

White Paper Providing an Economic Framework for Thinking Through Possible Effects of Prescribed Safer Supply (PSS)

Purpose:

Part of the Provincial Health Officer's independent role and legal obligations under the *Public Health Act* are to monitor issues pertaining to the health of the population and provide advice and reports to the public and to the government.

This paper is the final product of a contract between the Office of the Provincial Health Officer (OPHO) and Jonathan Caulkins, PhD. Its purpose is to provide a framework by which government could consider the economic and market implications of enabling access to alternatives to unregulated drugs, including the outcomes of various costing structures, as well as the impact on different populations. The paper supports the Provincial Health Officer in providing advice to government on this topic and may be used by government departments and evaluators to inform their work.

The economic framework is just one aspect of my work on this issue. It is important that, in addition to health impacts, the economics and dynamics of drug markets are taken into consideration as programs enabling access to prescribed alternatives to the unregulated drug supply are implemented. This could include monitoring the price paid at various levels and purity of illegal drugs, to understand how B.C.'s situation might align with or differ from scenarios described in the report.

Dr. Caulkins' research paper is not an assessment or evaluation of B.C.'s approach to prescribed alternatives. The paper represents the views and observations of the author. It does not represent the views or positions of the Provincial Health Officer.

Development:

This paper was developed between November 2023 and March 2024. It was developed independently by Dr. Caulkins, with brief input by the OPHO.

Alignment with BC *Declaration on the Rights of Indigenous Peoples Act* and equity implications:

These topics are not explored in the paper and would be important to consider if this work is used in program planning, policy development and evaluation.

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Thinking Through Possible Effects of Prescribed Safer Supply (PSS)**

Submitted to the Office of the Provincial Health Officer by

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1.0 Goals, Scope, and Limitations of This Report

1.1 Goal

This document uses an economic framework to describe potential effects of Prescribed Safer Supply (PSS) and contrasts the potential effects of (a) requiring individuals to pay for PSS vs. (b) providing these medications at no cost to individuals, encompassing effects on the markets for illegal opioids. In particular, the contrast will be between requiring individuals to pay the going market price vs. paying little or nothing. I.e., for analytical purposes, a requirement to pay a token amount (e.g., \$1 for drugs worth \$20 in illegal markets) is more akin to giving the supply free than to charging the market price.

The report's analysis focuses on opioid PSS. Additional caveats and considerations are then provided for PSS for stimulants or other drugs.

1.2 Methods and Their Limitations

British Columbia (BC) and Canada more generally have embarked on an unprecedented experiment that attempts to reduce harms from the distribution, acquisition, and use of illegal drugs by providing those same or similar substances via legal and quality-controlled channels outside of the traditional medical drug treatment system. This policy of "safer supply" can now and/or could in the future take various forms (various substances, different prices charged, varying restrictions on who can access the safer supply, choices between on-site vs. "take home" consumption, etc.).

This document attempts to help readers think through the potential intended and unintended effects on overall market outcomes that might follow from safer supply in various forms and scales, not just those in place today. The approach is rooted in economic theory. An economic perspective is necessary because the objects of the intervention are markets, and the reliance on theory is driven by limitations on data and time that preclude estimating a causal model or other formal statistical approach. However, the analysis is not theoretical in the sense of being abstract; it attempts to be sensitive to the institutional factors that make markets for illegal drugs distinctive.

The core idea is that safer supply is a market-level intervention that can indirectly affect people who are not themselves in the program, including current and potential consumers who do not yet have opioid use disorder. Hence, reviews of evidence concerning effects on program participants (e.g., Fischer and Robinson, 2023; Slaunwhite et al., 2024) are relevant but inherently limited because no amount of analysis of outcomes for program participants (only) can discover whether the program is good for society overall. That is a problem because the bulk of the literature on Canada's PSS that I examined looks primarily at effects on clients.¹

¹ In January 2024 Nguyen et al. (2024) published in *JAMA Internal Medicine* a province-level statistical analysis that contrasted BC with Manitoba and Saskatchewan that they claim "provide[s] the first evidence, to our knowledge, on the association of British Columbia's Safer Opioid Supply policy with opioid prescribing and opioid-related health outcomes" at the provincial level. Nguyen et al.'s (2024) conclusions are pessimistic concerning PSS. I don't stress their findings. It is just one study; more should follow. Rather, what is striking is that a paper published in 2024 studying overall effects, as opposed to effects just on program participants, can claim to be the first of its kind, despite the large literature evaluating effects on program participants.

Supplying antibiotics may be a useful analogy. Over-use of antibiotics is not (primarily) a concern for the patients receiving those antibiotics. Rather, the primary concern is diffuse effects on the broader population from the development of antibiotic resistant bacteria. Likewise, while there may be mechanisms through which PSS could harm participants (e.g., if greater overall opioid consumption led to worse hyperalgesia),² the primary concerns pertain to unintended effects on third parties.

Indeed, inasmuch as safer supply lets clients take home for-free (or little cost) drugs that are highly valued in resale markets, it would be shocking if those clients did not benefit from the program. Giving clients valuable drugs – particularly if it were a week or more supply at once – is almost as good as giving them cash from the perspective of participants’ household budgets; it is a financial windfall. The real and difficult to answer question is how large might be any unintended effects relative to the benefits enjoyed by program participants.

It is important to stress what this analysis cannot do. It cannot predict what will happen. No modern jurisdiction has ever implemented a policy of this sort at scale, so there are no close historical models to consult. Furthermore, government efforts to intervene in markets – on either the supply or demand side – can produce unanticipated effects that take years to manifest. Consider, the possibility that expanding supply might lead additional individuals to develop substance use disorder (SUD). Since SUD generally takes years to develop, it is literally impossible to empirically verify today the scale of such an unintended effect, even if one had perfect data on all that has happened to date.³

It is hoped that this document can help clarify various readers’ thinking, but there is no aspiration that it will produce agreement among readers, let alone unanimity of thinking. Different people with different understandings of “how the world works” can agree on the framework and yet reach different conclusions about the relative scale of different effects or outcomes. I will illustrate that idea here with two examples.

The first pertains to the determination and ability of prescribers and/or dispensers of safer supply to detect and deter recipients from selling their supply to other parties. One image of PSS anticipates a close and trusting therapeutic relationship between the prescriber/dispenser and the participant, such that participants would rarely be able to re-sell the safer supply to third parties. At the other extreme, clever retail drug dealers might sign up to receive a “low barriers” safer supply because PSS is cheaper and/or better quality than what they could otherwise purchase from wholesale drug dealers in illegal markets. Or sellers might pay people who use drugs (PWUD) to sign up, and then take a portion of that excess from the users. Those providing safer supplies might either willingly cooperate with this (reasoning that their supply is still safer than what wholesaler dealers would have sold) or be duped – as well-intentioned physicians have been duped into supplying prescription opioids to “doctor shoppers” in the past (Inciardi et al, 2007; Rigg et al., 2010; McDonald & Carlson, 2014).

The second example pertains to the extent to which British Columbia’s (BC’s) drug markets are perceived to be an island unto themselves, or whether they are linked through arbitrage to illegal drug

² One reviewer of a draft of this report suggested adding also the possibility that access to safer supply might reduce incentives for seeking treatment.

³ Concluding that diversion of PSS won’t ever create additional OUD just because there is not evidence of that to date is a bit like the classic joke of a person who has jumped off the Empire State Building reporting, upon passing the 20th floor on the way down, “So far so good.”

markets throughout Canada and the United States. Just to clarify the term: someone who thinks that illegal markets are linked believes that if a sufficiently large price gap emerged between the price in BC and the price in Alberta or Washington State, then resourceful smugglers would buy in the jurisdiction where drugs are cheap, transport them across borders, and re-sell where those drugs command a higher market price. When British Columbia subsidizes the introduction of safer supply, the impact on local prices and market outcomes would be different if BC's markets were islands unto themselves than if some of that supply were then exported out of province.

More such differences in understandings of how the world works will be elaborated below, but these two suffice to make the meta-point that people with different worldviews will persist in believing different things about how safer supply will play out. For example, someone who believes that (1) Some participants will swap PSS pills for fentanyl, thereby letting drug dealers accumulate significant quantities of hydromorphone pills, and (2) drug markets in various provinces and states are linked by arbitrage will think that the effects of BC's program on hydromorphone prices could extend beyond BC's borders. By contrast, someone who disbelieved either or both of those ideas would expect the effects of BC's safer supply to remain primarily confined to BC.

With respect to some of these distinctions, I have personal views rooted in my expertise in drug markets. For example, I do believe drug markets in adjacent jurisdictions are linked by arbitrage. With respect to other distinctions, I have no opinion. For example, I claim no ability to predict how safer supply's implementation in BC will evolve regarding its ability and determination to detect and deter resale by those who receive safer supply.

My goal in laying out the various scenarios, and making the distinctions that I do, is just to help readers clarify their own expectations of likely outcomes, not to pretend that I know how this policy will turn out. If BC's safer supply experiment discovers for the world a new and better way to deal with SUD and illegal markets, I will be delighted. If BC's safer supply experiment backfires, I will not be surprised. I and observers around the world look forward to learning from BC's experiment. I sincerely hope it proves successful and that the analysis and distinctions that follow may help BC choose a prudent implementation of that broad policy.

1.3 Safer supply of stimulants and benzodiazepines vs. safer supply of opioids

Safer supply builds on medication assisted treatment (MAT) with agonists, but extends it in fundamental ways. The literature and historical experience with agonist-based MAT predominantly pertains to *opioid* agonist treatment. There is much less experience with substitution therapy for stimulant use disorders, and the outcomes assessed to date often pertain to use of the target drug, or to retention (Tardelli et al., 2020), not to important life outcomes like overall health, employment, and social outcomes.

As a scientist, I would rather limit my comments to safer supply of opioids. That already feels like a heroic extrapolation beyond what can be solidly supported by past precedent. Guessing at how safer supply of stimulants will turn out seems like pure hubris.

So, my approach will be that the body of this report discusses only safer supply of opioids. Then in a separate, final section (Section 10) I briefly speculate about how safer supply might play out differently with stimulants and/or benzodiazepines. To foreshadow, I think the overall economic framework – and

the necessary distinctions – will carry over, but the many medical and biological differences between opioids and other drugs mean that safer supply might work for opioids but fail for other drugs. Or vice versa. Since I am not a medical doctor, I will simply raise some possible differences between opioids and other drugs that might alter outcomes materially, but leave it to others to judge whether those differences are large enough to matter.

1.4 Structure of this Report

For most readers, economic analysis and terminology is dry, if not dull. So after the next section defines and describes PSS, and the many varieties and forms it might take, Section 3 illustrates the range of possible proximate outcomes with a series of vignettes. Since PSS effects on participants are – according to the literature and to the expert judgment of those involved – net positives, the core question is how much PSS leaks out to other people, and what effects that might have. The vignettes are intended to help readers recognize the range of motivations and mechanisms that can produce such leakage.

One charge for this report is to understand the effects of requiring PSS clients to pay for their drugs, so Section 4 dives into what it would actually mean to charge “market prices” for the PSS. That may sound pedantic, but there is not just one market price and the particular choices about how to operationalize the idea of charging the market price could be highly consequential.

The analysis then proceeds in stages. Section 5 considers the effects of PSS operating on such a small-scale that it does not alter market prices. Section 6 then asks whether BC PSS today (or a plausible expansion of it) operates on a large enough scale to alter equilibria in opioid markets, and concludes that the answer is both yes and no. It could already be depressing BC hydromorphone prices, but at present is very small compared to the broader illegal market for fentanyl and other opioids. Section 7 explores whether existing price gaps could be large enough to induce arbitrage (export) to markets outside of BC and concludes that the answer is yes. Section 8 recapitulates the main findings. Section 9 offers a few concluding comments about opioid PSS, before Section 10 cautions that outcomes of PSS of stimulants could be materially different than for PSS of opioids.

2.0 Safer Supply Mechanics & Opportunities for Profit-Oriented Diversion

BC's definition of PSS is "*physicians and nurse practitioners prescribing drugs of known content and concentration (i.e., prescribed medications) as a safer alternative to the toxic illegal drug supply to people who are at high risk of death or injury from accessing the unregulated drug market*".

That definition can encompass a wide variety of programs, and their "details" matter (Kilmer and Pardo, 2023). It is a bit cavalier to say "safer supply does X" or "safer supply is good" because the outcomes likely depend on program particulars. E.g., this section will note that PSS taken in a clinic while observed by a clinician (i.e., directly *witnessed*) may have entirely different effects than letting PSS participants take home a week's worth of safer supply all at once. The former is essentially a medical intervention whose effects can be understood just by studying clients' outcomes. Because of the potential for diversion, the latter is a market-level intervention whose effects need to be studied at that level.

Diversion is a broad public health concern, not one affecting just youth or any other specific demographic group. In the late 1990s and early 2000s, when liberal prescribing made diversion of prescription opioids (PO) common, the harms fell broadly across the age and income distribution, not just on the most vulnerable.

2.1 Distinguishing two categories of PSS participants: "profiteers" vs. "sincere"

One might hope that most PSS participants would never accept supply that they don't plan either to use themselves or to give to close associates who share their same medical conditions. For lack of a better word call them "sincere" participants because they are following the intent and spirit of the program.

However, as long as PSS gives valuable things away for free, or for far below market prices, one should expect there to also be "profiteers" wishing to profit by obtaining supply for resale. Some profiteers will be PSS participants. Others will be "exploiters" who organize and motivate other people to become participants, but obtain some of those participants' supply.

In practice some participants may be a mixture of these two types. So it might be more accurate to distinguish between "sincere" demand and demand from "profiteering", but it can be simpler to explain the concepts if one thinks about the pure type individuals, meaning "sincere participants" and "profiteers".

The idea that government programs need to be cognizant of both sincere participants and profiteers is in no way specific to PSS. It is just part of good government, and failure to acknowledge the existence of profiteers is bad government. E.g., the US General Accountancy Office (2023) recently estimated that fraudsters received between \$100 billion and \$135 billion from U.S. unemployment insurance (UI) programs during the COVID pandemic. As the GAO notes "In response to historic pandemic job losses, Congress created new temporary UI programs to provide relief to the unemployed. The unprecedented demand for benefits and the need to quickly implement the new programs increased the risk of fraud." More specifically, "the increased amount of benefits awarded and the PUA program's initial reliance on self-certification gave criminals incentive and opportunities to commit fraud" (p.11).

The U.S. UI system and the BC risk mitigation guidelines (RMG) were responding with similar urgency to different humanitarian crises exacerbated by the same pandemic shock. To use jargon from PSS, the

U.S. UI system was a “low barriers” program that tolerated a large amount of fraud to make sure that all deserving participants had access.

Creating low barrier programs that are widely exploited by profiteers is not necessarily a mistake. But creating a low barriers program while pretending that profiteers don’t exist is naïve.

2.2 Health Canada definition and key distinctions

Health Canada⁴ makes the following statement about prescribed safer supply services. I place in boldface phrases that I discuss further below.

“Safer supply services provide prescribed medications to people who use drugs, overseen by a health care practitioner, with the goal of preventing overdoses and saving lives. They are provided in a less clinical and more flexible way compared to other care options for substance use, such as opioid agonist treatment (OAT). For example, safer supply services may offer

- **a range of medication options**
- accessible locations (for example, services available at a community health centre)
- **flexible eligibility requirements**
- **flexible dosing conditions** and **carrying rules** (for example, clients may be able to pick up their supply and use as needed)
- flexible client goals (for example, focusing on improving health and not requiring that clients stop using illegal drugs)”.

2.3 The loud silence: What will clients be charged for safer supply?

Health Canada’s definition is silent on how much if anything clients will be charged for safer supply.

In theory, profiteering can be deterred by charging PSS participants the going market price for the drugs supplied. If there is no gap between what PSS participants pay to obtain the PSS drugs and what those same drugs could be sold for, there is no room for profiteering. Some PSS supply might still be diverted, but since there would be no markup, that would be more of a gift than a selfish business transaction. Such “social diversion” is likely to be smaller scale and less problematic than could be diversion for profit.

It turns out to be complicated to determine what is the market price, not only for practical reasons (limitations on data) but also for important conceptual reasons, which are explored in Section 4.

2.4 Carrying rules: On-site vs. “take home” supply

Over-simplifying slightly to convey a key point: If safer opioid supply had to be consumed on-site (“witnessed”), then safer supply’s effects on markets should not be materially different than those of traditional on-site OAT, which is to say that the effects would be beneficial. On-site OAT creates

⁴ <https://www.canada.ca/en/health-canada/services/opioids/responding-canada-opioid-crisis/safer-supply.html>

minimal diversion while reducing demand for and consumption of illegal opioids and related harms. Safer supply that must be consumed on site should be similar, but that does not appear to be the primary path Canada has chosen, so the rest of this document discusses PSS that permits take home doses.

2.5 Carrying rules governing the amount of “take home” supply

Profiteers can be understood as self-interested actors who balance the benefits of obtaining supply for re-sale against the costs of doing so. They experience three prominent categories of cost: (1) The dollar cost of purchasing the PSS, (2) The risk of arrest and punishment from re-selling, and (3) The time and hassle of obtaining and re-selling the PSS.⁵

BC does not aggressively police retail drug selling, so the risk of arrest and punishment from re-selling is modest. Hence, if PSS is provided below the going market price, that leaves only the third category of cost (time or hassle) to deter profiteering. Unfortunately, things that are a hassle or are time consuming for profiteers, will generally also be a hassle or time-consuming for sincere participants, which is contrary to the goal of creating a friendly, low-barriers PSS program that brings in the greatest number of sincere participants.

Some simple arithmetic may shed light on the implications of providing larger or smaller take home PSS amounts. Suppose for the sake of illustration, that hydromorphone pills supplied by PSS can be sold for \$1.50 more per pill than the clients pay for them in the PSS. That could be free PSS supply with a market price of \$1.50 per pill, or a PSS that charges \$0.50 per pill when the market price is \$2.00 per pill. It is the gap in price that matters.

If the PSS only offered a day’s supply at a time, or 14 pills, then the profiteers’ potential net revenue per visit to the PSS is only \$1.50 per pill times 14 pills per visit = \$21. Depending on how long a visit takes, that might not be worth their time. But if PSS gave out a week’s supply, then the profit rises to \$147 per visit.

Other considerations may matter, such as whether the supply is provided in a secure “smart” dispenser that releases only a day’s pill at a time, how frequently urine is monitored, and the like, but the decision to provide only daily vs. weekly quantities might materially affect the appeal of safe supply to profiteers.

As a closing note, a mixture of strict and loose PSS sites may be the worst of all worlds because profiteers may seek out the most permissive sites. So having some “loose” PSS sites may facilitate profiteering while needlessly burdening the sincere participants who attend strict sites.

2.6 Offering a range of medication options

The ideal PSS medication would help sincere users but not be highly-valued in the illegal marketplace. There may be no such medication; those that are most appealing to sincere participants will also tend to be the most appealing to profiteers, and those that are less appealing to profiteers tend to be less appealing to sincere participants as well. But the PSS can choose different points on the spectrum.

⁵ As noted below, “hassle” can be broadly construed to include the risk of victimization, theft, and violence.

At one extreme, if PSS provides fentanyl or heroin powder, it is providing drugs that are valued all over Canada and the U.S., and that are compact and easy to smuggle. Profiteers should welcome that.⁶

At the other extreme, if PSS provided only buprenorphine then profiteers would have limited opportunities, and diversion of buprenorphine has relatively fewer downsides, but the PSS also wouldn't be offering much beyond what other treatment and harm reduction initiatives already offer.

Most PSS in BC today supply tablet hydromorphone. E.g., Selfridge et al. (2022) report that at Victoria's Community Health Centre, 274 out of 286 clients were receiving hydromorphone. Many clients say that hydromorphone relieves pain and withdrawal, but has less appeal recreationally.⁷ That is somewhat surprising inasmuch as laboratory studies find that "Hydromorphone produced similar subjective and physiological effects as heroin" (Dunn et al., 2018, p. 971), and the DEA (2023) reports that "Prior to the current popularity of hydrocodone and oxycodone among drug abusers, low dose (2 and 4 mg) immediate release hydromorphone formulations (i.e., Dilaudid®) were the leading opioid products for abuse and diversion". The explanation may have to do with dose and tolerance. An 8-mg hydromorphone pill's 40 morphine milligram equivalent (MME) can have substantial effects on an opioid-naïve user, but little effect on someone who uses two "points" of down per day (~2,400 MME per day).⁸

As Appendix A describes, prescription opioids have long been traded in illegal markets. Historically PO markets were thinner and less organized, with more peer-to-peer selling and fewer large-scale suppliers, but if the volume increases, the diverted PO markets may become more organized and more efficient. Anecdotally, the PO market in Vancouver's downtown east side (DTES) is already quite vibrant.

Appendix A also describes how diverted PO command a price premium in illegal markets relative to illegally manufactured opioids, often selling for three times as much per MME. Subsequent sections work through the implications of this for diversion. A key insight, though, is that although there are measurable market prices for diverted hydrocodone pills (and sometimes for fentanyl patches), there really isn't a current illegal market price for safe fentanyl powder. Almost by definition, the illegal market does not supply safe fentanyl in powder form, and fentanyl powder from a PSS and illegal market fentanyl powder are very different things.⁹

⁶ Some PSS sites such as Vancouver's Safer Alternatives for Emergency Response (SAFER) do offer fentanyl, including fentanyl powder (Klaire et al., 2022), and there is support among stakeholders for making the safely-supplied drug match as closely as possible the drugs that were being used (e.g., Foreman-MacKey et al., 2022).

⁷ As one Bardwell et al.'s (2021, p.3) interview subjects reported, "I get pain relief from the pills, but I don't get any fun out of it".

⁸ Opioids are a broad family of related drugs with different potencies (using the term informally). Converting them into equivalent weights of morphine (MME) is a common way to facilitate comparisons. The equivalency ratios were developed to help clinicians treating pain, and may not apply exactly to other effects, but it is common to use the equianalgesic ratios in the absence of better guidance, and as Appendix A discusses the ratios of the prices at which prescription opioids trade in illegal markets often roughly follow the equianalgesic ratios.

⁹ As a highly imperfect analogy, consider that at the time of this writing I can buy on-line a 0.5-meter lightning to USB adaptor cord from Apple for \$17.50, or a visually identical "apple-certified" cord made by Inateck for \$8.99. Superficially the two items might seem identical, but buying from Apple is "safer". I know from past experience that sometimes purchasing from other sources leads to problems with quality. Genuine Apple products and those that merely claim to be "Apple-certified" are not necessarily of equal quality, so they don't sell for the same market price. Likewise, the market price for illegally supplied fentanyl powder may differ from the value illegal

2.7 Flexible dosing conditions

The spirit of PSS in BC/Canada is to offer participants considerable flexibility and say in the amounts prescribed. Typical language speaks of supporting participants' agency and autonomy in deciding what to put in their bodies. Foreman-Mackey et al. (2022) interview 17 professional PSS stakeholders supportive of that perspective, including one particularly candid quote: "ask people what they need, do that, and then keep asking them what's not working and keep changing to meet that need".

To be blunt, profiteers should be the thrilled with such attitudes.

An obvious but important point is that profiteers will want their prescriptions to be as large as possible. "Sincere" program participants might work with clinicians to find the right dose for them, but profiteers are essentially con artists who seek to dupe providers into providing the largest possible quantity. Program rules that are adequate and supportive for sincere clients may fail to control profiteers.¹⁰

RMG guidelines permit 14 8-mg hydromorphone tablets per day (McNeil et al., 2022), which is 560 MME per day. Selfridge et al. (2022) report participants receiving 347 MME per day, on average. Ottawa's safer supply program allows up to 30 8-mg tablets or 1200 MME per day (Haynes and O'Byrne, 2023).

The BC PSS amounts are smaller than for many forms of medication assisted treatment. E.g., methadone maintenance therapy (MMT) involving 60-90 mg of methadone per day is 720 – 1080 MME per day (assuming methadone's morphine equivalence ratio is 12). Likewise, the average doses in Canada's NAOMI trial (Oviedo-Joekes et al., 2009) and among intravenous patients in the Swiss heroin treatment (HAT) trials (Gschwend et al., 2004) were 392.3 and 474 milligrams per day, respectively.¹¹ Heroin's morphine equivalence ratio is usually listed as 2-5, suggesting average doses of 785 – 1962 and 948 – 2370 MME per day.

At the same time, the PSS daily quantities are large compared to typical guidelines for treating chronic pain. E.g., the CDC (2016) guidelines suggest 90 MME as a daily dose ceiling for treating chronic pain (a perspective that was originally endorsed also by the College of Physicians and Surgeons of British Columbia, before later being revised).

If sincere PSS clients push for quantities comparable to those in HAT trials, and that permits profiteers to receive comparable amounts, then the quantities profiteers might be able to obtain could be considerably larger than they can obtain today by diverting PO used to treat chronic pain.

markets would place on fentanyl powder whose quality is known to be that of PSS fentanyl (e.g., because it is still in the original PSS packaging – and PSS packaging is difficult to counterfeit).

¹⁰ This is another of those "different worldviews" issues. One colleague who reviewed a draft of this paper expressed confidence that "a good [PSS] program would try to assess the quantities needed such that profiteers would be easy to spot and excluded". I tend to lean in the other direction, having great respect for the ingenuity of scammers. Time will tell which of our world views turns out to be more representative of PSS programs and clients.

¹¹ Average dose in the Swiss trials was 993 mg per day when in smokable form.

2.8 Flexible eligibility requirements

There is considerable support in for expanded eligibility. For example, the BC Coroners Service Death Review Panel (2023) supports allowing “access without a prescription to the class of opioid and stimulant drugs, for people at risk of dying due to the toxicity of the drug supply in British Columbia”. Since essentially everyone who uses these drugs even once is at some risk of dying, taken literally, that recommendation would open PSS to everyone who wishes to use these drugs. Indeed, that same report states that “as many as 225,000 in British Columbia may be at risk of death or serious injury through accessing unregulated drugs via the illicit market” (p., 13). To the extent that many of those 225,000 are consuming well less than 560 MME per day, such an expansion would leave considerable room for PSS supply to be diverted. Section 6 explores such matters of scale in more detail.

3.0 Stylized Examples to Illustrate that Various Outcomes Are Possible

3.1 Introduction

Economic analysis can be dry and abstract. This section considers some stylized scenarios that illustrate possible effects of prescribed safer supply (PSS) in more tangible terms. The aggregate effects of PSS on market equilibria depend on what proportion of PSS clients look more like the first few (favorable) scenarios, and what proportion look more like the latter few (concerning) scenarios. To be clear, this section is not making any statements about which scenarios are most common today, or any predictions about which would come to dominate under various potential future expansions of PSS. The goal is just to make concrete what some concerning scenarios might look like, and to help readers refine their own understanding about which scenario(s) are plausible or common.

These examples imagine that PSS: (1) Lets clients take home a week's supply of 14 8-mg hydromorphone tablets per day, (2) There is an active (illegal) market in those diverted hydromorphone tablets, and (3) The hydromorphone is provided at a highly subsidized price equal to 10% of that drug's value in the illegal markets. The examples use a positive but low price, not a price of zero, to illustrate that the key question is not whether PSS clients are charged something, but rather whether PSS is priced at or near market prices vs. being priced far enough below market prices that participants could profit from re-selling their supply.

Our primary protagonist will be an individual (call him "Mark") who has been spending \$40 per day purchasing and using 2-4 "points" of illegal opioids out of his total daily income of \$50, which he obtains from a combination of legal and illegal sources. That means Mark has been spending only \$10 per day on food, housing, and all other goods and services. For ease of exposition, I will refer to the illegal opioids as "down" and the other spending as being on "basic necessities".¹²

Finally, suppose that the safer supply matches in value Mark's prior daily use. I.e., Mark is charged \$4 to purchase PSS hydromorphone which could be sold for \$40 in the illegal markets. That is consistent with data below showing that diverted hydromorphone has historically sold for 3-4 times as much per MME as does down, and PSS provides only a fraction as many MME as its clients had been consuming of down.

3.2 Scenario #1: Mark Uses the Safer Supply and no Other Opioids

The ideal outcome is that Mark uses the safer-supplied hydromorphone instead of down. That would be a pure win because:

*Mark's risk of overdose, suffering violence at the hands of drug dealers, and other harms have all been reduced.

¹² Before 2014, "down" was mostly heroin; today in BC it is almost entirely synthetic opioids, notably illegally manufactured fentanyl (perhaps mixed with adulterants). The Drug Analysis Service and Cannabis Laboratory (<https://health-infobase.canada.ca/drug-analysis-service/analyzed-drug-report.html?p=BC&y=2023&q=Q3&r=DASreport>) reports that in BC in the 3rd quarter of 2023 there were 893 fentanyl identifications and 359 para-fluorofentanyl identifications as against only 19 heroin identifications.

*Mark is richer because his “after drugs” income has more than quadrupled from $\$50 - \$40 = \$10$ per day to $\$50 - \$4 = \$46$ per day. He can spend that additional $\$36$ per day ($\$13,140$ per year) buying more and better basic necessities or he might cut back on how hard he works at generating legal and/or illegal income. I.e., the safer supply program reduces Mark’s poverty and/or criminal activity.

*The illegal markets have lost revenue. In the short run, a shrinking market might conceivably produce violent conflict between competing sellers, but overall, a smaller illegal market should translate into less violence and corruption, both in BC and further up the supply chain.

In short, Mark is healthier and happier, and the rest of society likely enjoys lower rates of criminal offending by both Mark and Mark’s drug suppliers. The only direct cost to the taxpayer is the cost of providing safer supply, net of what Mark pays for that supply,¹³ and if Mark reduces his criminal offending, that could save the Province money.

3.3 Scenario #2: Mark Uses His Safer Supply and Down, While Maintaining Income & Other Spending

At the other extreme, suppose Mark continues to make $\$50$ per day and spend $\$10$ per day on basic necessities, and so continues to spend $\$40$ per day purchasing opioids. Since PSS has made opioids cheaper, Mark is using more opioids. In particular, he now spends $\$4$ per day purchasing safer supply hydromorphone and $\$36$ per day buying down. Under this scenario

*Mark’s income (including from income-generating crime) and spending on basic necessities have not changed.

*Mark’s total opioid consumption has increased because he is using 90% as much down as before and also all of the safer-supplied hydromorphone.

*Mark’s risk of overdose may have gone up or down depending on how much safer the safer supply is,¹⁴ and also on whether engagement with PSS leads to greater engagement with other harm reduction services.

*Illegal markets have lost 10% of the revenue they had obtained from Mark, presumably putting some downward pressure on market-related violence and corruption.

Note: Scenarios #1 and #2 are (intentionally) two ends of a continuum, between Mark ceasing all illegal purchasing and Mark continuing to spend as much as before purchasing opioids. In reality, people likely

¹³ I was unable to obtain costs to the taxpayer per PSS participant, but some hypothetical numbers may illustrate the point. Suppose the salaries of the prescriber and dispenser, and their buildings, benefits, etc., plus the cost of any monitoring and regulatory oversight worked out to $\$30$ per episode of supply, and Mark were given a week’s supply at a time. Then the cost of PSS to taxpayers would be $\$30 / 7 = \4.29 per day, which would be almost entirely offset by Mark’s payment of $\$4$ per day.

¹⁴ If safer-supplied hydromorphone is ten times as safe as down, meaning it is 10% as dangerous per day of supply, then there is no change in Mark’s risk of overdose because the 10% reduction in down consumption is offset by the risks from the hydromorphone. If the hydromorphone is 20 times safer than down, then Mark’s OD risk has been cut by 5%. If it only 5 times safer than down, then his OD risk has increased by 10%.

fall somewhere in between, continuing to use some illegal opioids but spending less on them than before. E.g., 38 out of 42 participants interviewed by Ivsins et al. (2021) report continuing to use fentanyl, as did 40 out of 46 interviewed by Bardwell et al. (2023), but the literature evaluating PSS reports that many if not most participants reduce the quantity of illegal opioids consumed, and that change is greatly valued by participants.¹⁵

3.4 Scenario #3: Mark Sells His Safer Supply and Uses the Proceeds to Buy Illegal Down

Suppose that Mark avails himself of the opportunity to buy \$40 worth of hydromorphone for \$4, but he prefers down to hydromorphone,¹⁶ so he sells the hydromorphone and spends the proceeds buying down.¹⁷ Under this scenario:

*Mark's criminality and spending on basic necessities have not changed.

*Mark's consumption of illegal opioids has increased by 90% because he is now buying and using \$76 not just \$40 per day of illegal down.

*Mark's risk of overdose may have gone up, perhaps by 90%.

*The illegal markets are getting 90% more revenue from Mark, but the aggregate effect on illegal market demand depends on who uses the hydromorphone that Mark sells.

Scenario #3a: Mark's safe supply ends up being consumed by a long-time consumer of illegal opioids who for whatever reason could not access the safer supply program directly, and that 2nd individual uses \$40 worth of oxycodone instead of down. In that case, aggregate effects on illegal market demand and community-wide overdose is as in scenario #1, but the program shifts overdose risk from this 2nd individual to Mark.

Scenario #3b: Mark's safe supply ends up being consumed by people who were not previously using opioids, at least not heavily. In this case, the overdose risk for both Mark and these other individuals has increased, and the illegal markets have increased total sales revenue. I.e., PSS has increased total opioid use, exacerbated over risk, and increased criminals' income from selling illegally manufactured opioids.

Section 1 explained that I only hope to clarify readers' thinking, and do not expect readers' views on PSS to converge. The distinction between Scenarios #3a and #3b is a prime example. Some people believe

¹⁵ E.g., McNeil et al. (2022, p.156) report "33 of 40 participants [in BC's COVID risk mitigation program in 2021] reported regular illicit drug use. These participants reported supplementing prescriptions with illicit drugs because of guideline limitations, namely that they were oriented toward keeping people from experiencing withdrawal and cravings. Although a minority of those interviewed expressed that this approach was "good enough" because they were "ready to quit" or primarily concerned with avoiding "getting sick," it was in tension with the objectives of most participants. Many participants emphasized that they wanted to continue to be able to get high."

¹⁶ BC (2023, p.27) reports that "diversion of PSS hydromorphone is identified by clients and staff of reviewed PSS services as a common occurrence, likely due to the undesirability of this medication among people with high opioid tolerance".

¹⁷ The scenario describes Mark as selling to another person who uses the PSS drugs, but sometimes sellers of down will accept prescription drugs (the PSS drugs) as partial payment for the down, saving Mark from the hassle of finding the person who wants to use the PSS drugs. C.f., Fischer et al. (2009).

that diversion will be beneficial because it will only go to people who in some sense should have been program participants anyhow. E.g., Bonn et al. (2023, pp.648-649) say that “Diversion could be considered to be ‘secondary safe supply’.” People with that worldview include some academic scholars (e.g., Bardwell et al., 2021b)¹⁸, and the authors of the National Safer Supply Community of Practice publication *Reframing Diversion for Healthcare Providers* (NSSCP, 2023, p.12) which describes diversion as “a harm reduction practice rooted in mutual aid that saves lives and improves quality of life”.

The other camp thinks that profiteers can only sell to people who do not themselves have free access, and that consumption of illegal drugs, like the consumption of almost all consumer goods, goes up when supply increases and prices fall (Gallett, 2014; Payne et al., 2020). They might also point out that some of the evidence of favorable effects concerning diversion pertains to diversion of buprenorphine, which has very different effects and market appeal than hydromorphone or some other full opioid agonists.

In principle, it is an empirical question whether diversion looks more like Scenario #3a or #3b, but no available data can speak decisively on the matter. People’s views about PSS in this and other respects may tend to be shaped by their general worldviews. Those who work with and are close to sincere program participants may tend to see the world as resembling Scenario #3a. E.g., if one were to investigate the effects of diverted PSS by surveying only people who are themselves eligible for PSS, then one will naturally conclude that diversion takes the form of Scenario #3a. However, those who encounter more selfish rule breakers, in PSS or in life more generally, may tend to see the world as resembling Scenario #3b. Time will tell whose worldview is more accurate.

As a final note, even Scenario #3b might be a win from BC’s perspective if the final consumers of the diverted PSS live in Alberta or Washington State. Conversely, even Scenario #3a could be a loss for BC if the former down user who ends up using Mark’s PSS lives in Alberta, because then BC’s PSS increases down consumption in BC but reduces it in Alberta.

3.5 Scenario #4: Mark Convinces His Girlfriend to Access Safer Supply

Mark’s girlfriend Mindy has been in successful recovery from OUD for several years, but she and Mark are struggling to get by on her modest income working in retail. Mark encourages Mindy to tell her doctor that she is relapsing and so needs safer supply, and to use some occasionally to make sure any prescriber-mandated drug tests come up positive.¹⁹ Mindy initially declines because she doesn’t want the hydromorphone herself and is afraid to sell in illegal markets, but Mark convinces her to approach this as a joint venture. If Mindy obtains the safer supply, at a cost of \$4 per day, Mark will take care of selling it in the illegal markets, and they can split the \$36 per day in profits 50/50. Mindy says yes

¹⁸ Bardwell et al.’s article title (“People need them or else they’re going to take fentanyl and die”: A qualitative study examining the ‘problem’ of prescription opioid diversion during an overdose epidemic) even puts the word problem in quotation marks.

¹⁹ Selfridge et al. (2022, p.3) state that “At the CHC [Community Health Centre in Victoria], the clinical care standards specify that those who are currently stable on OAT (defined as taking as prescribed without additional illicit opioid use) are not eligible for the novel prescription program. Co-prescription with OAT is possible for others.” Since receiving PSS can be profitable even for those who have no intention of consuming the PSS themselves, this can create perverse incentives.

because she could use the extra $\$13,140 / 2 = \$6,570$ per year to spend on basic necessities and Mark is delighted because now he can spend $\$6,570$ more per year on down and other goods.

The full effects of this scenario depend on many particulars, but I include it to make the point that when the qualifying condition for receiving an economically valuable safer supply is a chronic relapsing condition, the profit opportunity could tempt people to (feign) relapse.

3.6 Scenario #5: Mark Gets His Brother Matt into the Safer Supply Program

Mark's brother Matt has never been interested in drugs other than alcohol, but he has also never been interested in legitimate work. Instead, he has relied on hustles ranging from shoplifting up to residential burglary and occasionally armed robbery. But in his own words he is "getting too old for that life", so Mark locates a low barrier PSS, coaches Matt on the right things to say, and gets Matt enrolled. Matt only takes enough of the PSS to test positive in the urine tests, but once a month he drives to the Alberta oil patch and sells the pills to a dealer-friend there, where prices are higher. Even after paying for gas, Matt nets close to $\$10,000$ per year and stops committing burglaries and robberies. In this scenario, BC's PSS has

- *Zero effect on legal or illegal drug use or overdose in BC.

- *Reduces Matt's criminality and poverty.

- *Increases the supply of diverted PO in Alberta.

Note: If Matt originally lived in BC, that is the end of the story. However, if Matt originally lived in Alberta and only moved to BC to take advantage of BC's PSS program, then even if Matt commits fewer crimes than before, the remaining crimes would now be committed in BC, not in Alberta.

3.7 Scenario #6: Mark Gets His Cousin Michael into the Safer Supply Program

Like Matt, Mark's cousin Michael was never a big fan of using opioids, but he does sell them for one of the local gangs. Also like Matt, Michael recognizes the income-potential from receiving PSS, but instead of selling the hydromorphone pills as pills, Michael uses them as a fentanyl extender. He used to buy bundles of 10 "points" for $\$160$ and sell the ten individual points for an average of $\$20$ each, netting $\$40$ per day of work.²⁰ Now when he buys a bundle, he pours out the contents, mixes in some ground up hydromorphone pills, and repackages the mixture into 12 not just 10 "point" sized packages, which he sells as before. That only increases his revenue by 20% (from $\$200$ to $\$240$ per day), but it doubles his daily profit (from $\$40$ to $\$80$ per day).

In this scenario, PSS has no beneficial effects on overdose. Michael's bags of down still contain various impurities, and their doses are just as variable from bag to bag. All PSS has done is increase the supply of down and slightly alter the mix of opioids that comprise that down, while giving Michael a reason to

²⁰ BCACP (2021) reports fentanyl prices of $\$20$ per 0.1 gm unit and $\$160$ when purchased a gram at a time.

start taking some hydromorphone pills on occasion, in order to defeat the PSS program’s urine test monitoring requirement.

3.8 Summary

The table below summarizes this list of scenarios, which could be extended, but these six make the point that when a re-sale market exists, the safer supply participant may not be the one who consumes the safer supply, and diversion can have a range of effects, both good and bad.

Table 1 Summary of Stylized PSS Scenarios

Scenario	Protagonist	The PSS Received by the PSS Client	Client's Own Use of Down	Client's Own OD Risk	PSS Client's Income or Spending Power	Total Market Volume of Illegal Opioids Used
PSS is consumed by participant						
#1	Mark	Mark uses the PSS instead of down	Eliminated	Greatly reduced	Becomes more affluent	Greatly reduced
#2	Mark	Mark uses the PSS in addition to down	Reduced slightly by amount Mark pays for PSS	Could go up or down	No change	Slightly reduced
PSS client sells safe supply (even though it was meant for them)						
#3a	Mark	Sold and used by someone who was eligible for PSS	Mark's use goes up. Total effect is as in Scenarios #1 and #2.	Goes up	No change	As in Scenarios #1 and #2
#3b	Mark	Sold and consumed by someone who is not yet opioid dependent	Mark's use goes up, as does market total.	Goes up	No change	Increases
PSS client is a profiteer/scammer attracted only by the chance to make money						
#4	Girlfriend Mindy, who is in recovery	Sold by Mark	Mindy continues not to use opioids	Remains zero	Mark and Mindy are both better off	Expanded supply of diverted hydromorphone
#5	Brother Matt, the burglar	Matt sells it in Alberta	Matt continues not to use opioids	Remains zero	Matt has higher income and/or fewer arrests for burglary	Expanded supply of diverted hydromorphone in Alberta
#6	Cousin Michael, the drug peddler	Michael mixes PSS into the illegal opioids he sells	Michael continues not to use opioids	Remains zero	Michael makes more money selling down	Increases

Note that Mark and his compatriots almost always benefit from safer supply, because they obtain something for \$4 that the market values at \$40. That inflates their effective annual income by $365 * \$36 = \$13,140$ per year regardless of whether they use the safer supply or sell it to someone else. Indeed, improved economic outcomes are commonly reported in the literature (e.g., Ivsins et al., 2021). The only way PSS can hurt Mark is if Mark makes systematically bad choices with his new income. That is not entirely implausible. People who use heroin self-report that their consumption would change in response to changes in income (e.g., Roddy et al., 2011), and there is a literature documenting how overdoses increase immediately after government income-support checks are received (e.g., Zlotorzynska et al., 2014; Otterstatter et al., 2016). But the standard assumption is that making people better off financially makes them better off overall.

As a final note, it is worth contrasting safer supply with syringe exchange from this economic perspective. When syringe exchanges were first debated, back in the 1980s, the street price of a syringe

was often \$1 (e.g., purchased from a diabetic) and that syringe might be used 5 or so times to inject \$20 worth of heroin per session. That meant the total dollar cost of 5 injection sessions was \$101, namely \$100 for the heroin plus \$1 for the syringe. Providing free syringes only reduced the financial cost by about 1%, from \$101 down to \$100. By contrast, providing a safe, subsidized supply of opioids has a much bigger effect on economic incentives, possibilities, and outcomes than does syringe exchange.

4.0 Thinking Carefully about the Market Price(s) of Illegal Opioids

A central question motivating this inquiry is how the intended and unintended consequences of PSS could depend on what if anything PSS clients are charged for their safer supply. Price exists on a continuum, but it is convenient to focus on two distinct options: (a) requiring individuals to pay the current market price for PSS vs. (b) providing these medications at little or no (monetary) cost.

Implementing a policy of charging the going “market price” creates practical challenges because prices in illegal markets are not always well-measured.²¹ The challenges, however, are not only practical. There are also important conceptual challenges, including:

#1: There is not just one opioid price, even in a single place and market level. Rather, a family of related opioid compounds sell in illegal markets. Each has its own average price, but those prices are interrelated, not independent, because many opioid consumers are polydrug users who substitute from one drug to another as price and availability vary.

#2: Furthermore, a prescription opioid (PO) pill whose provenance is known and trusted can sell for a premium over an equivalent amount of illegally manufactured opioids. That suggests that PSS supplied fentanyl powder may command a price premium relative to “street” fentanyl.

#3: If PSS matches the illegal market’s dollar price, but does not match the convenience of illegal supply (which sometimes operates 24/7 with home delivery) it may not outcompete illegal supply for all potential participants. (But as discussed in the previous section, maximizing convenience may jeopardize the ability to distinguish “sincere” participants from “profiteers”.)

#4: There is considerable variation in illegal market prices within the Province. Prices tend to be lowest in Vancouver’s Downtown Eastside (DTES), intermediate elsewhere in the metro area, and highest in the interior. The Province would need to decide whether to charge PSS clients different prices, depending on where they lived, or to charge uniform prices across the Province which might be too high in DTES and too low in the Okanagan or in smaller towns.

#5: There can be substantial quantity discounts in illegal drug markets, so the market price per milligram of a typical retail unit (e.g., a “point”) is considerably higher than the price per milligram when buying larger quantities. If PSS charged the retail price, someone used to buying in bulk might refuse to participate. If PSS charged the lower bulk price, then the participant could profit by reselling at the retail price.

We develop these ideas by first stepping back to think about what a “going market price” means at a fundamental level.

²¹ It would be boon if PSS implementation pushed government to invest more in monitoring prices in illegal drug markets, including monitoring the MME contents of packages of illegal opioids, not just their nominal price. It is generally price per MME that matters, not price per bag.

4.1 Determinants of Price

For homogenous commodities, price is well-defined. E.g., at the time of this writing, one share of IBM common stock sells for \$159.16 USD. Since every share of IBM is identical, it's fair to say that \$159.16 per share is the current market price, and that is the price all over the world.

Many goods act like single-price commodities once one controls for location. E.g., oil is pretty much oil, and movements in the price of oil in Alberta ("West Canada Select" or WCS) closely track movements in the international benchmark ("West Texas Intermediate", WTI), but the WCS and WTI prices are not the same. E.g., in November 2023 the prices were \$56.61 per barrel for WCS and \$77.38 per barrel for WTI oil. There is not just one price of oil, but rather one price in each geographic location.

There is considerable geographic variation in drug prices. That is most obvious when crossing international borders. E.g., the 2023 UNODC World Drug Report data annex²² states that a gram of heroin (of unspecified purity) cost between \$108 and \$464 USD in Canada in 2018 (the most recent year for which data are reported for Canada), whereas the corresponding range in Pakistan (close to Afghan production) in that year was only \$4.18 to \$6.35 USD.

There is also variation within a country; hydromorphone pill prices may be cheaper in BC than in other provinces. And there can be variation within a Province. Both hydromorphone pills and illegally manufactured opioids ("down") are cheaper in Vancouver's Downtown Eastside than they are in the interior.

Opioids though, are more complicated than oil, because even in a single location there is not just one price. Opioids might loosely be compared to diamonds whose price is determined by the four C's: carat weight, cut, colour, and clarity. The four key factors determining the relative price of different opioids in the same market are (1) Gross weight, (2) purity, (3) type of opioid, and (4) a premium when there is a consistent dose and quality.

Before 2014, only the first two were generally important for bags of illegal manufactured opioids because heroin was the only economically important ingredient in those bags. The various diluents and adulterants back then were both cheap for the producer and relatively innocuous for the consumer. Put differently, heroin was so expensive that the main driver of price (besides location) was the pure quantity of heroin in the bag.

There tended to be large price markups as heroin moved down the distribution chain,²³ so the price per pure gram was much higher when sold in small lot sizes at retail than was the price per pure gram for wholesale transactions. But the retail prices could fairly be estimated by dividing the price of a standard retail unit by the typical pure quantity of heroin contained in such a bag.

For example, circa 2013, when retail units in Australia often sold for \$50 AUD, Stam et al. (2018) analyzed 983 retail heroin seizures and concluded that small (< 150 mg total weight) retail bags

²² https://www.unodc.org/unodc/en/data-and-analysis/wdr2023_annex.html

²³ Since most drug markets are highly competitive (many sellers competing with each other and relatively free entry), the conventional economic explanation for the price markups is that they were primarily compensation for the risks and inconveniences created by prohibition and law enforcement. C.f., Caulkins and Reuter (2010).

contained an average of 12 pure milligrams per bag, suggesting a retail price of $\$50 / 12 = \4.17 AUD per pure milligram of heroin.

As Appendix A discusses, price differences across types of opioids (the 3rd component of the price equation) can readily be seen in the prices of diverted prescription opioid pills. Opioids traditionally sold in illegal markets generally activate the same or similar neuroreceptors and have similar effects, but the specific type of opioid matters. E.g., the price per milligram is higher for hydromorphone than for hydrocodone. Most of the differences can be explained by differences in the drugs' morphine milligram equivalency ratios (informally, "potency"). For example, Dasgupta reported that 2012 prices per milligram for hydromorphone (\$3.29) were 4.06 times higher than for hydrocodone (\$0.81 per milligram), and the equianalgesic potency equivalence ratio for those two opioids is 4 to 1. However, prices are not always exactly proportional to analgesic power. For example, Dart et al. (2015) report that tramadol sold at a discount relative to some other prescription opioids, even after adjusting for differences in their MMEs.²⁴

The fourth component is the least well-studied, but historically pills that could be presumed to be legally produced but diverted pharmaceutical products sold at a substantial price premium over heroin, even after adjusting for relative analgesic potency.²⁵ Appendix A gives two examples from the pre-fentanyl era suggesting that in Canada the price per MME of diverted pharmaceuticals was 4 times higher than the price per MME of heroin, and the corresponding estimate for the U.S. was 5 to 1. Recent ratios in BC might be closer to 3 to 1.

I want to reiterate. The extent of this premium is not well-studied. I am confident that there has been such a premium. I am pretty confident that it has been substantial. But I do not know whether it is a factor of 3 (a ratio I often use in rough calculations) or whether it is a little larger, more like the 4 or 5 to 1 that I found in the literature while working on this project.

Furthermore, whatever the premium was in the past, it may or may not be the same today.

The arrival of fentanyl could have affected this premium for consistent ("pharmaceutical grade") illegal opioids in at least two ways. First, that illegal opioids became deadlier as fentanyl replaced heroin might have led people who use opioids to value the dose-consistency of diverted legal opioids even more, tending to increase the premium. Second, counterfeit fentanyl-laced pills are now common. That might create what economist George Akerlof (1970) called a "lemons market" in which high-quality ("real") diverted prescription opioids no longer command as great a premium as before because they are indistinguishable to the buyer before purchase from lower quality (counterfeit) pills.²⁶

²⁴ The variety of synthetic opioids in today's markets, variations in mode of administration, and the changing nature of adulterants (e.g., xylazine), may complicate things relative to this traditional perspective.

²⁵ A colleague who reviewed a draft suggested that it is not just pills, but also diverted medical patches and ampules that enjoy a premium. I have not verified that, but it makes sense. It is not the physical form per se that is probably of the greatest value, but rather the consistency and reliability of the dose.

²⁶ It is an open question whether counterfeit pills containing fentanyl have more consistent content, from pill to pill, than do illegal powder opioids, from bag to bag. I have worked with some very limited data from the U.S. suggesting that may be the case. If so, there might end up being three pricing tiers: (1) Biggest premia for pills that are known to be diverted from legal sources, (2) Lowest prices per MME for powder, and (3) Intermediate prices per MME for pills of unknown provenance.

Hence, the effect of illegally manufactured fentanyl on the price premium for pills seems to me to be theoretically ambiguous.

Appendix A reviews contemporary Canadian and BC price data for down and hydromorphone pills. Prices for both have been falling sharply. For hydromorphone that is a simple reduction in the price for pill. For down that manifests in “point” bags selling for more or less the same number of dollars even though they have higher purities and so more MMEs per bag. It appears that the hydromorphone price premium may have declined somewhat after the arrival of illegally manufactured fentanyl (IMF), but still remains on the order of three to one.

There are differences of opinion as to whether prices have collapsed to the same degree everywhere, or whether the decline in BC is greater than in, say, Alberta or Washington State. It is also not clear whether price trends have been parallel in all parts of BC, or if the price declines have been particularly pronounced in Vancouver.

4.2 Additional Determinants of the Cost to Purchase

The previous section discussed price – meaning the amount of money (or its equivalent in bartered goods and services²⁷) that the customer gives to the seller to obtain the drugs. That price is not, however, the total cost that the customer incurs when purchasing drugs.

Purchasing anything – legal or illegal – also takes some time and effort. The time might be minimal when clicking on an item in Amazon’s online marketplace. It could be substantial when driving to a bricks and mortar store at rush hour, let alone when haggling over prices at a souq in the Middle East.

The concept can be generalized to encompass other non-dollar costs. For example, purchasing illegal drugs sometimes entails interacting with dangerous individuals who might take the would-be purchaser’s money without actually delivering the goods. For simplicity, I will refer to the summation of all of these non-dollar costs of purchasing as time and/or hassle, but they should be understood to be broader than that.²⁸

Even if PSS were offered at the same dollar price as the illegal market price, PSS might still have a different all-in purchase cost, counting non-dollar as well as dollar costs. Hopefully, the non-dollar cost from the risk of suffering physical violence is lower when obtaining PSS, although that is not strictly guaranteed. Illegal sales are often surreptitious and for small quantities, whereas a client exiting a PSS site that lets someone take home a week’s supply might be an appealing mugging target.

²⁷ Retail distribution often occurs between friends and compatriots (sometimes called “social supply”), not via arms-length business transactions between a supplier and customer with no other relationship, so considerations other than money can be part of what is offered in exchange for the drugs.

²⁸ One of the earliest theories of effective drug policy stressed the benefits of driving up non-dollar costs, while allowing the dollar price to be low (Moore, 1973). Non-dollar as well as dollar costs discourage use, but only dollar costs translate into revenue for criminal drug sellers. The few efforts to quantify time and hassle costs of which I am aware are dated. Rocheleau and Kleiman (1993) and Rocheleau and Boyum (1994) found that the non-dollar costs of purchasing heroin at retail in the U.S. were not negligible compared to the dollar price, and Rouen et al. (2001) and Weatherburn et al. (2001) found those costs increased appreciably when supply contracted during the Australian heroin drought.

The larger consideration, though, is probably time and convenience. Depending on the customer, the PSS location and rules, and the customer's relationship with their illegal supplier(s), the PSS may or may not offer greater convenience. On the plus side, many people purchase illegal drugs daily or even multiple times per day, so if PSS offered multi-day take-home supplies, that would greatly reduce the number of transactions per week. On the other hand, PSS may or may not operate 24/7 the way many illegal markets do,²⁹ apparently most PSS in BC today limit take home quantities to one day's supply, and drug dealers often deliver whereas PSS may require clients to come to them.³⁰ Furthermore, dealers are often socio-culturally similar to their clientele (similar age, education-level, first language, etc.).

All of that is to say that if PSS charge the same dollar price as the illegal market, the total cost to purchase – combining non-dollar as well as dollar considerations – might be higher for a (perhaps small) subset of potential clients, which might limit the reach of the program somewhat.

4.3 Understanding the Price Premium for Trusted Pharmaceutical Products

Based on the data reviewed in Appendix A, a 100-milligram “point” bag of down that is 16% fentanyl by weight sells for approximately \$20.³¹ That is $\$20 / 16 = \1.25 per pure mg of fentanyl.³² Assuming fentanyl's morphine equivalence is 75 (the midpoint of the usual 50 – 100 range) implies a price per MME of $\$1.25 / 75 = \0.017 .³³

Likewise, suppose that 8-mg hydromorphone tablets that are known to be “real” (i.e., diverted from legal sources, not “counterfeit”) sell today for \$2. That is $\$2 / 8 = \0.25 per mg of hydromorphone and $\$0.25 / 5 = \0.05 per MME.

Those figures imply that diverted legal hydromorphone tablets enjoy at $\$0.05 / \$0.017 = 3:1$ price premium per MME relative to down, and one could trade a bag of down for 10 pills at current market prices.

A 3:1 or greater price premium has existed for years, but it is not a universal physical constant. Nor is it set by statute. It emerges through the interplay of supply and demand. It can be thought of as reflecting the average valuation that different customers place on an opioid dose being of known quality and strength.

²⁹ The MySafe “vending machines” can be available 24/7, but most PSS programs today are not. That is not necessarily a major issue for hydromorphone PSS that dispense multiple days' supply at once, but there is at least one account of a client of the SAFER powder fentanyl PSS reporting that they turn to illegal opioids mostly at night, when PSS the SAFER facility is closed (Laupacis, 2022).

³⁰ These points about illegal supply offering the convenience of 24/7 hours and home delivery were also stressed by a policing contact.

³¹ BCACP (2021) cites \$20 as the standard price for a single 0.1-gram packet of either heroin or fentanyl. Prices vary by location, being somewhat lower in the DTES and somewhat higher further from Vancouver.

³² I understand based on December 2023 correspondence with a BC government official that the SAFER program charges \$25 for a 20-mg tablet, which is also \$1.25 per mg.

³³ BC palliative care guidelines treat IV fentanyl as 100 times not just 75 times as potent as IV morphine. (https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/palliative2 - pain_equianalgesic.pdf) The 75:1 is more common in the literature I work in, and tends to be conservative with respect to some of the main conclusions of this report.

In a hypothetical and unrealistic case in which suddenly no customers cared at all about their risk of overdose or arrest, then all demand would shift to down, which is cheaper per MME. This would increase the price of down, and the reduced demand for hydromorphone tablets would reduce their price, until the market reached a new equilibrium in which both opioids sold at the same price per MME.³⁴

In another hypothetical and equally unrealistic case, imagine that all customers suddenly became infinitely concerned with overdose risk. Then everyone would buy only hydromorphone, driving its price up, and demand for down would disappear, sending its price effectively to zero. Then the price premium would essentially be infinite.

An observed 3 to 1 price premium can thus be seen as reflecting the current average valuation that customers in the marketplace collectively place on the greater safety of hydromorphone pills – as well as the supply of the two opioids.

Not everyone is average. Some customers place a lower and some a higher valuation on safety. Those differences create opportunities for mutually beneficial trades. Imagine two friends. The first cares enormously about MME content, and is something of a risk taker with respect to health, and so views one bag of down as worth 20 pills (a safety premium of only 1.5). The second cares about MME content, but cares much more about avoiding an overdose, and so views a bag of down as only as valuable as 5 pills (a safety premium of 6). If the first friend has 10 hydromorphone pills and the second has 1 bag of down, the two could trade those drugs and both be better off. The first started with pills that were only as valuable to him or her as half a bag of down, but ended up with a full bag. The second started with down that was only worth as much as 5 pills to them, but ended up with 10 pills. Both are made happier by the trade.

In a market, people with higher and lower valuations on safety, compared to MME content, can trade back and forth – either directly or with retail drug sellers acting as intermediaries – until the price premium reaches a level at which no one wishes to trade any further.

4.4 Implications

One implication of this discussion is that there is no single market price and no single PSS price that can entirely eliminate incentives for diverting PSS supply by re-sale or barter. If the market offers a 3:1 price premium for hydromorphone pills, and PSS provides pills to someone who only cares about maximizing their MME consumption, they will trade their PSS pills for down (either directly or by selling the pills and using the proceeds to buy down).

Inasmuch as that price premium is really a premium for the safety provided by a reliable supplier offering consistent dosing, then PSS fentanyl may also enjoy a price premium relative to illegal market fentanyl. That means that someone whose focus is maximizing MME consumption would wish to trade

³⁴ This is a simplification. There could remain some gap in price per MME if the quality of the hedonic effects of the two drugs differed, but the concepts discussed in this subsection are complicated enough that it is useful to set that aside for now. In that case the original observed 3:1 premium would include both a “safety premium” and a “hedonic preference adjustment” and the logic of this subsection could still carry through but apply only to the safety premium.

their PSS fentanyl for a quantity of illegal market-supplied down whose fentanyl content is more variable but larger in expectation.

The next section develops these ideas more systematically.

5.0 Implications of Varying the PSS Price for a Small PSS Program

Given the forgoing, we now attempt to describe how different people might respond to PSS hydromorphone and fentanyl at various prices if – and this is an important caveat – the scale of the PSS program is too small to alter the market equilibrium. I.e., if the illegal market prices remained (for purposes of these illustrations) at \$2 for a hydromorphone tablet and \$20 for a bag of down containing an average of 16 mg of fentanyl. The subsequent few sections explore whether in fact PSS might be a large enough infusion of new supply that it alters the market equilibrium.

5.1 Implications of Selling a (Small) Safe Supply of Hydromorphone at Various Prices if There is an Illegal Market for Diverted Pharmaceutical Hydromorphone

If PSS charges the same dollar price for the same product that can be purchased in illegal markets, then some potential clients would opt for the convenience and familiarity of illegal supply. So consider the possibility that PSS sells 8-mg hydromorphone tablets at a 25% discount relative to the illegal market, i.e., for \$1.50 not \$2. That makes them 2.3 times as expensive per MME as down.

Consider three illustrative types of customers who are personally willing to pay multiples of 2, 3, or 4, respectively, relative to the price per MME of down for any hydromorphone they will consume. That is, relative to the market average, the groups are somewhat less, equally, and somewhat more safety conscious than the market-wide multiplier of 3.0, respectively.

All three groups have a financial incentive to purchase this discounted PSS if they are able to re-sell it. However, at this price, the first group would only buy PSS if they could re-sell it; when buying drugs for their own use, they'd prefer to buy down. The last group would buy and use the PSS hydromorphone themselves, not sell or trade, because they value the safety of PSS hydromorphone more than does the market average. Indeed, they may well have been already using only hydromorphone anyhow. If they stumbled on some down, they could have exchanged it in illegal markets for a number of hydromorphone pills that they would have preferred to that down. The middle group wants to buy the subsidized PSS, but is indifferent as to whether they keep or trade it.

If the PSS price of hydromorphone drops to \$1, the first group's behavior changes in that they would always want to buy PSS even if they had to use it themselves, but they'd still try to trade it if they could.

There is a 4th type of potential PSS client, which is profiteers who have no interest in using opioids, but who would take advantage of the chance to buy something for \$1.50 that they could turn around and sell for \$2.

These four groups' behaviors as a function of the PSS price are summarized in the following table.

Table 2 Various Groups' Potential Responses to PSS Hydromorphone at Different Prices

					Customer Type #1	Customer Type #2	Customer Type #3	Customer Type #4
					Takes risk with health Personal safety ratio = 2	Matches market average Personal safety ratio = 3	More safety conscious Personal safety ratio = 4	Does not use opioids
PSS price per 8 mg hydromorphone tablet	Relative to \$2 market price	Price per MME	Price Premium Relative to Down	Prefers down. Will always wish to sell/trade any PSS obtained	Does not buy PSS	Does not buy PSS	Will only want to buy PSS if they can re-sell at a profit	Will only want to buy PSS if they can re-sell at a profit
\$2.50	Above	\$0.063	3.8	Does not buy PSS	Does not buy PSS	Does not buy PSS	Does not buy PSS	Does not buy PSS
\$2.00	Equal	\$0.050	3.0	Does not buy PSS	Indifferent between buying from PSS, illegal pills, and down	Indifferent between buying from PSS and illegal pills	Does not buy PSS	Does not buy PSS
\$1.50	Slightly Below	\$0.038	2.3	Only buys PSS if can sell/trade	Buys PSS and indifferent between using or sell/trading	Buys PSS and uses; no trading	Only buys PSS if can sell/trade	Only buys PSS if can sell/trade
\$1.00	Below	\$0.025	1.5	Buys PSS, wants to trade, but content to use	""	""	""	""
\$0.67	Below	\$0.017	1.0	""	""	""	""	""
\$0.50	Below	\$0.013	0.8	""	""	""	""	""
\$0.00	Below	\$0.000	0.0	""	""	""	""	""

The table shows that if the goal is to avoid diversion, the ideal clients for PSS hydromorphone are safety-conscious individuals who prefer hydromorphone. But those individuals wouldn't necessarily have been using much illegal fentanyl anyhow. If they happened to come by some illegal fentanyl, they could have sold that into the illegal market for an amount of money that would let them buy a number of pills that they'd rather use than the fentanyl.

If the goal is reducing illegal opioid use, the ideal clients for a small PSS program may be those whose concerns about safety match the market average. They might have been using fentanyl before and cannot gain by trading PSS pills in the illegal markets. That indifference between using pills or fentanyl means that they would be happy to use any pills they are given.

The challenge is that there may not be very many people who are exactly average – or more precisely are close enough to average relative to the transaction costs in the illegal market that they behave as if they were exactly average.

5.2 Implications of Selling a (Small) Safe Supply of Fentanyl

If the PSS supplies fentanyl powder, not hydromorphone tablets, at below market prices then the outcomes could differ, because PSS would be supplying something that does not exist now in the illegal market, namely fentanyl that comes in reliable doses. An important question – not yet answered empirically so far as I know – is whether that quality guarantee could be “preserved” during re-sale.

One possibility is that when a PSS client sells PSS fentanyl into the illegal market, his or her customers have no way to know that the fentanyl was in fact PSS fentanyl, as opposed to illegally supplied fentanyl. In that case, PSS fentanyl may be more valuable to the PSS client – and to a few friends and family members who trust the PSS client – than it is when sold into the illegal market, reducing the opportunities for profiting from resale.

Another possibility is that PSS provides fentanyl in distinctive packaging, so unopened PSS packages can continue to be trusted as distinguishable from, and safer than, a comparable quantity of illegal market fentanyl. Indeed, Zivo (2023b) reports that hydromorphone sellers on Reddit boast that their product is genuine PSS supply and show pictures depicting it in PSS packaging.³⁵

However, if fentanyl in PSS packaging is worth more than fentanyl without packaging, that creates incentives for the illegal market to produce counterfeit packaging.³⁶ Criminals could then multiply the value of cheap illegal fentanyl by putting it in forged PSS packaging – at least until the practice became so common that packaging that appeared to be PSS packaging was no longer trusted and so no longer commanded a price premium.

³⁵ Zivo reports that “To prove that their hydromorphone is legitimate, traffickers also regularly include safer supply prescription bottles or packages in their photos” and provides links to such photos.

³⁶ Illegal markets exist not only for physical objects, like guns and drugs, but also for forged documents. E.g., one site (<https://www.statista.com/statistics/1350154/selling-price-forged-documents-dark-web/>) reports the prices of forged Alberta driver's licenses as \$140 and of forged prescriptions Rx labels as \$100.

That would create an interesting conundrum. Should PSS designers try to package PSS fentanyl in a way that it is hard for the illegal markets to imitate? On the one hand, distinctively packaged PSS fentanyl would be preferred to illegal fentanyl, and so have a better chance of driving illegal fentanyl out of the market. On the other hand, distinctive packaging would expand the scope of potential re-sale.

If PSS fentanyl packaging cannot be counterfeited, then the market considerations may be similar to those discussed in the previous section for PSS hydromorphone, with one very important difference. Diverted PSS hydromorphone just increases the supply to an existing illegal market, but diverted PSS fentanyl powder in distinctive packaging would create a brand-new illegal market that has not existed heretofore, namely an illegal market in fentanyl powder that is packaged in known and consistent doses. That new market might sustain a price per milligram that is substantially higher than current illegal fentanyl prices, because of the safety premium.

Now consider the situation in which PSS fentanyl becomes indistinguishable from down as soon as the PSS client tries to re-sell it. In that case, if PSS fentanyl is priced close to the current (illegal) market price for fentanyl, then all three types of customers would have an incentive to purchase PSS and use at least some of it themselves.

How much they would use, and how much they re-sell, depends on the quantity of fentanyl supplied relative to the amount they wanted to use. But they may well consume more fentanyl than they did before entering the program, because the PSS safety premium would reduce their effective cost of fentanyl, even if the dollar price remained the same. E.g., consider the first type of customer, whose safety premium multiplier is 2. For them, a \$20 PSS bag containing 16-mg of pharmaceutical grade fentanyl could be as desirable as 2 bags of down, meaning that PSS cuts their effective cost of using fentanyl by 50% – even if the PSS charged the going market price of \$20 per bag with 16 mg of fentanyl. The effective price declines would be even larger for the 2nd and 3rd groups, who value reliable and consistent dosing more.

This arithmetic stretches the concept of the price premium, but it makes a conceptual point. Making the PSS fentanyl price per milligram match the current illegal market price of fentanyl, on average, could reduce the effective total cost of using, and so potentially increase PSS clients' fentanyl consumption – albeit still reduce their overdose risk since some of that fentanyl would be PSS fentanyl.

In sum, fentanyl that is known to come from PSS could be much more desirable than an equal amount of fentanyl purchased in illegal markets. That could effectively reduce the cost of using fentanyl. If the PSS fentanyl cannot be packaged in a distinctive way that is immune to counterfeiting, that decline in effective cost of use would be limited to PSS program clients, and their close friends and associates. But if PSS packaging were distinctive and resistant to counterfeiting, then PSS clients with a lower than market average safety premium would have an incentive to divert it, and PSS would be creating a new market for a new illegal opioid, namely fentanyl sold in consistent reliable doses – something that is not now available in illegal markets.

5.3 Implications of Selling a (Small) Safe Supply of Hydromorphone Pills if the Illegal Pills Market Has Become a Lemons Market

Even though in years past illegal markets sold pills that customers could reliably judge to be diverted pharmaceutical products, that may not be the case in the future, and may not even be the case today. Counterfeit pills have become so common that pills purchased in illegal markets may not be able to command the price premium that they did in the past. Or, in other words, customers buying pills in illegal markets that look like diverted prescription opioid pills may not be able to assume that those pills are in fact “real” pharmaceutical pills with a reliable dose size.

In such a world, the analysis for PSS hydromorphone would need to be adjusted to reflect the considerations that would apply to PSS fentanyl whose packaging is not distinctive or is easy to counterfeit.

6.0 Could PSS Alter Market Prices? Providing a Sense of Scale

The preceding section considered how varying prices for PSS hydromorphone or fentanyl might affect outcomes when the PSS program was so small that its supply did not alter the market equilibrium or its prices. This section observes that while current PSS opioid flows are indeed small compared to the supply of illegally manufactured fentanyl (IMF), they are not small compared to amounts prescribed for pain management. Thus, depending on rates of diversion of hydromorphone from PSS and from medical treatment of pain, PSS could already be putting downward pressure hydromorphone prices in illegal markets.

Appendix A documents the sharp declines in hydromorphone prices in BC. Hydromorphone prices are also dropping elsewhere, and there is disagreement as to whether the price declines are steeper in BC than elsewhere, and whether there is a causal link. There are at least three possibilities: (1) PSS caused price declines in BC (only), (2) PSS caused price declines across the country (e.g., because dealers buy in BC and sell elsewhere), and (3) Price would have declined that much anyhow, and the declines are not caused by PSS, e.g., because hydromorphone prices maintain a 3:1 price ratio relative to IMF, and IMF prices were falling.

It is beyond the scope of this report to adjudicate that dispute. However, this section carries through three arithmetic exercises to get a sense of the potential scale of PSS programs in BC, and whether they may be large enough to affect market equilibrium and prices. The short answer is “No” or “Not yet” for IMF but “Yes” for hydromorphone.

6.1 Two Estimates of the Size of PSS Today

I have two estimates of the “size” of PSS in BC today. They are similar and point to similar conclusions, so I will describe both but carry forward subsequent analysis only with the second.

First, my understanding is that about 88.8 million milligrams of tablet hydromorphone were dispensed as PSS in the fiscal year 2022/2023.³⁷ Using a morphine equivalence ratio of 5 for hydromorphone, that multiplies out to about 1.2 million MME per day in the form of tablet hydromorphone.

Second, Selfridge et al. (2022) reports that in one study, PSS clients received an average 347 MME per day. There are now about 4,500 PSS participants. If the Selfridge et al. (2022) figure applied to them all, that would multiply out to about 1.5 million MME per day.

Those two estimates are in the same ballpark and two things might help further reconcile them: (1) The lower figure applies only to tablet hydromorphone whereas the larger figure applies to all opioids and (2) The figure of 4,500 PSS participants includes not only what one might informally think of as standard, “full time” PSS but also some for whom PSS is just an adjunct to titration.

For simplicity I will proceed with the 1.5 million MME estimate, but in its interpretation will remember that it may be slightly on the high side.

³⁷ PharmaNet, Healthideas, Health Sector Information, Analysis and Reporting, Ministry of Health, March 18, 2024.

6.2 Comparing the Size of PSS to Illegal Supply of Fentanyl

Appendix B examines a variety of estimates which collectively suggest that most of the risk of opioid overdose in BC is concentrated within a population of perhaps somewhere between 20,000 and 80,000. If there are 20,000 people in the province using an average of two 0.1-gram “points” of fentanyl per day that is 16% pure, that multiplies out to 2,400 MME per person per day, and 48 million MME per day provincewide, assuming fentanyl’s morphine equivalency ratio is 75 (the midpoint of the 50-100 range that is usually cited). That would make illegal supply about 30 times larger than PSS supply in terms of MME, even using the larger of the two PSS estimates.

The ratio might even be greater. For one, some people think the 20,000 figure is definitely too low.

For another, the two “points” per day figure may be conservative. When I pressed an individual connected with the Professionals for Ethical Engagement of Peers (PEEP) Consultation and Advisory Board³⁸ for a best guess of the average consumption rate the suggestion was 0.35 grams. That would imply that the illegal market may now be closer to 50 times the size of today’s PSS in terms of MME.³⁹

Table 3 The Illegal Opioid Market is Much Larger than PSS in BC

	Illegal fentanyl (down)		PSS
	Scenario #1	Scenario #2	
grams per day	0.2	0.35	
mg per gram	1000	1000	
purity of fentanyl	16%	16%	
MED ratio	75	75	
MME per day	2,400	4,200	347
People	20,000	20,000	4,500
Provincewide MME per day	48,000,000	84,000,000	1,561,500
Multiple of PSS	31	54	

PSS could expand, both in terms of number of participants and MME dispensed per participant per day. Since it is hard to know average MME consumption rates, it is more fruitful to think of this in terms of (1) What share of total IMF consumption is due to the frequent and/or dependent consumers who are

³⁸

<https://towardtheheart.com/peep#:~:text=The%20goal%20of%20PEEP%20is,for%20more%20meaningful%2C%20ongoing%20dialogue.>

³⁹ I want to acknowledge that this individual was reluctant to give a number and stressed the great variability across individuals. In particular, the statement was “PEEP speculated on the range varying between vary between .05 of a gram to possibly close to 3 grams, depending on quality and “legs” of the drug, and tolerance of the person. My guess (for what it’s worth) for an average daily use of all people who use fentanyl daily is .35 grams, but many people use much more than this”.

PSS's target audience and (2) PSS's MME per participant as a proportion of those individuals' pre-PSS consumption.

Bouchard et al.'s (2020) analysis of people in BC who use or are otherwise exposed to fentanyl (PWUEF) estimated that daily and near daily PWUEF accounted for 85.8% of consumption, whereas PWUEF infrequently accounted for just 14.2%.

Similarly, Midgette et al.'s (2019) analysis for the U.S. finds that people who use illegal opioids (PWUO) 21 or more times per month accounted for 85% of spending on illegal opioids.⁴⁰ Including those using opioids 11 – 20 times per month bumps that up to 93%.

Note: Not all PWUO do so frequently. The Midgette et al. (2019) figures also imply that only 36% of PWUO in the past-year consumed on 21 days per month or more often, and 45% consumed on 11 or more days per month. The subset who use frequently account for a disproportionate share of consumption because they consume on more days, and use more per day of use.

At any rate, suppose hypothetically that PSS enrolled all daily and near daily (DND) PWUO, that those DND PWUO accounted for 85% of consumption, and PSS supplied half as many MME per day as those clients had been using beforehand. Then the PSS supply would be $0.5 * 85\% = 42.5\%$ as great, in MME terms, as was the original illegal market supply. That would likely be large enough to affect the equilibrium in the market for illegal opioids. But PSS in BC today is nowhere near those quantities.

6.3 Comparing the Size of PSS Supply to the Supply of Legal Opioids in Canada

We next show that the flow of PSS opioids is not negligible compared to the amount of PO used to manage chronic pain and, hence, diversion from PSS may rival diversion from pain management.

Jayawardana et al. (2021) report that Canada's sales of opioid analgesics in 2019 for consumption in pain management (i.e., excluding opioid dependence treatment) as recorded in IQVIA's MIDAS database was about 1,000 MME per thousand inhabitants per day.

If BC had 4,500 PSS participants receiving an average of 347 MME per day, then since BC's population is 5.071 million that works out to be $4,500 * 347 / 5,071 = 308$ MME per thousand inhabitants per day. I.e., PSS today may already be supplying roughly 30% as many MME per capita in BC as are used in Canada to treat pain.

If BC expanded to 40,000 PSS clients receiving an average of 347 MME per day, that would be over 2,700 MME per 1,000 people in the province, or almost triple the rate recorded in IQVIA's database for pain management in Canada in 2019.

I do not know the rates of diversion of opioids from either PSS or from pain management in Canada, but suppose, just for the sake of argument, that diversion rates in PSS programs were triple what they are for opioid analgesics used in medicine generally. E.g., one U.S. study estimated that diversion via doctor shopping fell between 2008 and 2012 from 1.75% to 1.27% of prescriptions, and from 2.95% to 2.19% of

⁴⁰ Author's calculations for 2000-2016 with spreadsheets supporting Midgette et al. (2019).

MME (Simeone, 2019), so this hypothetical might correspond to diversion rates of 7.5% for PSS and 2.5% for opioid analgesics.⁴¹

If PSS were one-third the scale but had triple the rate of diversion, then the amount of diversion from PSS would equal the diversion of opioid analgesics.⁴² I.e., PSS would be doubling the supply of diverted prescription opioids. Likewise, if the diversion rate from PSS were six times higher (e.g., 15% vs. 2.5%) then PSS would be tripling the supply of diverted prescription opioids.

Recall that I had two estimates of the size of PSS. The same source that estimated that PSS dispensed 88.8 million mg of tablet hydromorphone per year in 2022-2023 also estimated that about 57.4 million mg of tablet hydromorphone were dispensed per year at that time for pain management.^{43 44} So for hydromorphone in particular, PSS supply apparently already exceeds supply for analgesic purposes.

6.4 Comparing the Size of PSS Supply to Diversion of PO in the U.S. via Doctor Shopping

This subsection investigates what rate of diversion from PSS would make that diversion match in scale PO diversion from doctor shopping in the U.S., a form of diversion which is widely believed to have been an important driver of increased OUD and opioid death.

McDonald and Carlson's (2014, p.1261) study of doctor shoppers in the U.S. estimated that "a small outlier population, comprising 0.7% of all opioid patients" accounted for "one of every 50 prescriptions dispensed [containing] 5.4 million morphine equivalent grams."⁴⁵ That works out to doctor shoppers obtaining 48.7 MME per 1,000 Americans. By that metric, if roughly $48.7 / 308 = 16\%$ of current PSS supply were diverted, that would be a flow comparable to what McDonald and Carlson estimate the U.S. was experiencing from those doctor shoppers in 2008.

If BC had 40,000 PSS clients receiving an average of 347 MME per day, then if even $48.7 / 2,700 = 1.8\%$ of that expanded PSS supply were diverted, the per capita volume of diversion would match McDonald and Carlson's estimate for those doctor shoppers in the U.S. in 2008.

While I do not know what are the rates of diversion from PSS,⁴⁶ diversion in other contexts is not altogether uncommon. E.g., Arria (2011) found that among a sample of 192 first-year college students in the U.S. who were prescribed analgesics to treat acute pain, 27% reported diverting some of their medication. Another study of college students found that 35% of those with prescriptions for analgesics diverted at least some, although most did it rarely and as gifts not for profit (Garnier et al., 2010).

⁴¹ One Canadian "retrospective cohort study of people living with chronic noncancer pain (CNCP) and treated with opioids for at least 6 months between 2006 and 2017 in the province of Quebec" found that 7.8% met its criteria for doctor shopping (receiving opioids from 2 or more doctors and 3 or more pharmacies) (Kaboré et al., 2021).

⁴² Jones et al. (2020) report that as of 2018, BC's rate of dispensing PO was lower, per capita, than in other provinces, so PSS in BC might actually be more than one-third as large as PO dispensing to treat chronic pain.

⁴³ Tablet hydromorphone includes 2mg, 4mg, and 8mg tablets. Most of the tablet hydromorphone dispensed for PSS is in 8mg tablet form.

⁴⁴ PharmaNet, Healthideas, Health Sector Information, Analysis and Reporting, Ministry of Health, March 18, 2024.

⁴⁵ To give a sense of how extreme these outliers were, McDonald and Carlson report that they "obtained an average of 32 opioid prescriptions from 9.3 prescribers during the last 10 months of 2008".

⁴⁶ Ivsins et al. (2021) report that 12 of 42 PSS participants they interviewed reported drug selling, but it is not clear whether they were selling PSS or other drugs.

6.5 Sketch of One Hypothetical, Stylized New Market Equilibrium

The forgoing suggests that while current PSS supply is large enough to potentially affect illegal market prices for hydromorphone, and may be large enough to affect prices for other diverted PO, it is very small compared to the total market for fentanyl and other illegally manufactured opioids. So PSS could not at this time be materially affecting equilibrium in that market. We can though offer a very rough illustrative calculation of potential effects on the fentanyl market if PSS were expanded to all high-frequency consumers of illegal opioids.

The calculations are only illustrative because the elasticities of supply and demand are not known.⁴⁷ It is also not clear how tightly linked BC's markets are to those in other provinces (and U.S. states). So, the calculations in this subsection are a bit of a toy exercise, but they may nonetheless be instructive.

Imagine an ideal situation in which BC is an island unto itself, there is no diversion to people who are not already buying illegal opioids, and no one tries to profit by arbitraging between lower opioid prices in BC and higher prices elsewhere.

Suppose further that among people who use or were otherwise exposed to illegal fentanyl (PWUEF), the 40% of who use daily or near daily (DND) consume 85% of the illegal opioids – meaning they consume 8.5 times as much per person per year as do the 60% who consume less frequently. Finally, suppose that all 85% DND PWUEF get enrolled in PSS that supplies for free PSS opioids whose total quantity (e.g., in MME) is half as much as the PWUEF DND were consuming before PSS.

Finally, suppose that the elasticity of demand among PWUEF is -0.75 (consistent with Gallett, 2014 and Payne et al., 2020⁴⁸), the elasticity of illegal supply is $+0.25$, and both supply and demand are of the constant elasticity form. (I am not aware of any empirical estimate of the elasticity of supply for illegal opioids in Canada. That $+0.25$ figure is not implausible, but it is selected arbitrarily just for the sake of illustration.)

Then if we normalize pre-PSS consumption of illegal opioids to be 1.0, the PSS effects could look like this.

⁴⁷ Elasticities measure how responsive supply and demand are to changes in price. They are defined as the percentage change in quantity that is associated with a 1% increase in price. E.g., for a commodity – a drug or any other item – with an elasticity of demand of -0.75 , a 10% increase in price would reduce consumption by 7.5%.

⁴⁸ Payne et al.'s (2020) overall elasticity for heroin across studies in all countries is -0.9 , but the U.S. specific figure is -0.79 . Payne et al. do not report an estimate specifically for Canada, but arguably North American heroin markets could be more similar to each other than they are to markets elsewhere around the world.

Table 4 Hypothetical Illustration of Potential Market Effects of a Full-Scale Ideal PSS

	DND PWUEF	Others	Total
Before PSS			
Consumption of illegal opioids	0.85	0.15	1
After PSS			
Consumption of illegal opioids	0.708	0.200	0.909
Consumption of legal opioids	0.425	0	0.425
Total opioid consumption	1.133	0.200	1.334
Effect of PSS			
% change in use of down	-16.6%	33.4%	-9.1%
% change in use of opioids	33.4%	33.4%	33.4%

Competition from PSS supply could drive down illegal market prices by enough to increase total opioid consumption by about one-third. If there is no diversion, then for those not in PSS, that implies a one-third increase in consumption of illegal opioids. For those in PSS, their consumption goes up by about one-third from 0.85 to $0.85 \times 1.334 = 1.133$, but 0.425 of that comes from PSS, so their consumption of illegal opioids falls by about one-sixth from 0.85 to $1.133 - 0.425 = 0.708$.

So, in this hypothetical example, PSS for all DND PWUEF with zero diversion or exports increases consumption of illegal opioids by about one-third for the 60% of PWUEF who had previously consumed less than daily (and so are not in PSS),⁴⁹ and it reduces illegal opioid consumption by one-sixth for the 40% of PWUEF DND. Since PWUEF DND consume so much more than do less than daily users, that implies an overall reduction of 9.1% in consumption of illegal opioids. Revenues for the suppliers of illegal opioids fall much more than that, however, because not only do they sell less, the market price for illegal opioids has also fallen.

Two caveats. First, PSS effectively increases the income of PSS clients, and these calculations do not factor in any income elasticity of demand. I.e., because PSS makes its clients more affluent (less poor), they might increase their spending on drugs as well as other things. Factoring in an income elasticity would lead to somewhat higher rates of consumption after PSS.

Second, even though consumption of illegal opioids declines by 9.1%, it is not clear that OD deaths would decline by as much as 9.1% for two reasons. First, consumption of PSS opioids is not entirely risk-free. It is possible to overdose on prescription opioids. Second, the rate of fatal overdose per MME of illegal opioids consumed might be higher for less than daily users, who have lower tolerance, than it is for PWUEF daily or near daily.

If fatal overdoses per MME of illegal opioids consumed were twice as high for less than daily PWUEF than it is for PWUEF DND, then the reduction in fatal overdose would be only 3.6%. If it were three times as high, then the number of fatal overdoses among PWUEF before PSS would go up not down. Total fatal OD would also increase if the rate were twice as high among less than daily than DND PWUEF

⁴⁹ Because there is no diversion in this hypothetical thought experiment, the Table omits effects on people who would not have used opioids but for the PSS.

and also PSS supply were one-tenth as dangerous as illegal opioids (in terms of deaths per MME consumed).

(All of this also still leaves aside the possibility that PSS might cause death or other harms via diversion of PSS supply beyond people who were already using fentanyl before the PSS.)

7.0 Potential for Exporting PSS beyond BC

The previous section suggested that PSS already operates on a scale that has the potential to depress hydromorphone market prices in BC. Appendix A offers substantial anecdotal evidence that such price declines may already be occurring. This section briefly explores whether gaps between prices in BC and other jurisdictions could be large enough to make it profitable for drug dealers to export PSS-derived drugs to other jurisdictions (i.e., more than social supply from a PSS client in BC to a friend outside the province).

The data are extremely thin, but the numbers support the idea that arbitrage could happen, at least within Canada and possibly across the U.S. border as well.

7.1 Two Reports of Export Already Happening within Canada

A policing contact in BC reported anecdotally that: “everyday our officers observe people openly selling diverted safe supply medications. Of concern, the diversion isn’t to other users, rather, it is organized crime groups that are buying safe supply medications here in [location], where the price is relatively cheap, and then shipping these medications to other provinces where there is no, or much more stringent, safe supply – where these medications can typically be sold for \$10 per pill. Effectively, organized crime groups are cashing in on the arbitrage scenario that exists due to our hydromorphone pills being sold at a price that is 10-20 times less than these pills are worth in other Canadian communities”.

Likewise, Zivo (2023b) – who is clearly highly critical of PSS – claims to have interviewed a white-collar worker in Toronto who uses Reddit to buy and sell hydromorphone that has been diverted from safer supply. He says that “through conversations with his suppliers, Jacob learned that drug traffickers in B.C. would assemble teams of five or six safer supply clients who would receive 32 hydromorphone pills a day. These clients would sell their pills to the dealer “pretty much like right outside the pharmacy” for 50 cents to \$1 per pill, allowing dealers to easily procure 1,000 pills per week. The dealers would then sell in bulk to buyers in other provinces at around \$3 per pill, and those buyers would then sell hydromorphone on the street for \$5-10 per pill.”

I cannot verify these numbers, and Zivo’s source’s statement about 32 pills per day per PSS client seems unlikely. I can say, though, that before reading these two accounts I had created my own estimates of what criminal organizations might do. My calculations were rough, because I lacked systematic data on drug prices at various market levels and in different provinces. But what information I had suggested that activities such as what the previous two paragraphs describe are plausible and consistent with the sort of behavior that is observed in illegal markets for various drugs in various places.

7.2 Sketching a “Business Model” for Aggregating PSS Pills to Wholesale Quantities

My sense is that the main challenge to wholesale “export” of diverted PSS pills – particularly within Canada – is not moving wholesale quantities from province to province, but rather aggregating pills from individual PSS clients up to wholesale quantities. Crime groups moving drugs between provinces want to work with kilogram quantities, not handfuls of pills. This section investigates the viability of dealers

collecting wholesale quantities of diverted PSS pills. E.g., how much effort that would involve and, hence, whether that effort seems prohibitive given other opportunities for gaining illegal income.

To clarify terminology, I use the term “wholesale dealer” to describe a person who supplies illegal opioids to the retail sellers who in turn sell to the people who use those opioids. These wholesale dealers are not high-level kingpins or importers. They are the market layer that stands in between such high-level kingpins and the retail sellers.

In pre-fentanyl times, when kilograms of heroin were 30-40% pure, a kilogram of heroin contained about 1 – 1.4 million MME, the same as 25,000 – 35,000 8-mg hydromorphone pills (which, incidentally, would weigh about 3-4 kilograms). At 14 pills per day, that is 2,000 – 2,500 days’ worth of pills. It would take a single PSS client half a decade to receive that many pills.

However, there already exists a mechanism for connecting wholesale dealers to PSS clients, namely the drug distribution system that is now moving fentanyl from wholesale dealers to PWUEF via retail sellers. That distribution apparatus is already bidirectional. It not only moves drugs from wholesalers to PWUEF, it also moves money from PWUEF to those wholesale dealers via the same group of retail sellers. So getting pills from PSS clients to wholesale dealers doesn’t require creating any new connections. It just requires having PWUEF pay for some of their illegal opioids with diverted PSS pills, instead of entirely with cash.

If one wholesale dealer supplied 10 retail sellers who each supply 10 PWUEF, then that wholesale dealer is (indirectly) connected to 100 PWUEF. If all were enrolled in PSS and they wanted to sell two-thirds of their 14 pill per day supply, that wholesale dealer could collect 1,000 pills per day. Every month such a wholesale dealer could collect the equivalent in MME terms of a kilogram of traditional heroin, which is a large enough quantity to efficiently ship between provinces.

Imagine that the PSS clients “sold” their pills for \$1 each to the retail sellers. The PSS clients would never actually receive this as cash. Rather, the retail sellers would just accept \$1 less in cash for the down they were selling to the PSS clients in exchange for each pill the PSS client offered. It would be a barter transaction, with the equivalent price being \$1 per pill.

If those retailers sold the pills to the wholesale suppliers for \$1.50 per pill (again, the sale would take the form of paying less cash to the wholesaler who was supplying down to the retailers, not retailers giving money to wholesalers) then the retailers would earn an additional \$50 per day as compensation just for the hassle of accepting payment in the form of pills and cash, not just cash.⁵⁰

This would let wholesale dealers accumulate 30,000 pills each month, without any change in the number of people contacted or the number of transactions with them, while paying \$1.50 per pill or \$45,000 in total. Those pills might be sold to a wholesale dealer in another province for \$3 per pill (who might sell to retailers for \$4 per pill who sell to final consumers for \$5 per pill there). That would generate net revenues for the BC-based wholesale dealer of 30,000 pills * (\$3 – \$1.50 per pill) = \$45,000 per month, or more than half a million per year, just for sending a courier across Canada once a month with a 3-4 kilogram parcel containing 30,000 pills.

⁵⁰ 10 customers selling 10 pills per day with the retailer marking up those pills from \$1 to \$1.50 works out to \$50 per day.

7.3 Potential for Export to U.S. Markets

The previous subsection explained how wholesale dealers might accumulate packages of 30,000 PSS pills per month and sell them in other provinces with higher hydromorphone prices. However, retail hydromorphone prices might collapse throughout Canada. If that happened, could BC wholesalers export to the much larger U.S. markets? This subsection suggest that the answer may be yes.

I did not for this project obtain systematic current prices on hydromorphone pills in the U.S. Historically, those prices were much higher than they are today in BC. The DEA (2023) reports that (nationally) “the street price of a 4 mg tablet of Dilaudid® ... has ranged from \$5 to \$100 per tablet depending on the region” and Mutter et al.’s (2023, p.64) data suggest that U.S. PO prices were stable or even rose some between 2015 and the COVID years, with “mean prices per milligram during the last three quarters of 2020 were \$4.52 for hydromorphone”. Appendix A notes that at the time of this writing, StreetRx quotes prices that are lower than that, but still considerably higher than current prices in BC.⁵¹

A price gap creates an opportunity to profit by arbitraging the price difference if there is a way of moving the drugs and making connections that costs less than the price gap.

One widely utilized smuggling model is to pay couriers, often referred to as “mules”, to carry a few kilograms across the border at a time. Bjerk and Mason (2014) provide a detailed economic analysis of using mules to smuggle drugs into the U.S. across the Southwest Border from Mexico. They report median pay per trip for the mule of about \$1,500 for meth and \$2,000 for cocaine loads, with median load sizes of 8 and 22 kilograms, respectively.

Since one pill weighs roughly 120 mg, 8 kgs of pills is a bit more than 60,000 pills, or two months’ accumulation in this hypothetical. If a BC wholesaler had to pay what couriers are paid along the SW border, that would be only about \$1,750 / 60,000 = \$0.03 per pill – which is very small compared to the gap between BC and US market prices.

Courier pay may be so low on the SW border in part because legitimate labor market opportunities there are poor, but even if one multiplied the courier’s wages by 5 (roughly the ratio of GDP per capita in Canada vs. Mexico), that is still only \$0.15 pill. Furthermore, U.S. Customs and Border Protection agents may not scrutinize individuals crossing the U.S. Northern border as carefully as they do those crossing the Southwest border, so the probability of arrest might be lower.

I have heard anecdotally that as of last year, organized crime cell heads in the U.S. sold Mexican-produced fentanyl-containing counterfeit oxycodone pills for \$5.50 per pill in packages of 8,000 pills to local distributors. Genuine Canadian hydromorphone pills would presumably be valued more highly than Mexican counterfeit oxycodone pills. If B.C. wholesalers could connect with a cell head, they might work out a sales price between the \$1.50 per pill that the BC wholesaler pays to obtain pills, and the \$5.50 per pill price in the U.S. that would make it worthwhile for both. At a sales price of \$3.50 per pill, the BC wholesale would net \$120,000 per bi-monthly sale of 60,000 pills, or about \$0.7 million per year.

These numbers are speculative. They ought to be reworked by law enforcement analysts who have more accurate and more current price data. The overall message, though, is that very low-cost hydromorphone pills in BC might find their way across the border to U.S. markets.

⁵¹ The quotes were \$5 and \$10 for 2-mg pills in AZ and PA, \$5 for a 4-mg pill (OH), and \$12 for an 8-mg pill (ME).

8.0 Recapitulation of Key Points

We summarize the main points made above, which all merit three broad caveats: (1) Available data on illegal market prices and other market outcomes are limited, (2) This study made no effort to analyze primary data in a manner that permits causal inference as to program effects, and (3) This is a small scoping study that is only intended to provide an economic framework to help organize readers' thoughts. It may provide a point of departure for further analysis, but there is no intention or ambition to be able to make definitive statements about PSS programs' various effects.

1. PSS in its current form (i.e., unwitnessed supply at low or no cost) should benefit its clients. That is what the PSS literature reports, and it makes economic sense. Even if the client never uses any of the PSS, giving someone 14 pills per day that can be resold in illegal markets makes them better off financially, and people who are better off financially generally have better health outcomes. Before the collapse in pill prices, those pills could have been sold for perhaps \$5 each, meaning PSS participants could originally have netted about \$70 per day or more than \$25,000 per year. Even at \$2 per pill, diversion could generate \$10,000 per year in revenue.

2. The societal level question is whether diversion generates harms that more than offset the benefits to PSS participants. The primary risk is that diverted PSS pills find their way into the hands of individuals who are not yet opioid dependent (or, equivalently, PSS collapses the market price of prescription opioid (PO) pills and thereby increases their use). That could (1) cause overdose or other harms now amongst individuals who have little tolerance and/or (2) cause some of those individuals to develop opioid use disorder (OUD) over time, and perhaps eventually "trade down" to using illegally manufactured opioids in future years. At this time, it is impossible to determine empirically the full extent of the latter because most of the effects are delayed. As an analogy, if something lowered prices and increased availability of cigarettes, the full effects on lung cancer rates could not be observed in the first few years after the change.

3. At present, only a minority of daily and near daily illegal opioid users are enrolled in PSS (perhaps 20% or less). Furthermore, they receive on average only about 347 MME per day, whereas someone using two 100-mg "points" of illegal fentanyl that is 16% pure is consuming 2,400 MME per day. Since the illegal markets have five or more times as many participants consuming six or more times as much per person, PSS supply today is very small compared to the illegal opioid markets. Hence, although the price per MME of "down" continues to fall (because MMEs per bag goes up, and the bag price remains stable), those declines are unlikely to have been caused by PSS. However, a full-scale PSS program that enrolled all or substantially all daily or near daily consumers of illegal opioids and supplied them with more MME per day could put downward pressure on the price of illegally manufactured opioids in BC.

4. By contrast, the quantities of PSS already being distributed in BC create diversion potential that is not small compared to the diversion of traditional PO. If roughly 4,500 clients receive an average of 347 morphine milligram equivalents (MME) per day, that works out to 308 MME per thousand people in the province, which is 30% as great as the roughly 1,000 MME per thousand inhabitants per day that Jayawardana et al. (2021) report is Canada's 2019 sales of opioid analgesics for pain management as recorded in IQVIA's MIDAS database. That implies that if diversion rates in PSS programs today were

triple what they are for opioid analgesics generally, then diversion from PSS in 2023 would be about as great as is diversion of opioid analgesics.

5. Hydromorphone prices have collapsed in parts of BC, particularly around Vancouver. This is an extension of a long-term, national trend. E.g., Dart et al. (2015) report hydromorphone prices of \$2.50 per milligram in 2011-2015, vs. Sajan et al.'s (1998) figure of \$6.25 in 1997. However, if 8-mg pills now sell for \$2 in Vancouver, that is a further 90% decline to \$0.25 per milligram, and there are reports of prices closer to \$1 per pill, which would be a 95% decline in a decade (more if one adjusts for inflation). I could not ascertain whether BC's hydromorphone price declines exceed those in other provinces, let alone whether they were caused by PSS. Hydromorphone prices may also have not dropped as much in the interior as they appear to have in Vancouver.

6. It is possible to sketch a "business model" whereby wholesale drug dealers can accumulate wholesale quantities of diverted PSS pills (e.g., 30,000 pills per month) if PSS clients continue to consume illegal opioids (as the majority are reported to do, albeit at reduced levels) and they pay for those illegal opioids with a combination of PSS pills and cash, not just cash. That business model would permit profitable export of PSS pills not only to other provinces, but also to U.S. markets.

7. Witnessed, on-site PSS would presumably produce little diversion, thereby muting the effects just discussed, although also potentially (greatly?) reducing PSS participation. It is unclear whether other forms of supervision (e.g., distributing PSS in tamper-proof cartridges) could do so.

8. Another strategy for eliminating incentives for diversion is to charge PSS clients the going market price for those opioids. That concept is sound in theory, but complicated to implement, not only because of practical challenges (limited data on the price per pure milligram in illegal markets) but also more fundamental issues, including that illegal market prices vary considerably around the province. Either PSS prices would have to also vary around the province, or they would be above market rates in some places (reducing PSS participation there) or too low in others (creating incentives for diversion).

9. There is not just one market price for illegal opioids, even in a single location, but rather a suite of interrelated prices for a family of related opioid products. With some exceptions (e.g., for tramadol) prescription opioid prices are often proportional to their morphine milligram equivalent doses, but they enjoy a substantial (e.g., 3 to 1) "safety premium" relative to unregulated illegally manufactured opioids.

10. That implies that if PSS supplies hydromorphone at the illegal market price for diverted hydromorphone, the price per MME would be considerably higher than the price per MME of down. That might undermine uptake. However, if PSS supplies hydromorphone at the same price per MME as down, then PSS clients would be buying hydromorphone pills for only about one-third of what those pills are worth in illegal markets. Because of the potential to aggregate pills to wholesale quantities and arbitrage price gaps between BC and other markets, selling PSS clients hydromorphone pills at the same price per MME as down would not eliminate incentives for profiteering via diversion.

11. Not all individuals have the same personal "safety premium". If someone who very strongly values the additional safety of diverted PO possesses some down, and someone else who cares more about maximizing MME has some pills, those two can exchange pills for down at a price that makes both of them better off. The market-wide safety premium or price ratio is in some sense the "average" that emerges from such trading. Note, that incentives for trading exists no matter what price the two

individuals originally paid for the drugs they now possess, and the individuals do not need to meet in person. The illegal markets can serve as an intermediary, with the first type of individuals selling down for cash which they use to buy pills, and the second selling pills for cash which they use to buy down.

12. Thus, if someone with a low personal premium on safety receives hydromorphone pills via PSS, they have an incentive to trade those pills into the illegal market to buy more down because down offers more MME per dollar. If daily and near daily (DND) fentanyl users have, on average, lower safety premia than do new opioid users who are not yet dependent, then supplying those DND fentanyl users with hydromorphone pills creates opportunities for those hydromorphone pills to be profitably diverted to new opioid users regardless of what price the DND fentanyl users paid for those pills.

13. When PSS supplies hydromorphone pills, it is supplying something for which there is already an illegal market. By contrast, there has never been a significant illegal market for reliably labeled, legally manufactured fentanyl powder packaged in known doses. (There are modest markets in analgesic fentanyl patches and ampules of fentanyl solution diverted from hospitals, but not quality controlled packages of fentanyl powder.) Put differently, the existence of a safety price premium suggests that the illegal markets would not view illegally manufactured and diverted PSS fentanyl as the same product.

14. That makes it hard to determine what it would mean to price PSS fentanyl powder at the going market price. If PSS priced its fentanyl at the same price per MME as down, that would be pricing it below what the illegal market would pay for PSS fentanyl – *if* that act of resale did not destroy trust in the quality (dose reliability) of the PSS fentanyl.

15. Because markets offer a premium for reliably produced, packaged, and labeled opioids, putting illegally manufactured fentanyl into counterfeit PSS packaging could instantly increase its value, unless that practice became so common that packaging which appears to be PSS packaging ceases to be a reliable signal of quality. Counterfeiting of PSS packaging could have complicated effects on the market equilibrium. It is unclear how hard BC should work to defeat such counterfeiting, or whether it could succeed if it tried.

9.0 Closing Comments on Opioid PSS

9.1 Inability to Project the Overall Net Success or Failure of PSS

I make no predictions as to whether in five or ten years BC will celebrate or rue PSS. Success and failure are both plausible outcomes depending on parameter values that I do not know, and probably no one does at this time. If most participants just use their PSS or divert it only to other people who “should” be in PSS, then it would likely be a win. If much diversion is to people for whom the PSS drugs are an addition, not a substitute to their drug taking, it will likely be a fail.

Only time will tell.

Hopefully, though, understanding some of the history of changing prices and looking at PSS through a market lens can clarify what conditions promote success and what are the downside risks.

Understanding this market intervention policy in that way suggests some aspects of program implementation that may increase the odds of success.

9.2 Some Possible Components of a “Start Low, Go Slow” Approach to PSS

In March 2020 BC introduced province-wide PSS in response to the unique challenges of COVID, recognizing it was an emerging approach with a limited evidence-base.⁵² Sometimes boldness is appropriate; Franklin Delano Roosevelt’s “New Deal” is an example in the U.S. But sometimes radical policy innovations are better implemented incrementally. If BC wished to take that approach, here are some suggestions for how it might start small and expand later.

- Restrict PSS to witnessed (in-person) supply.
- Start with only opioids, not stimulants. The track record and research base for opioid maintenance is much deeper than for stimulant maintenance.
- Start with drugs that are less appealing than hydromorphone to the market and to people who are not yet opioid dependent. E.g., limit PSS to buprenorphine.
- Require participants to come in frequently to get small amounts. That would make it less convenient for profiteers who join the program only to get drugs that they will re-sell.
- Distribute pills in smart pill dispensers that only open one slot per day or per half-day, and only with biometric touch, to make it less convenient to sell to a dealer/aggregator.
- Restrict access to people who already lived in BC before the program was launched to avoid attracting profiteers from outside of the province.

⁵² McNeil et al. (2022) praise the speed of response: “Following the arrival of the COVID-19 pandemic, the British Columbia government, in collaboration with researchers, clinicians, and PWUD, quickly developed and, in March 2020, released new clinical guidelines—termed “risk mitigation”—to provide guidance to clinicians and facilitate access to prescription opioids [and other drugs] for people otherwise dependent on the illicit drug market during the pandemic”. Nguyen et al. (2024) stress how innovative this was: “In March 2020, British Columbia, Canada, became the first jurisdiction globally to launch a large-scale provincewide safer supply policy”.

- Limit prescribers' caseloads so that they have time to provide individual attention that might help detect and deter diversion.
- Limit PSS prescribing to physicians and/or monitor the amounts being dispensed by any one provider or pharmacy to reduce the risk of creating the PSS equivalent of "pill mills" or "Dr. 420s". If the government gives someone permission to give away products that are worth a lot of money, that creates an incentive for corruption. Less dramatically, there can also be well-meaning individuals who over-estimate benefits or under-estimate risks of a novel intervention and so over-prescribe without any personal financial motivations.

9.3 The Need to Monitor Illegal Markets and Prices

PSS is two things at once. (1) PSS is a medical intervention intended to improve health outcomes for participants. (2) PSS is a government intervention in markets that seeks to alter the market equilibrium.

When monitoring the success of medical interventions, the performance metrics one monitors relate to the patients' health and well-being.

When monitoring the success of a market interventions, one monitors market prices, quantities, purity, and a variety of indirect effects.

Since PSS is both individual medicine and a market intervention, it is incumbent upon BC to monitor and assess both sets of outcomes. However, at least within the academic literature on PSS, the emphasis is almost entirely on the first to the neglect of the second.

It is important to monitor illegal market prices of all opioids in the province at the retail ("street") and wholesale levels (including but not limited to fentanyl/down and hydromorphone pills), and also to understand how BC price levels compare to prices in other jurisdictions with which BC's illegal markets are linked (notably those in Alberta and Washington State) to track incentives and opportunities for criminals to arbitrage any significant price differentials. To be explicit, because purity varies and it is essential to be able to describe the price per MME, not just the price per gram, monitoring prices also implies monitoring purity/potency.

10.0 Brief comments on potential differences with PSS of other drugs

As noted in the introduction, I do not think there is sufficient evidence concerning PSS for stimulants or benzodiazepines to support even the very rough analysis provided above concerning opioids. Some overarching themes may carry over, including:

- Giving valuable drugs away for free, or at below-market prices, should almost always make the recipient better off.
- As long as the PSS is given at below-market costs, in large quantities, and with low barriers, there may be both “sincere participants” and “profiteers” seeking to purchase the PSS drugs for resale.
- Professional or high-volume resale depends on there being a large enough price gap to justify the time and hassle to arbitrage that gap.
- Participants are not the only stakeholders. There can be spillover effects – good and bad – on other members of society.
- Different substances are different. That diversion is mostly beneficial for buprenorphine does not mean it would be for PSS fentanyl. Whether PSS of opioids does or does not turn out to improve aggregate social welfare, the outcome with PSS of other drugs may be different.

10.1 A Few Considerations with PSS of Stimulants

PSS for opioids builds on 50+ years of successful experience providing opioid agonist therapy (OAT), and benefits from an enormous research base on OAT. That research base provides insight into how PSS for opioids may play out – even though PSS and MAT are very different interventions – and it provides solid evidence that OAT is a cost-effective intervention.

There simply is not a comparable research foundation for PSS with stimulants. At least in the United States, there are no pharmacotherapies approved specifically for treating stimulant use disorder,⁵³ and that is not for lack of effort. The National Institute on Drug Abuse has invested billions of dollars over more than three decades trying to develop such pharmacotherapies.

There are clinical trials that attempt to take an agonist approach to treating psychostimulant use disorder (PSUD). Tardelli et al. (2020) review that literature. My interpretation of Tardelli et al. is that there has been some success at getting participants to switch from the previous to the new stimulant, but there is nothing comparable to the literature on OAT in terms of evidence for resulting improved life outcomes. However, Palis and MacDonald (2023, pE934), who support PSS of stimulants, read that same study far more enthusiastically than I do, stating that it “concluded that prescribed psychostimulants constitute a safe, effective intervention for stimulant use disorder, particularly in the

⁵³ ASAM/AAAP clinical practice guidelines for the management of stimulant use disorder recognize certain off label prescribing, but make a strong recommendation with high certainty that “Contingency Management (CM) should be a primary component of the treatment plan in conjunction with other psychosocial treatments” (p.8, https://downloads.asam.org/sitefinity-production-blobs/docs/default-source/quality-science/stud_guideline_document_final.pdf?sfvrsn=71094b38_1).

treatment of cocaine dependence when prescribed at 60 mg or more (of prescription amphetamines or methylphenidate) per day”.

Even authors who are supportive of PSS for stimulants state that to be successful it would require “doses and user agency that trials to date have not provided” (Fleming et al., 2020) which I interpret as affirmation that the evidence base for stimulant PSS is not yet robust.

Concerns about diversion of stimulant PSS mirror or exceed those with opioid PSS. E.g., Ferguson et al. (2023) report that the majority of potential stimulant PSS clients who were surveyed would have preferred to receive methamphetamine. Methamphetamine is both compact (high value to weight ratio) and has an active illegal market.

There is also considerable demand for stimulants among those who are not yet dependent, not only “to get high” (common question wording) but also as a cognitive enhancer. E.g., a Canadian Centre on Substance Use and Addiction document (CCSUA, 2022, p.5) notes that “Academic enhancement is often cited as the primary motive underlying non-medical use in this [post-secondary student] population” even though those using stimulants non-medically earned lower grades than others. Regardless of the efficacy, even a mistakenly perceived cognitive benefit could mean there is a demand among people not eligible for PSS that those who are eligible for PSS could meet by diverting some of their supply.

The stimulant market, and hence demand for diversion, may also simply be larger. The Canadian Alcohol and Drug Survey finds that about 2% of Canadian adults self-report past-year use of cocaine, not including other psychostimulants, vs. only 1% reporting problematic use of opioid pain relievers.⁵⁴ (And to the extent that cocaine is more stigmatized than PO misuse, the extent of under-counting may be greater for cocaine.)

Although I think the strength of evidence for the points I just made is quite weak, they tend to point in the direction of caution. However hard it is to achieve the benefits of opioid PSS without creating unintended adverse consequences, it may be even more difficult to achieve that with stimulant PSS.

10.2 A Comment on PSS with Buprenorphine

I am not a medical doctor, but my sense is that PSS for buprenorphine could play out quite differently than PSS for opioid agonists, so I would not presume that the cautions and concerns in the body of this report necessarily carry over to PSS for buprenorphine.

The illegal markets in diverted buprenorphine are active enough to support meaningful analysis of their market prices (e.g., Surratt et al., 2013; Hswen et al., 2020). That suggests that at least initially there would be opportunities and incentives for diversion for profit. However, if PSS collapsed the prices for diverted buprenorphine, the resulting potential harms may be less severe than from, say, diverted hydromorphone. Buprenorphine has meaningfully lower risk of overdose. Carlson et al. (2020) in an associational study conclude that “higher frequency of non-prescribed buprenorphine use is associated with lower risk of drug overdose, a potential harm reduction consequence of diversion”. It is also less rewarding than opioid agonists. It may get lumped together with agonists like methadone because it

⁵⁴ <https://www.canada.ca/en/health-canada/services/canadian-alcohol-drugs-survey/2019-summary.html>

also is used for treating OUD, but its appeal and its dangers from diversion could be quite different. Roy and Stein (2019) for instance suggest that it could even be generally available without a prescription.⁵⁵

Given my limited knowledge and the limited relevance of the analysis in this report to PSS for buprenorphine, I am not in a position to endorse PSS for buprenorphine. But I do want to say explicitly that I would not extrapolate cautions I raise concerning full agonist PSS to PSS of buprenorphine.

⁵⁵ One reviewer pushed back and while acknowledging that the risks may be lower, thought the Finnish experience with buprenorphine problematic use and death are a reason for caution.

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Appendix A: Trends in Illegal Market Prices of Diverted Pharmaceutical Drugs and “Down”⁵⁶

A.1 General Literature on Prices of Diverted Pharmaceutical Opioids

Diverted prescription medicines are re-sold in illegal markets often enough for those drugs to have recognized market prices, and those “street markets” can sometimes be a dominant supply source for individuals obtaining prescription drugs illegally (Frauger et al., 2012). Haydon et al. (2005) find that amongst a cohort of illegal opioids users in five Canadian cities, the majority of those reporting Dilaudid and OxyContin use described sourcing those drugs from drug dealers, with friends and (in the case of OxyContin) doctors being other important sources. Nosyk et al. (2012) find that a sample of 1,871 illegal drug users in Vancouver reported large and steady increases in availability of diverted prescription opioids, with 41% reporting “instant availability” of hydromorphone by 2010.

One early academic study of prices for diverted prescription medicines examined markets in Vancouver’s Downtown Eastside (Sajan et al., 1998). Those authors asked 32 people in DTES about prices in 1997. The modal price for 2- and 4-mg Dilaudid tablets was reported to be \$15 and \$25, respectively, which was roughly 70 times the pharmacy cost, highlighting the potential financial rewards from diverting prescription drugs to the illegal market. See Fischer et al. (2010) for a review of mechanisms of diversion in North America.

Strang and Rashiq (2005) reported lower prices a half dozen years later in Edmonton, with Dilaudid selling for of \$10, \$20, and \$30 for 2-, 4-, and 8-mg tablets, respectively. Declines were steeper for MS Contin, with prices for 100- and 200-mg tablets reported to be \$20 and \$40, vs. Sajan et al.’s prices of \$40, and \$60.

More systematic analysis of prices began with the Researched Abuse, Diversion, and Addiction-Related Surveillance (RADARS) System (Surratt et al., 2013) and the StreetRx crowd-sourced research web site (e.g., Dasgupta et al., 2013), as well as prices scraped from darkweb markets such as SilkRoad. General conclusions from that literature include that: (1) Prices from these different data sources are highly consistent, (2) There are quantity discounts, with lower prices per milligram for larger purchases, and (3) Relative prices per milligram for the various PO’s are broadly consistent with their clinical equianalgesic potencies, with a few exceptions such as a premium for hydromorphone, hydrocodone, and methadone and a penalty for tramadol. For example, Dasgupta et al. report prices in 2012 per milligram for hydromorphone (\$3.29) that is 4.06 times higher than for hydrocodone (\$0.81 per milligram), and the equianalgesic potency equivalence ratio for those two opioids is 4 to 1. Not all the ratios were that close, but the overall pattern is clear: price per milligram increases roughly proportionally to the standard analgesic dosing ratios. Lebin et al. (2018) find the same pattern, e.g., reporting that the price per milligram was 2.1 times higher for oxymorphone relative to oxycodone, which is very close to their 2 to 1 analgesic ratio.

Lebin et al. (2018) provide a detailed analysis of how price per milligram varies with pill size, finding that a doubling in size (e.g., from 4- to 8-mg) is associated with a 20-25% reduction in the price per milligram. Crushable oxycodone and oxymorphone sold for a 20% or 40% premium relative to crush resistant versions of the same drug. There were also discounts in the price per pill when buying multiple pills.

⁵⁶ “Down” refers to illegal (street) opioids. Before 2014 that was primarily heroin. Now it is primarily fentanyl.

Caulkins et al. (2023) provide a detailed analysis of quantity discounts for one darkweb seller, reporting that a ten-fold increase in the number of counterfeit oxycodone pills was associated with a 25% discount in the price per pill.

A.2 Historical Ratio of PO to Heroin Prices per Milligram & per MME

Prescription opioids (PO) have generally sold in illegal markets at a premium relative to the price of heroin. Here we offer two specific comparisons, one from the U.S. and one from Canada. I personally have used a 3:1 multiple in price per MME as a rough guide in my own work in the past.

Dasgupta et al. (2013) estimate that hydromorphone sold in the U.S. for \$3.29 per milligram in 2012. At the same time, the U.S. Office of National Drug Control Policy (ONDCP, 2016) reports the U.S. national average retail price of heroin in 2012 was \$465 per pure gram when sold at retail (defined as quantities of 10 grams or less), or \$0.465 per pure milligram.⁵⁷ That means that Dasgupta et al. (2013) estimated price per pure milligram of pharmaceutical hydromorphone was 7.1 times the price per pure milligram of heroin.

As a second example, Dart et al. (2015) report that hydromorphone sold in Canada for a median price of \$2.50 per milligram in the 2011 – 2015 era. Meanwhile, Stockwell (2010) reports that 0.1-gram points sold for \$8 - \$20 in Vancouver. Taking the midpoint of that range and assuming purity was similar to that in the U.S. suggests a retail heroin price of $\$14 / (100 * 31\%) = \0.45 per pure milligram, which would mean that pharmaceutical hydromorphone was selling in Canada for 5.5 times the price per pure milligram of heroin in Vancouver in that era. If heroin prices in Vancouver were lower than the national average, then the correct ratio would be larger.

We need to adjust those two ratios to put them on a morphine milligram equivalent basis. Dasgupta et al. report hydromorphone's morphine equivalent (MED) ratio is 4 (as do CDC training documents⁵⁸), but BC guidance⁵⁹ and Purdue Pharma's Dilaudid Prescribing Information use a ratio of 5, so we will use that here. Heroin's MED ratio is not known as precisely because heroin is not commonly used in medicine, but a range of 2-5 is often cited in the literature (c.f., e.g., Kilmer et al., 2022). At the mid-point of that range, the relative potency of hydromorphone relative to heroin would be $5 / 3.5 = 1.43$, suggesting that in the early 2010s hydromorphone was selling for about $7.1 / 1.43 = 5$ times as much as heroin per MME in the U.S. The corresponding arithmetic for "Canada" is $5.5 / 1.43 = 3.9$, but the true ratio might be somewhat higher because we are comparing a national price for hydromorphone with the price of heroin specifically in Vancouver.

⁵⁷ https://obamawhitehouse.archives.gov/sites/default/files/ondcp/policy-and-research/2016_ndcs_data_supplement_20170110.pdf

⁵⁸ <https://www.cdc.gov/drugoverdose/training/dosing/accessible/index.html>

⁵⁹ [https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/palliative2 - pain equianalgesic.pdf](https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/palliative2_-_pain_equianalgesic.pdf). Note, the 5:1 is for IV. For PO it is 7.5 to 1. But the fentanyl MED's are for IV, and I do not want to compare across drugs with one via one mode of administration and the other a different mode of administration.

A.3 Recent Declines in PO Prices in BC

The academic literature on prices of diverted prescription drugs now seems to be dominated by U.S. studies. At one time U.S. and Canadian prices were fairly similar, but it is unclear whether that remains true. In particular, Dart et al. (2015) provide a systematic comparison based on StreetRx prices in both countries between the 2nd quarter of 2011 and the 2nd quarter of 2015. Prices were the same in both countries for hydromorphone (\$2.50 per milligram), crushable oxycodone (\$1 per milligram), and non-crushable oxycodone (\$0.63 per milligram).⁶⁰

Mutter et al. (2023) report that prices of PO in illegal markets in the U.S. were fairly stable from 2015 – 2019, but then bumped up by 10-20% in at the beginning of the COVID pandemic. E.g., hydromorphone prices rose to \$4.52 per milligram in 2020. It is not clear what has happened to U.S. PO prices since then.

I located no systematic information on trends in Canadian diverted PO prices since the Dart et al. study, just one 2018 newspaper article (Taylor, 2018) that describes street prices in Saskatoon as \$20 for a 6 mg hydromorphone pill, which seems broadly consistent with what Dart et al. report a few years earlier.

It is hard to reconcile the reported stability in U.S. prices – or the Taylor (2018) price quote – with recent reports concerning PO prices in BC, which suggest that hydromorphone prices have fallen very steeply.

Understanding the extent and nature of possible declines in hydromorphone prices since the launch of PSS is crucial for judging whether diversion from PSS may have made hydromorphone cheaper and more available to people who are not yet opioid dependent, so I made a concerted effort to gather all possible snippets of information, and the results are collated here.

I located only two price mentions in the peer-reviewed academic literature.

Bardwell et al. (2021, p.4) interviewed 21 people who used diverted PO in late 2019 through March 2020. One described how increased availability of slow-release oral morphine from OAT had driven down Kadian (morphine sulfate) prices: “It used to be \$10 a pill, but because everyone’s getting on it right now pretty easy, it’s \$5 a pill for five for \$20.” Another subject in the same study predicted in early 2020 that the same would happen with Dilaudid prices “because they’re now giving out large quantities downtown”.

Matthew et al. (2021, p.13) is a peer-reviewed journal article, but its source is a single informant (a drug seller) interviewed in August 2020. That individual is described as saying “the street price of 8 mg hydromorphone tablets before safer supply was \$5 a tablet. After the initiation of safer supply, it went down to \$2 a tablet.” Note: August 2020 was fairly early in the PSS era.

The following are a larger number of recent price citations that come from newspaper articles and other sources that are not peer-reviewed.

⁶⁰ Because of the average currency exchange rate in 2015 was \$1.28CAD per USD, that effectively means prices were somewhat higher in the U.S. Prices for a few other drugs were close but not identical (methadone, morphine), and there were also some differences. Hydrocodone and tramadol were cheaper in the U.S., whereas Oxycodone was cheaper in Canada.

- A May *Vancouver Sun* article (Ryan, 2023) refers to Dilaudid pills selling in illegal markets “for a dollar or two”, and describes one couple who were each using 5 to 10 8-milligram tablets per day at a cost of “around \$700” every two weeks, which works out to \$2.50 - \$5 per tablet.
- Little and Johnson (2023) quote someone claiming even lower prices, although that was from a person sharply critical of PSS policy.
- Zivo (2023a) cites doctors in multiple cities who report large price declines, e.g., in London fell from \$20 to \$2 after safer supply and in Vancouver from \$10 to \$0.50 to \$1 per tablet, or from \$8 to less than \$1, depending on the doctor. Slightly smaller but still very large declines were cited in Toronto and Ottawa.
- A policing contact in BC confirmed that they are seeing price declines of the sort Zivo describes, with prices of \$0.50 - \$1 per tablet in Vancouver overall, and towards the lower end of the range in DTES.
- A colleague of mine reported two statements from a journalist and a doctor in Vancouver. (1) “About a dollar a pill now. Although it varies widely. In downtown 4 for a dollar. In the valley \$5 to \$10 a pill” and (2) “safer supply recipients sell for \$0.5-\$1 per pill. Then the dealers who buy from these dealers resell for \$2-3 per pill. The further you get from downtown Vancouver, the more expensive it is- eg \$5-10/pp.”
- In September 2023, StreetRx/ca listed four current price quotes for 8-mg Dilaudid pills in British Columbia with prices of \$1.50, \$1.50, \$4.00, and \$6.00 (average \$3.25), with lower prices in Vancouver and the \$6 price in Kelowna. Those are slightly lower than the four prices quoted for Ontario and Quebec (\$2, \$5, \$8, and \$10; average \$6.25).
- A May 2023 Global News journalist reported purchasing a bag of 26 pills for \$30 in the DTES (<https://globalnews.ca/video/9696039/global-news-tests-claims-that-safe-supply-drugs-are-being-sold-and-traded-on-the-street-2>).
- In January 2024, the only two StreetRx/ca quotes for 8-mg Dilaudid pills were \$1 in Vancouver and \$5 in London, Ontario. A 12-mg Hydromorphone Contin pill sold for \$2 in Kelowna. The only U.S. price quotes were \$5 and \$10 for 2-mg pills in Arizona and Pennsylvania, respectively, \$5 for a 4-mg pill (Ohio), and \$12 for an 8-mg pill (Maine).
- A contact at the BCCDC relayed that a DTES physician with connections to that community reports that “I think it's very hard to sell HDM in the DTES for money - it's mostly just trading for fentanyl, they need to be moved to a new location to have monetary value.”

A contact connected to the Peer Engagement and Evaluation Project (PEEP) Consultation and Advisory Board⁶¹ reported the following prices in January 2024. They are broadly consistent with the note above, but suggest that hydromorphone prices might have edged back up recently. They also underscore the variation in prices across the province, with lower prices in Vancouver and DTES in particular:

8-mg hydromorphone pills:
 \$2 in DTES
 \$5 in Quesnel and Cranbrook/Kimberly

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<https://towardtheheart.com/peep#:~:text=The%20goal%20of%20PEEP%20is,for%20more%20meaningful%2C%20ongoing%20dialogue.>

\$5-\$10 in Terrace

For concreteness, and the simplicity of round numbers, assume that Vancouver prices for 8-mg Hydromorphone pills were \$5 shortly before PSS and are \$1 or \$2 now. Those figures correspond to the price per mg of hydromorphone falling from \$0.625 to \$0.125 - \$0.25, and the price per MME falling from \$0.125 to \$0.025 - \$0.05.

That would mean that even before PSS, the price per mg of hydromorphone had already fallen by 90% in nominal terms relative Sajan et al.’s (1998) description of 4-mg Dilaudid tablets selling in 1997 in DTES for \$25, and by 94% after adjusting for inflation. Even relative to Dart et al.’s 2011-2015 figure of \$2.50 per milligram, an 8-mg pill selling for \$5 represents a price decline of 75% in nominal and 81% inflation-adjusted terms.

If prices have fallen to \$2 per pill, that would be a 98% decline in real prices since Sajan et al.’s 1997 figure, and a 92% since Dart’s 2011-2015 figures.

A.4 Recent Declines in the Price of Illegal Opioid Powders in BC

Declines in the prices for real (not counterfeit) prescription opioid pills happen in the familiar and straightforward way. The commodity stays the same (an 8-mg hydromorphone tablet is always an 8-mg hydromorphone tablet), but the number of dollars exchanged for that tablet declines over time.

Price declines for illegal opioid powder (“down”) are the opposite. The nominal price for a roughly 100 mg “point” is quite stable over time, but the number of MME in the bag has grown enormously, thereby cutting the price per MME. This is the opposite of the “shrinkflation” seen with many legal goods, in which the package price stays the same but its contents shrink.

Bouchard et al. (2020) report systematic data on the price for different quantities of “down” before PSS, circa 2017-2019, based on information from the Vancouver Police Department. The only more recent data I located in the academic literature were based on an interview with a single drug seller (Matthew et al., 2021) and a single user (Ali et al., 2023). These figures are summarized in the table below.

Table 5 Down Prices Reported in the Academic Literature

	Cite:	Bouchard et al. (2020)	Ali et al. (2023)	Matthew et al. (2021)		
	Source:	Vancouver PD	One person (user)	One person (seller)		
	Time:	2017-2019	2022	Before COVID	During COVID	Before COVID
	Location:	Vancouver	Prince George	Vancouver		
Unit	Weight (g)	Down	Down	Down	Down	Meth
Point	0.1	\$20	\$20-\$40	\$20	\$25	\$10
Quarter gram	0.4	\$70-\$80	\$50-\$70	\$50		\$30
Half Ball	1	\$140-\$160	\$80-\$120	\$90		\$60
Ball	1.75		\$150	\$150	\$170	\$100
	3.5			\$275		\$175

Less formal and unpublished reports suggest that the nominal prices for the standard retail units remain largely the same. For example, BCACP (2021) cites \$20 as the standard price for a single 0.1-gram packet of either heroin or fentanyl, although a DTES physician reported to a contact at BCCDC that “It's usually always \$10 for a "point".

Those statements may not be inconsistent because prices tend to be lower in the DTES, and \$20 per point should probably be understood as the list or “sticker” price, with many people obtaining discounts, particularly when buying in bulk. E.g., just as Stockwell (2010) reports that 0.1-gram points used to sell for \$8 - \$20 in Vancouver, not always \$20, the contact associated with PEEP reported in January 2024 a current range of prices of \$10 to \$20 in the DTES.

That individual also describes how prices increase with distance from the DTES, specifically:

- Between \$10 and \$20 in DTES
- Between \$15 and \$20 in Victoria
- \$20 in Prince George, Quesnel, Cranbrook, Nelson
- \$30 in Terrace

To convert nominal prices for a 100-mg bag into prices per pure milligram we need an estimate of the concentration (purity) of the fentanyl. Then by factoring in fentanyl’s morphine equivalency ratio (usually described as 50-100), we can compute the current price per MME.

I consulted two main sources of fentanyl purity data. The Drug Analysis Service and Cannabis Laboratory reports the purity of fentanyl samples nationwide (<https://health-infobase.canada.ca/drug-analysis-service/analyzed-drug-report.html?p=BC&y=2023&q=Q3&r=DASreport>).⁶²

Table 6 Drug Analysis Service and Cannabis Laboratory Data on Fentanyl Purity (Nationwide)

		Powder		Tablets	
		#	Average	#	Average
2020	Full Year	624	10.7	15	0.7
2021	Q1	113	14.0	2	0.8
	Q2	139	13.1	0	
	Q3	115	13.2	1	1.5
	Q4	114	12.1	7	1.1
2022	Q1	178	14.0	10	0.5
	Q2	93	14.1	2	0.4
	Q3	137	13.8	0	
	Q4	102	14.2	5	1.2
2023	Q1	161	15.1	11	0.7
	Q2	170	11.2	33	1.2
	Q3	180	17.4	9	1.6
	Q4	114	10.7	12	1.9

⁶² The site reports numbers for the first three quarters and for the year as a whole. The Q4 numbers below are ones I back-calculated to reconcile the annual numbers with those from the first three quarters. They are not available directly from the website.

The BC Centre on Substance Use drug checking trend reports contain purity figures (e.g., BCCSU, 2022 and their website <https://drugcheckingbc.ca/monthly-reports/>).⁶³ Regular monthly quantification began in May 2021 with results summarized in the graph below. Two written reports give (lower) figures for earlier time periods. In particular, based on 2,591 samples from June 2018 to December 2019, the 2019 report gave a median absolute concentration of 7%. A report covering January 1, 2020 to May 31, 2021 found average concentrations around BC of 10% to 14%, except at GYDT in Vancouver where the concentration was 21% (mail-in) or 22% (in-person).

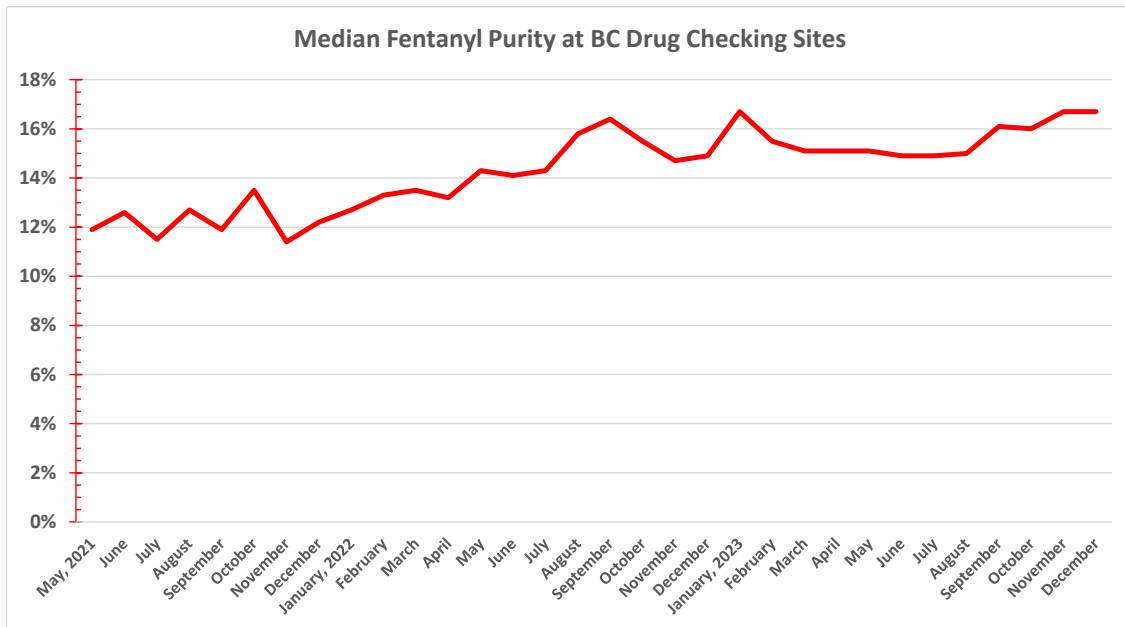


Figure 1 Median Fentanyl Purity at BC Drug Checking Sites

Considering both sources, and their general upward trends, I will assume a 16% concentration for 2023 in BC. Two knowledgeable observers affirmed that they viewed that as a reasonable guesstimate.⁶⁴

Note: If “points” are approximately the same weight and sell for about the same price now as before fentanyl, then a shift from heroin at perhaps roughly 32% purity before the fentanyl era to fentanyl at 16% would represent a roughly ten-fold increase in the MME per bag with no change in price per bag, which is equivalent to a 90% decline in the price per MME (slightly more if one adjusted for inflation).

⁶³ There are reasons why samples at drug checking services may not be representative of the larger market. E.g., PWUD may only bother to have tested samples that are unusual or suspicious. Nevertheless, they are among the best data that I have.

⁶⁴ A policing contact in BC affirmed that 16% purity “seems reasonable”. Another contact reported based on experience and meetings with the PEEP consultation and advisory board that “fentanyl concentrations are between 15% and 20%.”

A.5 Current Ratio of PO to Heroin Prices per Milligram & per MME

The market prices per MME of hydromorphone and “down” have both fallen enormously in BC over the last decade, but hydromorphone has maintained a price premium relative to down. The ratio may have changed somewhat over time, but remains at least three as long as pill prices have not fallen below \$2.

E.g., if hydromorphone prices back in 2018-2019 were \$5 per 8-mg pill, and so \$0.125 per MME, and down was 7% fentanyl by weight and so \$0.038 per MME using 75 as fentanyl’s MED, then hydromorphone was selling for $\$0.125 / \$0.038 = 3.3$ times as much per MME as was down before PSS.

If in 2023 fentanyl purity has risen to 16%, that implies its price had fallen to \$1.25 per pure mg of fentanyl and \$0.017 per MME. Likewise, if hydromorphone is now selling for \$2 per 8-mg pill, that would be \$0.05 per MME, which is 3 times as much per MME. However, if hydromorphone prices have actually fallen to \$1 per pill, then its price premium would be below historical norms.

These observations are summarized in the following table.

Table 7 Hydromorphone and Down Price Declines, and the Hydromorphone Price “Safety Premium”

Drug & Time	Price per point or pill	Milligrams	Purity/ Concentration	Price per pure mg	MED Ratio	Price per MME	
Down, Heroin Era							
circa 2007-2010	\$14	100	31%	\$0.45	3.5	\$0.129	
Down, Fentanyl Era							
2018-2019	\$20	100	7%	\$2.86	75	\$0.038	
2020-2021	\$20	100	12%	\$1.67	75	\$0.022	
2023	\$20	100	16%	\$1.25	75	\$0.017	
							Hydro Premium per MME vs. Down
Hydromorphone oral pills							
1997 per Sajan et al. (National, not BC)	\$25	4		\$6.250	5	\$1.250	
2011-2015 per Dart et al. (National, not BC)				\$2.50	5	\$0.500	3.9*
Pre-PSS (2018-2019)	\$5	8		\$0.625	5	\$0.125	3.3
After-PSS (2023), Guess #1	\$2	8		\$0.25	5	\$0.050	3.0
After-PSS (2023), Guess #2	\$1	8		\$0.125	5	\$0.025	1.5

**The 3.9 premium in 2011-2015 may be understated because hydromorphone price is national, not for BC*

The figure below plots the same data, but taking logs of price per MME to stress rates of decline in percentage terms. (A straight line with a logged vertical axis corresponds to a steady annual percentage decline.) There are really not enough data points to support average statements, but if one took the four price points for down seriously, they would imply a 14% annual compound rate of price decline between 2007-2010 and 2023. The graph also shows a dotted redline at 3 times that price. It shows that unless pill prices fell to \$1, hydromorphone would be maintaining its price premium of 3 or more, although hydromorphone prices may have been falling even faster than down prices.

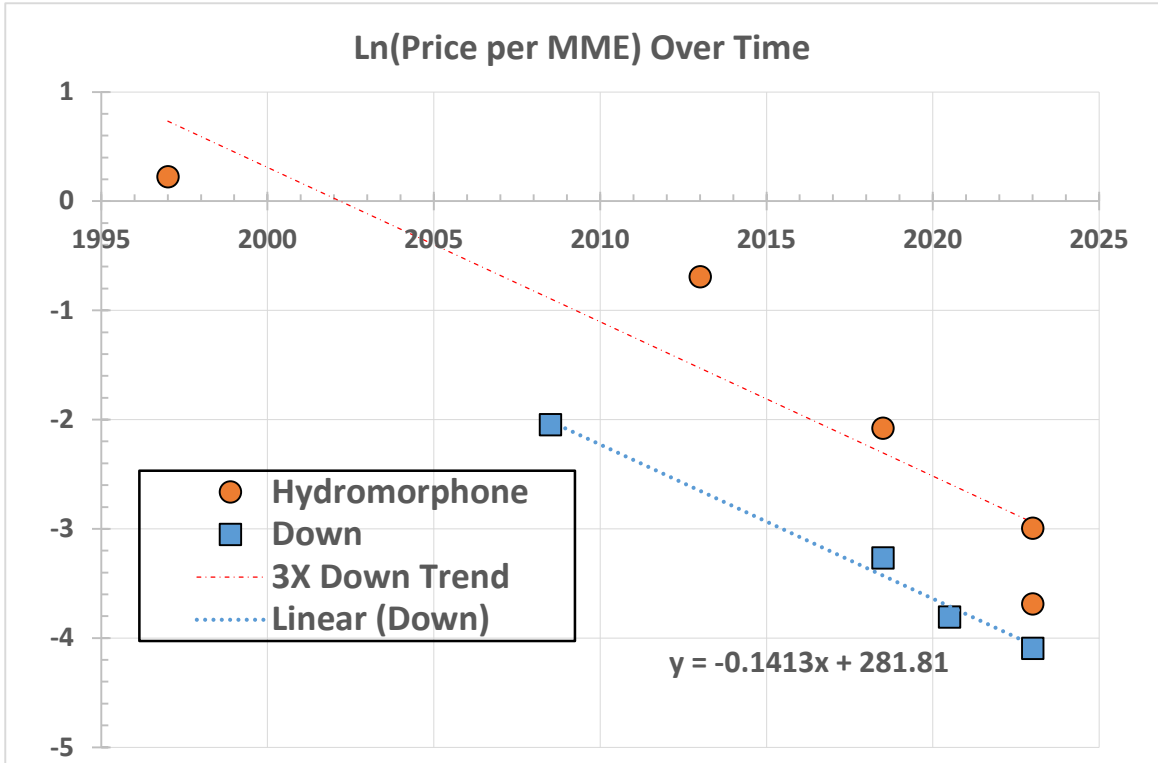


Figure 2 Graph of Hydromorphone and Down Price Declines, and "Safety Premium"

Appendix B: Data Concerning Potential Scale of PSS

B.1 Size of Target Market for PSS

Now that fentanyl is often present in counterfeit pills and other drugs (Palamar et al., 2022), essentially everyone who uses an illegal drug is at some risk of overdose, but deaths are concentrated among people who frequently use illegal opioids, particularly those with opioid use disorder (OUD). This appendix reviews some evidence pertinent to estimating the size of that population.

There have been several high-quality efforts to estimate the number of people who inject drugs (PWID) in BC. Janjua et al. (2018) estimate there were 41,358 between 2013 and 2015, the BC Centers for Disease Control (2016) estimates 42,200 in 2015, and Jacka et al. (2020) estimate there were 42,100 – 53,000 in 2016.

Bouchard et al. (2020) estimates the size of the fentanyl using population in BC, or more formally “people who use or are otherwise exposed to fentanyl” or PWUEF, under two scenarios. These estimates are of interest because fentanyl plays such a dominant role in fatal overdoses in BC (Baldwin et al., 2018). The following table summarizes their estimates.

Table 8 Bouchard et al.'s (2020) Estimated Numbers of People Who Use Fentanyl

	Frequency of Drug Use			Total
	Daily	Near Daily	Infrequent	
Number of PWUF in BC				
Scenario 1	5,263	4,644	5,573	15,480
Scenario 2	7,740	6,829	8,195	22,764
Spending per person per year	\$23,747	\$10,699	\$5,192	
Implied average daily spending	\$65	\$29	\$14	
Expenditures in CAD				
Scenario 1	\$124,980,461	\$49,686,156	\$28,935,016	\$203,601,633
Scenario 2	\$183,801,780	\$73,063,471	\$42,548,440	\$299,413,691
Percent of Total Expenditure	61%	24%	14%	

Min et al. (2020) estimate that the prevalence of OUD among people 12 and older in BC nearly doubled between 2000 and 2017, to a total of 83,760 individuals in 2017. Apparently, this estimate has been updated to 105,000 in 2022, with a parallel estimate of 59,000 people with stimulant use disorder.⁶⁵

That increase in the stock of people with OUD by $(105,000 - 83,760) / 5 = 4,248$ per year is not inconsistent with Piske et al.'s (2020) earlier estimate there were about 5,000 people newly diagnosed with OUD each year 2012 – 2016, since there is also some outflow from the pool of people with OUD (including via death).

⁶⁵ Based on an unpublished memo provided to me by Richard Taylor.

Of those with OUD, about 25,000 are enrolled in some form of MAT (roughly half MMT and half other modalities).⁶⁶ So if the 105,000 figure were correct, that would suggest there are perhaps 80,000 people in BC with OUD who are not currently enrolled in MAT.

Hence, we might guess that most of the risk of overdose in BC is concentrated within a population of perhaps somewhere between 20,000 and 80,000 people.⁶⁷

The total number of people using any illegal drug is considerably higher, because there are many people who use illegal drugs in moderation. E.g., the BC Coroner's Death Review Panel (2023) suggests considering expansion from the current limited PSS to non-medical supply without a prescription to the 225,000 or so who are at some risk of dying.

⁶⁶ <https://public.tableau.com/app/profile/bccdc/viz/UnregulatedDrugPoisoningEmergencyDashboard/Introduction>

⁶⁷ One reviewer challenged the 20,000 figure, suggesting that the lower bound must be larger than 20,000 given the large number of deaths since 2016. I am retaining the 20,000 because it is conservative in two respects. First, if someone believes that the evidence supports a range of 40,000 – 80,000, for example, it is not wrong to state that the population is between 20,000 and 80,000. Second, one of the key conclusions derived from the 20,000 – 80,000 range is that the size of the illegally manufactured opioid market (mostly fentanyl) is large in terms of MME compared to the size of PSS to date. If the range should have a larger lower bound, that would just reinforce that primary conclusion, not undermine it.