Research Report: Determining costs and intervention savings for Syphilis transmission in Saskatchewan

Daksha Dhingra

Department of Public Health, University of Saskatchewan

Dr. Barbara Fornssler

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Table of Contents

Executive Summary

Syphilis cases have risen sharply across Canada between 2018 and 2023, including in Saskatchewan, resulting in a growing public health and economic burden. This research report aimed to synthesize evidence on the costs and cost-effectiveness of syphilis interventions in Saskatchewan. A comprehensive search of academic databases and grey literature revealed a lack of Saskatchewan-specific evidence on the economic impact or cost-effectiveness of syphilis prevention, diagnostic, and treatment strategies. Moreover, the limited Canadian data that does exist focus almost exclusively on pregnant populations. Findings from Manitoba demonstrated that expanded prenatal screening, i.e., tests conducted in the first and third trimesters and at delivery, costs approximately CAD$139,600 annually, helping save an estimated CAD$2.27 million in 2021 alone by preventing hospitalizations. Additionally, the estimated cost per screening test for syphilis was CAD$2.77, while confirmatory testing costs ranged from CAD$7.84 to CAD$15.84 per test. Similarly, Canada's Drug Agency reported a lack of Canadian cost-effectiveness studies and relied on international evidence from Brazil, suggesting that point-of-care testing with same-day treatment in antenatal care may be a cost-effective alternative to standard testing. These findings underscore an urgent need to conduct Saskatchewan-specific cost evaluations to guide future screening strategies and public health investments in the province.

Introduction

Sexually transmitted and blood-borne infection (STBBI) is a class of infections that are transmitted through human-to-human contact or exposure to infected blood (Gouvernement du Québec, 2013; Sexuality Education Resource Centre, 2018). STBBIs include Human Immunodeficiency Virus (HIV), Hepatitis B and C, Human papillomavirus (HPV), chlamydia, syphilis, and gonorrhea (Jackson & Tremblay, 2019). These infections can be caused by a range of pathogens, including bacteria, viruses or parasites. In addition to sexual contact, STBBI can spread through direct skin contact, during pregnancy or childbirth, sharing of drug-use equipment (needles and pipes), infected sex toys and exposure to non-sterile tattoo or piercing equipment (Gouvernement du Québec, 2013; Sexuality Education Resource Centre, 2018).

Although most STBBIs can be prevented, managed or cured through clinical interventions, there has been an increase in certain STBBIs across Canada since 2012 (Public Health Agency of Canada [PHAC], 2025). Notably, there has been a rapid increase in chlamydia, gonorrhea and infectious syphilis rates in the country. Between 2018-2023, rates of infectious syphilis doubled, to 12,135 cases (Government of Canada, 2025), underscoring both the clinical and economic burden of the disease. Syphilis is caused by a gram-negative bacterium, *Treponema pallidum,* and, similar to other STBBIs, it can be spread either through sexual contact (infectious) or can be transmitted during pregnancy (congenital) as vertical transmission (Peeling et al., 2017). The disease itself progresses through four key stages of infection. During primary syphilis, patients present with chancres on the genitals about 3 weeks after exposure. If left untreated, it progresses within 2-12 weeks following exposure, manifesting as headaches, swollen glands, and wart-like sores (PHAC, 2025a). Again, if no treatment is provided, latent syphilis may manifest symptoms

up to 20 years later. Ultimately, the untreated disease progresses to tertiary syphilis, leading to fatal neurological or cardiovascular manifestations (Peeling et al., 2017).

According to the Public Health Agency of Canada (PHAC), the 2023 incidence of infectious syphilis was 12,135, representing an increase of 77% compared to 2018 and 53 cases of congenital syphilis, an increase of >200% since 2018 (PHAC, 2025b). Although the men-to-women ratio was 1.8 for infectious syphilis, rates in women have increased by staggering 204%. In Saskatchewan, this percentage increase in overall cases is significantly higher compared to the national average. The infectious syphilis rates have increased by 1,213% since 2018, reaching 1,913; whereas the incidence rates for congenital syphilis remain under 5 per 100,000 in the province. Syphilis is a notifiable disease, for which PHAC conducts both routine and enhanced surveillance (PHAC, 2025c). Data from the Saskatchewan Health Authority indicates that there were 68 cases of congenital between 2019-2022 in the province, with 8 stillbirths (Saskatchewan Health Authority [SHA], n.d.). Most cases have been reported among individuals aged 20 to 39 years, with women and gay, bisexual, and other men who have sex with men identified as high-risk population groups.

In Saskatchewan, testing for syphilis is accessible at public health offices, sexual health clinics and can be conducted by physicians and nurse practitioners (Saskatchewan Health Authority [SHA], n.d.). The screening algorithm starts with *T. pallidum* antibody screening, followed by confirmatory tests using rapid plasma reagin (RPR) and *T. pallidum* particle agglutination (TPPA) tests (SHA, 2025). Treatment depends on the stage of infection and typically involves benzathine penicillin or doxycycline, if the patient is contraindicated to the former (PHAC, 2024).

The rising incidence of syphilis warrants a comprehensive analysis of the costs and cost-effectiveness of interventions across all stages of care, including prevention, diagnosis, and treatment, in order to inform evidence-based public health planning, optimize resource allocation, and guide policy decisions aimed at reducing the clinical and economic burden of the disease.

Methods

Search Strategy

The overall goal of this review was to collect evidence on the costs and cost-effectiveness of interventions for Syphilis in Saskatchewan, Canada. This analysis included studies published from 2015 to 2025, and grey literature (including documents from government and public health/private organizations). For this purpose, three main databases, MEDLINE, CINAHL and Cochrane, along with different public health websites (e.g., provincial health organizations) were scanned. Key search terms for both academic and grey literature included (but were not limited to):

- ("Syphilis"[Mesh] OR "Syphilis")
- **AND** ("cost*" OR "expenditure*" OR "economic burden" OR "cost-effectiveness" OR "budget impact" OR "financial burden" OR "healthcare cost" OR "pricing" OR "reimbursement" OR "Costs and Cost Analysis"[Mesh])
- **AND** ("Saskatchewan" OR "Canada")

Selection Criteria

The inclusion criteria for this review were primarily based on the PICO (Population, Intervention, Comparison, and Outcome) framework. The details of the selection criteria are as follows:

- **Population:** Individuals affected by or at risk for syphilis in Saskatchewan, Canada.

- **Intervention:** Cost-related interventions, economic evaluations, prevention programs, diagnosis, or treatment strategies for syphilis.
- **Comparison:** Not applicable.
- **Outcome:** Costs, economic burden, cost-effectiveness, budget impact, financial burden, healthcare cost, pricing, and reimbursement associated with syphilis interventions in Saskatchewan, Canada.
- **Study Type:** Clinical studies, observational studies, quasi-experimental studies, and narrative, systematic, and meta-analysis reviews.
- **Other Characteristics:** Academic or grey literature in English that was available as full text.

Results

Lack of Cost Evidence

A comprehensive search strategy was employed to extract evidence from three academic databases and the grey literature, in order to identify evidence on the costs and cost-effectiveness of syphilis interventions in Saskatchewan, Canada. The research was designed to capture economic data related to prevention, diagnostic testing, and treatment strategies across all population groups in the province. Despite this broad scope, little to no evidence was identified. While there was evidence on the economic benefits of conducting testing, these analyses were limited to the pregnant population groups, with no direct or indirect cost for prevention or treatment strategies (Boodman et al., 2023; Brett & Askin, 2023). Consequently, it highlights the research gap in the economic burden of syphilis and the potential savings associated with pharmacological and non-pharmacological interventions, particularly outside of pregnancy.

Landscape in Manitoba

While no direct or indirect costs for Saskatchewan were identified, data from Manitoba indicate that the estimated cost of syphilis universal screening in the first trimester would be CAD$46,436 per year (Boodman et al., 2023). If chemiluminescent microparticle immunoassay (CMIA) were used for screening at three time points during pregnancy, i.e., expanded screening (first & third trimester, as well as at delivery), the cost increased to CAD$139,608 per year, with differential costs between universal screening and expanded screening estimated at CAD$93,072.

The short-term direct cost for congenital syphilis (uncomplicated single case) in Manitoba is estimated to be CAD$17,010 ($1,701 × 10 days of standard treatment time), which includes a 10-day hospital admission only. The physician billing for such a case would be an additional CAD$1,141.40 (includes: $221.15 for pediatric infectious disease consultations + $177.75 for pediatrics consultations + the remaining for follow-up care). As a result, a typical uncomplicated case of congenital syphilis (treated with intravenous penicillin) has a short-term direct cost of CAD $18,151.40.

Boodman et al. (2023) also demonstrated that implementation of expanded prenatal screening in Manitoba enabled early identification and prevented inpatient management of 125 congenital syphilis cases (out of 206 diagnosed in 2021). Without screening, the incurred cost due to hospitalization would have been CAD $2,268,925.00 ($18,151.40 x 125). Given the annual cost of the expanded prenatal screening program was CAD $139,608, the cost-avoidance ratio with expanded screening was 16.25 ($1 spent on screening, saved $16.25 in treatment costs). On the other hand, if all 206 syphilis-exposed pediatric subjects required inpatient care, this cost-avoidance ratio would have risen to 26.78.

In terms of the testing itself, the CMIA using the Abbott Architect i2000SR instrument is performed at Cadham Provincial Laboratory (CPL). Since this machine is used for a variety of serological tests, the indirect costs related to the instrument are estimated at CAD $0.11 per test. Other test consumables include tip cartridges ($0.12), reagents ($0.66), and other disposable items such as caps and gloves (totalling: $0.07), resulting in $0.85 per assay. Labour costs were estimated at the pre-analytical, analytical, and post-analytical phases. Pre-analytical tasks were estimated at $0.98 per test (CAD $0.39 per minute x total 2.5 minutes required). The analytical processing requires 0.9 minutes, culminating in $0.62 per test, whereas the analytical review, which includes a senior technologist (0.25 minutes at $0.74/minute) and a junior technologist (0.05 minutes at $0.64/minute), adds $0.18 and $0.03, respectively. In total, the labour costs were estimated as $1.81 per test. When combined with the indirect instrument cost and disposables, the total per-test cost is $2.77, plus $2 per collection for phlebotomy costs.

The RPR and TPPA are used as the confirmatory tests following a positive CMIA screen. The RPR costs CAD $7.84 per test, accounting for disposables (CAD $0.37 per test), indirect instrument costs (CAD $0.11 per test), staff time (CAD $7.36 per test), with the antigen cost (CAD $0.13 per test). In comparison, the TPPA test costs CAD $15.84 per test, including consumables (CAD $9.89 per test), indirect instrument costs (CAD $0.11 per test), and staff time (CAD $5.84 per test). Since these tests are performed after CMIA confirmation, they are not included in the calculation for expanded screening costs.

Other Canadian Benchmarks

A similar attempt to gather evidence for identifying cost-effectiveness analysis for providing syphilis screening to pregnant women was conducted by Canada's Drug Agency (Brett & Askin, 2023). However, consistent with the findings of the present review, the agency was

unable to identify Canada-specific cost-effectiveness benchmarks. Instead, the authors used metrics from Brazil as a benchmark, comparing point-of-care (POC) testing plus same-day treatment with the standard laboratory diagnosis method in the antenatal population. It was identified that POC per woman screened was US $2.63 compared to US $2.48 for standard-laboratory testing (i.e., US$0.15 incremental cost). However, the POC was considered cost-saving by 42.8% compared to standard testing. Additionally, POC testing was associated with a gain of 0.00042 (95 % credible interval: –0.0036 to 0.0044) disability-adjusted life years (DALYs). The incremental cost-effectiveness ratio (ICER) was estimated to be US $357.44 per DALY at 3% discount rate and US $342.29 per DALY at 5% discount rate. Furthermore, the threshold of willingness to pay was ascertained at US$3,200 per DALY, making it 58% cost-effective. These findings highlight that POC testing, although it has a higher upfront cost, has higher potential to be a cost-effective intervention for preventing congenital syphilis.

Conclusion

This report highlights a substantial gap in research pertaining to costs and cost-effectiveness analysis of syphilis interventions in Saskatchewan. While no Saskatchewan-specific cost-effectiveness data were identified, a similar lack of evidence exists at the national level. Furthermore, the limited available evidence focuses predominantly on the cost-effectiveness of interventions related to the screening and treatment of congenital syphilis, with little focus on broader prevention, screening, or treatment strategies across different population groups. This lack of evidence could likely be due to the structure of Canada's publicly funded health care system, with costs not routinely being reported in the public domain. While data from Manitoba provides estimates of per-test costs for screening and confirmatory testing that could serve as benchmarks for Saskatchewan, the absence of province-specific data underscores the need to evaluate the

economic impact of expanding screening programs and highlights the importance of conducting Saskatchewan-specific cost analyses to inform policy development and resource allocation.

References

Boodman, C., Bullard, J., Stein, D. R., Lee, S., Poliquin, V., & Van Caeseele, P. (2023). Expanded prenatal syphilis screening in Manitoba, Canada: A direct short-term cost-avoidance analysis in an outbreak context. *Canadian Journal of Public Health = Revue Canadienne De Sante Publique*, *114*(2), 287–294. https://doi.org/10.17269/s41997-022-00682-0

Brett, K., & Askin, N. (2023). Point-of-Care HIV and Syphilis Screening. *Canadian Journal of Health Technologies*, *3*(7), Article 7. https://doi.org/10.51731/cjht.2023.689

Gouvernement du Québec. (2013). *Getting to know STBBIs*. https://publications.msss.gouv.qc.ca/msss/fichiers/2013/13-314-04A.pdf

Government of Canada. (2025, February 21). *Syphilis cases are on the rise in Canada* [Campaigns]. https://www.canada.ca/en/services/health/campaigns/syphilis.html

Jackson, C., & Tremblay, G. (2019). Accelerating our response: Government of Canada five-year action plan on sexually transmitted and blood-borne infections. *Canada Communicable Disease Report*, *45*(12), 323–326. https://doi.org/10.14745/ccdr.v45i12a04

Peeling, R. W., Mabey, D., Kamb, M. L., Chen, X.-S., Radolf, J. D., & Benzaken, A. S. (2017). Syphilis. *Nature Reviews. Disease Primers*, *3*, 17073. https://doi.org/10.1038/nrdp.2017.73

Public Health Agency of Canada [PHAC]. (2025, January 20). *Sexually Transmitted and Blood Borne Infections (STBBI) prevention guide* [Education and awareness]. https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/stbbi-prevention-guide.html

PHAC. (2025a, June 2). *Syphilis: Symptoms and treatment* [Education and awareness]. https://www.canada.ca/en/public-health/services/diseases/syphilis.html

PHAC. (2025b, May 26). *Infectious syphilis and congenital syphilis in Canada, 2023, CCDR 51(2/3)* [Research]. https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2025-51/issue-2-3-february-march-2025/infectious-congenital-syphilis-2023.html

PHAC. (2025c, March 6). *Sexually transmitted and blood-borne infections surveillance* resources and publications [Research]. https://www.canada.ca/en/public-health/services/surveillance/sexually-transmitted-blood-borne-infections.html

PHAC. (2024, April 11). Syphilis guide: Treatment and follow-up [Education and awareness;guidance]. https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/syphilis/treatment-follow-up.html

Saskatchewan Health Authority [SHA]. (n.d.). *Syphilis | Sexually Transmitted Infections Services*. Government of Saskatchewan. Retrieved July 23, 2025, from https://www.saskatchewan.ca/residents/health/diseases-and-conditions/sexually-transmitted-infections-services/syphilis

SHA. (2025, May). *SYPHILIS LABORATORY TESTING ALGORITHM*. https://rrpl-testviewer.ehealthsask.ca/SCI/What%20is%20new%20at%20SDCL/2025%20May%20-%20Syphilis%20Algorithm%20Interpretation%20v4.pdf

Sexuality Education Resource Centre. (2018, February 17). *What are STBBIs? - SERC*. https://serc.mb.ca/sexual-health-info/safer-sex-stbbis/what-are-stbbis/