Supervised Injection Facility:
A Causal loop design and analysis.

Research Project

University of Victoria

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Agenda

- Objective
- Research Question
- Methodology
  - Literature review
  - System dynamics
- Results
- Discussion. Designing a policy decision
- Conclusions and recommendations

Objective

- This study focuses on supervised injection facility (SIF) operations, providing and analyzing services for clients, crime reports, workflow, metrics, e-health applications, and managing overdose events to reduce overdose deaths.
- Acronyms
    - Drug Consumption Room (DCRs) in Europe
    - Medical Supervised Injection Center (MSIC) in Australia
    - Supervised Injection Facility (SIF) in Canada
- This study does not intend to discuss government approval to make the operations of the SIF available.

Research Question:

- 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?

- *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.
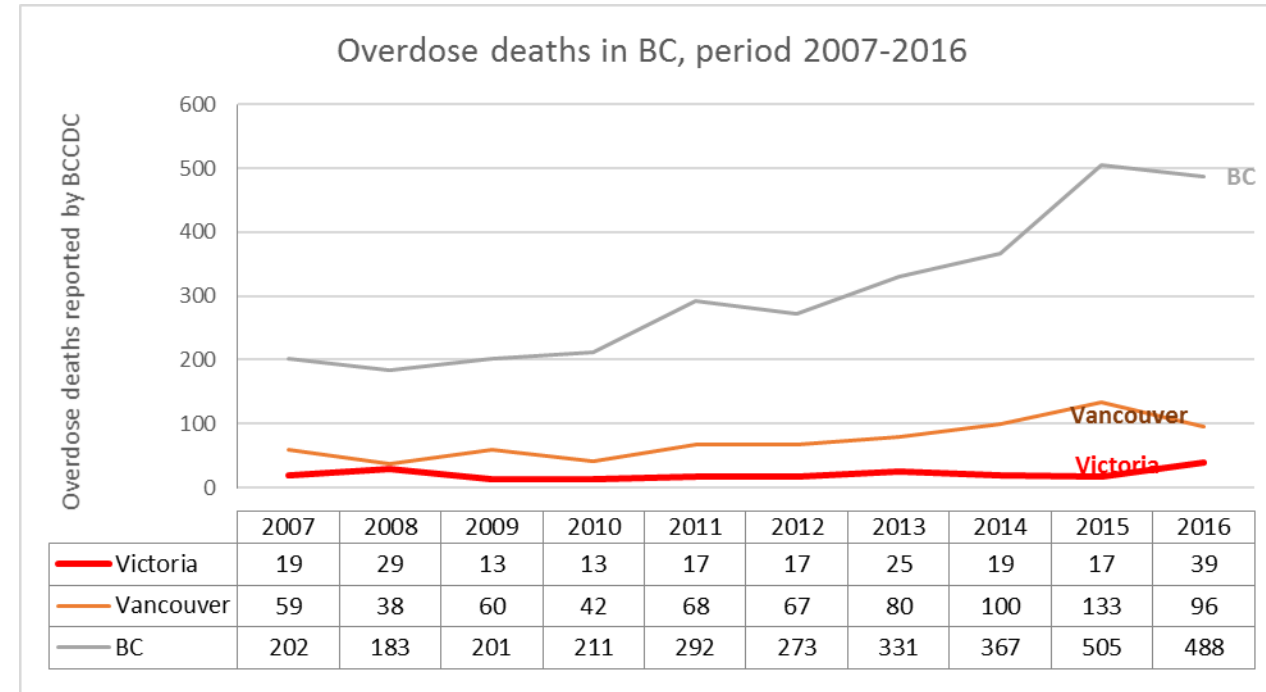
Positive outcomes SIF Vancouver

- 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.

Positive outcomes SIF Vancouver

- Figure 1 shows overdose deaths in Victoria, Vancouver, and BC (BC CDC, 2016). There has been warnings of 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).

- Victoria may represent 10% of total overdose deaths at the end of 2016.

Overdose deaths in BC, period 2007-2016

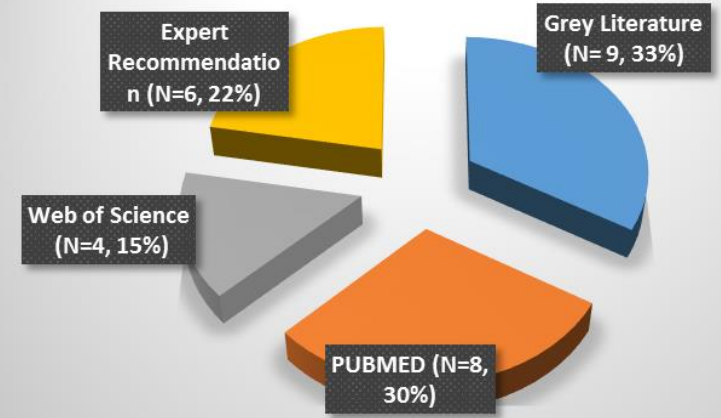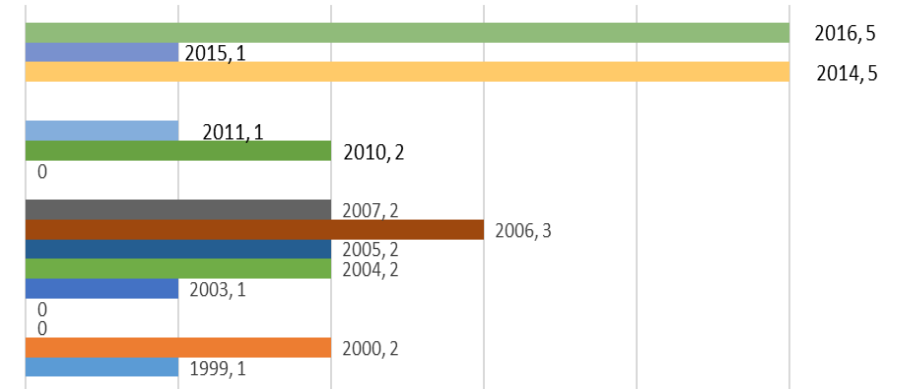|	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Victoria	19	29	13	13	17	17	25	19	17	39
Vancouver	59	38	60	42	68	67	80	100	133	96
BC	202	183	201	211	292	273	331	367	505	488

Methodology. Literature review.

- **Process 1.** Inclusion and exclusion criteria .

- Algorithm developed to search papers
  - The strategy used in PUBMED and Web of Science was looking for 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. (N=1,895)
  - Peer review papers (N=39)
  - Place equals to Canada, Europe, or Australia (N=10). Discarded 3.
  - Data bases accessed: PUBMED, Web of Science, Google Scholar (Ministries of Health, Research Institutes) and Expert recommendation.
  - Timing: 51.85% of all papers (N=14) have been published between 2010 to 2016 (last six years).
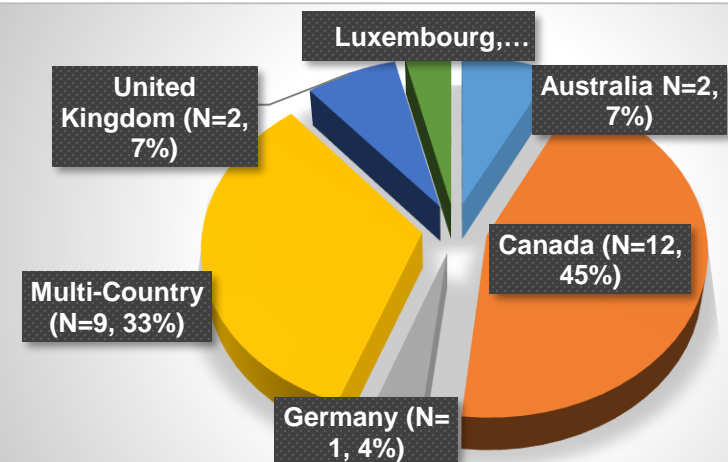
By source

By year
of publication

By country
Of publication

Methodology. Literature Review (cont.)

Process 2: *Deconstructing all papers in specific fields*

- Extracting data from literature: author, year of publication, title, research approach used.

- Major Point, Topics, Ideas, (Include inconsistencies, similarities, questions, concerns, and possible omissions); summary and conclusions.

Process 3: Domain of knowledge: integration analysis. Variable relationships

- Elaborate domains of knowledge
  1. Overdose deaths
  2. Services provision
  3. Crime reports
  4. eHealth applications used/designed
  5. Workflow
  6. Ethics
  7. Metrics
  8. Budget

Domain Analysis

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	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 oh 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., Laprévote, 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., &Gilmour, S. (2000)., metrics, services, crime reports	1	1	1	0	1	0	0	0	7	
16	16. Vancouver Costal 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 consumptions room (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 Françoise 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
	Total academic, government papers and website									**27**	

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.

Methodology. Process 3: Variable relationships
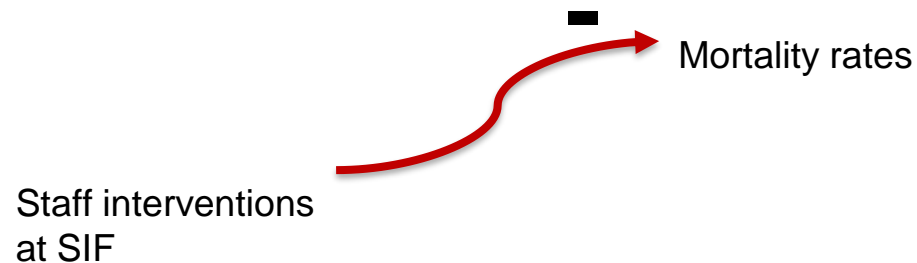
Integration

- 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.

Variables relationships

- 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. **Looking for words as increment, decrement in papers text: identifying control variables: cause and effect.**

- 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. Causal model representation," which includes relations among terms and domains to be transferred to the causal loop diagram.
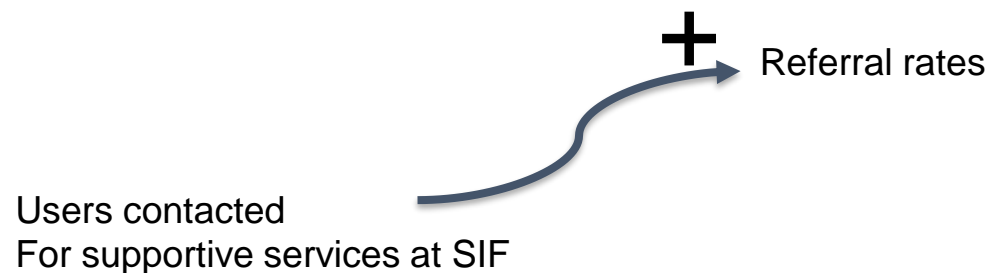
Examples of variable relationships: Overdose

Terms	Source	Structural question	Causal diagram representation
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.	Health Canada (2016)	What are the results of SIF about overdose fatalities?	As staff intervene in overdose events in the SIF, mortality rates decrease

Mortality rates

Staff interventions at SIF

Examples of variable relationships: Service provision

Terms	Source	Structural question	Causal diagram representation
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.	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%).

+

Referral rates

Users contacted
For supportive services at SIF

Examples of variable relationships: Crime reports

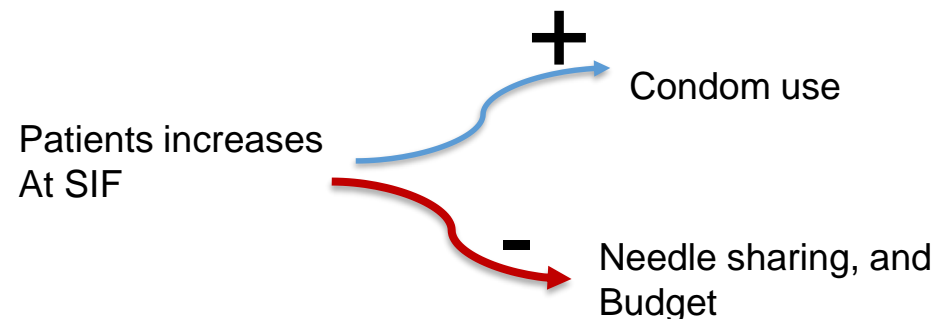| Terms	Source	Structural question	Causal diagram representation
The opening of Insite resulted in a reduction of public injection, discarded syringes and drug-related litter, and no observed increase in the number of suspected drug dealers in the vicinity of the facility Drug-related crimes have not increased and even a small reduction in vehicle break-ins and thefts	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.

Patients increases
At SIF

— Public injection,
Discarded syringes, and drug-related litter

Examples of variable relationships: Budget

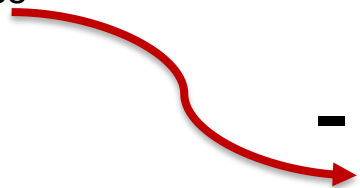| Terms	Source	Structural question	Causal diagram representation
The SIF may have reduced needle sharing and increased condom use; these behavioural changes could translate to about $6 million in annual healthcare cost savings. Peer-reviewed research demonstrates other health benefits that InSite has provided for the larger community.	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 a decrease in budget up to $6 million

+

Patients increases
At SIF ⟶ Condom use

–

⟶ Needle sharing, and
Budget

Examples of variable relationships: Metrics

Terms	Source	Structural question	Causal diagram representation
Ambulance administered naloxone events in BC peaked in 2011 (the year that overdose deaths due to increased heroin potency were also noted see chapter 5) with 2,242 events, and decreased subsequently reaching 2,011 in 2013. Based on ambulance attendances, the reduction in opioid-related overdoses was much more substantial in the immediate vicinity of the MSIC than in other neighbouring areas and in New South Wales in general. **This finding suggests that the Sydney MSIC provided an environment where injecting drug users at risk of overdose were able to receive early intervention and thereby avoid the need for ambulance services.**	*BC Center for Disease Control (2014)* *NSW Department of Health, Australia*	*What are the results of ambulances services?*	*As SIF operates, the number of ambulance services decreases due to ingestion of poisoning calls.*

Patients increases
At SIF

— Number of ambulances services due to
Ingestion of poisoning calls

Methodology. Literature review (Cont.)

- Process 4. Quantitative analysis
  - Transform Table of Domain of Knowledge into the Table of truth. What papers cover each domain.
  - a Fuzzi-Set / Qualitative comparative analysis (fsQCA) software, developed by the University of Arizona (2008).
  - Elaboration the excel spreadsheet with 2^k cases, being k=number of domains.
  - 256 rows in excel, which then translate to fsQCA.

- solution coverage: 0.800781
- solution consistency: 1.000000

- The combinations of all domains have coverage solution equals to 0.8 indicating they are a subset of the outcome (SIF effectiveness); and these variables have a solution consistency equal to 1.0 reflecting that they explain by themselves the effectiveness of the supervised injecting facility.

Table of truth

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25	Dolan, Kimber, Fry,McDonald, Fitzgerald, & Trautmann. (2000).	1	1	1	0	1	0	0	1	0	Included in 15
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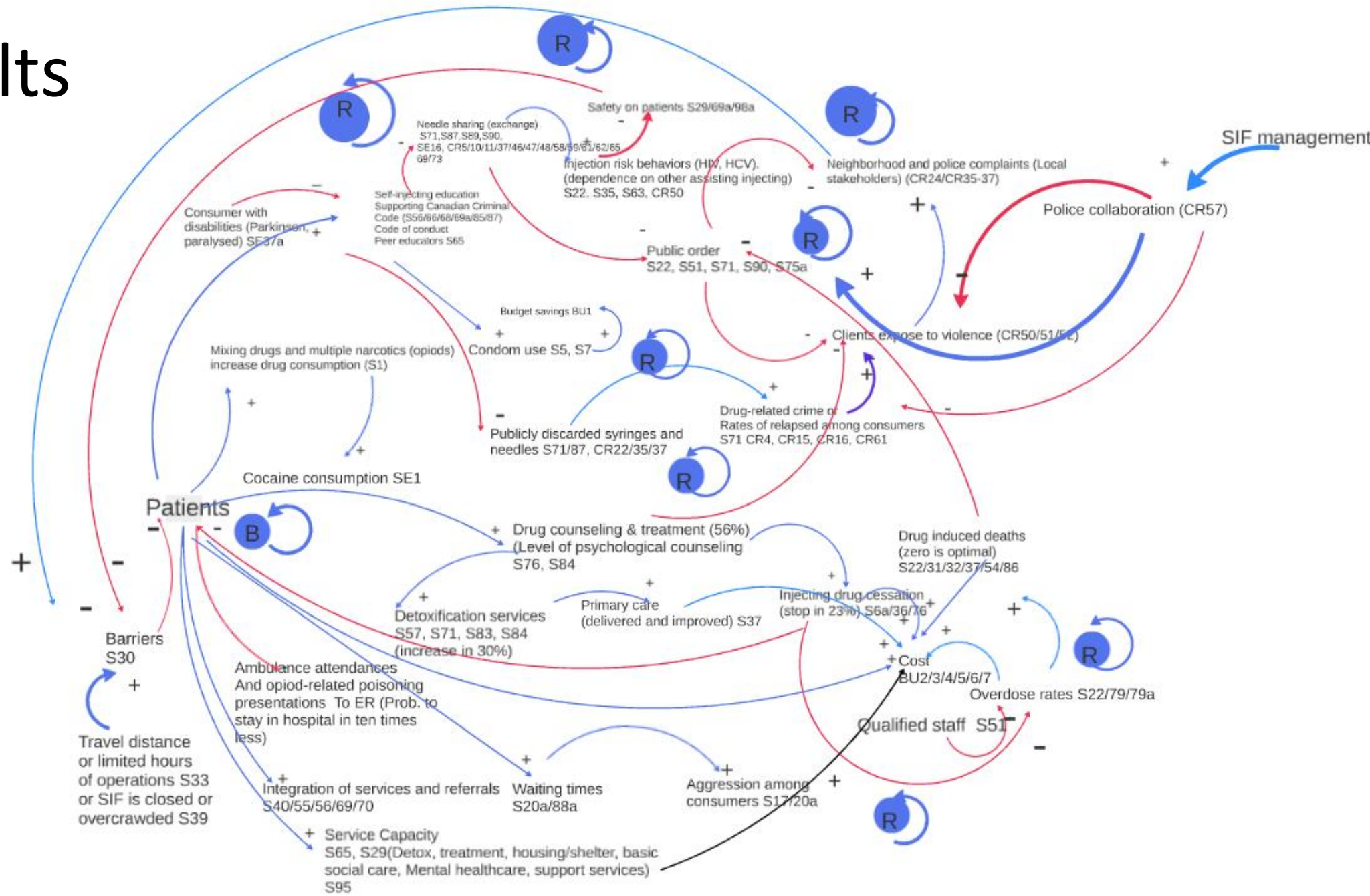# Methodology. Variable relationships summary

- 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
- 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.

Methodology. System Dynamics: Designing the Causal Loop Diagram

- System Dynamic 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 nodes (health services inside or outside the facility), time, and a purpose in policy making (Brailsford & Hilton, 2001). (Pg. 62-63 paper)

- DCRs, 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

Results

Discussion

- By focusing on the 8 domains of knowledges, SIF reduces overdose deaths to zero, provides services for consumers, and reduces crime reports. Answer the research question.

- Identifying loops, the changes in SIF variables and multiple stakeholders' decisions, understanding SIF fragments and entire knowledge, and pointing out the consequences of proposed actions.

- SIF improves patients' health allowing access to the healthcare system, reducing overdose deaths, and improving public safety through trained staff intervening when overdose events arise.

- Patients grow exponentially in all reinforce loops when connecting barriers to patients.

- Drug cessation in the balance loop.

- Limited e-Health applications used at SIFs.

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?

- **Overdose deaths:** All 27 papers from this literature agree that all supervised injection sites around the globe have capable and trained staff who managed all overdose cases with zero deaths.

  - **Service provision.** The literature review from 27 papers reflects that facilities provide primary and supportive services varying among countries and sites. Germany focuses on evaluating current services.

    - 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.

    - As supportive services, there are: (a) temporary arrangement of housing; (b) Peer-drug-service (c) hygiene; (d) education (injecting risk behaviours), (e) drug preparation equipment, (f) sterile injections, (g) food, (h) shower/laundry, (i) legal advice, (j) advice for debtors, (k) arrangement for doctors, (m) (n) substitutes, (o) therapies, (p) crisis interventions, (q) counseling for relatives, (r) counselling concerning children, (s) services for women.

- **Crime reports.** Vancouver has multiple sources of documentations of public order/disorder, showing the positive effects before and after opening the facility.

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?

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 nochange in the number of drug deals			
Residents (p<0.8)	28%	26%	
Business Operators (p<0.26)	33%	28%	

Limitation and next steps

- 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, Luxembourg, 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.

- SD is developed under the mental model which focuses on individuals' perceptions of the reality. This LR may produce a different causal model analysis and design managed by different researchers focusing in new SIF variables.

- 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.

Conclusions and recommendations

- The influential causal loop diagram is a mirror of the researcher's perception of what is documented from LR in all variables relations.

- Potier et al. (2014) developed the first study connecting the SIF to injecting drug cessation which is represented as a balance loop, self –regulatory process.

- In the reinforcing loops, resources increase exponentially (consumers, services, budget). At some point, the system collapses. Policy makers can identify variables which variables regulated the loops (detecting negative relations) transforming to a balance loop.

- The literature review methodology can be replicated by following the steps described in this research project.

- It is recommended to continue this study developing the quantitative analysis by transforming the causal loop diagram in stocks, programming in iThink Stella, accessing and managing real data comparing real vs. simulation outcomes, validating the model.

- Two extra outcomes
  - Project Webpage design http://antonio.ezonlinestrategies.com
  - Register in the poster competition for ITCH 2017 Building Capacity for Health Informatics in the Future.