

Research Article

A Cost Analysis of Overdose Management at a Supervised Consumption Site in Calgary, Canada

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Background and Aims: We report on a cost study, using population level data to determine the impact of emergency overdose management at supervised consumption services (SCS) versus conventional services.

Design: We completed a cost analysis from a payer's perspective. In this setting, there is a single-payer model of service delivery.

Setting: In Calgary, 'Safeworks Harm Reduction Program,' was established in late 2017 and offers 24/7 access to SCS. The facility is a nurse-led service, available for client drop-in. We conducted a cost analysis for the entire duration of the program. This covers two years and three months.

Measurements: We assessed costs using the following factors, using government health databases: monthly operational costs of providing services for drug consumption, cost of providing EMS for clients with overdoses who could not be revived at the facility, and benefit of EMS costs averted from overdoses that were successfully managed at the SCS.

Findings: The proportion of clients who have overdosed at the SCS has decreased steadily for the duration of the program. The number of overdoses that can be managed on site at the SCS has trended upward, currently 98%. Each overdose that is managed at the SCS produces approximately \$1,600 CAD in cost savings, with a savings of over \$2.3 million for the lifetime of the program.

Conclusions: Overdose management at an SCS creates cost savings by offsetting costs required for managing overdoses using emergency services.

Introduction

Supervised consumption services (SCS) are a harm reduction intervention to provide a sanctioned area for clients to use illicit substances, under medical supervision, without criminalization (1). A primary aim of SCS is overdose prevention and SCS are widely accepted as decreasing fatal accidental overdoses (2). SCS in Canada began with the creation of Insite in Vancouver in 2003 (1). Before SCS were introduced, conventional services, including ambulance response and emergency departments, are used to support people with overdoses who need medical attention. There is substantial evidence of the benefits of SCS. Insite, in Vancouver, has been widely studied and demonstrated social and economic benefits across a range of measures (1-6). The cost savings relating to HIV infections alone were enough to offset Insite's operating costs (1, 5). Estimates related to the prevention of Hepatitis C transmission also showed evidence of significant cost savings (1, 4). Proposals for SCS illustrated projected cost effectiveness in Toronto (7), Victoria (8), Ottawa (7, 9), San Francisco (10) and Baltimore (11).

While there are well documented benefits of SCS, studies are limited to a few sites (6). Cost-benefit analyses have tended to focus on HIV prevention or economic benefit of prevented deaths, without including other aspects of the SCS programs (6). There are also challenges in evaluating cost benefits. Clients at SCS may not be required to provide personal health numbers or identifying information, to avoid potential criminalization. However, SCS do collect population level data about service use. Our cost analysis study overcomes these limitations by evaluating the population level benefit of decreased use of emergency services, at an SCS site that has not been previously reported in the literature. In this article, we use population level data in a cost analysis, to determine the impact of emergency overdose management at SCS versus conventional services. Please note that all currencies are reported in Canadian dollars. At time of writing, \$1 CAD = £0.59 GBP.

Methods

Overdose management was the point of analysis in this study. Overdose (OD) management in this study is defined as the application of a medical intervention to a client who is not rousable, following consumption of an illicit substance. This includes application of oxygen, administration of naloxone, or calling Emergency Medical Services (EMS). Verbally rousing the client, or a client with a 'heavy nod' were excluded from definitions of overdose in this study, limiting the definition of overdose to objectively verifiable information. Oxygen is considered a medical intervention, because the primary cause of overdose related death is hypoxia (12).

Research Site

In Calgary, a large city in Canada, 'Safeworks Harm Reduction Program,' was established in late 2017 and offers 24/7 access to SCS (13). The facility is a nurse-led service, available for client drop-in. Registered Nurses are always available to reverse an overdose or resuscitate a client. The nurses are equipped to administer oxygen and naloxone, if needed. We conducted a cost analysis for the entire duration of the program. This covers two years and three since the service began.

Study Design

This cost analysis was completed from a payer's perspective. A payer in this study refers to the entity (provincial government) providing funding to run the service. The following factors were chosen based on the availability of data to evaluate the cost effectiveness of the site: monthly operational costs of providing service for drug consumption, cost of providing EMS for clients with overdoses who could not be revived at the facility, and benefit of EMS costs averted from overdoses that were successfully managed at the SCS.

Data

Overdose data was extracted from the monthly, publicly available Government opioid reports (14-16) for the months of November 2017 to January 2020. Some data was imputed, and the methodology is provided in Appendix A.

Analytic methods

We computed descriptive statistics for the dataset. In addition, we examined the trend in the number of clients who overdosed at the SCS site. To develop an accurate visualization of the data, we have calculated a percentage for the number of overdoses for each month per number of total visits for drug consumption to the SCS, illustrating an overall trend line for overdose rates.

Costs

The costs were divided into two categories: 1) operating costs for providing services at the SCS and 2) cost of EMS for clients who overdosed at the site but required additional intervention.

Operating Costs at the SCS site

The first component of the analysis comprised of the operating costs at SCS site. A recent study (13) by the government of Alberta reports that the average cost per visit for drug consumption is \$62.19. The operating cost at the SCS was calculated by employing the following formula:

$$OC = NDC (\$62.19)$$

Where, OC is the total operating cost and NDC is the number visits to the site for drug consumption each month, from November 2017 to January 2020. This calculation provided the total monthly cost at this site.

Cost of EMS for Overdoses

The second part of this analysis was the cost of EMS for clients who could not be revived at the SCS site after an overdose. This cost was calculated by employing the following formula:

$$EMSC = \{(TOD) (\$385)\} + \{(TOD) (\$1,061 + \$176)\}$$

Where, EMSC is the total cost of clients needing EMS and TOD is the total number of clients with overdoses taken to EMS for each year. The transport cost of utilizing an ambulance is \$385 (17) per use.

The cost for an emergency visit for residents of Alberta, Canada is \$ 1,061. We used the Comprehensive Ambulatory Classification System (18) grouping methodology resource intensity weight (RIW) and cost of standard hospital stay from the Alberta Health Services to calculate an average cost of an emergency visit due to an overdose. Specific codes for RIW were B184 (Poisoning without Intervention), B204 (Trauma High Resource Intervention), B217 (Trauma with Acute Admission/Transfer without High Resource Intervention), B224 (Trauma with Moderate Intervention) and B234 (Poisoning with Minor Intervention).

The cost of physician fees per emergency visit lasting 45 minutes is \$176 (19) .

Benefits

Calgary's SCS site has not experienced a single overdose related death since its inception, as reported by Alberta Health Services (13). Therefore, we assume that EMS costs are averted due to efficient handling of overdoses at the site.

Benefit from Overdose EMS Averted

The benefits of managing overdoses at the SCS, without EMS, is calculated by the formula:

$$EMSAB = \{(TODA) (\$385)\} + \{(TODA) (\$1,061 + \$176)\}$$

Where, EMSAB is the total benefit from overdose related EMS averted and TODA is the total number of overdoses averted for each year.

Total Benefit, Net Savings, Benefit–Cost Ratios and Cost Effectiveness Ratios

We added the values for overdose EMS costs that were averted to determine the total benefits of overdose management at the SCS.

Results

Preliminary Analysis

Table 1 shows descriptive statistics, including the number of clients, proportion of visits used for drug consumption and referrals for other social services, total number of overdoses, and other related outcomes.

Table 1: Drug Consumption Site Summary Statistics at an SCS site in Calgary, Canada

Population Outcomes

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Population Outcomes	2017* ¹		2018		2019		2020* ²	
	n	%	n	%	n	%	n	%
Number of unique clients	540		7970		12645		1270	
Total number of visits	2551	100%	51791	100%	69028	100%	6623	100%
Visits used for drug consumption	2108	83%	42386	82%	58629	85%	5994	91%
Visits for referrals to other services	70	3%	329	1%	1969	3%	153	2%
Total overdoses (ODs)	55	100%	716	100%	727	100%	47	100%
ODs provided oxygen	35	64%	543	76%	714	98%	46	98%
ODs provided naloxone	20	36%	338	47%	312	43%	13	28%
OD EMS	6	11%	51	7%	29	4%	1	2%
OD EMS averted	49	89%	665	93%	698	96%	46	98%

2017*¹-November and December data

2020*²- January data

Figure

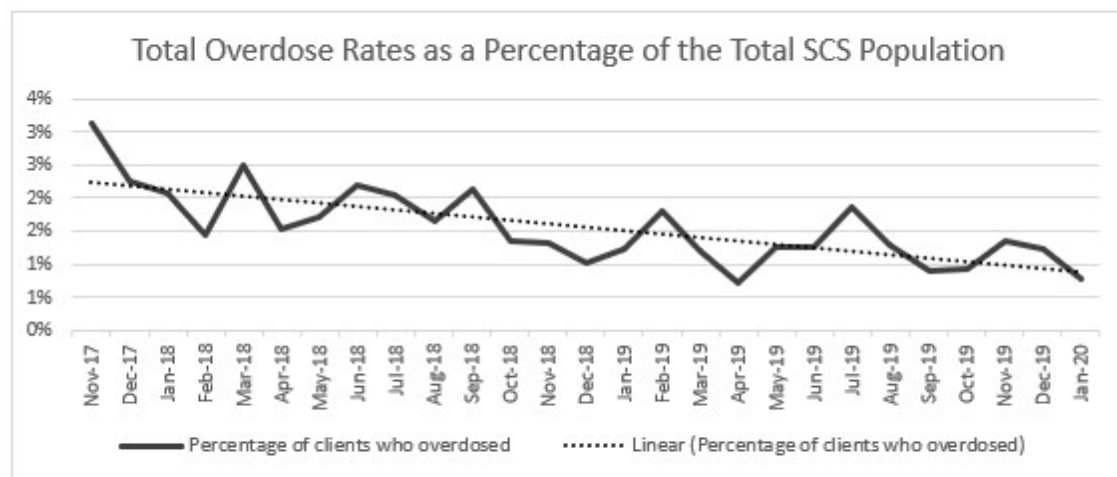
The proportion of visits for drug consumption has increased over time, but it is notable that nearly 10% of clients who have accessed the SCS between 2017 and 2020 are not doing so for drug consumption. This finding reinforces the role of the SCS in providing ancillary services, including referrals and wound care. The overall population for drug use at the SCS has increased, while the need for EMS has decreased over time. Presently, 98% of overdoses are managed on site. This rate has increased steadily since the opening of the SCS. In the most recent full year of operation (2019), 698 overdoses were managed at the SCS, thus avoiding EMS calls.

Overdose trends

The data shows that the number of overdoses at the site have been increasing over time. However, the number of visits for drug consumption have also increased over time. The linear trend line in Figure 1 shows that the percentage of overdoses declined between November 2017 to January 2020.

Figure 1: Trend analysis of overdoses over the period of Supervised Consumption Site utilization

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2017*1-November and December data, 2020*2- January data

Figure

Costs

The total costs, which includes the cost of operating the SCS site and the cost of EMS for overdoses, ranged approximately from \$70,000 to \$374,00 per month for November 2017 and January 2020. The annual cost for the most recent full year of operation (2019) was \$3.7 million. Table 2 provides the total annual and monthly costs. Costs have increased over time, which reflects a corresponding increase in service use.

Benefits

Benefit from Overdose EMS Averted

Each overdose that is managed at the SCS produced a benefit of \$1622 for January 2020. The benefit of averting the cost of an EMS visit ranges approximately between \$39,000 and \$94,000 per month, from November 2017 to January 2020. Table 2 provides the total annual and monthly benefits.

Table 2: Total costs and EMS averted Benefits for the SCS site

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Year	Operating Costs	Cost of OD EMS	Average Total Cost (Monthly)	Total Cost (Annual)	Average EMS Benefits (Monthly)	EMS Benefits (Annual)
2017* ¹	\$131,097	\$9,732	\$70,414	\$140,829	\$39,739	\$79,478
2018	\$2,635,985	\$82,722	\$226,559	\$2,718,707	\$89,886	\$1,078,630
2019	\$3,646,138	\$47,038	\$307,765	\$3,693,176	\$94,346	\$1,132,156
2020* ²	\$372,767	\$1,622	\$374,389	\$374,389	\$74,612	\$74,612

2017*¹-November and December data, 2020*²- January data

Figure

Overall, there were \$2,364,876 cost savings produced from the overdoses that were managed at the SCS, by avoiding the need for EMS, for the life of the program to date. These costs use the minimum billing fee for the payer and exclude overdose related hospitalization costs, and thus, likely underestimate total costs saved.

Discussion

This study focuses on a harm reduction service that is part of a complement of programs to address substance misuse, in the context of an opioid crisis. Our study demonstrates that SCS can be justified in part by their benefits in managing overdoses. The declining trend of overdoses indicates the effectiveness of the program in preventing overdoses, as well as managing them. A reduction in the number of overdoses would result in lowering the rate of overdose related deaths and saving more lives, which adds value to the economy and society.

The cost savings of overdose management at the SCS, although substantial, were not sufficient to offset the operating cost of the program. However, this study examined only one aspect of the SCS's potential cost benefits. Several authors found significant cost savings associated with reduced needle sharing at SCS sites (1, 3). It is likely that the total cost of this SCS could be offset if additional variables were examined. There is potential for further analysis in future studies.

We predict there are secondary benefits, as our study demonstrated that the SCS prevents approximately 700 calls to EMS per year. In addition to the cost savings, it is reasonable to project that

other people may be able to access ambulance or emergency department care more quickly, with fewer overdose-related calls for EMS. It has long been known that wait times are a primary determinant of patient satisfaction in emergency departments (20). The SCS in this study prevented notable numbers of patients attending emergency departments each year, which is especially important during COVID-19, where health services are under considerable strain.

Additionally, the SCS site also provides ancillary services, such as referrals for housing. There may be economic and social benefits from clients receiving such additional services, which they may have difficulty accessing elsewhere. Future studies can evaluate the cost benefits of SCS staff supporting clients to access housing and other supportive services.

The methodology employed in this study may be applied to evaluate SCS sites at other locations. Overdose management has been considered in prospective cost analyses (7-11) but we have not found other published examples of this analysis with operating SCS.

This study was conducted using available data since the inception of the SCS site in late 2017. Some missing data had to be inferred from similar studies conducted in other provinces and countries. Given the limitations of the anonymous service in this study, more in-depth data on hospitalization and other social service referrals also could not be obtained. Future studies could explore other ways to measure cost-benefit without identifying information from clients.

The study does not employ an economic evaluation methodology due to time and data restrictions. The SCS site is currently under review and have been assigned limited time to present evidence of cost evaluation. As a result, the scope and underlying methodologies are brief and allow limited analysis. Moreover, due to the COVID-19 pandemic, movements are restricted, rendering it infeasible to conduct primary surveys.

This analysis demonstrates the need to conduct economic evaluations of SCS sites. Literature on SCS widely documents the direct benefits of reduced HIV and Hepatitis C infections, skin and soft-tissue infections, economic benefits of overdose related deaths prevented and the indirect benefits of social service referrals; adding these factors to overdose management will improve the analysis.

Conclusion

In this study, we identified notable cost savings produced through overdose management at SCS. This reduced the reliance on emergency services. In addition, the number of overdoses at the SCS has

decreased. The SCS thus offers direct savings, and secondary benefits from fewer visits to emergency departments. Future studies could explore these benefits in more depth.

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