i>N</i>)	1,052,903		Raville (2017) ⁴³
Percent PWID shared syringes in past year	35.5%	Converted to per-injection value (<i>s</i>) by comparing to 15.1% in San Francisco	Denver Public Health (2014) ⁴⁴
Rate of syringe sharing (<i>s</i>)	2.58%	Percent of injections with a syringe already used by another person	Calculated using SF data from Bluthenthal et al (2015) ⁴⁵
Percentage of syringes not bleached (<i>d</i>)	100%		Bluthenthal et al. (2015) ⁴⁶
Proportion of PWID HCV+ (<i>q</i>)	51%	See p12	Denver Public Health (2014) ⁴⁷
Probability of HCV infections from a single injection (<i>l</i>)	3%		Kaplan and O'Keefe (1993) ⁴⁸ ; Kwon et al. (2012) ⁴⁹
Number of sharing partners (<i>m</i>)	1.4	HRAC Intake data	Raville (2017) ⁵⁰
SIF client reduction in syringe - sharing (<i>n</i>)	70%	From Insite	Kerr et al. (2005) ⁵¹
Number of SIF clients (<i>N</i>)	2,100	Approximate monthly unique Insite injection room clients	Maynard (2017) ⁵²
PWID population (<i>T</i>)	7,500	Estimated using HRAC registration, Denver metro area estimate	Raville (2017) ⁵³ ; Tempalski et al. (2008) ⁵⁴
Lifetime HCV treatment cost	\$68,200	Adjusted for inflation	Razavi et al. (2013) ⁵⁵
Cross-check: New HCV infections among PWID	359	Adjusted the 617 total since 58% are PWID	CDPHE (2017) ⁵⁶

We cross-checked the model by comparing its predictions for total HIV and HCV incidence to actual HIV and HCV incidence data. Since actual incidence exceeded our model's predictions (16 to 4 for HIV and 359 to 284 for HCV), we believe that our estimates are quite conservative, and that actual prevention would likely be higher. For a discussion of the limitations and uncertainties with this model, see Irwin et al. 2017.

Skin and soft-tissue infection savings

Our calculation relies on the finding by Lloyd-Smith et al (2010) that the hospital stays of patients referred by the Insite SCS facility were on average 67% shorter than those not referred by Insite.⁵⁷ We use the model from Irwin et al. (2017):

$$S_{SSTI} = NhLrC$$

For the variable definitions and Denver data, see Table 5 below.

Importantly, we were able to generate new data on the hospitalization rate, cost, and length of stay for Denver PWID admitted to the hospital for SSTI. Following the methodology of Lloyd-Smith et al. (2010), we identified all Denver County hospital admissions that included ICD-10 codes for both SSTI and drug abuse. We believe that this approach yields a conservative estimate, since hospitals often admit PWID for SSTI without including a drug abuse code in the file, excluding those cases from the analysis.

Table 5. Values, notes and sources for variables used to predict skin and soft-tissue infection reduction savings

Variable	Value	Note	Source
Number of SIF clients (N)	2,100	Approximate monthly unique Insite injection room clients	Maynard (2017) ⁵⁸
Hospitalization rate for skin and soft-tissue infection (h)	6.49%	Denver hospital data analysis using ICD-10 codes	Smith (2017) ⁵⁹
Average length of skin infection-related hospital stay for PWID (L)	5.06 days	Denver hospital data analysis using ICD-10 codes	Smith (2017) ⁶⁰
Reduction in soft-tissue and skin infection for PWID that visit SIF (r)	67%	From Insite	Lloyd-Smith et al. (2010) ⁶¹
Average hospital cost per day (C)	\$6,090	Denver hospital data analysis using ICD-10 codes	Smith (2017) ⁶²

For a discussion of the limitations and uncertainties with this model, see Irwin et al. 2017.

Averted Overdose Deaths

Methodology:

Since medical staff revive anyone who overdoses in a SCS facility, we expect that the share of the city's overdose deaths prevented by the SUS would be the same as the share of citywide injections taking place inside the facility. We follow the overdose prevention model that Irwin et al. (2016) used for San Francisco⁶³ and the financial valuation approach that Irwin et al. (2017) used for Baltimore:

$$S_o = \frac{I}{PN} DV$$

and

$$V = \sum_{n=1}^{30} \frac{W}{(1+r)^n}$$

For the variable definitions and Denver data, see Table 6 below.

Table 6. Values, notes and sources for variables used to predict savings from averted overdose deaths

Variable	Value	Note	Source
Total annual injections in the SIF (<i>I</i>)	213,621	Based on Insite capacity and use	Health Canada (2008) ⁶⁴ ; Milloy et al. (2008) ⁶⁵
PWID Population (<i>I</i>)	7,500	Estimated using HRAC registration, Denver metro area estimate	Raville (2017) ⁶⁶ ; Tempalski et al. (2008) ⁶⁷
Average number of injections per person per year (<i>N</i>)	508.8		Bluthenthal et al. (2015) ⁶⁸
Annual heroin overdose deaths (<i>D</i>)	50	2016 heroin overdose deaths	Raville (2017) ⁶⁹
Estimated value per death averted (<i>V</i>)	\$475,311		Calculated using the below variables:
Average years until retirement (<i>n</i>)	30	Average age 35, retirement age 65	Genberg et al. (2011) ⁷⁰
Poverty line annual wage (<i>W</i>)	\$24,250	Federal data	DHHS (2015) ⁷¹
Discount rate (<i>r</i>)	3%		Andresen & Boyd (2010) ⁷²

For a discussion of the limitations and uncertainties with this model, see Irwin et al. 2016.

Medication-Assisted Treatment Savings

Studies of Vancouver’s Insite show that SCS users are significantly more likely than non-SCS-users to accept referrals to medication-assisted treatment (MAT).⁷³ As a result, we base our analysis of treatment savings on a finding from Sydney, Australia’s Medically Supervised Injecting Centre (MSIC) that 5.8% of SCS users accepted MAT referrals per year.⁷⁴ MAT programs, principally methadone and buprenorphine maintenance, have been shown to reduce patients’ health care needs and criminal activity, as well their drug and alcohol use.⁷⁵ Studies estimate that they save taxpayers \$4 to \$13 for every \$1 spent, mostly by reducing users’ criminal activity to get money to buy drugs.⁷⁶ We estimate the financial benefits of SUS referrals to MAT programs, considering both health care and crime savings, according to the model

$$S_{MAT} = Nr(b - 1)T$$

For the variable definitions and Denver data, see Table 7 below.

Table 7. Sources for variables used to predict savings from medication-assisted treatment referrals

Variable	Value	Note	Source
Number of SIF clients (N)	2,100	Approximate monthly unique Insite injection room clients	Maynard (2017) ⁷⁷
Percent of SIF users who access MAT as a result of SIF referrals (r)	5.78%	From MSIC	MSIC (2003) ⁷⁸
Treatment retention factor (f)	50%	General retention rate estimated at 60-90%	CSAM (2011) ⁷⁹
Cost-benefit ratio for MAT (b)	4.5	Conservative: average of low estimates	CHPDM (2007) ⁸⁰ ; Gerstein (1994) ⁸¹
Average cost of one year of MAT (T)	\$3,000	Conservative: average of low estimates	Jones et al. (2009) ⁸²

For a discussion of the limitations and uncertainties with this model, see Irwin et al. 2017.

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