



## **Supervisory Committee**

Supervised Injecting Facility. A causal model design and analysis.

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## Abstract

This project develops and analyzes the causal model diagram of the supervised injection facility (SIF). The outcomes of the research project support AIDS Vancouver Island (AVI) in the implementation of the SIF in Victoria. The project provides data on (1) mortality rates; (2) the additional services provided for clients, including budget considerations; and (3) crime rates. This research study reviews literature from 27 academic papers, government reports, and web pages worldwide. It identifies eight domains of knowledge: (1) overdose deaths; (2) provision of services; (3) crime reports; (4) budget; (5) metrics; (6) workflow; (7) eHealth applications; and (8) ethics. Analysis of the domains is conducted via a fuzzy quantitative software. The outcomes from this software explain that all domains of knowledge are a SIF subset, and explain the SIF by themselves. Through deep analysis of the literature, the variable relationships support generating the causal dynamic model, describing SIF behavior, identifying how SIF variables interact and impact the operations of the SIF as a network. The balance loop manages the number of patients by decreasing their numbers when they stop drug injecting for 6 months after initial drug counseling, and reinforce loops shows patient numbers increase exponentially. There is a lack of e-health solutions, such as electronic medical records (EMR), which negatively impacts clients' healthcare. It is recommended to continue this research study with quantitative analysis, coding the causal diagram into stocks, programming in a simulation software package (e.g. iThink Stella), forecasting SIF operations, and supporting the SIF implementation in Victoria, BC.

**Keywords:** Supervised Injection Facility, SIF, Drug Consumption Room, DCR, Causal loop diagram, system dynamics, comprehensive literature review, table of truth, Fuzzy-Set / Qualitative comparative analysis (fsQCA) software, balance loop, reinforce loop.

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## Section I. Introduction

With objectives in public health and public order, DCRs [drug consumption rooms] operate within a triangle of individual and public health interests and the public order interests of local communities. More than many other public services, they rely on acceptance by a wide range of key actors: drug users, communities, other health and social agencies, police and politicians. (Rhodes & Hedrich, 2010, pp. 307).

This study focuses on supervised injection facility (SIF) operations, providing services for clients, crime reports, workflow, metrics, and e-health applications existing in the SIF, and managing overdose events to reduce overdose deaths. This study does not intend to discuss government approval to make the operations of the SIF available.

The SIF research project answers the following research question: How does the supervised injection facility affect (a) the reduction or elimination of mortalities due to overdose, (b) services provision, and (c) the reduction in neighborhood crime reports?

The SIF research project manages the following positive outcomes: (1) reduction of mortality rates; (2) the services provision, which offers self-injecting training for consumers and detoxification services, and connects consumers to the healthcare system; and (3) significant reduction in visible drug consumption because clients will use SIF, not public spaces; also the number of violent events will be reduced because clients have less stress compared to using drugs on the street and facing police non-compliance.

*Why is this important?* The value of this project provides data on (1) mortality rates; (2) the additional services provided for clients, including budget considerations; and (3) crime rates. The project will develop a causal model of the positive outcomes of the implementation of SIF.

The outcomes of the research project support regional health authorities in implementing a supervised injection facility in Victoria.

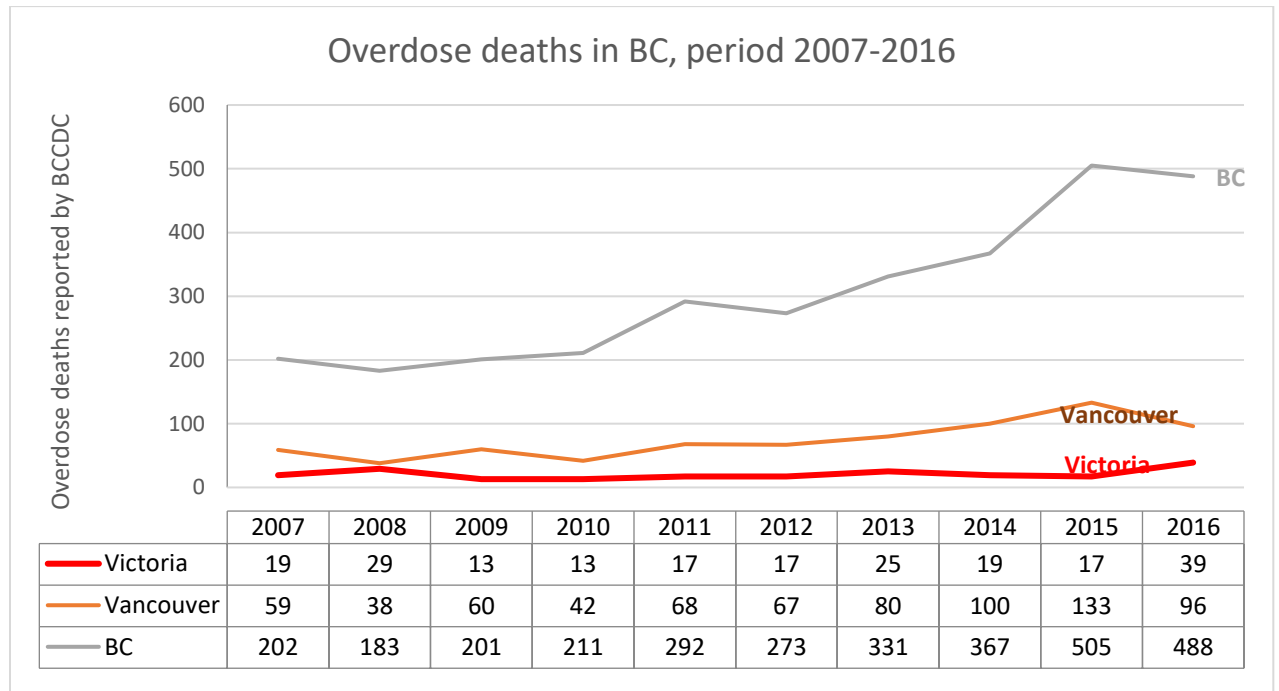
In British Columbia, there were 484 reported overdose deaths in 2015, and 488 deaths in first quarter 2016. Figure 1 illustrates the overdosed deaths from 2007 to 2016 in Victoria, Vancouver, and BC province as a whole. Overdosed deaths in Victoria in the eight months of 2016 were 39 cases, greater than the total cases in 2015 (17). The SIF in Vancouver reported 1,114 overdose incidents from 2004 to 2010 with zero deaths, demonstrating that staff are able to intervene each time (Vancouver Coastal Health Authority, 2016). Consequently, overdose deaths in Vancouver occurred outside the facility. Additionally, Vancouver Coastal Health Authority reported a 35% decrease in overdoses at the InSite program and 9% over the city. Figure 1 shows overdose deaths in Victoria, Vancouver, and BC (BC CDC, 2016). There has been warning overdose alerts in Victoria, Kelowna, and in the Interior Health Authority. It is expected that fatalities will reach 800 by the end of 2016 (CBC 2016).

Drug consumption room (DCR, called in Europe), medically supervised injection center (MSIC, called in Australia), or supervised injection center (SIF, called in Canada) are challenged by multiple factors, including the repression focused on the approach to drug control instead of developing strategies for health policy reforms (Fisher, Murphy, Rudzinsky, & McPherson, 2016). DCRs do not accept illegal drug consumption as a depravity. Instead, DCRs provide alternatives for drug users, reducing overdose deaths, and connecting clients to the healthcare system (De Yong & Webber, 1999). Furthermore, DCRs ensure survival for drug addicts and medical care for emergency cases, such as reducing overdose fatalities, providing supportive rehabilitation oriented care, increasing access to health and addiction care, utilizing drug consumption rooms for clients who meet specific criteria, preventing drug related criminal activities in the areas



surrounding the facility, improving public order, and complying with the Narcotics Act and international drug treaties (Environmental and Social Research Universitätsstr, 2003; Health Canada, 2016).

Figure 1. Overdose deaths in Victoria, Vancouver, and BC, from 2007 to 2016. Source BC CDC (2016)



This paper is organized into four sections. Section I introduces the topic and the organization of information. In Section II, the literature review describes the methodology in extracting data from 27 papers. The methodology includes five processes starting with explaining the inclusion and exclusion criteria. As a second data analysis, from all papers extracting data, making connections to categories or themes, and finally to eight domains of knowledge (see Attachment 1). As a third analysis, each domain of knowledge is explained, identifying paragraphs or sentences are extracted from each paper which describe the behavior of one variable impacting the result of another variable, thereby seeing the SIF as a network (Anderson & Aydin, 2005). It includes the analysis of the table of truth (see table 5) describing which papers explain which domains of knowledge. As a fourth process in analyzing the literature, the fuzzy

comparative analysis software developed by Ragin and Davey (2008) provides outcomes, such as the solution coverage and consistency demonstrating the eight domains of knowledge that are a subset of the SIF and explaining the SIF operations. As a fifth process included in Section III graphs, analyzes, and discusses the causal loop diagram, identifying balance loops and reinforce loops. Finally, Section IV concludes and makes recommendations.

Seeing DCRs, SIFs, or MSCRs as a component in managing drug consumption not only as drug injecting places promoting users' connections to medical care and public order, but also reducing crime reports. Doing this, SIF builds a bridge connecting key marginalized populations from the streets to the healthcare delivery system including detoxification and addiction treatment (Health Canada, 2016).

## Section II. Comprehensive Literature Review

Drug consumption rooms (DCRs) are challenged with multiple factors. They do not accept illegal drug consumption as a depravity. DCRs provide alternatives for drug users to reduce overdose deaths and connect them to the healthcare system (De Yong & Webber, 1999). This section includes the analysis of Onwuegbuzie and Frels' (2016) literature review analysis: paper topic and strategies are collected from academic databases and gray literature, country and year of research origin, domain analysis, advance quantitative themes analysis, and variables relationships allowing graphing and connecting to the causal diagram network (Anderson & Aydin, 2005).

This literature review follows the comprehensive review proposed by Onwuegbuzie and Frels (2016), the domain analysis proposed by Spradley (1979), and integration proposed by Torraco (2005). Additionally, this literature review integrates the qualitative and quantitative research methods applied to global SIFs in Australia, Canada, and Europe. Moreover, this literature review analyzes and integrates data from all academic and government papers.

### **Data collection methodology**

This methodology includes five processes. The first process describes the inclusion and exclusion criteria for all databases used. The second process deconstructs 27 academic points using several data elements: author, year, title of the paper, research methodology (contains 10 fields), major points, discussion, recommendations, categories/domains, and retrieved from information. The analysis among major points, conclusions, and recommendations is derived from examining the descriptions in the text or the graphs in each paper as a way for the researcher to communicate the meaning of the topic in the discussion (Onwuegbuzie & Frels, 2016). This examining step results in the identification of the eight domains of knowledge (see Attachment 1). Thus, one paper can have more than one domain of knowledge.

As a third process, each domain of knowledge is then analyzed by looking at the literature descriptions or narratives at how one variable increases, decreases, or has no impact on other variables (see Attachment 2). The researcher searches for specific words, such as increase, decrease, or no impact, and then identifies which variables are under discussion. Additionally, the researcher translates the relationships found into an Excel spreadsheet (see Attachment 2). In the fourth process, a fuzzy comparative analysis software is performed. This software was developed by Ragin and Davey (2008). For this study, two variables are considered: (a) the solution coverage and (b) the consistency coverage. Those values show that each domain of knowledge found is a subset of the SIF, and together they explain by themselves the SIF operations. Finally, as a fifth process, the relationships found in the third process (see Attachment 2) are translated into a causal loop diagram, graphing the inter-relationship found. The following subsections describe each process.

**Process 1: Inclusion and exclusion criteria.** This literature review creates a perspective of knowledge focusing on categories extracted from 27 academic papers. The inclusion and exclusion criteria contain the following terms: MeshTerm = Supervised injection service; OR MeshTerm = Safer injection facility; OR MeshTerm = Supervised injecting center; OR MeshTerm = Drug consumption room; OR MeshTerm = Drug consumption facility; OR MeshTerm = Injection drug user. These criteria were implemented in PUBMED and Web of Science. Originally, 1895 papers were detected, and then only those with a peer review, full text and research place in Europe, Australia or Canada, resulting in 10 papers in PUBMED. Three of them were discarded because they did not explain services related to SIF (Cox et al. (2013); Papalepu et al. (2009); & Wood et al. (2004a), leaving seven papers in PUBMED. During the analysis phase, a new paper was included that helped understand the reason for injecting drug cessation programs

in Vancouver, proposed by DeBeck, Kerr, Bird, Zhang, Marsh, Tyndall, Montaner, and Wood (2011), finally resulting in a total of eight PUBMED papers.

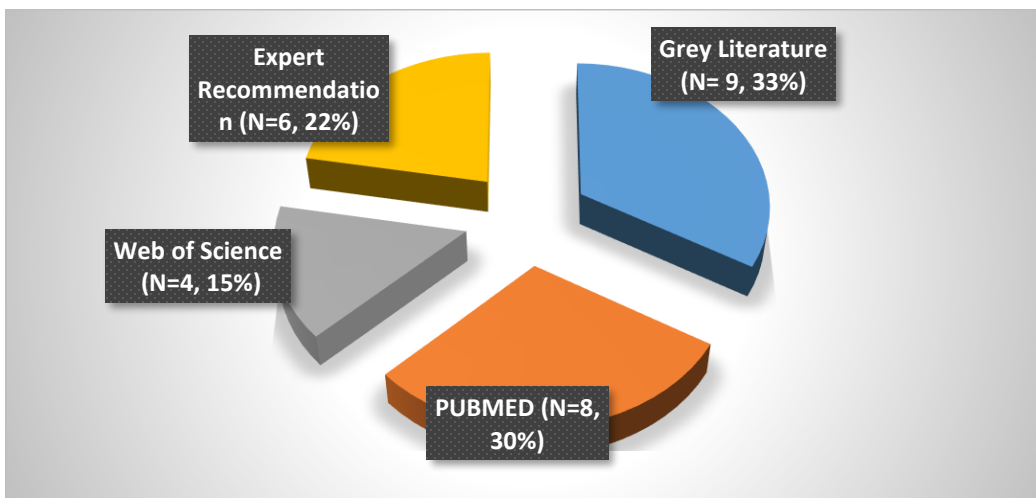
In the Web of Science database, the strategy used was looking for the same topics as PUBMED. The number of papers found were 20, and only five papers were specifically related to supervise injection facilities; the remaining articles were associated with drug user programs and needle exchange programs. One paper from Web of Science was discarded because it was not related to SIF, leaving four papers. During the first review of this project, six papers were included, by expert recommendation from Dr. Scott Macdonald.

From gray literature, such as Google Scholar, nine government reports were found from the Ministries of Health in Canada, Australia, and Germany; the International Drug Consumption Room web site; the Canada Drug Use Report; Center for Addiction Research British Columbia (CARBC) feasibility study; and Independent Work Group. Government reports provide a robust description of services; community and police interactions; managing zero overdose deaths; and SIF operations, workflow, metrics, and budget required (Environmental and Social Research Universitätsstr, 2003; Health Canada, 2016; NSW National Centre in HIV Epidemiology and Clinical Research, 2007). Additionally, the international website of supervised injection facilities provides SIF origin, objectives, outcomes, staff, and a survey developed in 2014 with relevant information of SIF operations, budgets, and staff. However, it does not include a robust metrics study, workflows, and community/police collaboration projects (International Network of Consumption Rooms, 2016). Figures 2, 3, and 4 describe the papers distributed by source of origin, year of publication, and author's country of origin, respectively.

During the analysis phase, six papers were included by expert recommendation.

The majority of literature was extracted from gray literature (N=9, 33%). Gray literature was accessed from the Ministries of Health from Australia, Canada, and Germany. Additionally, indirect searches obtained literature from Independent Work Group in England, Center of Addiction Research British Columbia, the International Consumption Room web site, and BC Center for Disease Control. The additional databases accessed are PUBMED (N=8, 30%), Web of Science (N=4, 15%), and expert recommendation via google scholar (N=6, 22%) presented several SIF research studies bringing a diverse discussion.

Figure 2. Number of papers per origin of source



Literature managed in this SIF project started in 1999 with two papers bringing 17 years of experience in managing supervised injecting sites around the globe (see Figure 3), 51.85% of all papers (N=14) have been published between 2010 to 2016 (last six years).

Figure 3. Distribution of literature by year of publication

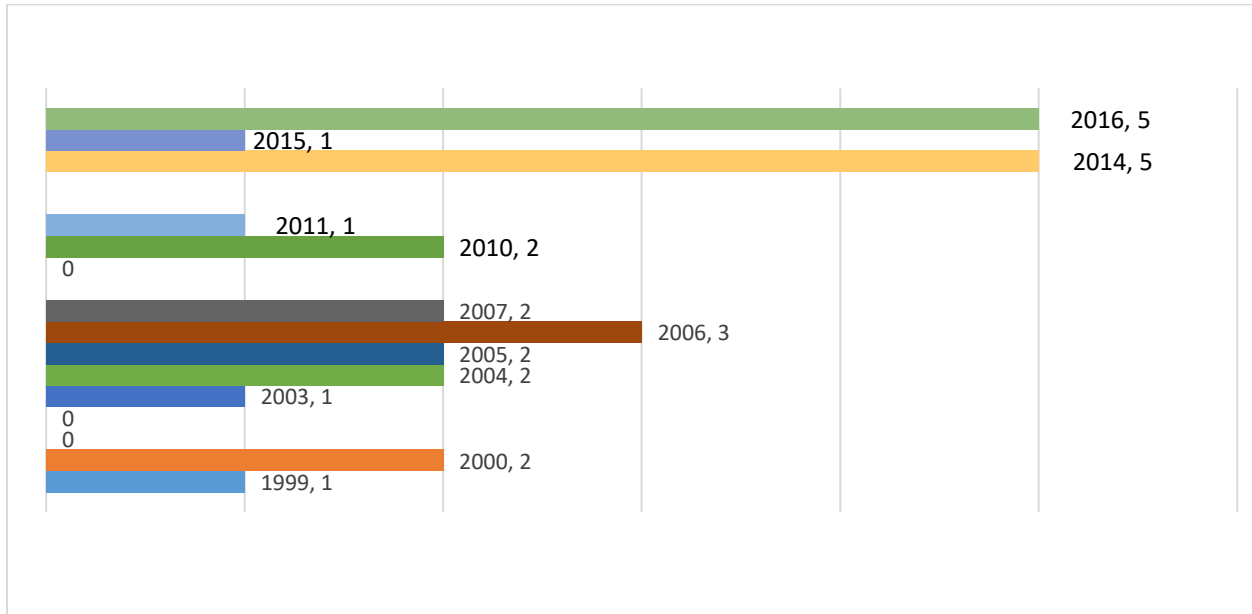


Figure 4. Distribution of papers by authors' country of origin

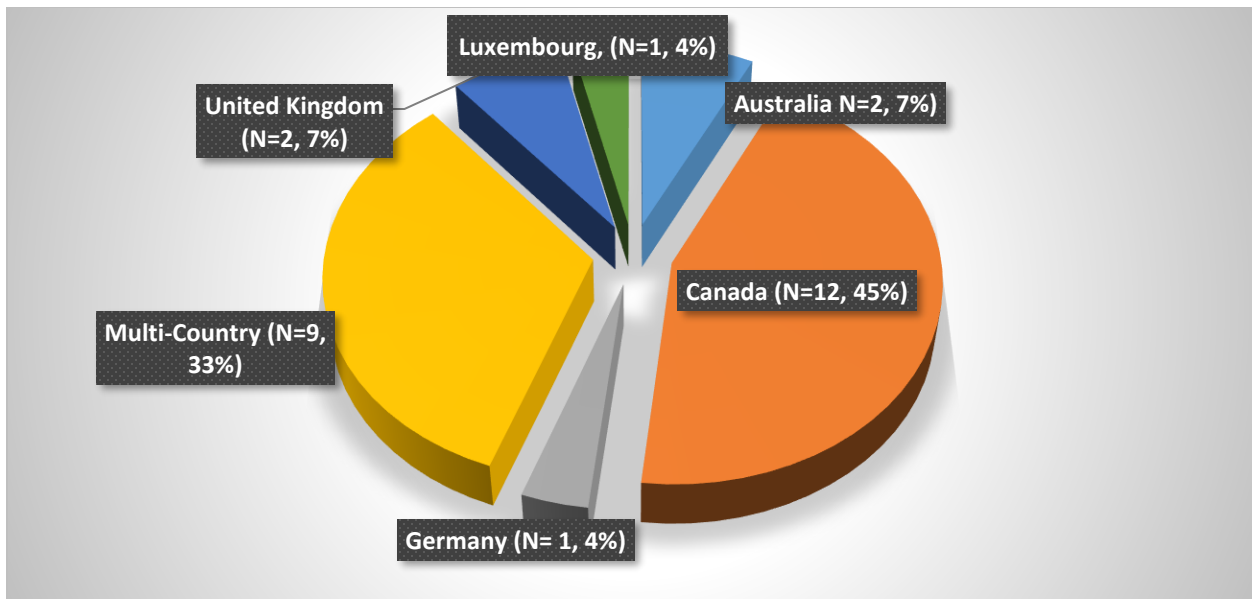


Figure 4 provides a representation of countries researching supervised injecting sites in Australia, Europe, and Canada. There are nine papers that include authors from multiple European countries (Switzerland, The Netherlands, Germany, Spain, and others), Australia, and Canada. The first drug consumption room was established in The Netherlands in 1970 (De Jong

& Webber, 1999). Rhodes & Hedrich (2010) states that “was the first legally sanctioned DCR established in Berne, Switzerland in 1986” (Rhodes & Hedrich, 2010, p. 309). The sites in Sydney, Australia and Vancouver, Canada have more extensive research to obtain government approval based on population health improvement data. Even though European sites were established earlier, their approval processes were not as rigorous as those in Australia and Canada (Wikipedia, 2016). However, all sites worldwide must provide service data, including overdose events and referrals proving they are a gateway for further healthcare service.

**Process 2: Deconstructing all papers in specific fields.** Tables 1 to 4 show major outcomes in the literature review extracted from PUBMED, Web of Science, gray literature, and expert recommendation. Attachment 1 includes all data elements extracted from papers: author, title of the paper, year of publication, country, theoretical framework used (includes 10 fields), major points, implications or summary, conclusions, recommendations, categories/domains, other comments, and retrieved from. For practical purposes, Tables 1 to 4 show only three data elements.

Table 1. Findings on academic papers extracted from PUBMED (N=8)

<b>Authors</b>	<b>Methodological Component</b>	<b>Main outcomes on services</b>
<b>De Beck, Kerr, Bird, Zhang, Marsh, Tyndall, Montaner, and Wood (2011)</b>	Interviews, Cox regression analysis, multi regression analysis.	<i>This study is the first to consider the potential role of SIF in supporting injection cessation. These findings build on previous international analyses demonstrating a link between SIF attendance and entry into detoxification programs (Wood et al., 2006, 2007a; Kimber et al., 2008). The present study provides additional evidence that SIF appear to promote utilization of addiction services and builds on past evaluations to demonstrate that, through this mechanism, they may also lead to increased injecting cessation.</i>
<b>McNeil, Small, Lampkin, Shannon, &amp; Kerr (2014).</b>	Qualitative survey.	<i>SID requires self-injecting member. SIF provides training on safer injection education. Assisted injections accordance with a harm reduction policy.</i>
<b>Portier at al., 2014</b>	Systematic review. Mixed Methods	<p><i>Systematic review on drug treatment, services provided, crime reports.</i></p> <ul style="list-style-type: none"> <li>• 57% start addiction treatment.</li> <li>• 23% stop injecting drugs.</li> <li>• 18% engaged in detoxification programs.</li> </ul> <p><i>Comparing before and after SIF operates:</i></p> <ul style="list-style-type: none"> <li>• daily mean number of PWID injecting in public (4.3, IQR = [4.0–4.3] vs. 2.4 IQR = [1.5–3.0]; p = 0.022).</li> <li>• syringes dropped (11.5, IQR = [7.3–14.3] vs. 5.3, IQR = [3.0–8.0]; p = 0.010), and</li> <li>• injection-related litter (601.7, IQR = [490.0–830.3] vs. 305.3, IQR = [246.3–387.0]; p = 0.014).</li> </ul>



		<p><i>Crime:</i></p> <ul style="list-style-type: none"> <li>• No increase in crime, violence or drug trafficking around the SIF was found after the opening of the SIF.</li> <li>• In Sydney, compared to the other cities, data collected over a period of 10 years also revealed no increase in offenses related to the trafficking or consumption of drugs in the areas that surrounded the SIF.</li> </ul> <p><i>Impact SIF and local PWID:</i></p> <ul style="list-style-type: none"> <li>• There was no increase in the local number of PWID</li> <li>• There was no decrease in the number of PWID who started methadone therapy (11% vs. 7%), and no increase in relapse rates (17% vs. 20%; Kerr et al., 2006a).</li> <li>• 70% of the local residents and 58% of the companies located around the SIS were in favor of the SIF.</li> <li>• SISs do not accept individuals under 18 or pregnant women, it remains difficult to conclude anything regarding these specific subpopulations, which are particularly vulnerable and require specific care and support.</li> <li>• No survey investigated the subjective assessment of SISs among PWID who no longer attended SISs.</li> <li>• Promoting safer and thus more comfortable injection conditions, might foster risk-taking in PWID and thus expose them to increased risks of overdose.</li> <li>• Rates of overdoses did not increase after the implementation of SISs</li> </ul>
<b>De Jong, W. &amp; Weber, U. (1999).</b>	Narrative of experiences in managing Supervised Injection sites. Mixed Methods	The probability to stay in hospital for at least 1 night is ten times higher for OD's happening on the street.
<b>Patel, K. (2007).</b>	Literature review. Qualitative method.	(1) Effectiveness and cost effectiveness of needle and syringe exchange and DCR programs. (2) Ethical and political concerns relate to the view in government that DCRs.
<b>Van Beek, I., &amp; Gimour, S. (2000).</b>	Survey. Mixed methods.	Preference in using MSIC instead of injecting alone or in group outside MSIC.
<b>Wood, E., Kerr, T., Lloyd-Smith, E., Buchner, C., Marsh, D., Montaner, J., &amp; Tyndall, M. (2004b).</b>	Administrative database analysis. Qualitative.	A primary purpose of the evaluation is to measure process indicators related to service uptake within the SIF, and this is enabled through the Insite database. SIF database. <b>Community satisfaction</b> and the perceived impact of the SIF on business persons. <b>Public order indicators.</b> SIF 500 injections/day. SIF demand often exceeds capacity and waiting times to get into the 12 seat injection room can result in participants obtaining syringes and injecting elsewhere. Public order and metrics on public injection drug use: predefined geographical areas in the neighborhood in the timeframe under study, number of discarded syringes, injection-related litter, and public injection drug use. Injection related litter was defined as syringe wrappers, syringe caps, sterile water containers and "cookers" (containers used to heat drugs before injection.
<b>Wood, E., Kerr, T., Small, W., Li, K., Marsh, D., Montaner, J., &amp; Tyndall, M. (2004c).</b>	Standardized prospective data collection protocol. Mixed.	<p>Analysis on the impact on daily use of the facility, public order indicators, police statistics, SIF is not increasing drug dealing. Detox services, needle and syringes study. SIF is associated with increased uptake of detoxification services; the facility has been a central referral mechanism to a range of other community and medical resources and a key venue for education about safer injecting. Measurements were taken for 6 weeks before and 12 weeks after the opening of the safer injecting facility.</p> <p>Indicators of public disorder for measurements:  (1) Public Injection drug use (2) Publicly discarded syringes (3) Injection-related litter. (4) Number of suspected drug dealers (5) Number of police patrols.</p> <p>Outcomes. Reductions in the daily mean numbers of IDUs injecting in public (4.3 [interquartile range (IQR) 4.0–4.3] v. 2.4 [IQR 1.5–3.0]; <math>p = 0.022</math>), publicly discarded syringes (11.5 [IQR 7.3–14.3] v. 5.3 [IQR 3.0–8.0]; <math>p = 0.010</math>) and injection related litter (601.7 [IQR 490.0–830.3] v. 305.3 [IQR 246.3–387.0]; <math>p = 0.014</math>)</p>

Table 2. Findings on academic papers extracted from Web of Science. (N=4)

Authors	Methodological Component	Main outcomes on services
<p><b>Fischer, B., Murphy, Y., Rudzinski, K., &amp; MacPherson, D. (2015)</b></p>	<p>Reviewed journal publications, as well as key reports, government publications, surveys, etc. Reporting on data and information since 2000. Mixed Method.</p>	<p><i>Benefits of the SIF in Vancouver. New services under study in Montreal and Toronto are decentralized and/or integrated services) or scope parameters (e.g., to include both IDUs and drug inhalers, e.g., stimulant smokers) but have faced extensive controversy.</i></p> <p><i>Drug use epidemiology: National Adults drug use prevalence (2004–2012) have found prevalence levels for 'past year use' ranging from 10% to 14%. The use of other illicit drugs in adults ranges 1–2%.</i></p> <p><i>Drug-related risk and harm indicators: Cost substance abuse in Canada \$8.24B</i></p> <p><i>Drugs and driving: Analysis of drug consumption (Cannabis, cocaine) to car accidents.</i></p> <p><i>Needle/Paraphernalia sharing among SDUs: Analysis of specific population (e.g., homelessness, NES availability or access) and specific drug use behaviors (e.g., cocaine injecting).</i></p> <p><i>Morbidity: HIV / Morbidity: Hepatitis C Virus (HCV): Impact of reduction of the diseases due to SIF implementation.</i></p> <p><i>Mortality: overdose deaths: Analysis of deaths per drug consumption in Canada.</i></p> <p><i>Supervised consumption facilities (SCFs): 12,000 clients, 500 visits per day, 2,000,000 total visits. Positive outcomes: reduced injection risk- behaviors, OD rates and public disorder; increased treatment service utilization; in addition, no overdose death has ever occurred at the facility. Feasibility studies in Victoria, Montreal, and Toronto.</i></p> <p><i>Analysis on Naloxone use,</i></p> <p><i>Drug treatment: integration and functioning of 'continuum of care', treatment for co-occurring disorders, and treatment access for marginalized/risk populations as major challenges. Drug treatment system (excluding opioid maintenance treatment) indicated that cannabis (steady at 31%), cocaine/crack (declining from 40% to 28%) and heroin/POs (15–20%)</i></p> <p><i>Opioid dependence treatment: 12,000 to 50,000 clients using opioid in Canada; in BC clients increases from 12,000 in 2009 to 16,000 in 2013. About 1000 inmates – or about 7% of the Correctional Service of Canada inmate population – were enrolled in correctional MMT by 2007.</i></p> <p><i>HIV and HCV treatment for drug users: HIV+ IDUs across Canada, 95% were in doctors' care, 77% had ever taken prescribed drugs as part of HIV treatment, and 66% were taking prescribed HIV treatment medications.</i></p> <p><i>Drug law enforcement: drug law offenses increased from 87,945 (2000) to 109,057 (2013), constituting 5% of all criminal offenses in 2013.</i></p>
<p><b>MacArthur, Van Velzen, Palmateer, Kimber, Pharris, Hope, Hutchinson (2014).</b></p>	<p>Review of reviews. Mixed method.</p>	<p><i>Vancouver demonstrated a statistically significant association between attendance at the SIF and a reduction in the sharing of syringes (OR 0.30, 95% CI 0.11–0.82; p = 0.02), whilst cross-sectional evaluation of a SIF in Australia</i></p>
<p><b>McNeil &amp; Small (2014)</b></p>	<p>Systematic review, meta-analysis. Quantitative.</p>	<p><i>Reduction of violence for PWID, in streets, inside the SIF, providing /teaching safer drug practices (fostering social and spatial conditions that reduced drug and health harms (e.g., HIV and HCV transmission, overdose). that SEIs established situations and spaces that enabled reductions in risk behaviors, such as "rushed injections, SEIs mediated access to ancillary services. Participants articulated how access to support through these interventions was highly influenced by geographical considerations, improve medical care, providing/accepting referrals.</i></p>
<p><b>Wood, E., Tyndall, M., Montaner, J., &amp; Kerr, T. (2006).</b></p>	<p>Summarizing of findings from evaluations of injecting sites in Canada.</p>	<p><i>Requiring help with injections was negatively associated with daily use of the facility. The analysis of public order indicators described above showed that suspected drug dealing did not increase in the vicinity of the facility and that public drug use declined. Police statistics during the year before versus the year after the facility opened showed that crime rates remained stable in the neighbourhood where the facility is located. The facility's opening has not been associated with increases in charges for drug dealing or several markers of drug-related crime, including assaults, robbery and vehicle break-ins. use of the facility has been associated with an increased uptake of detoxification services, which suggests that the facility has not resulted in a reduced number of IDUs seeking addiction treatment. There is no evidence that the provision of a safe and sterile place for injection drug use has resulted in increased rates of relapse into injection drug use or decreased rates of cessation of injection drug use in</i></p>

		<i>the community. Large reductions in public drug use, publicly discarded syringes and syringe sharing after the facility opened. SIF is associated with increased uptake of detoxification services; the facility has been a central referral mechanism to a range of other community and medical resources and a key venue for education about safer injecting</i>
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Table 3. Findings on academic papers extracted from Gray Literature. (N=9)

<b>Authors</b>	<b>Methodological component.</b>	<b>Main outcomes on services</b>
<b>BC Center for Disease Control (2014)</b>	Narrative	<i>Current services in INSITE: Addictions counseling, mental health, Connections to Housing resources, addictions treatment, and other support services. There is no evidence suggesting InSite is linked to an increase in drug-related crime activities in the surrounding area. The presence of InSite improved public order in the area around the facility.</i>
<b>BC Center for Disease Control (2016)</b>	Narrative	<i>In BC, there were reported 476 overdose deaths in 2015, and 201 deaths in first quarter 2016. Graph no. 4 illustrates the overdosed deaths from 2007 to 2016 in Victoria, Vancouver, and BC province. Overdosed deaths in Victoria in first 6 months of 2016 accounted of 29 cases, overpasses 17 overdose fatalities occurred in 2015.</i>
<b>Federal Ministry of Health, Germany. Environmental and Social Research Universitätsstr (2003).</b>	Government report	<i>Services provided. SIF makes statistically contribution to the reduction of drug related deaths. Sterile injections, food, shower, laundry service, basic medical care, arrangement for places to sleep, counseling on health issues, safer use, legal advice, advice for debtors, arrangement for doctors, substitutes, therapy, crisis intervention, counseling for relatives, counselling concerning children. Drug-related crime and neighbourly complaints were not conducted due to incomplete police files and no reliable figures with respect to the different drug consumption rooms available. In the cities of Saarbuken, Hanover, Hamburg, and Frankfurt there is a significant statistical relationship between the operation of the drug consumption room and the reduction of drug deaths. Auto regressive integrated moving average model (ARIMA Model) was used to compute relation between opened SIF and reduce deaths drug related. DCR waiting times increases aggression among clients.</i>
<b>Health Canada (2016).</b>	Government report	<i>Services provided: clean supervised environments for drug users, clear syringes, needles and swabs, and ensure safe disposal of used needles. Cohort studies detected 1,090 users of INSITE 638 (58.59%) reported a life-time history of non-fatal overdose and 97 (8.83%) reported at least one non-fatal overdose in the last six months; 638 (58.59%) reported a life-time history of non-fatal overdose and 97 (8.83%) reported at least one non-fatal overdose in the last six months; construct a Insite'smember data base: demographics, health history; addictions history (data set), sexual health history (sex-trades, etc.)</i>
<b>Independent Working Group (2006). [Joseph Rowntree Foundation]</b>	Independent report	<i>Services provided: (1) ensure relatively safe and hygienic injecting in the facility, (2) provide personalised advice and information on safe injecting practice, (3) recognise and respond to emergencies.If these services are successfully delivered to a sufficient number of people, it is likely that the DCR can then have an impact on a number of health-related outcomes:1 overdose; 2 transmissions of blood-borne viruses; 3 other health problems, such as abscesses; 4 rates of drug use; 4 provide access to a range of other on-site and off-site interventions and support.</i>
<b>Center of Addictions Research, UVIC, 2006</b>	Qualitative/quantitative research.	<i>ONSITE Services (4); Indicators of success (Metrics) assessing the SIF in Vancouver; Gaps (12); delivery option model centralized Vs. multiple centers. Public concerns: reduce criminal activity around the centers, treat or cure users' addictions; current drug users in Victoria: 1,500 - 2,000 injections alone; a large young injector population; a large share of injections occurring in public space. Service Referral: Sydney: Drug treatment and rehabilitation (15%), Primary care services (31%).Spain: 10% referrals to medical and/or social services. Switzerland: 5% of referrals to Medical and social services. Vancouver: 2,000 referrals a detoxification program. Cost effective is difficult to ascertain given that the evidence relating to their impact on the above-mentioned outcome measures is generally sparse, and the fact that only the relatively newer initiatives (e.g., Vancouver and Sydney) provide cost data. In Sydney set up facility were \$1,334,041, operation costs first year were \$1,995,784. In the first year the cost was \$ 63.01 per client, expecting to reduce to \$37.23 in the second year. Community and Stakeholders attitude improved from 68% in 2000 to 78% in 2002. In Vancouver 50% of 117 surveyed local business people were in favor of the facility.</i>

<b>NSW Department of Health. National Centre in HIV Epidemiology and Clinical Research. (2007).</b>	Government report	<i>Registration process. Database in Microsoft Access. user data set: demographics on hours of operations, client registration, socio-demographic, injecting drug use and risk behaviour profile; Number of visits and clients attending, Reasons for refusal of registration or entry to Sydney MSIC, behavioral and injecting episodes, Provision of client referrals. Managing overdosed-related events, and MSIC cost of operations. Services: Clinical, Medical, and psycho-social services. Training patients on injecting techniques. Decreased on the ambulances attendances at suspected opioid overdosed. Decreased in visible syringes and needles reported by local businesses in 48% Expected visits of clients to the services in 2006/2007 was 21 per hour, an increase from 17 in 2004/05, and 18 in 2005/06 impact in cost of services. The evaluation findings for the current trial are consistent with international research which suggests that supervised injecting facilities are effective in reducing the harms associated with injecting drug use. SEIs facilitated access to social and material resources that helped PWID survive within the context of poverty and social marginalization. SEIs to minimize health harms associated with injection drug use, including the need to address geographical disparities in access to these interventions between and within communities. Partnership between the police and health authorities decrease perceived public disorder problems.</i>
<b>Vancouver Coastal Health Authority (2016).</b>	Government report (Web page)	<i>InSite and Onsite are wrap-around programs that exist one above the other in the same Hastings Street location. When clients, usually InSite users, are ready to access withdrawal management, they can be immediately accommodated at Onsite. On the second floor of OnSite people have access to 12 rooms with private bathrooms where they can detox. Mental health workers, counselors, nurses and doctors work together to help people stabilize and plan their next steps. People can then move up to the 3rd floor transitional recovery housing for further stabilization and connection to community support, treatment programs and housing. INSITE is a Harm reduction facility as well as Health Care facility. As Harm reduction facility, INSITE provides Harm Reduction Education, safe injection education, Insite provides guidance for participants to ensure their drug they use in a safer manner as possible. Health care facility is endorsed by the nursing College of registered nurses of British Columbia. Participants consume drugs as a relief to reduce their pain or trauma they have experienced in their lives, even it is a temporary relief.</i>
<b>International Network of drug consumptions room (2016)</b>	Government report (Web page)	<i>Services, staff, outcomes of all supervised injecting sites around the globe. It is complex to related different outcomes for a standard evaluation.</i>

Table 4. Findings on academic papers extracted from Expert Recommendation. (N=6)

<b>Authors</b>	<b>Methodological Component</b>	<b>Main outcomes on services</b>
Wikipedia (2016)	<b>Narrative</b>	<i>Summary of evaluations of SIF worldwide. The evaluators asserted that MSIC was thereby evidenced as a gateway for treatment. European consumption rooms cater more so to users older than 30 years, mainly with problematic heroin and cocaine habits. Clients' referrals. Evaluators of the Sydney MSIC found that over an 8-year period staff provided 47,396 other occasions of service (94.6 per 1,000 visits) including advice on drug and alcohol treatment on 7,856 occasions, 22,531 occasions where staff had provided vein care and safer injecting advice, with a total of 8,508 referrals to other services where 3,871 of referrals were to treatment.[29] Of the 3,871 referrals to treatment 1,292 were to detox and 434 to abstinence-based rehabilitation or therapy.[30] The evaluators asserted that the MSIC was thereby evidenced as a gateway for treatment. Impact on nuisance. The Sydney MSIC client survey conducted</i>

		<p><i>in 2005, found that public injecting (defined as injecting in a street, park, public toilet or car), which is a high risk practice with both health and public amenity impacts, was reported as the main alternative to injecting at the MSIC by 78% of clients. 49% of clients indicated resort to public injection if the MSIC was not available on the day of registration with the MSIC. From this, the evaluators calculated a total 191,673 public injections averted by the centre</i></p>
Dagmar Hedrich, Thomas Kerr and Françoise Dubois-Arber (2010)	Methodological	<p><i>Aims and objectives of drug consumption rooms (see attachment 2, metrics). The available evidence on DCRs was reviewed in 2004 (Hedrich, 2004), based mainly on research published during the 1990s in the languages of countries where DCRs were operating (German, Dutch, French and Spanish), and which were relatively inaccessible to the English-speaking world. Evidence statement for DCRs and overdose deaths. There is insufficient review-level evidence to support or discount the effect of DCRs on reduction of overdose deaths at the community level. One time-series study found DCR operation was associated with reduced drug-related deaths at a city level. Process data show no overdose deaths have occurred on DCR premises and clinical and epidemiological data suggest it is likely that a proportion of overdoses treated in DCR settings would have been fatal if they had occurred elsewhere. Emergency rates vary from 0.5 to 7 per 1 000 injections. (see Hedrich, 2004, for Germany, Netherlands, Switzerland and Spain; Kerr et al., 2006b, for Vancouver; NCHECR, 2007b, for Sydney; and Skretting and Olsen, 2008, for Norway). It has been estimated that these facilities helped prevent 10 deaths per year in Germany, and four per year in Sydney (Hedrich, 2004; MSIC Evaluation Committee, 2003). In a comparison of overdose death trends in the vicinity of the DCR with the rest of the region of New South Wales, no statistically significant impact of the Sydney facility on opioid-related deaths in Kings Cross was found. In their simulation of the impact of the Vancouver DCR, Milloy and colleagues (2008) concluded that the facility may have prevented between 1.9 and 11.7 overdose deaths per year. Nuisance is more likely when capacity or location of the facility does not meet local needs and waiting times are long. In some instances, these problems can be addressed by an adjustment of service capacity, aided by police cooperation and the involvement of the DCR in local order maintenance.</i></p>
Robert Haemmig; Ingrid van Beek (2005).	Methodological	<p><i>The Drug Free Australia 2010 analysis found that the 7% of clients who attended the centre more than 98 times in a year were still injecting 80% of the time outside the centre, while the 26% who visited 10-98 times per year injected 95% of the time on the street, in a car, a toilet, at home or someone else's home.[22] With injector safety the most prominent rationale for the establishment of injecting rooms, the analysis questioned such low utilization rates in light of the room's capacity for 330 injections per day,[23] but where between 2001 and 2010 it had averaged just 185 injections per day.</i></p>
Dolan, Kimber, Fry, McDonald, Fitzgerald, & Trautmann.	Methodological	<p><i>Health workers established special cafes for IDUs who did not utilize health services and IDUs began injecting on-site. The workers took the opportunity to monitor and modify IDUs risk behaviour to reduce harms associated with injecting. Clients</i></p>

(2000).		<p><i>are not allowed to smoke anything in the injecting rooms, and most centres apply a maximum time limit (30 or 60 minutes) in the injecting room. Clients are only allowed to prepare their own drugs in the injecting room. Staff are not permitted to help clients inject; however, clients may assist one another. Centres open for about 7 hours a day, 5 or 6 days a week, and cities with a number of centres often stagger operating times to increase the number of hours per day that IDUs can inject safely. Doctors work a few hours a week at the centres, and some centres have direct phone lines to the police and ambulance service.</i></p> <p><i>All Swiss centres have at least one staff member present in the injecting rooms at all times, and all staff are trained to resuscitate clients if they overdose—although one staff member has prime responsibility for this duty.</i></p>
Ingrid Van Beck (2005)	Narrative	<p><i>Summary of evaluations in Europe and Australia. Describing the following areas: Staff and clean if the facility, HIV situation in center in Europe and Australia, No crack cocaine consumption in Australia, Staff performance, DCRs do not use nurses but counsellors trained to manage overdose. Violence among clients in busy times, drug treatment services provided, accommodation facilities, industrial areas designated for MSIC or CDRs., offering transportation services for clients from other DCRs. to the fourth DCRs in Germany. DCRs also offered subsidised food, showers, and laundry.</i></p>
Hedrich	Methodological	<p><i>Consumption rooms developed in cities where – despite the availability of a variety of treatment options, including methadone substitution, as well as a range of harm reduction services such as outreach and needle and syringe programmes – public drug use persisted and there remained serious concerns about rises in infectious diseases and drug-related deaths.</i></p> <p><i>Consumption rooms typically target drug injectors. However, in all Dutch services and in an increasing number of services in Germany and Switzerland, supervised consumption areas for drug inhalation are in place.</i></p> <p><i>The expected benefits are decreases in high-risk drug use, morbidity and mortality among the target population, increased uptake of health and social care including drug treatment, and reductions in public drug use and neighbourhood nuisance.</i></p> <p><i>Possible risks are that they encourage increased drug use, that new users might be initiated, that they make drug use more acceptable and comfortable, thus conflicting with treatment goals, and that they increase public order problems by attracting drug users and drug dealers from other areas.</i></p> <p><i>Because consumption rooms target those who are not ready for treatment, a major function is to offer other survival-oriented services, including basic medical care, food, drinks, clothes and shelter. Heroin and cocaine are the main drugs used in the rooms, and the main mode of administration is injection, except in the Netherlands.</i></p>

**Process 3: Domain of knowledge: integration analysis.** By integrating the columns of major points, conclusion, and recommendations for each paper, the following domains of knowledge were found: ethical perspectives, overdose deaths, services provided in the injecting facility, crime reports, budget considerations, metrics, workflow, e-health tools developed for the injecting facilities, and ethical considerations. The integration consists of looking for terminologies and descriptions included in the columns' major points, summary, conclusion, and recommendations. In the analysis and integration of a paper, the domain of knowledge outcomes are specific words that describe the information included in each paper. In simpler terms, this process can be compared to a student using major bullet points to explain what a paper discusses. Hence, one paper can have more than one domain of knowledge. Table 5 contains the number of papers associated with each domain of knowledge.

All papers were coded in an Excel spreadsheet, identifying the domain of knowledge per paper. Table 5 describes the domains by papers. Each domain is a binary variable: number 1 means the domain explains some information, and 0 means the opposite. The following paragraphs provide a summary of each domain of knowledge.

*Overdose deaths.* All 27 papers from this literature selection agree that all supervised injection sites around the globe have capable and trained staff who manage all overdose cases with zero deaths. Australia reports no statistically significant difference in overdose fatalities when comparing data before and after MSIC opened in 1998 to 2011. However, the International Drug Consumption Room (2016) reported no overdose deaths in Australia. Australian Health Department reported a 35% decrease in presenting overdose cases at hospital emergency rooms, and a reduction in ambulance services for suspected opioid overdoses in the Kings Cross vicinity (NSW Department of Health, 2007). It demonstrated the effectiveness of the injecting facility in

saving lives. The evaluation of a medically supervised injecting center in Sydney, Australia, over an 18-month period revealed that staff intervened in 329 overdoses over one year with an estimate of at least four lives saved per year (NSW Department of Health, 2007). In Germany, there have been no death overdoses since 2001 within the largest facilities in Germany, North Rhine Westphalia (International Drug Consumption Room, 2016). Luxemburg reported a reduction of overdose deaths to 5 in 2011, and Spain reported a reduction of overdose deaths from 1,833 in 1991 to 773 in 2008. Denmark, The Netherlands, Norway, and Switzerland do not provide information on overdose deaths.

SIFs in Vancouver have managed efficiently 366 overdose events since 2006 with zero fatalities (Health Canada, 2016), and engaged 18% of clients into detoxification services, 57% into drug treatment counseling, and 23% to stop injecting drugs (Portier, Lapr evote, Dubois-Arber, Cottencin, & Rolland, 2014). Vancouver Coastal Health (2016) reported 768 overdose incidents. As of August 31, 2016, BC CDC reported 96 drug-induced-deaths in Vancouver, 120 deaths in 2015. Vancouver's InSite program reported 768 overdose incidents reporting zero fatalities since the facility opened in 2003 (Vancouver Coastal Health Authority, 2016). Drug users require an understanding that injecting alone is a risk factor for overdose death which is minimized by visiting the SIF (Potier, Lapr evote, Dubois-Arber, Cottencin, & Rolland, 2014). *The Lancet* study revealed that 35% of overdose cases have been reduced within 500 meters around the facility, and 9% in the rest of Vancouver since the facility opened, saving 51 lives per year between March 1, 2004 and July 1, 2008 (Vancouver Cost Authority, 2016).



Table 5. Domain of knowledge per paper.

N	papers / domains	overdose deaths	services	crime reports	budget	metrics	workflow	ehealth	ethics	Frequencies	Note
1	1. BC Center for Disease Control (2014), overdosed deaths, metrics, services	1	1	1	0	1	0	0	0	3	
2	2. BC Center for Disease Control (2016), overdosed deaths	1	0	0	0	0	0	0	0	2, 21	
3	3. De Jong, W. & Weber, U. (1999). , Metrics, crime reports, services	1	1	1	0	1	0	0	0	0	Included in 1
4	4. Federal Ministry of Health, Germany. Environmental and Social Research Universitätsstr (2003).. legal, services, metrics, ehealth app.	1	1	0	0	1	0	1	1	1	
5	5. Fischer, B., Murphy, Y., Rudzinski K., & MacPherson, D. (2016;2015;), Metrics, services, overdose deaths										Included in 1
6	6. Health Canada (2016). , services, metrics, budget	1	1	1	1	1	1	1	1	1	
7	7. Independent Working Group (2006). [Joseph Rowntree Foundation], ethics, services, crime reports	1	1	1	1	1	0	0	1	1	
8	8. Center of Addictions Research, UVIC, 2006, Metrics, services, overdose deaths, budget	1	1	1	1	1	1	0	1	2	
9	9. MacArthur, G., van Velzen, E., Palmateer, N., Kimber, J., Pharris, A., Hope, V., Hutchinson, S. (2014). , services, metrics,	1	1	1	0	1	1	0	0	1	
10	10. McNeil, R., Small, W., Lampkin, H., Shannon, K., & Kerr, T. (2014). , services, crime reports,	0	1	1	0	0	0	0	0	1	
11	11. McNeil, R., & Small, W. (2014), crime reports, services,	1	1	1	1	0	0	0	0	1	
12	12. NSW Department of Health. National Centre in HIV Epidemiology and Clinical Research. (2007). , services, overdosed, metrics, crime reports, registration process.	1	1	1	1	1	1	0	0	1	
13	13. Patel, K. (2007).. overdosed deaths, metrics, services	1	1	1	1	1	0	0	1	1	
14	14. Potier, C., Lapr�votte, V., Dubois-Arber, F., Cottencin, O., Rolland, B. (2014). , services, overdosed, metrics, crime reports,	1	1	1	1	1	0	0	0	1	
15	15. Van Beek, I. & Gimour, S. (2000).. metrics, services, crime reports,	1	1	1	0	1	0	0	0	7	
16	16. Vancouver Coastal Health Authority (2016).. services, metrics, overdose deaths, budget										Included in 8
17	17. Wood, E., Kerr, T., Lloyd-Smith, E., Buchner, C., Marsh, D., Montaner, J., & Tyndall, M. (2004b).. eHealth app, crime reports, services, metrics,	1	1	1	0	1	0	1	1	3	
18	18. Wood, E., Kerr, T., Small, W., Li, K., Marsh, D., Montaner, J., & Tyndall, M. (2004c).. Metrics, crime reports, services	1	1	1	0	1	0	1	1	0	Included in 17
19	19. Wood, E., Tyndall, M., Montaner, J., & Kerr, T. (2006). metrics, services, crime reports,	1	1	1	0	1	0	1	1	0	Included in 17
20	20. International Network of drug consumption rooms (2016) services, budget, crime reports, ethics,	0	1	1	1	0	0	0	1	1	
21	De Beck, Kerr, Bird, Zhang, Marsh, Tyndall, Montaner, and Wood (2011)	1	0	0	0	0	0	0	0	0	Included in 2
22	Wikipedia (2016). Overdose deaths, Services, crime reports, ethics	1	1	1	0	1	0	0	1	0	Included in 15
23	Dagmar Hedrich, Thomas Kerr and Fran�oise Dubois-Arber (2010) Overdose deaths, services, metrics, crime reports	1	1	1	0	1	0	0	1	0	Included in 15
24	Robert Haemmig; Ingrid van Beek (2005).	1	1	1	0	1	0	0	1	0	Included in 15
25	Dolan, Kimber, Fry, McDonald, Fitzgerald, & Trautmann. (2000).	1	1	1	0	1	0	0	1	0	Included in 15
26	Ingrid Van Beek (2005). Services, overdose, crime reports, metrics, ethics	1	1	1	0	1	0	0	1	0	Included in 15
27	Hedrich	1	1	1	0	1	0	0	1	0	Included in 15
<b>Total academic, government papers and website</b>										<b>27</b>	

*Services provided in the injecting facility.* The literature review from 27 papers reflects that facilities provide primary and supportive services varying among countries and sites. Primary care services include: (a) reduction of drug related death; (b) harm reduction and safe injection education; (c) mental health and addiction counseling; (d) detoxification services; and (e) drug treatment programs. Supportive services include: (a) temporary arrangement of housing; (b) peer-drug-service; (c) hygiene; (d) education (injecting risk behaviors); (e) drug preparation equipment;

(f) sterile injections; (g) food; (h) shower/laundry; (i) legal advice; (j) advice for debtors; (k) arrangement for doctors; (l) substitutes; (m) therapies; (n) crisis interventions; (o) counseling for relatives; (p) counseling concerning children; and (q) services for women. Table 5 shows a detailed explanation of services found. Table 6 explains services in Vancouver, Australia, Germany, and Switzerland differentiating primary (in green) and supportive services (in yellow).

DCRs, MSICs, or SIFs do not provide injecting assistance due to Narcotics Law prohibiting staff from performing the injection to consumers when they use their injecting equipment. Staff would be committing a criminal act according to the Narcotics Act. As a result, patients require self-injecting training nurses provided in the facility. Pregnant women, first time users, those under 18 years of age, and intoxicated consumers are denied use of the facility (Environmental and Social Research Universitätsstr, 2003; NSW National Centre in HIV Epidemiology and Clinical Research, 2007; Vancouver Coastal Health, 2016).

Table 6. Detailed explanation of Services in DCRs, MSIC, and SIF.

**Legend: Primary services and Supportive services.**

Facility	Description of services
INSITE, Vancouver	As harm reduction facility, INSITE provides <b>harm reduction and safe injection education</b> , guiding members to ensure the drug they use in a safer manner as possible. In Vancouver, INSITE Health care facility is endorsed by the nursing College of registered nurses of British Columbia. Specific services in Vancouver include <b>addictions counseling, mental health, connections to housing resources, addictions treatments, and other support services (BC Center for Disease, 2014)</b> . INSITE Vancouver implement <b>peer-drug-service</b> . On the second floor of SIF in Vancouver, clients have access to 12 rooms with <b>private bathrooms where they can detox</b> . Mental health workers, counselors, nurses and doctors work together to help people <b>stabilize</b> and plan their next steps. People can then move up to the 3rd floor <b>transitional recovery housing</b> for further stabilization and connection to community support, <b>treatment programs</b> and housing.
<b>Multiple sites located in Australia, Europe, and Canada</b>	MacArthur, Van Velzen, Palmateer, Kimber, Pharris, Hope, & Hutchinson (2014) performed a review of reviewers, and found out the following facts about the implementation of supervised injection facilities: there is a sufficient evidence to support the effectiveness of needle and syringe program in reducing <b>injecting risk behaviors</b> ; (2) there is a tentative evidence to support the effectiveness of <b>needle and syringe program</b> in preventing HIV; (3) There is a tentative evidence to support effectiveness of pharmacy access to needles/syringes in reducing <b>injecting risk behaviors</b> . (4) Tentative evidence to support the effectiveness of <b>drug preparation equipment</b> provision in reducing <b>injecting risk behaviors</b> . (5) There is sufficient evidence to support the effectiveness of <b>opiod substitution treatment</b> in reducing injecting risk behavior. (6) There is a sufficient evidence to support the effectiveness of <b>opiod substitution treatment</b> in preventing HIV. (7) There is a tentative evidence to support the effectiveness of <b>opiod substitution treatment</b> in preventing HCV. (8) Tentative evidence to support the effectiveness of outreach which includes Informational <b>education counseling</b> in reducing injecting risk behavior. And (9) there is a tentative evidence to support the effectiveness of SIFs in reducing <b>injecting risk behavior</b> . The relations can be used as connectors in the causal model nodes, showing the influence of variables, impacting SIF positive outcomes on patients' health.
<b>Hypothetical SIF in Victoria</b>	Center for Addictions Research British Columbia (CARBC) (CARBC, 2007), applied a survey in 2006 in Victoria BC, analyzing the need to implement a supervised injection facility in Victoria, BC, considering SIF in operations in Vancouver and Europe. Existing injecting facilities share many common core operational elements, yet also differ greatly in terms of many aspects of design, operations and services provided. While some facilities exclusively target drug injectors (or even only heroin injectors in select instances), an increasing number of European facilities have – generally successfully – expanded their services to target oral drug users (e.g., heroin and crack smokers). Consumers said they require services on <b>injecting assistance</b> , considering users who have disabilities such as paralysis, amputated

	limbs or blindness. As indicators of success, CARBC pointed out to increase the <b>rate of referrals to supportive housing, mental health services, and additions treatments, connecting to hospitals and emergency services.</b>
<b>Multiple DCRs in Germany</b>	Germany has 19 facilities in operations, each site operates independently (Federal Ministry of Health, 2003), however, the International Drug Consumption Room web site reported 24 rooms as August, 2016. The related services are providing <b>sterile injections, food, shower, laundry service, basic medical care, arrangement for places to sleep, counseling of health issues, safer use, legal advice, and advice for debtors, arrangement for doctors, substitutes, therapies, crisis interventions, counseling for relatives, counseling concerning children.</b> The following services were evaluated as poor from visitors in Germany drug rooms consumption (DRCs): <b>hepatitis C counseling, medical care, services for women, data documentation, consumption rooms and substitution, public order, requirements for using drug consumption rooms, opening hours, medical help and counselling, qualified staff, concepts for crack consumers, cooperation with local authorities.</b> Each DCR has its own issues on services. According to The Federal Ministry of Health in Germany (2003), it is conclusive that the drug consumption room makes statistically significant contribution to the <b>reduction of drug related death.</b> See attachment 1 for more detail information. The probability to stay in hospital for at least 1 night is ten times higher for OD's happening on the street, compared to ODs inside an injection room, where immediate help is guaranteed (De Jong&Weber, 1999). As a metric, <b>the number of syringes given</b> out the institutions counted to visitors or IDUs services. The Ministry of Health in Germany expressed a concern to standardized same investigation method in a consistent way for all consumption rooms making possible to compare all facilities. The Environmental and Social Research Universitätsstr pointed out inconsistencies in documenting data for drug consumption facilities. For example, the consumption room in Eastside in Frankfurt computes <b>the number of consumptions equals to the number of syringes</b> given out; in contrast DrogenhilfeEimbutel DCRs computes <b>the number of consumptions equals to visitors and visits.</b> Moreover, the terminology is not standardized, for example, the terms "user", "visitors", "visits", and "consumptions" are treated as equal terms, making difficult to create any standard definitions.
<b>England study</b>	Yet there are not supervised injection facilities in the United Kingdom, the Independent Working Group (IWG) (2006), provides a detailed examination of weather CDRs should be introduced in U.K. IWG reported in a survey method applied to a sample of 398 drug users. <b>Interviewed reported that 42% of them use public spaces, including public toilets, streets and parks for drug consumption.</b> This report does not include the mortality rates due to overdosed, which reduce the impact in convincing stakeholders in approving a drug consumption room in England. A grey literature from BBC in London describes 3,300 deaths due to overdosed in 2015 (BBC News, 2015).
<b>MSIC, Australia</b>	The New South Wales Department of Health in Australia (2007) built a report pointing out services provided in medically supervised injection centre (MSCI) as follows: <b>clinical, medical, and psycho-social services, training patients on injecting techniques, ambulances services at suspected opioid overdosed, clinical services (injecting and vein care advice, Well woman advice, advice on drug treatment, drug and alcohol information, sexual health advice, Other health education), referral type (drug treatment, health care, social welfare); general medical services (other medical, wound dressing or tissue trauma, skin disorder, asthma/chest infection, sexual health information, Women's health advice); psycho-social services (general counselling, accommodation, legal, and crisis counselling, finances, other).</b> In Australia the MSCI services in 2006/2007 was 21 per hour, serving 84,009 clients, <b>nominal cost per hour</b> open was \$452, and <b>real cost per hour</b> open was \$368, and the <b>cost per visit</b> was \$24.87. The evaluation findings for the current trial are consistent with international research which suggests that supervised injecting facilities are effective in reducing the harms associated with injecting drug use. This report also mentioned increased in <b>drug detoxification services and addiction treatment programs.</b> Van Beek& Gilmour (2000) report a survey applied to 178 IDU in Sydney, 52 (29%) last injected in public spaces and 77 (44%) last injected alone. Seventy-one per cent of all respondents would have preferred to use an MSIC closer in the area of their last injection.
<b>CDRs, Switzerland</b>	In Switzerland, though proper evaluation studies on the effect of these facilities are lacking, data from these cities indicate <b>that drug consumption rooms have contributed to an improvement in the medical somatic condition of drug users.</b> In Zurich, which was struggling with a large open drug scene in the mid-1980s, it was found that after the introduction of drug consumption rooms, <b>drug use in the street went down considerably</b> (Sozialamt der Stadt Zurich, 1995).
<b>CDRs Australia; SIF, Canada</b>	A systematic review reported that the impact of SIF in accessing drug counseling programs on 5 studies implemented in Vancouver and 1 in Sydney (Portier et al., 2014). Portier et al. reported that SIF increase the <b>number of attendance to an addiction treatment center, initiation of detoxification services</b> "OR = 1.32, 95%CI = [1.11–1.58];p= 0.002 and <b>initiation of methadone therapy</b> (aHR = 1.57, 95% CI = [1.02–2.40;]" (Portier et al., 2014, pp. 62). In Vancouver 20% of drug users were interested in joining a dependence care program; in Sydney 25%. In Vancouver, an evaluative observational study shows that "18% of drug user population agree in start a <b>detoxification services, 57% started an addiction treatment, and 23% stopped injecting drugs</b> (Portier et al., p.63). This relationship is an important finding in connecting the causal model variables.
<b>Multiple sites.</b>	McNeil, Small, Lampkin, Shannon, & Kerr (2014), reported that nurses provide training to clients on <b>self-injecting, reducing harm when clients search their veins while injecting.</b> Clients also disclosed they are vulnerable when they search for help in injecting, they are victims of robbers, beaten, raped, assault, violence, exploitation, and infectious diseases. The implementation of this training increasing client's safety, reducing violence clients' experience, performed by trained peer volunteers and in accordance with a harm reduction policy.

Each country has its own ways to provide and report the services in the injection site, making it difficult to create a standardized report based on different current services in all

injection sites. Moreover, in Germany, there are 29 injection rooms, each of which may have different services, population, and reporting of its activities.

*Crime reports.* Table 7 describes the crime reports connected to each supervised injection facility. Vancouver has multiple sources of documentation of public disorder, showing the positive effects before and after opening the facility. Studies show that the facility reduces the number of events due to injecting in public in Vancouver before and after SIF operation, syringes dropped, and injection-related litter (Portier et al., 2014), and no increase in drug dealing in the SIF vicinity (500 meters). "...police statistics during the year before versus the year after the facility opened showed that crime rates remained stable in the neighbourhood where the facility is located" (Wood, Tyndall, Montaner, & Kerr, 2006, pp. 1403).

Table 7. Crime reports

Facility	Description
Vancouver	<p>Wood et al (2004c) pointed out five indicators of public disorder of measurements: (1) public injection drug use; (2) Publicly discarded syringes; (3) Injection-related litter; (4) Number of suspected drug dealers, and (5) Number of police patrols (Wood, Kerr, Small, Li, Marsh, Montaner, &amp; Tyndall, 2004c). Daily use of safer injecting facility (no. IDUs per visiting the center in 18 weeks), public injection drug use (No. IDUs per time: 18 weeks); publicly discarded syringes (no. syringes in 18 weeks); injection-related litter (no. of items found in 18 weeks). The average of publicly discarded syringes before SIF opened was 11.5 vs. 5.4 after SIF opened. Injection-related litter average number of items was 601 after SIF opened vs. 310 after SIF opened. Results show that the average (mean) of IDUs injecting in public after the facility opened was 4.3 vs. 2.5 after opened. In conclusion, there are significant reductions in public injection drug use, publicly discarded syringes and injection-related litter after the opening of the medically supervised safer injecting facility in Vancouver.</p> <p>BC Ministry of Health identifies the following public order issues: Public injection, visible people injecting in public spaces; littering and loitering, visible people in drug-related, drug dealing or petty crime in areas surrounding INSITE; drug related crime, through private security cameras, number of crime in business areas surrounding the DTE recorded by police.; drug use in the community, number of drug consumption in the community.</p> <p>Wood, Kerr, Small, Li, Marsh, Montaner, &amp; Tyndall (2004c) point out the following public order indicators: (1) public injection drug use; (2) publicly discarded syringes; (3) injection-related litter; (4) number of suspected drug dealers; and (5) number of police patrols. These variables impact the level of crime in SIF area, and are included in the causal model.</p> <p>In Vancouver, the community satisfaction and the perceived impact of the SIF on business persons are measured through a community survey that is performed in person among street recruited residents and at street-level businesses. Public order indicators within an a priori defined geographical area in the neighborhood and at a priori defined times of the week.</p> <p>Preliminary observations. The Center of Disease Control in British Columbia (BCCDC, 2014) reported that there is no evidence suggesting Insite is linked to an increase in drug-related crime activities in the surrounding area. The presence of Insite improved public order in the area around the facility. Local police are actively referring PWID to Insite, signifying that Insite is providing an opportunity to coordinate policing and public health efforts. Vancouver Police Department has been called to remove disruptive clients, and support and assistance from the police in this regard has been very positive. Overall the staff remains very committed to the activities at Insite and staff satisfaction has been high.</p> <p>Approximately 75% of the PWID in Vancouver reported that using the SIF induced positive changes in their behaviors, notably in terms of public nuisance and safe injection practices (Portier et al., 2014). PWID also reported they use SIF for safe injection drug, and quiet conditions without suffering violence or having to share drugs with others and to avoid the police.</p> <p>The main point in this subsection reveals that less needles and syringes collected on streets</p>

	<p>increasing the number of drug users who attend the injection facility, and decreasing the number of drug users injecting on public spaces. Portier et al. (2014) reported the daily mean of PWID injecting in public in Vancouver before and after SIF operation (4.3, IQR = [4.0–4.3] vs. 2.4 IQR = [1.5–3.0]; <math>p = 0.022</math>), syringes dropped (11.5, IQR = [7.3–14.3] vs. 5.3, IQR = [3.0–8.0]; <math>p = 0.010</math>) and injection-related litter (601.7, IQR = [490.0–830.3] vs. 305.3, IQR = [246.3–387.0]; <math>p = 0.014</math>).</p> <p>Wood, Tyndall, Montaner, &amp; Kerr (2006) argue that the SIF did not increase drug dealing in the vicinity, the police reports remains stable as before opening SIF, the facility's opening has not been associated with increases in charges for drug dealing or several markers of drug-related crime, including assaults, robbery and vehicle break-ins.</p>
DCRs, Germany	<p>In Germany, the general development indicates a shift towards harm reduction approaches at the community level in some of the major German cities (Klee, 1997). Increased police action, low threshold drug relief programmes were introduced on a large-scale. At the political level the city of Frankfurt has initiated weekly policy meetings that are attended by all parties involved in drug policy. This committee that has been in effect since 1991 supported the installation of drug consumption rooms from day one. The collaboration among the police, health, order and social welfare authorities, and other institutions guarantee the effectiveness of drug consumption rooms.</p>
MSIC, Australia	<p>Australia reported a significant reduction in the number of syringes collected prior the establishment of the MSCI from 4,468 needles and syringes prior MSIC opened to 2,302 in the period after the service opening (National Centre in HIV Epidemiology and Clinical Research, 2007). Portier et al. (2014) reported that qualitative studies performed in Sydney including 70% of local business and 58% of local residents around SIF support the site considering there is less drug consumption and syringe waste in public places.</p>
DCR's Netherlands	<p>The Netherlands. In order to prevent the controllability problems of the past, the city issued a number of preconditions relating to the installation of drug consumption rooms. Drug consumption rooms are considered by the city as facilities which can reduce public nuisance and promote health among drug users. A first evaluation of the facility 'IT' shows that since the opening of the drug consumption rooms, drug use in the streets has decreased and visitors of drug consumption rooms take fewer health risks than before (Warner, 1997). In a 1995 survey among regional 'Partij van de Arbeid' (PvdA) administrators initiated by the parliamentary faction of the PvdA (Dutch Labour Party), 55% of the respondents said they were in favour of controllable, small-scale drug consumption rooms in the communities.</p>

*Budget considerations.* Only papers referring to facilities in Australia (NSW Department of Health, National Centre in HIV Epidemiology and Clinical Research, 2007) and Vancouver (Vancouver Coastal Health Authority, 2016) analyze their budget. The InSite and OnSite programs' budget figures for the fiscal year ending March 31, 2016 were: InSite's operational budget was \$2,938,665, and OnSite's operational budget was \$1,454,351. However, there are not specific metrics tracking the SIF effectiveness. The BC Ministry of Health provides statistics from 2003 to 2004 on drug use reported by Vancouver InSite services and other supervised injection sites. Most of Vancouver Coastal Health's total expenditures on addiction are used for treatment and prevention, although harm reduction is an important service to link clients to abstinence programs. Vancouver Coastal Health spent \$231 million in 2015/16 for mental health and substance use community services, of which InSite/OnSite are small programs. Table 8

shows all costs considered by international supervised consumption rooms around the globe (see Attachment 1).

The Canadian Centre on Substance Abuse (2014) reported 34,746 stays for mental health disorders due to substance abuse in hospitals at an estimated cost of \$267 million. If total cost is divided by total hospitalization stays, there is a unit cost of \$7,684/hospitalization, which compares to \$14 per visit at SIF (Vancouver Coastal, 2016) or \$63 in Victoria (CARBC, 2007), which means it is economically feasible to implement SIF instead of dealing with hospitalizations.

In Australia, the set-up costs were \$1,334,041, the initial year's operating costs were \$1,995,784, and the budgeted costs for 12 months until June 30<sup>th</sup>, 2003 were \$2,420,214. The cost per client visit was projected to be \$37.23 assuming increased client throughput and efficiencies in the 2002/2003 years (National Centre in HIV Epidemiology and Clinical Research, 2007).

Table 8. International Injecting Centers around the globe, source <http://www.drugconsumptionroom-international.org/>

Country	Staff	Metrics Referrals	Services	Budget	Crime reports
<b>Australia</b>	3 nurses; 3 health ed., officers; A full time Referral Co-ordinator.	Referrals: 11,678; Clients: 15,054; Overdose deaths: Zero	<i>Clinical, medical, and psycho-social services, training patients on injecting techniques, ambulances services at suspected opioid overdosed, clinical services (injecting and vein care advice, Well woman advice, advice on drug treatment, drug and alcohol information, sexual health advice, Other health education), referral type (drug treatment, health care, social welfare); general medical services (other medical, wound dressing or tissue trauma, skin disorder, asthma/chest infection, sexual health information, Women's health advice); psycho-social services (general counselling, accommodation, legal, and crisis counselling, finances, other).</i>	Set-up costs were \$1,334,041; the initial year's operating costs were \$1,995,784; and the budgeted costs for 12 months until 30.06.03 were \$2,420,214. The cost per client visit was projected to be \$37.23 assuming increased client throughput and efficiencies in the 2002/2003 years	<i>Australia reported a significant reduction in the number of syringes collected prior the establishment of the MSC from 4,468 needles and syringes prior MSIC opened to 2,302 in the period after the service opening (National Centre in HIV Epidemiology and Clinical Research, 2007). Portier et al. (2014) reported that qualitative studies performed in Sydney including 70% of local business and 58% of local residents around SIF support the site considering there is less drug consumption and syringe waste in public places.</i>
<b>Canada</b>	2 nurses, 5 program workers, and 2 peer workers. In the injection room, the staff-to-client ratio is 1:6, and in the chill-out lounge	Referrals: 5,368; Clients: 18,093; Overdose deaths: zero	<i>Specific services in Vancouver includes addictions counseling, mental health, connections to housing resources, addictions treatments, and other support services (BC Center for Disease, 2004). On the second floor of SIF in Vancouver, clients have access to 12 rooms with private bathrooms where they can detox. Mental health</i>	As March, 2016: Insite's operational budget was \$2,938,665. Onsite's operational budget was	<i>BC Ministry of Health identifies the following public order issues: Public injection, visible people injecting in public spaces; littering and loitering, visible people in drug-related, drug dealing or petty crime in areas surrounding INSITE; drug related crime, through private security cameras, number of crime in business areas surrounding the DTE</i>

	it is 1:10.		<i>workers, counselors, nurses and doctors work together to help people stabilize and plan their next steps. People can then move up to the 3rd floor transitional recovery housing for further stabilization and connection to community support, treatment programs and housing.</i>	\$1,454,351.	<i>recorded by police.; drug use in the community, number of drug consumption in the community. Wood, Kerr, Small, Li, Marsh, Montaner, &amp; Tyndall (2004c) point out the following public order indicators: (1) public injection drug use; (2) publicly discarded syringes; (3) injection-related litter; (4) number of suspected drug dealers; and (5) number of police patrols. These variables impact the level of crime in SIF area, and are included in the causal model.</i>
<b>Denmark</b>	The multidisciplinary team of the DCRs contains: psychologists, social pedagogues, educators and nursing staff.	Referrals: Not available; Clients: 1,800; Overdose deaths: Not available	<i>A second DCR was opened in Copenhagen and both centers now host 1,800 users who smoke and inject heroin and cocaine. Nurses witness up to 800 injections each day at the centers.</i>	Not available	Not available
<b>Germany</b>	DCR staff is usually composed of doctors, nurses and educators, supported by qualified student assistants and freelancers (training-on-the-job and first-aid training for drug emergency cases).	Referrals: Not available; Clients: 1.2 million consumption processes, with 3,271 drug emergency cases and 710 CPRs. Overdose deaths: Zero	<i>The related services are providing sterile injections, food, shower, laundry service, basic medical care, arrangement for places to sleep, counseling of health issues, safer use, legal advice, and advice for debtors, arrangement for doctors, substitutes, therapies, crisis interventions, counseling for relatives, counseling concerning children. The following services were evaluated as poor from visitors in Germany drug rooms consumption (DCRs): hepatitis C counseling, medical care, services for women, data documentation, consumption rooms and substitution, public order, requirements for using drug consumption rooms, opening hours, medical help and counselling, qualified staff, concepts for crack consumers, cooperation with local authorities. There are now (June 2015) 24 drug consumption rooms operating in 15 cities and six German states (Berlin, Hamburg, Hesse, Lower Saxony, North Rhine-Westphalia and the Saarland). While Hamburg operates (5) five and Frankfurt am Main (4) four drug consumption rooms, many other cities have to manage with fewer facilities. Two consumption rooms are operated in Berlin.</i>	Not provided	<i>The general development indicates a shift towards harm reduction approaches at the community level in some of the major German cities (Klee, 1997). Increased police action, low threshold drug relief programmes were introduced on a large-scale. At the political level the city of Frankfurt has initiated weekly policy meetings that are attended by all parties involved in drug policy. This committee that has been in effect since 1991 supported the installation of drug consumption rooms from day one. The collaboration among the police, health, order and social welfare authorities, and other institutions guarantee the effectiveness of drug consumption rooms</i>
<b>Luxemburg</b>	The multidisciplinary team of the DCR contains: psychologists, social pedagogues, educators, sociologists and nursing staff.	Referrals: Not available; Clients: 1,600; Overdose deaths: Zero	<i>Safer use counselling, on-site testing of HIV and hepatitis C and the implementation of an on-site primary medical care service</i>	Not provided	Not provided
<b>The Netherlands</b>	Medical and/or social workers and a third of the facilities have ex-drug users working as staff.	Referrals: Not available; Clients: Not available; Overdose deaths: Zero	Not provided	Not provided	Not provided

<b>Norway</b>	The staff of the DCR is multidisciplinary, including nurses, auxiliary nurses and social workers, and there is always at least one nurse on duty during the DCR's opening hours.	Referrals, clients and overdose deaths: Not provided	<i>DCRs aim to provide a multidisciplinary specialised model of treatment. They seek to contribute to improving the health status of people who inject drugs through the presence and supervision of healthcare workers in order to prevent injection-related infections, to assist in case of overdose, and to link the client with other social and health services and drug dependence treatment programmes.</i>		
<b>Spain</b>	Facilities have multidisciplinary staff (including at least one nurse) on-hand to supervise and counsel clients during all stages of drug consumption. Staff can also refer clients to social and healthcare services or drug treatment centres. DCRs also enable research into new drug use patterns, and are also a useful tool to identify emergent problems or needs among people who use drugs.	Referrals, clients and overdose deaths: Not provided	<i>Facilities have multidisciplinary staff (including at least one nurse) on-hand to supervise and counsel clients during all stages of drug consumption. Staff can also refer clients to social and healthcare services or drug treatment centres. DCRs also enable research into new drug use patterns, and are also a useful tool to identify emergent problems or needs among people who use drugs.</i>	Not provided	Not provided.

*Metrics.* Facilities are monitored by the rate of services they provide, and compared with the increase or decrease in the number of deaths and consumers seeking services. Table 9 explains the metrics found.

Germany reported each of 19 DCRs individually with the following metrics: location within the city, size, opening hours, contracts per week (one visit room is equal to one contract), number of qualified staff, and special characteristics of the consumption room obtained from interviews with each manager. Additionally, each site reported the following information: visible structural minimum standards, emergency plan, guarantee of prompt medical care in cases of emergency, medical care/help, first consultation and further rehabilitation-oriented counseling, compliance with the house rules/sanctions, cooperation with authorities, effects on the immediate



vicinity/contact with the police, entitled group of users, and permitted substances/ways of consumption/visual control of substances.

Vancouver reports metrics on: visits to the site by unique individuals, average number of visits per day, average of injection room visits per day, overdose incidents, clinical treatment interventions, principle substances consumed per illegal drug, client demographics (gender, ethnicity, age), and number of referrals to other social or health services.

The reader can see different workflows and metrics that each injection room has, and some countries do not report workflow in the injection facility (e.g., Netherlands). Moreover, the terminology has its differences, such as “medically supervised injection room,” called in Australia; or “drug consumption room,” called in Europe; or “supervised injection facility” called in Canada. Services seem to be the same, but they are named differently. To compare all facilities, there is a need to standardize terminologies and meanings. It is recommended to apply the metrics from CARBC because they reflect stakeholders and consumers’ needs in Victoria, BC.

Table 9. Metrics reported by each DCR, or MSIC, or SIF.

Facility location	Metrics reported	Description
Vancouver, Canada	Rate of detoxification of services, no. of IDUs seeking services, rate or relapse into injection drug. Injections per day, visits per day, number of overdose incidents, and clinical treatment interventions.	<i>Wood, Tyndall, Montaner, &amp; Kerr (2006) argue that the use of the facility has been associated with an increased uptake of detoxification services, which suggests that the facility has not resulted in a reduced number of IDUs seeking addiction treatment. There is no evidence that the provision of a safe and sterile place for injection drug use has resulted in increased rates of relapse into injection drug use or decreased rates of cessation of injection drug use in the community. Large reductions in public drug use, publicly discarded syringes and syringe sharing after the facility opened. SIF is associated with increased uptake of detoxification services. The relations reveal positive outcomes on crime reports, and are included in the causal model.</i> <i>The Scientific Evaluation of Supervised Injecting (SEOSI) cohort is based on a representative sample of Insite users in Vancouver. The SEOSI questionnaire deals with items that are particularly relevant to Insite, such as risk behaviours, public drug use, satisfaction with Insite, and access to medical care and addiction treatment services. The study determines the illicit drugs consume by clients, the time of consumption, and services provided by SIF Vancouver. Participants consume drugs as a relief to reduce their pain or trauma they have experienced in their lives, even it is a temporary relief (Vancouver Coastal, 2016). As statistics, INSITE reported 263,713 visits to the site by 6,532 unique individuals. An average of 722 visits per day, an average of 440 injection room visits per day, 768 overdose incidents, 5,359 clinical treatment interventions. Principle substances reported were heroin (54% of instances) methamphetamine (23% of instances) and cocaine (10% of instances); 27% of participants were women, 20% of participants were aboriginal, 5,368 referrals to other social and health services, 464 referrals to Onsite detox.</i> <i>Vancouver, Canada, reported the following metrics: user statistics (visits to the site by unique individuals, average of visits per day, average of injection room</i>

		<p>visits per day, overdose incidents, clinical treatment interventions, principle substances reported by drug used (e.g., heroin, methamphetamine, and cocaine). Absolute number and percentage of women participants, by ethnicity (e.g., white, aboriginal), number of referrals to other social and health services, number of referrals to Onsite detoxification services.</p> <p>In Vancouver INSITE, there are 13 injection booths where clients inject pre-obtained illicit drugs under the supervision of nurses and health care staff. Clients require to register with the nurse in the front desk. The SIF database (VANDU, SEOSI, and CHASE, explained later) has a search function that allows for rapid searches based on demographic information, such as birth date, if an individual forgets their handle. Similar anonymous tracking of individual clients is commonly used at needle exchanges and other services for illicit injection drug users. The database tracks what drugs participants are consuming (e.g. heroin, cocaine, etc.) and what services, such as nursing care and counseling services, are accessed by each client. A collaboration SIF-Police support the site safety removing disruptive clients. Community satisfaction and the perceived impact of the SIF on business persons is performed by the following public order indicators: 500 injections/day, SIF busiest time exceeding its capacity while clients obtaining syringes and injecting elsewhere, predefined geographical areas in the neighborhood in the timeframe under study, number of discarded syringes, injection-related litter, and public injection drug use. Injection related litter was defined as syringe wrappers, syringe caps, sterile water containers and “cookers” (containers used to heat drugs before injection).</p>
<b>MSIC, Australia</b>	Hour of operations, provision of clients and services, injecting equipment supplied, etc.	<p>As metrics, Sydney reported results on operation on delivery service, including days and hours of operations, number of registered clients and their socio-demographic characteristics, client attendance, entry refusals and referral of ineligible attendees, behavioral episodes, injecting episodes, provision of clients and services (clinical, general, and psychological medical services), provision of clients referrals (drug treatment, healthcare, and social welfare), injecting equipment supplied, overdosed related events (ambulances attendances at suspected opioid overdoses, opioid-related deaths, opioid poisoning presentations at emergency departments, Needles and syringes disposal, cost analysis (Total costs, service delivery and service facility costs), cost per client visit, hours of operation, and costs excluding medical director position.</p>
<b>Center of Addictions Research in British Columbia (CARBC, 2007)</b>	Overdosed deaths (zero deaths is optimal), rate of people having recovering from addictions, rate of referrals to supportive housing, mental health services and addiction treatment, hospital and emergency rooms referrals, reduction in visible drug use and a reduction in publicly discarded needles	<p>The Center of Addictions Research in British Columbia (CARBC, 2007), proposed the following metrics to be implemented in an supervised injection facility in Vitoria: Overdosed deaths (zero deaths is optimal), rate of people having recovering from addictions, rate of referrals to supportive housing, mental health services and addiction treatment, hospital and emergency rooms referrals, reduction in visible drug use and a reduction in publicly discarded needles. CARBC reported nine gaps for the healthcare of drug users:</p> <p>(1) Withdrawal management, supportive recovery, and supporting housing. (2) There are not enough beds for detoxification and stabilization in Victoria. (3) Services are needed in order to support people in the early phases of addiction recovery.(4) Outpatient clinics, day treatment programs and residential treatment options.(5) Services also need to be tailored to the needs of specific population groups, such as women, Aboriginal people, and youth. (6) Lack of treatment services available specifically for stimulant users. For example, a few stakeholders noted that detoxification facilities do not admit people who use crystal methamphetamine or cocaine, or else require that they abstain from use before being admitted because use of these types of drugs is not considered to require medical detoxification. It is difficult for any type of drug user “to go through withdrawal symptoms alone”. (7) There is virtually no help at all for people who are addicted in this region. (8) Full continuum of services from health care to housing is needed in order to improve service provision for drug users in Victoria and that different points of entry into the system are needed, along with appropriate screening and referral mechanisms to properly assess clients’ needs and subsequently refer them to the most appropriate programs. And (9) there is a need for a full range of housing options with varying levels of support, especially “wet housing where someone can actively use and where abstinence is not mandatory because any progress should be viewed as a success, we have to deal with the here and now (CARBC, 2007).</p>
<b>Germany</b>	Visible structured standards, emergency plan, guarantee of medical care, rate of	Germany has 24 DCRs and each facility required to report these metrics.

	rehabilitations of services, compliance with rules and sanctions, cooperation with authorities, effect with vicinity and police, entitled of group of users, permitted substance and visual control of substances, number and qualification of staffs,	
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*Workflow.* In Sydney, Australia, the registration process for clients is performed by a health professional who collects the following data sets: (a) demographic characteristics; (b) information regarding drug use and drug treatment history; (c) health; and (d) drug overdose history and blood borne virus risk behaviors. No personal contact details are collected or recorded. Eligible clients are assigned a unique registration number, along with a client chosen password to allow for accurate linkage to visit records. Any referral or other service provided by staff during a client visit is also recorded in the database, as are any clinical episodes related to the visit, e.g., an overdose. Data are held in an operational database (Microsoft Access 2003), and operation and service delivery data are available for the period May 2001 to the end of April 2007. All data presented in this chapter relate to this six-year time frame.

Germany does not report specific activities related to workflow in the drug consumption rooms (DCR). Vancouver attaches workflow to register clients connected to specific e-health applications/databases developed for specific research studies (see e-health).

*E-health tools developed for the injection facilities.* The literature review describes the designing and implementation of multiple e-health tools in Vancouver, and one in Germany. Table 10 provides a description of each e-health solution.

SIF involves multiple inter-connections between health services, narcotics regulations, a close collaboration among the local police departments, SIF management, and community stakeholders (business, non-profit, and individual) relationships. System dynamics is a powerful

tool in analyzing these complex connections with multiple stakeholders, conflicting objectives, and different ownership (Brailsford, 2008). The purpose of this paper is to identify variables that describe the operations and services of SIF following a qualitative system dynamic model.

Table 10. eHealth applications.

eHealth	Description
<i>ARIMA Model</i>	<i>Germany developed the auto-regressive integrating moving average model (ARIMA) to measure the effectiveness of the injection facility. This model computes whether or not a statistical significant correlation between the establishment of the drug consumption room (DCR) and the reduction of drug related death in the investigated cities. The model computes and provides a p value. If the p value is less than 5% it concludes that there is a close statistical relationship between the opening of the consumption room and the long term reduction of the number of drug-related deaths. The model runs good values in Hanover, Saarbrücken. The model got a saturation effect for the cities of Hamburg and Frankfurt due to several consumption room are in operation simultaneously. In Hamburg, a statistical significant intervention occurred after the opening of the third consumption room (<math>p &lt; 0.05</math>). In Frankfurt, data shows a reduction in the number of deaths between 1993 and 1997, and there is a significant correlation when all interventions are combined. There is no p value described by Environmental and Social Research Universitätsstr. DCRs in Hanover, Hamburg, and Frankfurt support the fact that DCRs make a statistical contribution to the reduction of drug related deaths.</i>
<i>VANDU Database.</i>	<i>Vancouver Area Network of Drug Users (VANDU) reshaped the social, structural, and spatial contexts of assisted injection practices in a manner that minimized HIV and other health risks, while allowing people who require help injecting to escape drug scene violence. The findings demonstrate that drug-related risks were minimized when assisted injections were performed by trained peer volunteers and in accordance with a harm reduction policy.</i>
<i>CHASE database.</i>	<i>Data sources include the community health and safety evaluation (CHASE) cohort, which is a community recruited virtual cohort of Downtown Eastside Vancouver residents in Vancouver that prospectively and retrospectively examines health service use in the community by linking to administrative health record databases.</i>
<i>VIDUS research study.</i>	<i>The Vancouver Injection Drug Users Study (VIDUS) is an ongoing prospective cohort study of injection drug users that involves semi-annual serology of HIV and HCV as well as a semi-annual questionnaire.</i>
<i>SEOSI</i>	<i>The Scientific Evaluation of Supervised Injecting (SEOSI) cohort is based on a representative sample of Insite users. The SEOSI questionnaire deals with items that are particularly relevant to Insite, such as risk behaviours, public drug use, satisfaction with Insite, and access to medical care and addiction treatment services. All SEOSI participants provide informed consent to link to the Insite database so that SIF use can be tracked, as well as informed consent to access administrative health record databases in the community.</i>

*Ethical perspectives.* SIFs (Health Canada, 2016), MSICs (NSW National Centre in HIV Epidemiology and Clinical Research, 2007; Van Beek, & Gimour, 2000); and DCRs (Environmental and Social Research Universitätsstr, 2003) are created for the following reasons: SISs were implemented complementarily to other harm reduction measures for the following purposes (EMCDDA, 2009; INSERM, 2010; Noël et al., 2009): (1) to reach the most marginalized populations of drug consumers, who are least likely to obtain access to medical and social support, and connect them with health and social services; (2) to reduce overdose-induced morbidity and mortality; (3) to educate PWID to enhance their health behaviors; (4) to reduce injection-related risks by promoting the prevention and education of

safe self-injecting practices; (5) to improve the global health conditions of PWID by promoting the prevention, screening and medical orientation of viral infections; (6) to foster the initiation of dependence care programs among PWID; and (7) to reduce the nuisances triggered by injection drug use in public spaces, e.g., urban violence and crime, drug trafficking and drug-use waste. (Portier et al., 2014, p. 49).

There are initiatives in health policies trying to meet the causes of drug consumption, such as measures aimed at survival and health stabilization of the drug-dependent, as well as efforts to facilitate placement in therapy and supportive rehabilitation-oriented institutions. Basic classic approaches (drug counseling centers, therapies for substance abuse) exist to reform and create pilot projects to develop alternative ways of helping. These are intended for long-term addicts who have undergone several therapies unsuccessfully or could not be reached with existing resources. Among these alternative services, there is the treatment with substitution therapy, as well as the establishment of drug consumption rooms (Environmental and Social Research Universitätsstr, 2003). In Vancouver, the police/InSite collaboration increases safety and public order, and increases stakeholders' tolerance for the facility seeing it as a health center, not as a drug consumption site (Health Canada, 2016). Additionally, InSite increases harm reduction services effectiveness by including peer-volunteers. The reason for this is due to the fact that some clients may be more receptive to peer-based service delivery models (McNeil, Small, Lampkin, Shannon, & Kerr, 2014). Needle sharing and public drug consumption data show significant reduction after the opening of a facility (explained in crime report subsection). This evidence is geared to politicians, persuading and challenging them to objectively and proudly make their decisions on approving current or new facilities (Patel, 2007).

The integration of domains provides the elements for looking into how one variable impacts other variables. Attachment 2 includes all variable interrelations found. Each domain is analyzed independently, but then all interrelations are merging into one graph, explained in Process 5: Designing the causal loop diagram.

**Domain of knowledge variables relationships.** By identifying the relationships among variables in the structure of the system (e.g., DCRs, MSIC, SIRs, or SIFs), the system behavior is designed, describing how the system elements are related (Checkland & Howell, 1993; Brailsford, 2008). The process connects each sentence to paragraphs described in the literature, and builds a relation describing how one event influences other events (Forrester, 2009) with the goal to construct a causal relationship model.

From the electronic file, all academic and government papers (see Attachment 1) have been analyzed and converted into columns called “Major Point,” “Topics,” “Ideas,” and “Implications, or Summary,” and translated to another Excel file (see Attachment 2: Variables relationships). This new file has eight labels at the bottom indicating the domains analyzed from papers (overdose deaths, service provision, crime reports, budget, metrics, workflow, e-health, and ethics). One label is called Index, and another is for graphing the number of relationships per domain. Each spreadsheet has the following columns: terms, source, structural question, and causal model representation. Terms refers to the words extracted for each paper to be analyzed; source is the paper-data originator of the information; and the structural question consolidates domains and terms. This project identifies a new column called “Causal model representation,” which includes relations among terms and domains to be transferred to the causal loop diagram analysis objective of this project. For practical purposes, this paper is showing the relevant events

(for detailed information, see Attachment 2: Variable relationships). For practical purposes, Tables 11 to 17 show a sample of variable relationships.

Table 11. Overdose variable relationships

<b>Terms</b>	<b>Source</b>	<b>Structural Question</b>	<b>Causal diagram representation</b>
<i>INSITE staff have successfully intervened in over 336 overdose events since 2006 and no overdose deaths have occurred at the service. Mathematical modelling (see caution about validity below) suggests that INSITE saves about one life a year as a result of intervening in overdose events.</i>	Health Canada (2016)	What are the results of SIF about overdosed fatalities?	As staff intervene in overdose events in the SIF, mortality rates decrease
<i>This history helps to contextualise the decreases in all three measures of overdose-related events (ambulance attendances at suspected opioid overdoses, opioid-related deaths and opioid poisoning presentations to Emergency departments) observed in the period prior to and following the opening of the MSIC in both the Kings Cross vicinity and the rest of NSW.</i>	NSW Department of Health. National Centre in HIV Epidemiology and Clinical Research. (2007).	What are the results of overdose related events?	As SIF operates, the following variables decreases:(a) ambulance attendances at suspected opioid overdoses, (b) opioid-related deaths and ( c ) opioid poisoning presentations to Emergency Departments.
<i>By providing safety-related rules, supervision of the injecting process and medically trained staff, it is hoped that overdose deaths can be prevented. Non-fatal overdose is also a significant issue, frequently associated with serious health implications for users and drawing on ambulance and hospital resources</i>	Group (2006). [Joseph Rowntree Foundation]	What are the results of overdosed deaths in DCR?	As safety-related rules, supervision of the injecting process, and more trained staff available, then overdose deaths decrease.

Table 12. Service Provision variable relationships

<b>Terms</b>	<b>Source</b>	<b>Structural Question</b>	<b>Causal diagram representation</b>
<i>54.2% of users interviewed reported that a contact to another helping institution was arranged for them by the consumption room at least once. In 90.6% of these cases, the arranged contact actually took place. Further supportive services mentioned the most frequently were detoxification and therapy institution as well as public authorities.</i>	Environmental and Social Research Universitätsstr (2003)	What are the results of further supportive services outside the institution (e.g. referrals?)?	As users are contacted for supportive services in the SIF, the number of referrals increases (up to 90.6%).
<i>Approximately 20% of PWID were</i>	Potier, C.,	What re the	As patients' registration

<i>interested in joining a dependence care program (Milloy et al., 2010; Wood et al., 2006d), and in Sydney's SIS, 25% of the interested subjects started such a program (Kimber et al., 2008b). Among the PWID who used the Vancouver SIS, 18% secondarily engaged in a detoxification program (Wood et al., 2006d), 57% started an addiction treatment, and 23% stopped injecting drugs (DeBeck et al., 2011).</i>	LaPrévôté, V., Dubois-Arber, F., Cottencin, O., Rolland, B. (2014).	results in implementing SIF on regards to addiction treatment programs?	increase at SIF, dependence patients' care program increase (25%), the number of patients in detoxification program increases (18%), and patients suspended injecting drugs increases (23%)
<i>INSITE Vancouver has demonstrated largely positive outcomes in the facility's target population, including: reduced injection risk- behaviours, OD rates and public disorder; increased treatment service utilization; in addition, no overdose death has ever occurred at the facility.</i>	Fischer, B., Murphy, Y., Rudzinski, K., & MacPherson, D. (2016;2015;)	What are the results of the services evaluated in the SIF in Vancouver?	As SIF services increases, injection reduced injection risk- behaviours decreases, OD rates and public disorder also decreases. As SIF service increases, service treatment utilization increases. As SIF increases, overdose deaths decreases (to zero).

Table 13. Crime reports variable relationships

<b>Terms</b>	<b>Source</b>	<b>Structural Question</b>	<b>Causal diagram representation</b>
<i>The proportion of residents who agreed with the establishment of the injection site (68% in 2000 vs. 78% in 2002), agreed that the facility reduced the risk of HIV/HCV transmission (87% vs. 92%), and reduced discarded needles (80% vs. 82%) increased, while the proportion of residents who agreed that the facility attracted drug users to the area (65% vs. 55%) decreased. Increasingly, residents disagreed that the site encouraged injection drug use (62% vs. 73%), made law enforcement difficult (55% vs. 63%) or encouraged people to think that it is legal to inject heroin (44% vs. 52%)</i>	Center of Addictions Research, UVIC, 2006	What are the community and stakeholders' attitudes?	As SIF operates the attitudes of local residents and owner business increase positively, reducing HIV/HCV cases, discarded syringes, and the number of drug users. While injecting drug use decrease. law enforcement increase, or encourage people to think that is legal to injecting heroin increase
<i>Self-reports from users of the INSITE service and from users of SIS services in other countries indicate that needle sharing decreases with increased use of SISs. Mathematical modeling, based on assumptions about baseline rates of needle sharing, the risks of HIV transmission and other variables, generated very wide ranging estimates for the number of HIV cases that might have been prevented. The EAC were not convinced that these assumptions were entirely valid.</i>	Health Canada (2016)	What are the results of SIF on needle exchange programs?	As patients registered in the SIF, needle sharing decrease with an increase use of SIF.



<i>Influence of SISs on rates of drug-related crime in the vicinity in short and longer term (2-3 years) and, if appropriate, evidence for the cost-effectiveness of SISs relative to alternative means of reducing these crime rates.</i>	Health Canada (2016)	What are the results of SIF about drug related crime in the vicinity in short term?	As patients' registration increases, drug related crimes in the vicinity decreases.
<i>The opening of Insite resulted in a reduction of public injection, discarded syringes and drug-related litter, and no observed increase in the number of suspected drug dealers in the vicinity of the facility Drug-related crimes have not increased and even a small reduction in vehicle break-ins and thefts</i>	Center of Addictions Research, UVIC, 2006	What are the results of implementing SIF regards on public order?	As SIF operates, there is a reduction of public injection, discarded syringes and drug-related litter, and no observed increase in the number of suspected drug dealers in the vicinity of the facility.

Table 14. Budget variable relationships

<b>Terms</b>	<b>Source</b>	<b>Structural Question</b>	<b>Causal diagram representation</b>
<i>The SIF may have reduced needle sharing and increased condom use; these behavioural changes could translate to about \$6 million in annual healthcare cost savings. Peer-reviewed research demonstrates other health benefits that InSite has provided for the larger community.</i>	BC Center for Disease Control (2014)	What are the results of declining overdose deaths in regards healthcare cost savings?	As SIF operates, there is a reduction in needle sharing and increased condom use, and there is an increment in budget up to \$6 million
<i>Since the cost can be considerable—depending on the size of the facility and whether it is equipped with additional amenities—the local authority shall be prompted to take a closer look at policy priorities. This involves having to make a fairly good case that drug consumption rooms offer a solution for the—as real experienced—problem of drug use in the street.</i>	De Yong and Webber (1999)	What are the results of the Size of the SIF?	As SIF size increases, costs increase.
<i>Since these SCS were designed as research studies, overhead costs (especially for research data collection) were considerably higher than would be in the more established SCS across Europe, however it is impossible to tell since European facilities typically do not provide cost data. It seems, however, that integrated SCS offer the ‘best value for money’ (Independent Working Group, 2006).</i>	Center of Addictions Research, UVIC, 2006	What are the cost effective results SIF data?	As SIF operates, overhead costs increase. As SIF operates, cost per client decreases in the second year.

Table 15. Metrics variable relationships.

<b>Terms</b>	<b>Source</b>	<b>Structural Question</b>	<b>Causal diagram representation</b>
<i>BC Ambulance Service receives between 150 and 200 calls per week which are coded as Ingestion Poisoning calls.</i>	BC Center for Disease Control (2016)	What are the results of ambulances services?	As SIF operates, the number of ambulance services decreases due to ingestion of poisoning calls.
<i>In Germany, The probability to stay in hospital for at least 1 night is ten times higher for OD's happening on the street, compared to ODs inside an injection room, where immediate help is guaranteed (Integrative Drogenhilfe, 1997).</i>	De Jong, W. & Weber, U. (1999).	What are the results of DRC in Germany?	As patients' attend CDRs services, the probability to spend 1 night in the hospital due to overdose is 10 times less than if patients do not attend DCRs services.
<i>In The Netherlands, A first evaluation of the facility 'IT' shows that since the opening of the drug consumption rooms, drug use in the streets has decreased and visitors of drug consumption rooms take fewer health risks than before</i>	De Jong, W. & Weber, U. (1999).	What are the results of DRC in The Netherlands?	As DCRs patients' registration increases, drug use in the streets decreases, and consumers' health risks decrease.

Table 16. Workflow variable relationships.

<b>Terms</b>	<b>Source</b>	<b>Structural question</b>	<b>Causal Diagram representation</b>
<i>In Sydney, Australia, the registration process of clients is performed by a health professional who collects the following data sets: (a) demographic characteristics, (b) information regarding drug use and drug treatment history, (c) health, and (d) drug overdose history and blood borne virus risk behaviors.</i>	NSW Department of Health. National Centre in HIV Epidemiology and Clinical Research. (2007).	What are the registration steps in Sydney?	Not applicable. This information is used to visualize the process in causal loop.
<i>Eligible clients are assigned a unique registration number, along with a client chosen password to allow for accurate linkage to visit records. Any referral or other service provided by staff during a client visit is also recorded in the database, as are any clinical episodes related to the visit e.g. an overdose. Data are held in an operational database (Microsoft Access 2003) and operation and service delivery data are available for the period May 2001 to end</i>	NSW Department of Health. National Centre in HIV Epidemiology and Clinical Research. (2007).	What are the registration steps in Sydney?	Not applicable. This information is used to visualize the process in causal loop.

<i>April 2007 and therefore all data presented in this chapter relate to this six-year time frame.</i>			
<i>Vancouver attached workflow to register clients connected to specific eHealth applications/databases developed for specific research studies (see eHealth).</i>	Vancouver Coastal Health Authority (2016).	What are the registration steps in Vancouver?	Not applicable. This information is used to visualize the process in causal loop.
<i>The SIF database has a search function that allows for rapid searches based on demographic information, such as birth date, if an individual forgets their handle. Similar anonymous tracking of individual clients is commonly used at needle exchanges and other services for illicit injection drug users. The database tracks what drugs participants are consuming (heroin, cocaine, etc) and what services, such as nursing care and counseling services, are accessed by each client.</i>	Vancouver Coastal Health Authority (2016).	What are the registration steps in Vancouver?	Not applicable. This information is used to visualize the process in causal loop.
<i>Injecting centres are typically located within lowthreshold, professionally staffed centres that aim to provide an accessible, stress-free, hygienic and humane environment for drug users. Service delivery is based on harm reduction, acceptance and anonymity. There is typically no detailed assessment or registration process to track individuals or outcomes. Routinely collected data tend to be —count~ data used to generate operational statistics.</i>	Dolan, Kimbre, Fry, Fitzgerald, McDonald, & Trautman (2000).	What are the registration process in DCRs-Germany?	Not applicable. This information is used to visualize the process in causal loop.

Table 17. eHealth variable relationships

<i>Terms</i>	<i>Source</i>	<i>Structural question</i>	<i>Causal diagram representation</i>
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<p><i>Germany developed the auto-regressive integrating moving average model (ARIMA) to measure the effectiveness of the injection facility. This model computes whether or not a statistical significant correlation between the establishment of the drug consumption room (DCR) and the reduction of drug related death in the investigated cities. The model computes and provides a p value. If the p value is less than 5% it concludes that there is a close statistical relationship between the opening of the consumption room and the long term reduction of the number of drug-related deaths</i></p>	<p>Federal Ministry of Health, Germany. Environmental and Social Research Universitätsstr (2003).</p>	<p>What are the results of time series analysis performed in Germany?</p>	<p>AS third SIF operates in Germany, the statistical significance opening SIF reduces overdose deaths.</p>
<p><i>In the cities of Saarbrücken, Hanover, Hamburg, and Frankfurt there is a significant statistical relationship between the operation of the drug consumption room and the reduction of drug deaths. Auto regressive integrated moving average model (ARIMA Model) was used to compute relation between open the SIF and reducing deaths drug related.</i></p>	<p>Federal Ministry of Health, Germany. Environmental and Social Research Universitätsstr (2003).</p>	<p>What are the results of the DCR operations in Germany?</p>	<p>AS SIF operates the significant statistical relationship between the operation of DCR and the reduction of drug deaths increases.</p>
<p><i>The Vancouver Area Network of Drug Users (VANDU), a drug user-led organization in the Downtown East side made up of more than 1,000 current and former drug users, has undertaken efforts to facilitate safer injecting among this population. Vancouver Area Network of Drug Users (VANDU) reshaped the social, structural, and spatial contexts of assisted injection practices in a manner that minimized HIV and other health risks, while allowing people who require help injecting to escape drug scene violence. Drug consumption in jail have significant increases.</i></p>	<p>McNeil, R., Small, W., Lampkin, H., Shannon, K., &amp; Kerr, T. (2014).</p>	<p>What is VANDU?</p>	<p>Not applicable</p>

Table 18. Ethics variable relationships

<b><i>Terms</i></b>	<b><i>Source</i></b>	<b><i>Structural Question</i></b>	<b><i>Causal diagram representation</i></b>
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<i>Legal standards to evaluate SIF: functional furnishing, emergency medical care and counseling, rehabilitation oriented counseling and therapy programs, prevent criminal behaviors, cooperation with local authorities for public safety, exact specification for the consumers (data collection), SIF evaluation, permanent presence of staff, and identify a responsible for the site</i>	Federal Ministry of Health, Germany. Environmental and Social Research Universitätsstr (2003).	What are the legal standards to evaluate SIF?	Not applicable
<i>Drug consumption rooms (DCRs) challenges with multiple factors including the repression focused on approach to drug control instead of developing strategies for health policies reforms</i>	Fisher, Murphy, Rudzinsky, & McPherson (2016)	What is the legal reasons DCRs operates?	Not applicable
<i>Ethical and political concerns relate to the view in government that DCRs would be perceived by the public to be condoning and aiding illicit drug use and therefore would undermine the entire drug classificatory system and the criminal justice system in relation to the criminal offenses of drug possession and drug dealing.</i>	Patel (2007)	What are the ethical concerns related to SIF?	Not applicable

**Process 4: Fuzzy-Set / Qualitative comparative analysis (fsQCA) software, developed by the University of Arizona (2008).** The analysis of domains includes the use of computer software proposed by Onwuegbuzie & Frels (2016) developed by the University of Arizona, called Fuzzy-Set / Qualitative comparative analysis (fsQCA). The software considers all papers in a binary matrix checking whether or not they explain the following domains: (1) overdose deaths; (2) services provided by the supervised injecting facility; (3) budget consideration; (4) metrics, including overdose death statistics; (5) workflow; (6) crime reports; (7) e-health tools, and (8) ethical considerations for SIFs (see Table 5). The software requires an outcome variable, which has been called SIF effectiveness. The software computes in the Fuzzy analysis with two variables: solution consistency and solution coverage.

Consistency measures the degree to which solution terms and the solution as a whole are a subset of the outcome. Coverage measures how much of the outcome is covered (or explained) by each solution term and by the solution as a whole. (fs/QCA, 2016)

Table 5 has been transformed into a binary matrix for quantitative theme analysis (Onwuegbuzie & Frels, 2016; University of Arizona, 2008). There are eight domains, and the software demands there are  $2^k$  cases,  $k$  = number of domains of knowledge. Consequently, there are  $2^8 = 256$  cases to be added to Table 4, having zeros for the frequency variable, and then import these values from the Excel file to the data table in the software.

The Fuzzy analysis reveals the following scenarios:

Analyzing overdose, service provision, and crime reports. The values are:

compute: `sif_effectivene = calibrate (25,10,2)`

\*\*\*\*\*

\*TRUTH TABLE ANALYSIS\*

\*\*\*\*\*

File: C:/Users/acer user/Documents/Supervised Injection Site/Academic

papers/Abdul/Comprehensive Literature Review/Comprehensive Literature review/Table of truth.csv

Model: `sif_effectivene = f(overdose_deaths, metrics, services, crime_reports, ethics, budget, registration, e-health)`

Rows: 256

Algorithm: Quine-McCluskey

True: 1

0 Matrix: 0-CL

## --- TRUTH TABLE SOLUTION ---

Assumptions:

	raw	unique	
	coverage	coverage	consistency
	-----	-----	-----
~metrics	0.500000	0.199219	1.000000
~overdose_deaths	0.500000	0.199219	1.000000
~services*~crime_reports*~budget	0.125000	0.011719	1.000000
~services*~crime_reports*~ethics	0.125000	0.011719	1.000000
~services*~crime_reports*~registration*~e-health	0.062500	0.003906	1.000000

solution coverage: 0.800781

solution consistency: 1.000000

Previous results reflect that the combinations of all domains have coverage solution equal to 0.8, indicating they are a subset of the outcome (SIF effectiveness). These variables have a solution consistency equal to 1.0, indicating they explain by themselves the effectiveness of the supervised injecting facility. As shown in the above data, any other combination of domains has a weak coverage (less than 0.5), indicating that they fail in representing a subset of the outcome variable.

**Conclusion.** Categories from all 27 academic and government papers are grouped by (1) services provided by the supervised injecting facility, including (2) overdose death statistics; (3) budget consideration; (4) metrics; (5) workflow; (6) crime reports; (7) e-health tools; and (8) ethics considerations for SIFs. The robust domain includes overdose, services, crime reports, ethics, budget, metrics, and e-health, indicating they are a subset of the SIF and they explain by themselves the positive outcomes of the site. There are four papers reflecting the use of e-health applications, models, or databases in Germany and Vancouver. There have been detected the

following unduplicated numbers of relations in the following domains: overdose deaths (11), service provision (18), crime report (23), budget (3), metrics (4). Workflow (5) is embedded in the service provision. E-health (8), and ethics (17) domain of knowledge have different relationships and are not graphed in the causal loop diagram, (see Attachment 2). These domains are the nodes constructing a causal model network (Anderson & Aydin, 2005; Brailsford, 2008; Erdil & Emerson, 2009), making the evidence found from the literature review visible.



### Section III. Designing the Causal Model

System dynamics (SD) is an analytical modeling methodology with the goal of understanding system behavior, understanding how variables interact, and connecting their influence relations through arrows if they have a direct relationship increasing or decreasing in the same direction, indicated with a positive sign, or if variables are inversely related, indicated by a negative sign. It includes qualitative and quantitative analysis (Brailsford & Hilton, 2001). This pictorial representation is defined as the causal influence diagram (Erdil & Emerson, 2009). The aim of the causal influence diagram is to analyze two types of loops: reinforce loops, or vicious circles with an even number of negative signs; and balance loops, which have an odd number of negative signs. Reinforce loops grow exponentially such as for resource allocation. In the balance loops, the system regulates itself (Brailsford & Hilton). Unintended consequences of actions refer to unforeseen events for the purpose of actions. In this case, aggressiveness among consumers is an unintended consequence when patients' waiting time increases.

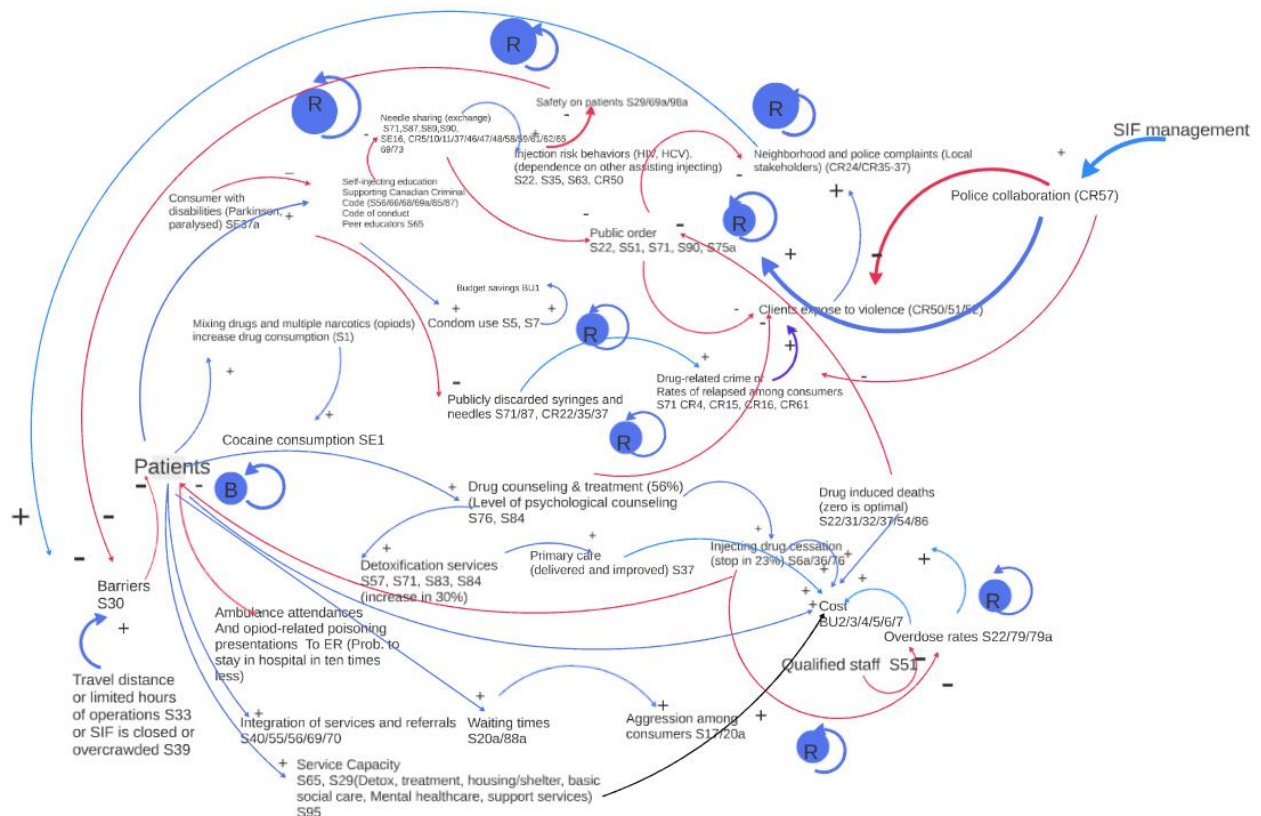
SD is efficient because it explains the system's strategic scope and has a large number of entities, control variables that are represented by rates (increment or decrement), members with similar behaviors, multiple connections with different health services inside or outside the facility, time, and a purpose in policy making (Brailsford & Hilton, 2001). CDRs, MSICs, or SIFs are suitable for this definition, because the facility manages interactions among government and society policies, local stakeholders' perceptions about drug users, vicinity neighbors, police agents, and public administrators. It is a complex system. In this paper, SIF uses descriptive, numerical, and experts' judgments, data extracted from academic databases, government reports, and other literature, such as organizational web pages. SD quantitative analysis uses stocks and accumulation converting the influential loop diagram in a flow diagram. Quantitative analysis is

out of the scope of this project. The influential causal diagram has been constructed by implementing the variable relationships extracted from the literature review (see Tables 12 to 18, already explained). Literature review data support the SD qualitative analysis: the CDR, MSCI, or SIF influential causal loop diagram. Figure 5 illustrates the supervised injection facility based on variable relationships, and follows system dynamics quality analysis.

Figure 5 illustrates the causal diagram pointing out one balance loop and seven reinforce loops. The following paragraphs discuss one balance loops and seven reinforce loops in the supervised injecting facility causal diagram loop. For practical use, each explanation considers the start point in the left side of the figure where the patient variable is located, and then moves following the arrows.

Figure 5 describes what happens as the number of patients attending the facility increases, the training for self-injecting increases, the number of syringes and needles among consumers decreases, the injecting risk behaviors decrease, and the budget of \$6 million increases. It reduces the dependence on others for injecting. As risk behaviors decrease, the safety of patients increases (the negative sign implies that risk behaviors and safety are inversely related). Consequently, barriers decrease. Barriers and patients have an inverse relationship. As barriers decrease, then the number of patients increases. There is an even number of negative signs (4). As a result, this is a reinforce loop, meaning the system grows exponentially. As an unintended consequence, as the number of patients increases, the waiting times also increase, thereby impacting the aggression among consumers. Germany is the only facility to reported violence when CDRs are overcrowded (Environmental and Social Research Universitätsstr, 2003). Additionally, ambulance attendance decreases, integration of services increases, and SIF service capacity, costs, and qualified staff all also increase.

Figure 5. Supervised Injection Facility Causal Diagram



As SIF patients' visits increase and needle sharing decreases, the public order increases (the negative sign implies inverse relation). Here there are two reinforce loops. The first loop states that as public order increases, clients exposed to violence decreases; then police complaints decrease, barriers decrease (indicated with the negative sign), and more patients' visits are recorded in the SIF. This is a reinforce loop because there are four negative relationships in this loop. The system (patients) may increase or decrease exponentially.

The second loop includes a path connecting public order to a decrease in neighborhood and police complaints, then barriers decrease, and more patients are attending the facility. This loop is a reinforce loop because there are four negative signs. This loop may increase or decrease

exponentially. In both loops, the system does not regulate itself. Hospital managers are required to incorporate new variables in order to control the number of clients, services, associated costs, and required staff, among others.

As the number of patients increases, self-injecting education increases, and publicly discarded syringes and needles decrease (indicated with the negative sign, center of the figure); then drug related crime or relapse among consumers decrease. This requires collaboration with the police to decrease drug-related crime. If drug related crime decreases, then clients exposed to violence decreases, then neighborhood and police complaints decrease, barriers to operating the facility decrease, and the number of patients visiting the facility increases (negative sign implies opposite relation). There are two negative signs in this loop, meaning this is a reinforce loop in which patients increase exponentially.

As patients' visits increase, 56% of patients agree to register for drug counseling, while 23% decide to stop drug injection for a limited time, at six months minimum (DeBeck, Kerr, Lai, Buxton, Montaner, Wood, 2012). Researchers argue that knowing the level of psychological counseling, drug cessation may increase, decreasing the number of patients who enter in next drug counseling and treatment program. Investigators also point out that this is the first research study connecting supervised injection facility to drug cessation. This is a balance loop due to the odd number of negative signs (1) (Brailsford, 2008; Erdil & Emerson, 2009; Forrester, 2009). It reveals how the system regulates itself. It controls the number of visits by reducing the number of patients when they agree to attend drug counseling and decide to stop injecting drugs. As a result, fewer patients attend the facility because 23% of them have ceased drug use. Unfortunately, some clients decided to stop injecting drugs for six months, but then started to use drugs again.

As the number of patients' visits increases, drug counseling increases, clients exposed to violence decreases (indicated with a negative sign); this decreases the neighborhood and police complaints, and reduces barriers to the facility (clients exposed to violence and barriers run in the same direction). If barriers decrease, then patients' visits increase. The number of negative signs are two, meaning this is a reinforce loop. The SIF may be interested in remaining in this loop, growing the number of patients and opening the doors for more patients. As unintended consequences, costs, services, and staff required will increase exponentially.

As drug counseling increases, drug cessation increases, and drug induced deaths decrease because they run in the opposite direction from injecting drug cessation. If drug induced deaths decrease, then public order increases, clients exposed to violence decreases, thereby decreasing neighborhood and police complaints, decreasing barriers to operate the facility, and increasing patients' visits. The number of negative signs are four, meaning this is a reinforce loop, the number of patients grows exponentially with unintended consequences of costs and personnel required to operate the facility. Drug overdose events are managed efficiently by trained staff who intervene when overdose events occur, resulting in reducing overdose deaths. All the facilities have reported no fatalities since their operation opened. There is a second loop associating public order with neighborhood and police complaints. This secondary loop is a reinforce one.

Figure 5 also explains that SIFs reduce the number of ambulance attendances and opioid-related poisoning, connecting patients to primary care and increasing the operational costs. By incorporating qualified staff, overdose events are managed. In Vancouver, there have been no overdose deaths since SIF began its operations in 2003 (Vancouver Health Coastal Authority, 2016). If patients have long distances to travel to use the facility, they decide to use public spaces,

increasing the barriers for SIF, thereby allowing fewer patients to attend the facility. Additionally, the collaboration between SIF and police increase the operations of the facility, implementing public order.

**Discussion.** As explained, this causal loop diagram describes the supervised injection facility behavior (Brailsford, 2008; Erdil & Emerson, 2009; Forrester, 2009), connecting all stakeholders to the domains of knowledge identified in the literature review: services, overdose deaths, ethics, metrics, crime reports, e-health, and budget managing the system variable relationships, described in 27 academic and government papers. The SIF behavior is explained by pointing out one balance and seven reinforce loops. Additionally, it includes identifying the changes in SIF variables and stakeholders' decisions, understanding SIF fragments and entire knowledge, and pointing out the consequences of proposed actions (Forrester, 2009). This research concludes that the facility improves patients' health allowing access to the healthcare system, reducing overdose deaths, and improving public safety through trained staff intervening when overdose events arise. As shown in Table No. 19, a comparison before and after opening a SIF shows the following crime reports benefits in reducing: (a) the average number of IDU's seen using public spaces; (b) the average number of publicly discarded syringes and injection-litter (Wood et al., 2004c); (d) the number of injection users seen in public spaces by residents, and (e) by business operators; the number of syringes reported by (f) residents and (g) business operators (Portier et al., 2014). Consequently, the research question is answered, and the positive outcomes of the facility are identified. Health administrators may use this theoretical causal diagram and customize it for their specific requirements, such as types of services and identifying/updating new/current stakeholders, improving healthcare for patients, and SIF operations. AVI can follow this recommendation in implementing SIF in Victoria, BC.

Table No. 19: SIF Effectiveness. Crime Reports

Average (daily mean)	Predicted daily mean no. (and 95% CI)		Source
	Before	After	
IDUs injecting in public	4.3 (3.5–5.4)	2.4 (1.9–3.0)	Wood et al (2004c). (Before 6 weeks opening SIF; After 12 weeks opening SIF)
Publicly discarded syringes	11.5 (10.0–13.2)	5.4 (4.7–6.3)	
Injection-related litter	601 (590–613)	310 (305–317)	
Public Injection: this population noted the following public injection pattern:			Portier et al. (2014). (Not specify time before and after SIG opened).
Residents (p<0.01)	33%	19%	
Business Operators (p<0.03)	38%	28%	
less syringes dropped (p<0.01)			
Residents	67%	40%	
Business Operators	72%	57%	
Complaints about PWID nuisances, but no change in the number of drug deals			
Residents (p<0.8)	28%	26%	
Business Operators (p<0.26)	33%	28%	

Patients grow exponentially in all reinforce loops when connecting barriers to patients. Hospitals and public health managers may be interested in the growth of patients attending the facility without limits because of the overdose death alert published in Victoria, BC (see Figure 1). The number of overdose deaths in Vancouver occurred outside the SIF (Vancouver Coastal Health Authority, 2016). As the number of patients increases, the clients' waiting times increase, impacting aggression among consumers in the facility. Also, the capacity of services is reduced, the number of ambulances is reduced, and the integration of services is increased. Additionally, the facility demands more financial resources to provide the required services. The balance loop regulates patients' visits, including services to the facility, and increases injecting drug cessation.

The supervised injecting facilities in Canada and Germany are the only centers that report the use of e-health applications mainly in showing the importance of the facility in guaranteeing how the facility reduces overdose deaths, thereby reducing crime reports. Vancouver is the pioneer in demonstrating that the facility increases drug cessation for a limited time (six months

minimum). However, there are no connections to electronic medical records in providing primary care, supportive services, or referrals for patients. Medical records are managed, safely stored and interchanged, and provide health data to clinicians to improve their decisions, thereby implying an improvement in patients' health. This is an area to pay attention to in order to enhance the services. Current crime public policies and laws may be redesigned to allow patients to disclose their addiction history to their doctors to improve the health system services.

E-health applications support patients' registration process, computing metrics, and implementation of solutions to improve primary and supportive services for patients. These studies also provide evidence for the legal aspects of the facility in decreasing barriers for current and future operations. Budget is impacted by training patients in self-injection and condom use, as well as the variety of services provided by the facility, such as overdose interventions, detoxification, drug counseling, and access to primary care. Additionally, services include hygiene, connecting to housing, and specialty referrals.

This research project has a limitation in focusing on specific references in 27 academic and government papers. However, it does not include specific outcomes from Denmark, Luxemburg, Spain, and Norway. It is recommended to search the health authority documents about their evaluations of consumption rooms. Moreover, the international consumption room website is not consistent in providing outcomes for all countries. Furthermore, the outcomes reported by Australia, Canada, and Germany are not standards, making the analysis difficult. It may require an international effort combining all experiences. Researchers can find new relationships from the literature review designing a new causal loop diagram. Yet this research study does not implement interviews for consumers; it includes a feasibility study developed by CARBC in Victoria, BC.



#### Section IV. Conclusions and Recommendations

The influential causal loop diagram figures the data extracted from the literature review. The information displays how the SIF provides self-injecting training for patients, reduces needle sharing among consumer, reduces their risk injecting behaviors, reduces overdose deaths and crime reports, and manages healthcare services. This action incorporates collaborative work with the police, reducing barriers for the facility to allow more patients' visits. The SIF reduces discarded needles and syringes in public spaces then reduces drug related crimes. These statements respond to the research question and identify the positive outcomes of the SIF.

Potier et al. (2014) developed the first study connecting the SIF to injecting drug cessation. Investigators argue for the need for more research on the level of psychological counseling to extend the drug cessation time. This drug cessation allows for fewer neighborhood complaints within the facility vicinity (500 meters) and fewer police complaints, thereby reducing barriers and increasing patients' visits. Drug injection cessation also impacts the reduction of overdose rates, increasing public order, reducing neighborhood complaints, creating fewer barriers and increasing patients' visits.

The literature review methodology can be replicated by following five processes described in this research project. In fact, the literature review supports the causal loop diagram by implementing the variable relationships connecting variables in the SIF causal loop diagram system. Qualitative software analysis reveals all eight domains that explain the SIF, and they are a subset of the facility. Because of the limitations exposed in the previous chapter, this project intends to support AIDS Vancouver Island (AVI) in implementing a SIF in Victoria, BC.

This research project provides the causal loop diagram. At the time of writing this project, there are no causal loop diagrams to explain other SIF behavior. Consequently, this project is the

first study to apply system dynamics in this area. It is recommended to continue this study developing the quantitative analysis by transforming the causal loop diagram in stocks, programming in iThink Stella (2016), accessing and managing real data to compare real world and system outcomes, and validating the quantitative model.

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