

**SDA490- Final Report
Capstone Project Term Paper**

Katherine Korovnikov, Trixie Nguyen, Annika Puls

Simon Fraser University

Background

The opioid crisis has claimed over 21,000 lives in British Columbia since 2016, with health authorities reporting a troubling rise in deaths among women, a demographic facing unique vulnerabilities including higher prescription opioid dependence and systemic barriers to gender-sensitive care. Emerging data reveals significant disparities across BC's health authorities, from higher mortality rates in Northern Health's rural communities to distinct urban challenges in Vancouver Coastal Health. These variations raise critical questions for policymakers: Why are opioid-related deaths increasing faster among women in certain regions? How do mortality patterns between genders differ across BC's health authorities? Understanding these dynamics is essential for targeting resources effectively, particularly as the toxic drug supply and pandemic-related isolation continue to disproportionately impact vulnerable populations. Addressing these questions will help shape region-specific interventions that account for both geographic and gender-based disparities in the crisis.

Literature

In order to understand gender-based differences within opioid-related deaths, we first wanted to look to the existing literature on the topic. According to Orpana et al. (2018), women's opioid deaths have been on the rise in recent years, particularly in less populated and rural areas. Other research indicates that this could in part be due to the COVID-19 pandemic worsening risks associated with opioid use and risk of overdose, mostly through an increase in solitary drug use and toxic supply exposure (Speed et al., 2025). When compared to men, women tend to report higher pain levels to healthcare professionals, meaning they tend to receive more opioid prescriptions than their male counterparts. These increased levels of opioid prescriptions generally lead to an increased reliance on prescription opioids, which in turn leads to rising overdose rates among women (Terplan, 2017).

Additionally, women face unique barriers in accessing treatment or harm reduction services for opioid addiction. Many women experience co-occurring psychiatric disorders, various forms of pain, and/or economic vulnerability. While these factors can create barriers individually, seeking treatment can become even more challenging for women experiencing multiple of these factors simultaneously. The stigma and judgement associated with opioid addiction, as well as co-occurring psychiatric disorders particularly, can heavily push women away from seeking care (Macleod et al., 2021). Ultimately, the literature on this topic and the rise in female opioid-related deaths highlights the need for gender-specific harm reduction and treatment policies, rather than a 'one size fits all' approach. It is clear that women specifically may benefit from an integrated treatment approach, in which both opioid use disorder and mental health issues are able to be addressed.

Objectives

1. Understanding gender-based differences in opioid-related harms in BC
2. Investigating key factors leading to and perpetuating opioid addiction for women
3. Considering evidence-based policy measures that could alleviate this crisis, specifically for women

Data Methods

To analyze patterns in opioid-related deaths, we employed a two-phase analytical approach. First, we conducted trend analysis by visualizing annual changes in death rates across gender and region, followed by age and region breakdowns, to identify broad patterns and highlight areas requiring deeper investigation. Building on these insights, we developed a baseline linear model (Female Opioid Death Rate ~ Health Authority + Time + Male Opioid Death Rate) to quantify key drivers of female mortality rates. This model isolates the effects of: (1) regional disparities across BC's health authorities, (2) temporal trends, and (3) correlation with male death rates. Together, these methods reveal not only geographic and temporal hotspots but also whether female mortality trends parallel male patterns which is critical for understanding gendered vulnerability in the crisis.

Analysis of Opioid Death Trends by Sex and Health Authority

The visualization reveals distinct patterns in opioid death rates across BC's health authorities from 2016 onward, stratified by gender. Two parallel trend lines—female (left) and male (right)—show escalating mortality rates (measured in deaths per 100,000 people), with health authorities differentiated by color. Key observations emerge: First, Northern Health consistently reports the highest rates for both genders, particularly among females, suggesting acute geographic disparities in access to harm reduction or treatment. Second, while male mortality rates surpass female rates overall, the widening gap over time implies divergent risk factors or intervention effectiveness. Notably, a temporary decline across most regions in 2019–2020 (potentially linked to pandemic-related service disruptions or reporting lags) was followed by a sharp resurgence, underscoring the crisis's persistent volatility. These trends highlight that while the epidemic affects all of BC, Northern Health's disproportionately high female mortality and the growing male-female disparity demand targeted, region-specific responses.

There are some other notable observations on the right-hand panel, which shows opioid death rates among males across BC's health authorities. The most striking pattern is the sharp and sustained rise in deaths beginning around 2016, aligning with the fentanyl crisis. By 2020 to

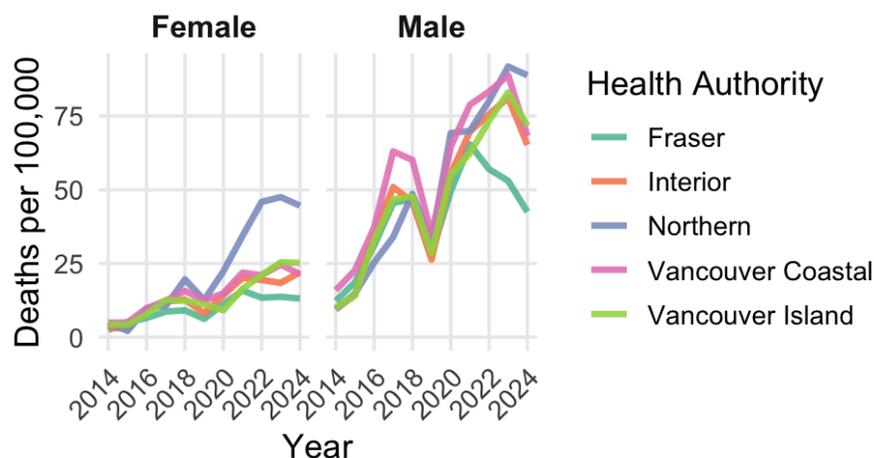
2022, rates peak across all regions—especially in Vancouver Coastal and Northern BC—with some areas exceeding 75 deaths per 100,000 (one hundred thousand). But these increases aren't evenly distributed. While all regions trend upward, Vancouver Coastal and Northern remain consistently highest, reflecting geographic vulnerabilities. Meanwhile, Fraser and Interior show signs of decline by 2025, possibly due to more effective harm-reduction strategies or other local dynamics. This graph makes one thing clear: male opioid deaths are rising fast, and the crisis is unevenly felt across regions.

Why male death rates are so high

The high male death rates, particularly from opioid-related overdoses, can be attributed to a combination of biological, behavioral, and systemic factors. Studies indicate that men are disproportionately affected by accidental opioid toxicity, constituting 76% of such deaths in Canada in 2020 (Hatt 2022, 1). Kaplovitch et al. (2015, 2) found that men were 44% more likely to escalate to high-dose opioid therapy and twice as likely to die from opioid-related causes compared to women. This disparity may stem from differences in pain management practices, as men are often prescribed more potent opioids and exhibit higher-risk behaviors, such as combining opioids with alcohol (Kaplovitch et al. 2015, 2–3). Additionally, men receiving opioid therapy were older, more likely to have alcohol use disorders, and less likely to use antidepressants, which may exacerbate overdose risks (Kaplovitch et al. 2015, 3). Behavioral tendencies, including a propensity for risk-taking and delayed help-seeking due to societal norms of masculinity, further amplify vulnerabilities. Socías et al. (2016, 4) note that gender norms discourage men from seeking medical care, framing such behavior as incompatible with traditional masculinity, which contributes to untreated dependencies and escalating substance use.

Sociocultural and systemic inequities also play a critical role. While women face structural barriers like precarious employment, men's health outcomes are more directly impacted by stigmatization of help-seeking and gaps in gender-sensitive care (Socías et al. 2016, 4). Physician biases in assessing pain and prescribing patterns—favoring aggressive treatment for men—may inadvertently increase overdose risks (Kaplovitch et al. 2015, 2). The stagnation in male life expectancy in Canada, driven by opioid deaths among men aged 25–45, underscores the intersection of these factors (Hatt 2022, 1). Notably, these trends are not uniform across populations; among First Nations in Alberta, gender disparities in opioid deaths were less pronounced, highlighting the complexity of intersecting identities and systemic inequities (Hatt 2022, 1). Addressing these issues requires multifaceted interventions, including destigmatizing mental health care for men and reforming prescribing practices to account for gendered risks.

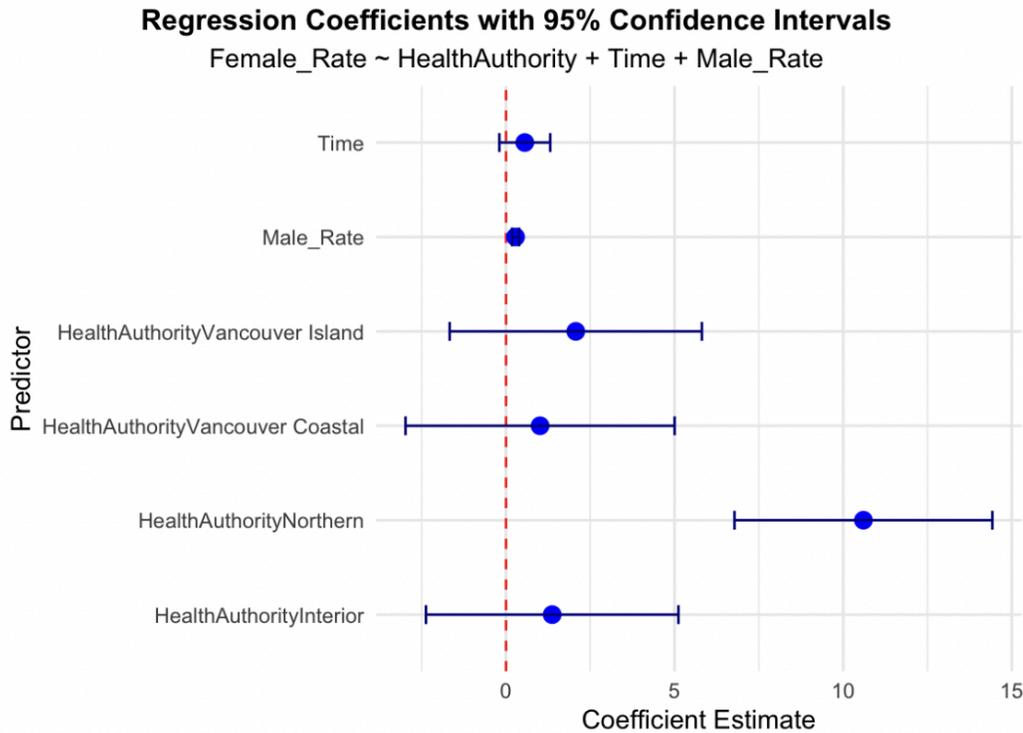
Opioid Death Rates Over Time by Sex and Health Authority



Regression Analysis Findings

Our linear model (Female Opioid Death Rate \sim Health Authority + Time + Male Death Rate) revealed two key insights: First, Northern Health Authority showed significantly higher female mortality rates, 10.6 points above Fraser Health (baseline), with this robust effect confirmed by non-zero-crossing confidence intervals. Second, male death rates strongly predicted female rates ($\beta=0.28$), indicating shared systemic drivers across genders. While Interior, Vancouver Coastal, and Island Health exhibited minor regional variations relative to Fraser, and time showed a nonsignificant negative trend, these effects lacked statistical reliability (CI crossed zero). These results highlight Northern Health's acute regional disparity and the gendered interdependence of mortality trends, suggesting public health responses should prioritize high-risk regions while addressing shared risk factors across genders.

	<i>Dependent variable:</i>
	Female_Rate
HealthAuthorityInterior	1.371 (1.862)
HealthAuthorityNorthern	10.601*** (1.902)
HealthAuthorityVancouver Coastal	1.011 (1.985)
HealthAuthorityVancouver Island	2.070 (1.860)
Time	0.558 (0.375)
Male_Rate	0.284*** (0.051)
Constant	-4.858*** (1.644)
Observations	55
R ²	0.845
Adjusted R ²	0.826
Residual Std. Error	4.282 (df = 48)
F Statistic	43.728*** (df = 6; 48)
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01



Limitations

A few of the major limitations we ran into include small sample sizes, lack of disaggregated data, linear time assumption, and interpretation challenges. First, we ran into smaller sample sizes in our health authority data when examining less populous health authorities, such as Northern Health. This had the potential to become problematic, as it meant that a comparatively smaller number of female deaths could present exaggerated trends in terms of gender disparities, leading to unstable estimates.

Second, lack of disaggregated data was likely our greatest limitation within this project, as it meant we were unfortunately unable to account for many intersectional factors in our analysis, which had the potential to carry some influence. This includes factors such as ethnicity, Indigenous status, socioeconomic background, and age, just to name a few. However, it is not entirely surprising that sensitive demographic information was unavailable to the public, especially in the context of a healthcare crisis.

Our third challenge was the linear time assumption within our model. Since our model assumes a linear trend over time, it is not able to account for sudden policy changes or other events that may have impacted opioid related death-rates. This could include the effects of the COVID-19 pandemic, as well as safer supply regulations that went into effect in BC in early 2023, but have since been withdrawn.

Lastly, we faced some interpretation challenges, specifically in terms of causation versus correlation. While our model was able to identify associations within our data, it was not able to definitively tell us why Northern Health shows a different trend in terms of gendered deaths than the rest of the province. This could be due to a number of factors, such as service gaps, drug supply differences, or social determinants, but our model is not able to pinpoint why this is.

Differences in Health Authorities

When examining opioid-related outcomes in British Columbia, it's essential to recognize that the crisis plays out not just demographically, but geographically—with stark differences across health authorities. Research shows that BC's regions operate in distinct service environments, shaped by geography, infrastructure, and access to care (Lavergne 2016, 11–14). These structural differences help explain why overdose death rates vary so widely.

The province can be broadly grouped into three clusters: metropolitan, non-metropolitan, and remote (Lavergne 2016, 11). Metropolitan regions, like Vancouver Coastal, have high access to specialists, diagnostic imaging, and pharmaceuticals, supported by teaching hospitals and dense infrastructure (Lavergne 2016, 12). Yet these areas also face greater exposure to toxic drug supplies, contributing to persistently high death rates. In contrast, remote regions—especially in Northern BC—rely on small hospitals, emergency departments, and general practitioners, with very limited access to specialist care or harm reduction services (Lavergne 2016, 12–13). These areas also have the highest share of residents in the lowest income quintile, which amplifies the challenges of limited care with economic vulnerability (Lavergne 2016, 13).

Even among non-metropolitan areas, service patterns vary—some lean on specialists, others depend on general hospital services (Lavergne 2016, 12). And crucially, health boards lack autonomy over major levers like physician pay and medication access, limiting their ability to respond effectively to local needs (Frankish et al. 2002, 10). There are also deeper governance issues. Health boards in BC are largely appointed, not elected, and often lack representation from Indigenous communities, youth, and working-class voices (Frankish et al. 2002, 6–7). Add to that top-down control from the Ministry of Health, frequent restructuring, and resistance from physicians and administrators (Frankish et al. 2002, 8–9), and it's clear that local leadership often lacks the flexibility to act decisively.

The takeaway is clear: a one-size-fits-all approach won't work. If we want to reduce opioid mortality, we need regionally tailored interventions—ones that acknowledge differences in service access, infrastructure, and population needs (Lavergne 2016, 14; Frankish et al. 2002, 10). Otherwise, the most vulnerable communities will continue to bear the heaviest burden.

Policy Implications

The findings demand targeted responses from BC health authorities: In Northern Health, where female mortality rates are disproportionately high, expansion of women-specific harm reduction programs, including trauma-informed care, childcare-supportive services, and integrated mental health treatment is urgently needed. Alongside, research to investigate the unique drivers of this disparity. While other regions should maintain evidence-based interventions for males (who face higher absolute mortality), all authorities must incorporate gender-responsive approaches that address divergent initial characteristics (e.g., women's higher rates of prescription opioid initiation, mental health comorbidities) and secondary outcomes (e.g., relapse risks tied to caregiving stress or intimate partner violence).

However, persistent data gaps, particularly the lack of disaggregated data on Indigenous identity, age cohorts, and urban/rural status somewhat hinder precise intervention design. Future research should employ mixed-methods approaches, combining statistical modeling with qualitative insights to uncover the structural factors behind regional variations. It is important to note that these efforts require improved access to sensitive opioid treatment data while upholding ethical protections, enabling health authorities to move beyond one-size-fits-all solutions to address the crisis's gendered and geographic dimensions effectively.

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