

**PROCEEDINGS AT HEARING
OF
DECEMBER 7, 2020**

COMMISSIONER AUSTIN F. CULLEN

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December 7, 2020
(Via Videoconference)

(PROCEEDINGS COMMENCED AT 9:30 A.M.)

THE REGISTRAR: Good morning. Thank you for waiting.

The hearing is now resumed. Mr. Commissioner.

THE COMMISSIONER: Thank you, Madam Registrar. Yes,
Ms. Rose.

MS. ROSE: Thank you, Mr. Commissioner. There are
two witnesses we'll be hearing from today.
Dr. Martin Bouchard and Dr. M-J Milloy.

I believe both witnesses have stated they
will affirm, Madam Registrar.

THE REGISTRAR: Yes. Witnesses, can you please
unmute yourselves. Thank you. Would each of
you please state your full name and spell your
first name and last name for the record. I'll
start with Dr. Bouchard.

THE WITNESS: (MB) My name is Martin Bouchard.

THE REGISTRAR: And can you please spell your first
name and last name for the record.

THE WITNESS: (MB) M-a-r-t-i-n B-o-u-c-h-a-r-d.

THE REGISTRAR: Thank you. And Dr. Milloy.

THE WITNESS: (MJM) My name is Michael-John Sheridan
Milloy. First name M-i-c-h-a-e-l - J-o-h-n.
Middle name Sheridan, S-h-e-r-i-d-a-n. Last

1 name Milloy, M-i-l-l-o-y.

2 **MARTIN BOUCHARD, a**
3 **witness called for the**
4 **commission, affirmed.**
5 **M-J MILLOY, a witness**
6 **called for the**
7 **commission, affirmed.**

8 THE COMMISSIONER: Yes, Ms. Rose.

9 MS. ROSE: Thank you, Mr. Commissioner, and thank
10 you, Madam Registrar. Mr. Commissioner, with
11 the document for today's panel we have no
12 concern about it being shared on the webcast. I
13 believe we just have the one document today, and
14 my expectation is that as we go forward we can
15 display it on both of the Zoom and the live
16 stream.

17 THE COMMISSIONER: Very well. Thank you.

18 MS. ROSE: And I would propose to spend some time
19 first walking through the witness's backgrounds,
20 mark their CVs and then turn to questions
21 regarding the report these witnesses have
22 authored.

23 **EXAMINATION BY MS. ROSE:**

24 Q So I will start with Professor Martin Bouchard.

25 Professor Bouchard, you obtained three degrees

1 in criminology from the University of Montreal;
2 is that right?

3 A (MB) That's correct.

4 Q So a Bachelor of Science, a Master of Science
5 and a doctorate in criminology?

6 A (MB) Yes.

7 Q And you conducted a post-doctoral fellowship at
8 the University of Maryland in 2007?

9 A (MB) I did. That's correct.

10 Q And since that time you have worked at SFU as an
11 assistant professor, associate professor and as
12 of 2016 a full professor in the school of
13 criminology?

14 A (MB) That's correct.

15 Q And you've published many books and articles on
16 the topic of illicit network, illegal markets
17 and counterterrorism among other aspects of
18 criminology?

19 A (MB) Yes, I did.

20 MS. ROSE: Madam Registrar, could I please have
21 Professor Bouchard's CV presented on the screen.

22 Q Professor Bouchard, do you recognize this as
23 your CV?

24 A (MB) Yes, this is my CV.

25 MS. ROSE: Thank you, Madam Registrar.

1 Mr. Commissioner, I would ask that this be
2 marked as the next exhibit, which, if I'm not
3 mistaken, we are at 332.

4 THE COMMISSIONER: I think we're at 333, but I may be
5 wrong about that. Madam Registrar.

6 THE REGISTRAR: Yes, that's correct. 333,
7 Mr. Commissioner.

8 THE COMMISSIONER: Thank you.

9 **EXHIBIT 333: Curriculum vitae of Martin**
10 **Bouchard**

11 MS. ROSE: Thank you.

12 Q Okay. Turning now to Professor Milloy.
13 Dr. Milloy, you earned a Bachelor of Science in
14 Molecular Ecology at Trent University?

15 A (MJM) That's correct.

16 Q And followed by a Masters of Science and a
17 doctorate in epidemiology from UBC?

18 A (MJM) Yes. I believe the doctorate was in
19 philosophy with a specialization in
20 epidemiology.

21 Q Thank you. And you were a researcher and later
22 became a principal investigator for the ACCESS
23 study?

24 A (MJM) That's correct.

25 Q And can you describe what the ACCESS study is.

1 A (MJM) Of course. The ACCESS study is an ongoing
2 prospective cohort of people who use drugs,
3 unregulated drugs, and that are living with HIV
4 infection. It began in 2005 and we have
5 recruited just over -- or just under 1,100
6 individuals whom we interview and draw
7 biological samples from every six months.

8 Q And you are also a research scientist at the
9 BC Centre on Substance Use?

10 A (MJM) That's correct.

11 Q And also a professor of cannabis science?

12 A (MJM) Yes. Since January 1st, 2019, I've been
13 the University of British Columbia's inaugural
14 canopy growth professor of cannabis science, and
15 I hold the rank of assistant professor in the
16 department of medicine.

17 Q You have published over 250 peer-reviewed
18 articles on the topics of narcotics and
19 epidemiology and related areas?

20 A (MJM) That's correct.

21 MS. ROSE: Madam Registrar, I'll ask Professor
22 Milloy's CV to be presented on the screen,
23 please.

24 Q Professor Milloy, do you recognize that document
25 to be your CV?

1 A (MJM) Yes, I do.

2 MS. ROSE: Thank you, Madam Registrar.

3 Mr. Commissioner, I would ask that this be
4 marked as the next exhibit.

5 THE COMMISSIONER: Very well, 334.

6 THE REGISTRAR: 334.

7 **EXHIBIT 334: Curriculum vitae of Michael-John**
8 **Milloy**

9 MS. ROSE: And, Madam Registrar, could we now have
10 the Bouchard expert report and the screen,
11 please.

12 Q Professor Bouchard, do you recognize this
13 report?

14 A (MB) Yes, I do.

15 Q And are you one of the authors of this report?

16 A (MB) Yes, I am one of the authors.

17 Q Could you explain what this study purports to
18 do.

19 A (MB) Oh, yes, I can. So we wanted to estimate
20 the size of the fentanyl market starting from a
21 population of people who were exposed to
22 fentanyl in the Downtown Eastside. It's a
23 population for which we had plenty of data, and
24 so we thought it was a good starting point to
25 attempt to make inferences to -- from the

1 Downtown Eastside to the rest of the province in
2 terms of how many people first are exposed to
3 fentanyl in the province.

4 And so we were able to accomplish this, like
5 I said, because we had access to the three
6 cohort studies, briefly mentioned when
7 discussing with M-J, capturing and tapping into
8 different types of people who use drugs in
9 Vancouver. We had access to the HIV -- people
10 who were HIV positive at the time of
11 recruitment. We also had -- VIDUS was a cohort
12 study focused on people who inject drugs in
13 general who are HIV negative as well. And we
14 had ARYS, a cohort study that were -- that was
15 targeted at people who were between the age of
16 16 and 28 years old.

17 So we felt confident that we were, you know,
18 capturing a large segment of the population
19 exposed to fentanyl in the Downtown Eastside.
20 And from this we used patterns of interviews
21 that -- these people were coming back to the
22 cohorts every six months, and from this we saw a
23 pattern of what we call capture and recapture in
24 biological sciences in order to estimate the
25 size of difficult to reach or hidden

1 populations.

2 And so we tested whether these models could
3 be applied to the phenomenon of -- that we had
4 with the cohort studies. People being recruited
5 in an ongoing study and then coming back for
6 re-interviews. And from -- in doing this we
7 estimated the size of the population that was at
8 risk or susceptible to participate in the three
9 cohort studies who were also exposed to fentanyl
10 in 2017, 2018, which were the two years under
11 study.

12 So we had our foundation, people in the
13 Downtown Eastside who we know for sure were
14 exposed to fentanyl. And then we needed to do a
15 few more things in order to get to the size of
16 the market. The first thing was to make
17 inferences from the Downtown Eastside to
18 Vancouver. And for this we used the overdose --
19 the fatal overdose data available from the
20 BC coroner's reports. And these data were
21 available for each of the health authorities in
22 British Columbia, from Vancouver but also health
23 authorities for the rest of the province.

24 So we used this as an anchor. Said, well,
25 if we know the population pretty well of people

1 who are exposed to fentanyl for the Vancouver
2 Coastal Health Authority, can we use the number
3 of overdoses in VCH and then the number of
4 overdoses in the other health authorities to
5 estimate the size of the market for the
6 province. And this is what we did.

7 So from an estimate in the Downtown Eastside
8 we came up with an estimate of 15,000 to 23,000
9 people in the province who were exposed to
10 fentanyl. So that was the -- I guess the second
11 part of the study.

12 And the last part was to transform these
13 estimates of individuals who were exposed to
14 fentanyl into dollar amounts or retail
15 expenditures. So how much did these 15- to
16 23,000 people spend on mixtures that likely
17 contained fentanyl in 2017, 2018. So how much
18 did they spend. And because we had detailed
19 data on the frequency of use for these
20 populations, we were able to break down our
21 population into daily users, near daily users
22 and infrequent users of mixtures of opioids that
23 contain fentanyl.

24 And then we had to apply a certain dollar
25 amount that they spent per day of use. And for

1 the daily users, for example, we used different
2 studies that converged on a number of grams per
3 day of use, which was around .4 grams. Whether
4 it's US, in British Columbia, daily users of
5 heroin and opioids tend to use these types of
6 amounts.

7 And we combined this with prices that were
8 obtained from the Vancouver Police Department by
9 the commission. So we used these prices to
10 estimate a dollar amount spent per day for each
11 type of user, then per month and then we made --
12 we just expanded to the year. So what does it
13 mean in terms of annual consumption and retail
14 expenditures for this population.

15 In doing this we came up with a range of
16 200 million to \$300 million spent by people who
17 were exposed to fentanyl in the province of BC.

18 MS. ROSE: Thank you. Madam Registrar, could we
19 please have this marked as the next exhibit.

20 THE COMMISSIONER: 335.

21 THE REGISTRAR: Exhibit 335.

22 **EXHIBIT 335: Research Report: Estimating The**
23 **Size of the Fentanyl Market in British**
24 **Columbia - October 26, 2020**

25 MS. ROSE: And I don't need it on the screen any

1 longer. Thank you, Madam Registrar.

2 Q And I'll be directing questions to both
3 Dr. Milloy and Dr. Bouchard during this
4 examination, and, you know, feel free to jump in
5 if one of you has more appropriate expertise for
6 the question.

7 Could you tell the Commissioner when --
8 approximately when fentanyl entered the
9 Vancouver marketplace.

10 A (MJM) Yes, of course. We lack a precise date of
11 when fentanyl became -- commonly appeared in the
12 unregulated opioid market in the Downtown
13 Eastside. To the best of our knowledge fentanyl
14 containing products like patches or lozenges
15 have circulated in very small numbers for
16 many years. However, as we all know, at a
17 certain point in the last ten years fentanyl,
18 primarily illicitly manufactured fentanyl,
19 became -- began to contaminate the unregulated
20 opioid supply, which is commonly called "down"
21 in the Downtown Eastside.

22 In the cohort studies we don't have an easy
23 way of determining that because of course down,
24 heroin and fentanyl, are -- can be difficult to
25 tell apart. Probably the best estimate comes

1 from coroner's data, which begins -- which
2 suggests that in the 2010/2011 period they began
3 to see a sharp increase in the number of people
4 who were dying of fentanyl overdoses. And so I
5 would suggest that given -- this is probably the
6 best data we have, and so I would suggest that
7 fentanyl probably began to be -- to contaminate
8 the opioid supply probably around the turn of
9 this last decade.

10 Q And you mentioned three different cohort studies
11 and these have been mentioned already in brief,
12 but could you please describe the VIDUS study,
13 the ACCESS study and the ARYS study.

14 A (MJM) Of course. In 1996 the VIDUS study began.
15 VIDUS stands for the Vancouver injection drug
16 users study. And it began as a response to the
17 explosive outbreak of HIV which began in the
18 early 1990s and which was at the time the
19 largest and swiftest HIV outbreak ever observed
20 in the western world.

21 As a result of that a number of things
22 happened, including the establishment of the
23 study, which was meant to investigate the roots
24 of the HIV outbreak and suggest ways in which it
25 could be mitigated. The study is a prospective

1 cohort study, and by that I mean we recruit
2 individuals and then follow them over time.

3 In VIDUS we recruit individuals from
4 community settings, from the open drug market,
5 from harm reduction services and they are
6 eligible for the study if they have used an
7 illicit drug via injection at least once in the
8 previous 30 days. We interview people. We take
9 blood and urine samples for analysis and then we
10 repeat the process every six months. And we've
11 been doing that since 1996.

12 ARYS and ACCESS are similar studies in that
13 they operate in a similar fashion and our
14 protocols are harmonized to allow us to analyze
15 the data all together when we like. ARYS stands
16 for the at-risk youth study and it focuses on
17 individuals who are between the ages of 14 and
18 28 years old, who are youth and who are street
19 involved. Either they are experiencing outright
20 homelessness or they are living in very marginal
21 situations like shelters or single-room
22 occupation hotels or they're using services
23 primarily focused on people who are homeless.

24 The ACCESS study, as I've mentioned, is
25 HIV-positive people who use drugs, similar to

1 generation, exposure to the healthcare and
2 correctional systems, things of that nature.

3 Q You described the interview process as
4 interviewer-administrated. Why is that
5 important?

6 A (MJM) It is important because it assures a
7 certain level of data quality. It assures that
8 all of the data is gathered in the correct
9 fashion. And as well it assures that if the
10 interviewee, for example, is unsure about the
11 question is asking, the interviewer can provide
12 assistance. It's also important, probably most
13 importantly, because many of these -- many of
14 the questions that we ask interviewers [sic]
15 deal with either criminalized topics or very
16 socially stigmatized topics. For example,
17 engagement in sex work and drug dealing,
18 experiences of trauma and violence. And so it's
19 important for us to generate and maintain
20 rapport with our interviewers -- interviewees,
21 excuse me, and to ensure that they are supported
22 and which can include counselling, et cetera, if
23 they -- if the topics are particularly
24 upsetting.

25 Q Is this type of study relatively unique in the

1 world of monitoring people who use drugs?

2 A (MJM) It's not a common study design,
3 particularly because it is relatively expensive
4 and difficult to operate. Certainly there are a
5 number of similar studies around the world. For
6 example, there's is the ALIVE study in
7 Baltimore, there's a cluster of studies in
8 San Diego and Tijuana and there are studies in
9 western Europe. But there are probably less
10 than 20 similar studies ongoing in the world at
11 this time, and certainly I am unaware of any
12 other similar studies anywhere else in Canada.

13 Q And just to recapture this, these studies have
14 been going on for several decades. And what
15 impact does that have on the data quality that
16 you have as a result of these studies?

17 A (MJM) Yes. One of the challenges of course of
18 conducting a study over more than 25 years is
19 that things change. And as we've seen with the
20 changes in the unregulated opioid market over
21 the last ten years, that has obviously caused us
22 to ensure that we are collecting the data in as
23 comprehensive and as accurate a manner as
24 possible.

25 Fortunately we have used the same measures

1 of drug use frequency, drug exposure, since
2 1996. So this allows us to compare the
3 frequency and prevalence of different types of
4 drug and substance use over time. We've also
5 kept similar measures of really the most
6 important exposures and outcomes in terms of
7 housing status, exposure to the criminal justice
8 system, uptake of healthcare, engagement in
9 treatment for opioid use disorder. These are
10 really the -- sort of the driving factors in
11 health and well-being of many of these
12 participants, and fortunately we've kept
13 identical or similar variable interview
14 questions throughout the 25 years.

15 Q And you mentioned the cost of conducting these
16 studies. Could you briefly describe what other
17 barriers there might be, or is it primarily a
18 cost barrier to conducting these types of
19 studies elsewhere?

20 A (MJM) Cost is an important barrier. These
21 costs -- these three studies all told cost above
22 \$2 million American per year to operate, which
23 is not a sum easily found in many research
24 funders, especially because of course these
25 studies involve marginalized and criminalized

1 individuals who don't have much political
2 influence, as, you know, you could suggest.

3 At the same time, beyond cost a key
4 challenge of course is operational. As you can
5 probably imagine, keeping in touch with any
6 group of individuals over a 25-year period would
7 be challenging. It is particularly challenging
8 given that these individuals, many of whom lack
9 many of the typical tools one would use to keep
10 in touch with people. So they lack stable
11 postal addresses, they lack stable residences.
12 They are commonly institutionalized, whether
13 that be in healthcare settings or in criminal
14 justice settings. They have many challenges to
15 maintaining sort a of stable lifestyle. So that
16 is probably the chief operational challenge.

17 I'm very happy to say that one way that we
18 have addressed this is by fortunately having
19 study staff who have been with us in some cases
20 since the beginning of the study, who maintain a
21 personal rapport with the participants and are
22 able to ensure that they are -- they come back
23 every six months for interviews.

24 Q Thank you. And this might be a question for
25 Dr. Bouchard. What other sources of data beyond

1 these three cohort studies did you use for this
2 study, and why did you use those sources of
3 data?

4 A (MB) The sources of data are mainly the cohort
5 studies. The capture-recapture estimates we did
6 are -- you know, that are crucial as a
7 foundation. But then we need to use
8 multipliers. We need to take this and, you
9 know, make it province-wide estimates. And in
10 doing so we use the BC coroner's data which was
11 broken down by health authority, and this
12 allowed us to make these inferences from the
13 Downtown Eastside to Vancouver, from Vancouver
14 to BC as a whole.

15 We also used street drug prices from the
16 Vancouver Police Department in order to get a
17 sense of the amount of dollars spent for
18 transactions of down on the street.

19 Q And, Dr. Bouchard, I just -- I noticed that --
20 are you referring to a document in front of you
21 right now?

22 A (MB) Well, I have --

23 Q And could you just tell us what that is.

24 A (MB) A document in front of me? For --

25 Q I just note --

1 A (MB) You mean for the drug prices or for ...

2 Q No. Sorry, I just noticed that you're looking
3 down. I wondered if you were referring to
4 something to assist you in your testimony today.
5 And if so, and I was wondering if you could just
6 tell us what that is.

7 A (MB) Oh, it's just -- it's my report. This is
8 table 3 of the report.

9 Q Okay.

10 A (MB) I have the report in front much me,
11 printed.

12 Q Okay. Great. Thank you for letting us know.

13 MS. ROSE: And I trust, Mr. Commissioner, that you
14 don't have any problem with that?

15 THE COMMISSIONER: No, not at all.

16 MS. ROSE: Okay. Thank you.

17 Q So the sources of data that were used were the
18 BC Coroner Service overdose data, the BCSCU, the
19 BC Centre on Substance Use, drug screening data
20 and Vancouver Police Department data on street
21 prices for fentanyl. Is that right?

22 A (MB) Yes.

23 Q And could you describe the methodology in terms
24 of -- you said you're using self-professed data
25 as well as screening data. And can you describe

1 how those two data sources originate and the
2 pros and cons of each one?

3 A (MB) Oh, yes. We -- so the cohort studies ask
4 participants whether they use different types of
5 substances over a last six months, like, prior
6 to -- I guess since the last interview. So they
7 have these lists of substances and one of them
8 is fentanyl, and it's been included for us in
9 2017/2018. It was included -- I think, a
10 few years before when fentanyl became a larger
11 component of the market, the cohort studies
12 added this substance in particular in the study.

13 And of course self-report data works really
14 well when people are aware that, you know, this
15 is what I purchased and this is what I'm using;
16 this is what I'm interested in. But in the case
17 of fentanyl, this all goes down. This is not
18 something that people, especially early on, were
19 necessarily aware that they were using. They
20 were buying down, they were buying -- which is
21 normally a term for heroin, in general, and
22 opioids. But the fact that they were -- that it
23 was fentanyl or not may not have been something
24 that they were completely aware. So very few
25 people in the cohort studies are reporting

1 purchasing fentanyl or using it on purpose.

2 And as described by M-J, the cohort studies
3 included urine screening. So people were tested
4 for -- whether the substances that they had used
5 for different metabolites, and fentanyl was one
6 of the substances that were tested. And many,
7 many people, almost -- the vast, vast majority
8 of people who reported using heroin, which has
9 always been extremely high in these cohorts, the
10 vast majority of the were also testing positive
11 for fentanyl. So -- and at one point,
12 especially in the years that we were doing the
13 study, most of the substances that people were
14 buying on the street contained fentanyl.

15 And this is what gave us in fact the
16 confidence to do that study because if almost
17 every mixture that is bought on the street
18 contains fentanyl, then we can estimate the size
19 of the people exposed to fentanyl using the
20 cohort studies and using this pattern. If half
21 the time what people are buying contains
22 fentanyl or even less than that, then we cannot
23 be as confident in making the types of
24 calculations that we made. But because it was
25 so frequent, we were able to do this.

1 So what we do in the end is we take -- you
2 know, of all the people who participated in the
3 cohort studies, we extracted those who either
4 self-reported fentanyl use at least once in the
5 two years under study or tested positive for
6 traces of fentanyl in their urine, which is the
7 detectible for as much as 96 hours after use.
8 So we combined those. Of course the urine
9 analysis sounds great in theory to compensate
10 and, you know, we needed it in this case quite a
11 bit. And at the same time we're also -- there
12 is a window period that we're missing. If
13 someone used fentanyl once, you know, over the
14 window of 96 hours, for example, we would not
15 necessarily capture that element, so the
16 self-report comes back to compensate for this.
17 But in the end it didn't make a ton of
18 differences because most people who reported
19 using fentanyl or heroin, which is what we
20 combined, also tested positive for fentanyl. I
21 think it was over 95 percent of them.

22 MS. ROSE: Madam Registrar, I wonder if we could have
23 the report back up. And if we turn to -- I
24 believe it's page 19 of the document, and so
25 page 21 of the PDF.

1 Q And towards the bottom of this page, I see at
2 the very middle of the bottom paragraph here
3 there's a statement:

4 "Upwards of 90% of heroin contained
5 fentanyl over much of our study period --"

6 And so:

7 "... our sampling criteria includes
8 self-reported heroin use."

9 And then over -- the sentence continues onto the
10 next page:

11 "In fact, the low overall levels of
12 self-reported fentanyl use for our sample
13 participants ... suggests most fentanyl
14 use identified through screening was tied
15 to using 'down.'"

16 Could either of you sort of expand on this
17 statement, and what does that mean? Is it that
18 all -- most people who are using fentanyl are
19 not aware that they are using it?

20 A (MJM) Yeah, I can jump in here. I think it's
21 important to understand that down is the general
22 terminology, certainly in the Downtown Eastside
23 and I imagine many other communities across
24 British Columbia, for unregulated powdered
25 opioids. And, you know, since the study started

1 in 2005, down typically referred to an admixture
2 in which heroin was predominant.

3 That began to change, as I've suggested, in
4 the sort of 2010 era. And now I would suggest
5 that in down diacetylmorphine or heroin has
6 almost been entirely replaced by fentanyl. And
7 so what it means in the context of the quote is
8 that few people were seeking fentanyl, the
9 product. Most people were probably seeking
10 down, the product, and since down is now almost
11 entirely contaminated by fentanyl, that is what
12 explains the very high prevalence of fentanyl
13 positivity in the cited report.

14 Q Right. And so am I right in saying that there
15 has been a stable demand for the product known
16 as "down," but the chemical composition of down
17 has changed over the past decade very
18 significantly?

19 A (MJM) That's correct. That would be a very good
20 way of characterizing it. In our studies we do
21 have a small number of people who are actively
22 seeking fentanyl, and this is sometimes the
23 diverted products which are still rarely
24 available in the unregulated market, and there
25 are people who are seeking heroin. Although of

1 course this is also quite rare given the changes
2 in the market itself. The majority of
3 unregulated opioid users are simply using down,
4 which, as you've explained, contains now
5 predominantly fentanyl.

6 Q And is there now a sort of a stable composition
7 of what down would be or is it quite variable?

8 A (MJM) It is quite variable, and in my opinion
9 that is the root of the danger it poses to
10 people who are using it. Fentanyl compared to
11 heroin needs much less matter, material for an
12 equivalent effect. This means -- this is
13 obviously an advantage, as you probably heard
14 from other witnesses, because it's much more --
15 easier to transport. An equal -- you know, a
16 smaller amount of fentanyl which would be
17 equivalent to a much larger amount of heroin.

18 However, in the -- sort of the drug
19 preparation phase, this means that the packets
20 of down contain a variable amount of fentanyl.
21 And so one packet might be an appropriate amount
22 for a user and the next might be a fatal amount.
23 And since users are unable to test how much
24 fentanyl is in their down before using it, they
25 face, you know, the risk of overdose. So that's

1 really the -- sort of the dynamic there.

2 Q And are there certain types of users that would
3 specifically seek out pure heroin or pure
4 fentanyl as opposed to down?

5 A (MJM) Yes, we are aware of people who prefer
6 heroin or fentanyl or down. Certainly there
7 are -- we've heard complaints from long-time
8 users that, you know, the current version of
9 down does not meet their needs or satisfy them
10 as well as previous versions of down. That is
11 probably sort of the primary dynamic there. And
12 there are also people who have told us that they
13 prefer fentanyl because of its specific effect.

14 Q And you mentioned that those users are typically
15 a bit more -- are rarer than the down -- the
16 individuals who would be content with down. Can
17 you describe why that might be.

18 A (MJM) Well, it's really a matter of
19 availability. Individuals are limited in their
20 sources of product and they often prefer to stay
21 with one source over a longer period of time,
22 especially if that source is providing the drugs
23 that they require or they prefer. So, you know,
24 most -- for most people they use down because
25 down is all that they can regularly acquire. It

1 being an unregulated market, as you can imagine,
2 there are probably out there who are saying yes,
3 that they can sell heroin but in fact what they
4 are selling is simply down.

5 So the differences -- you know, down is the
6 predominant form and so I think in speaking
7 about the market and its effects, I think, you
8 know, understanding down and using that as a
9 primary unit of analysis is probably the best
10 approach.

11 Q And could you describe the potency of fentanyl
12 as compared to heroin?

13 A (MJM) Yeah. Again, this being an unregulated
14 marketplace it's hard to make hard and fast
15 quantitative comparisons. In its sort of pure
16 molecular form I think fentanyl would probably
17 be about 10 to 15 times more potent, more toxic,
18 than heroin or diacetylmorphine. Whether this
19 comparison holds true in street-based samples I
20 think is probably more difficult to understand.
21 But I think, you know, the real sort of rule of
22 thumb is the most important thing to understand,
23 which is that fentanyl by weight is much more
24 powerful than a similar weight of heroin.

25 Q So 10 to 15 times is your usual metric. Could

1 it be anywhere up to 50 times more potent, or is
2 that ...

3 A (MJM) It could be because if you were comparing
4 a particularly potent batch of fentanyl versus a
5 less than potent batch of heroin, then you could
6 easily get into that sort of range. I would
7 suggest probably the -- 15 times is probably
8 reflective of the -- of a pure molecular form of
9 fentanyl versus diacetylmorphine. But what
10 people encounter on the street, again, because
11 there's such a variability with respect to both
12 fentanyl and down -- and heroin, excuse me, it's
13 tough to make, you know, hard and fast
14 comparisons, but certainly 50 times more potent
15 would not be out of the realm of possibility in
16 my experience.

17 Q Right. And then -- now turning to the portion
18 of your report discussing the number of people
19 who use or are exposed to fentanyl, I understand
20 that you used a combined model of self-reporting
21 as -- and screening, as you mentioned earlier.
22 And I believe if we turn to page 22 of the
23 report, which is page 24 of the PDF. This --
24 table 3. Could you describe what table 3 is
25 showing us here.

1 A (MB) Yes, I can. So this is -- are the four
2 waves that we use to generate the captures and
3 recaptures. So we broke down our two years of
4 data into six months period. And we found --
5 combining urine screening and self-report we
6 found 1,200 people who were exposed to fentanyl
7 over the period. These 1,200 people, if you
8 look, for example, at the first column, column 1
9 we had 881 of those who were found in those
10 first six months of the study. So that's how to
11 read the 881.

12 And then we -- if you look down at fentanyl
13 prevalence of use, the second part of the table,
14 you have the number 450 there. This means that
15 of the 881 who eventually will say yes to being
16 exposed or, you know, to having used fentanyl
17 one way or another, 450 of those did so in the
18 first wave of the study. So it's -- so there's
19 about 431 that did so but later in the study
20 period. So this is how you can read, for
21 example, the percentage fentanyl prevalence of
22 use, the last row, 51 percent. That's 450 who
23 used or were exposed to fentanyl in that period
24 compared to the total amount of people who
25 eventually will be exposed. So 450 were present

1 in that first wave that we call it. You also
2 have --

3 Q And --

4 A (MB) You also have -- yeah, go ahead.

5 Q Sorry. Just the 881, is that a combined figure
6 for both those individuals who reported use of
7 fentanyl and those who were found to have been
8 exposed through urine screening?

9 A (MB) Always. Always combined. If you want to,
10 you know, get an idea we only found 87 people in
11 total that we added to our sample based on
12 self-report and a lack of urine screening for
13 fentanyl. So 87 out of 1,200 people. So it's
14 extremely rare. The fact that we combined is
15 almost inconsequential. It's -- we just added
16 87 people overall based on that combination of
17 methods, so -- just to answer that question.

18 And then it's useful to look at the second
19 column, column number 2. Of those 881 people in
20 the first part of the table, 679 came back for
21 an interview in wave 2. And then we found 73
22 that never came back for an interview, at least
23 during that wave. So that's how we get to these
24 numbers. So we're trying to track how many
25 people, you know, come back in each wave.

1 So of our 1,213 people that we found over
2 the two years, we have about 800 to 935 people
3 at each wave. And this is the pattern that we
4 use for captures and recaptures. If someone
5 comes back once or comes once for an interview
6 but never comes back again, which is the case
7 for about 15 percent of the sample, then they
8 would count for one capture. If you come back
9 for two interviews, you will count for two, one
10 capture, one recapture. So two, in total,
11 interviews and so on and so forth.

12 So we tracked people at each wave in that
13 way. And then we can see that, you know,
14 there's a slight increase in prevalence over
15 time of self-report or urine screening for
16 fentanyl use from the first part of 2017 to the
17 last part of 2018.

18 Q And when you described the process of the
19 capture or recapture, could you just unpack that
20 language a little bit. What do you mean by
21 that?

22 A (MB) Yeah, we -- when we face a situation where
23 we don't have the total number of people that
24 are at risk -- or represented behaviour, for
25 example, so we -- there's a part that is hidden,

1 but we do see part of that population in one way
2 or another. So in -- so how many people, for
3 example, would enter treatment over the course
4 of a year and how many people would enter
5 treatment twice and three times over the course
6 of that year. It gives us a pattern. We see
7 these people.

8 And from that pattern we're trying to
9 estimate a number of people that fit the
10 behaviour. They look exactly the same or close
11 to that population that we see and -- but
12 they're not captured in the data. So they never
13 visited a treatment centre, for example, over
14 the course of the study. And then that zero can
15 be estimated using mathematical models.

16 So based on the pattern of what we see, can
17 we make an inference to the population we don't
18 see given the pattern of people appearing and
19 disappearing in the rest of the data. So that's
20 what we used in terms of logic, but our captures
21 and recaptures were based on interviews. So
22 what we were trying to estimate is, you know,
23 given the three cohort studies and what they
24 combine, the people that are visiting them and
25 that are able to come back for interviews and

1 re-interviews, how many people would form the
2 population -- the underlying population of
3 people that would be susceptible to participate
4 in those studies.

5 And the other criterion was -- and to have
6 been exposed to fentanyl one way or another.

7 Q Would you agree with me that it's sort of
8 similar to the -- and I'll put this as a
9 rudimentary model because I certainly don't
10 profess to be a biologist. But when you're
11 trying to determine how many fish that are in a
12 stream you take -- you capture a batch of fish,
13 you tag those fish, you release them out into
14 the stream and then you -- some months later you
15 capture another set of fish and you see what
16 proportion of those captured fish are tagged.
17 And from that you can extrapolate how many fish
18 that are there the stream. Is it sort of a
19 similar process?

20 A (MB) Similar process. We -- that's where the
21 capture-recapture methodologies were born.
22 Those are the first sort of hidden or difficult
23 to measure populations that there are. So
24 biologists would organize, as you say,
25 capture-recapture experiments. So they would

1 come back every six months to that stream and
2 then they would look at how many fish are new.

3 And if you come back every six months and
4 the fish are always new, it's always a new fish
5 and you barely see the fish that you captured
6 the first time, it means there is a high rate of
7 renewal in that fish population. And then the
8 model will estimate that the -- you know, the
9 size of the fish population would be much, much
10 larger.

11 And if you come back every six months and
12 it's always the same fish over and over. You
13 find, you know, 50 new captures and 40, 45 of
14 those were captured the first time, then that
15 population is very limited, you find the same
16 people over and over.

17 So that's the kind of pattern that we're
18 trying to capture here, not to use the same
19 word. But then we use, like, what our
20 rudimentary models may be for a fish population
21 that are based on, you know, animal instincts of
22 coming back to the same stream, and we have 20
23 to 25 covariates, characteristics of people in
24 these cohorts, that are included in our model.

25 So we call this heterogeneity. So variation

1 in this population, variation in behalf. And we
2 control for those variations in producing our
3 estimates, so we're trying to have a little bit
4 more of a human-based model, if you will, but
5 these models are very robust to different types
6 of data.

7 MS. ROSE: And, Madam Registrar, if we could turn to
8 page 38 of the PDF or page 36 of the document.

9 Q And this table 7, Professor Bouchard, could you
10 describe what this table 7 shows us.

11 A (MB) Yes. So the main goal of the table is to
12 give us a quick overview of the estimates that
13 we produced. The first column, column 1, would
14 be the simpler model that we ran. And the
15 second column would be the full model that we --
16 that is a better fit, I guess, from a
17 statistical point of view to the data.

18 And this second model has a trap effect.
19 That's the difference. That's the model that we
20 chose. The trap effect means are we, you know,
21 over -- the fact that people have to come back
22 on a schedule, if you will, for the cohort
23 studies is accounted for. We expect those
24 people to come back in the study. So we control
25 for this factor. And so the important number, I

1 guess, as a foundation for the study is 2,561.
2 That's our best estimate of the population of
3 people who are susceptible to participate in the
4 cohort studies and have been exposed to fentanyl
5 in 2017, 2018.

6 We broke down that number into daily use,
7 frequent use and infrequent use as well in order
8 to get an idea of -- later on in the report of
9 the dollar amounts spent by those people, which
10 is quite different. And so that is how to read
11 this table. So of course we provide goodness of
12 fit statistics, and we can see that we have the
13 N of 1,213. Those are the people in the cohort
14 studies that we observed. So from that observed
15 population of 1,200, we estimate that there are
16 2,500 people who could have participated in the
17 study, who could have fit that criterion of
18 having been exposed to fentanyl.

19 Q Right. And so these are individuals who meet
20 all of the criteria for one of the three
21 studies, the VIDUS, the ARYS or the ACCESS
22 study, you know, meaning that they -- as
23 Dr. Milloy mentioned, they live in Vancouver,
24 they inject drugs at some point within the pat
25 30 days and all of the other criteria that

1 Dr. Milloy set out. These are individuals who
2 meet those criteria as well as the recapture --
3 capture-recapture process for being exposed to
4 fentanyl use?

5 A (MB) Yes. That's correct.

6 Q Okay. And so earlier on Dr. Milloy described
7 some of the challenges for maintaining a stable
8 cohort throughout many years particularly with
9 the population being studied here. Can you
10 describe the two sort of methodologies in a bit
11 more detail, the one methodology of using a
12 stable -- assuming a stable cohort and another
13 methodology of a more open model of assuming
14 population change within the cohort.

15 A (MB) Yes. So what you described is called in
16 the capture-recapture, I guess, terminology a
17 closed population model. Closed because, as you
18 said, we're assuming that there are no entries
19 and exit during the period under study. And
20 then the word "open" is what we use to describe
21 the other sets of methodologies that allow us to
22 factor in entries and exits in the population
23 over the course of the study.

24 So of course we all like the open model in
25 terms of its assumptions of, you know, dynamic

1 movements in and out of the population. And
2 this is what we attempted to -- you know, and we
3 ran one of these models. We were able to run it
4 and -- but it comes also at costs, and the main
5 cost is, you know, additional assumptions of
6 what those entries and exits are. So we need
7 data to bring in. And the data that we had
8 here, for example, was the number of people not
9 coming back for an interview at the six months
10 schedule.

11 And so if someone did not come back for an
12 interview from wave 1 to wave 2, the model was
13 taking this as a person who was never coming
14 back in the study. That person was gone. And
15 of course what we saw is that people were coming
16 back sometimes in the third wave and the fourth
17 wave even if they were not there in the second
18 wave. So the patterns were not, you know, as
19 exact as this, and so -- but the model was
20 trying to factor that in.

21 So when you remove and you think that a
22 person not coming back in the study, you know,
23 was included in that process, it means that you
24 need to deflate the population as a model. The
25 algorithm will deflate the estimate accordingly.

1 Say, well, these people, you know, are not there
2 anymore to be taken, so our population is much,
3 much less.

4 And the closed population model has the
5 advantage of simplicity. So less assumptions
6 that are factored in. Yes, it does not include,
7 you know, people going in and out, but in the
8 literature over 20, 30 years of literature in
9 estimating these models, they are extremely
10 robust to these variations. Even in our case.
11 It also estimates one number, a number which
12 would represent, say, the mean number of people
13 that would be exposed to fentanyl at any day.
14 You know, during the course of the period. So
15 it does not accumulate people so much as it says
16 on average, you would have, say, 2,561 people
17 exposed to fentanyl in the Downtown Eastside
18 from these estimates that could participate in
19 the cohort studies.

20 The open model would produce four estimates
21 based on the waves. Not a single one but four
22 of them. And in the end when it was time to
23 decide between the two, we found first that they
24 were extremely close even though the estimates
25 or the assumptions are quite different between

1 the two. You know, I guess one of the waves for
2 the open model found that there was about 2,300
3 people from the open model that were estimated
4 to be present during those six months. And of
5 course our closed population model that we see
6 on the screen is 2,500, so 200 people difference
7 between the two. So there was extremely high
8 convergence between the two models.

9 Our process of capture-recapture was also
10 very tight. Same data being used, so we're not
11 that surprised. But the fact that even by, you
12 know, switching the assumptions and using an
13 alternative model we converged on the
14 populations gave us a little bit more confidence
15 that, at least from a statistical point of view,
16 we were probably in the ballpark.

17 Q When you say the exits and entries, what you
18 mean is someone not showing up for an interview
19 with the cohort study?

20 A (MB) Absolutely.

21 Q Or perhaps a new person showing up to
22 participate in the interview that previously had
23 not?

24 A (MB) Same. Same. And we found that the model
25 was giving a lot of weight to those people who

1 were not coming back. So really deflating as
2 though they would never come back. We found it
3 was maybe a little bit too much weight even on
4 these situations because people's schedules, you
5 know, can of course vary. And the fact that we
6 had to cut those waves at a specific date. The
7 30th of June, you know, was the last day of
8 wave 1, so people may come back five days later
9 and then they were assumed never to come back
10 again. We found that maybe it was a little bit
11 too much weight on this factor alone. But the
12 model itself, you know, is -- that's what it
13 does.

14 Q So would it be fair to say with the closed model
15 which does not allow for any population change,
16 so does not allow for a new person to join the
17 study halfway through or does not allow for an
18 individual to drop out of the study, that closed
19 model might be more reliable in the sense that
20 it's the same exact individuals all the way
21 through but it has the disadvantage of being
22 unrealistic in terms of the actual, you know,
23 day-to-day modes of individuals and their
24 schedules changing and they might, you know,
25 miss an interview and it might not actually have

1 a huge bearing on their eligibility for the
2 study or, you know, whether they should be
3 recaptured. Am I putting it fairly? Is that
4 right?

5 A (MB) Yeah, I would say that no one knows if one
6 is better than the other. That's important to
7 mention. But the word "robustness" captures, I
8 think, what you describe. These small
9 variations are kind of taken into consideration
10 much less. And we know that there are entries
11 as well. We have new people exposed to fentanyl
12 who were not exposed before and we found that
13 there were less of those new people in the
14 cohort studies that were pretty stable at that
15 point in some sense. And we were losing people
16 in different ways, in ways that, you know, we
17 perceive to be also technical. You know,
18 they're simply found in the next one or they
19 could leave the Downtown Eastside for one reason
20 or another and not come back for an interview
21 even though they are still exposed to fentanyl.

22 So I would say I would say it's a fair
23 representation that a robust simpler model that
24 seems to be valid is -- was favoured in this
25 case.

1 MS. ROSE: And, Madam Registrar, I think we are
2 finished with the table 7, so we can take that
3 down off the screen, if you don't mind. Thank
4 you.

5 Q And so, Professor Bouchard, you mentioned that
6 these two, the open model and the closed model,
7 that you noticed a great deal of convergence.
8 Can you sort of describe what that means.

9 A (MB) Yeah. We estimated 2,561 people
10 susceptible to participate in the cohort studies
11 who were also exposed to fentanyl with the
12 closed model, and one of -- you know, we had the
13 four estimates for the open models, one at each
14 wave, and one of the estimates, for example, was
15 2,300 individuals, so very close. So that's
16 what we mean by convergence. Of course we're
17 using the same data. We didn't expect them to
18 be completely off of each other, but that's what
19 we mean by convergence. Even if we're wrong,
20 we're not wrong by more than a few hundred
21 individuals at most.

22 Q And so the fact that using these two different
23 models yielded quite similar results gives you a
24 bit more, as you say, robustness to the study
25 overall?

1 A (MB) Yeah. Based on the process of interviews
2 and the cohort studies, even if we vary
3 assumptions and models, we're converging on a
4 number of people, around 2,500, yes.

5 Q And so when -- because we are -- in the next set
6 of questions we'll be talking about
7 extrapolating from this to, you know, Vancouver
8 and beyond. When you have that kind of
9 robustness in this smaller subset, what does
10 that -- how does that impact the -- your ability
11 to extrapolate beyond those numbers?

12 A (MB) Well, one thing that it does is, as you
13 said, it's a bit more confidence. This
14 confidence is based on the statistical answer to
15 the question, so it's not, you know, the end all
16 answer. If we could even have, you know,
17 alternative data sets, we would. We would bring
18 everything in. But from that perspective it
19 gives us that confidence to move forward and
20 use, for example, as we did, what we call the
21 point estimate of these models, which is 2,561.
22 We're pretty confident that it's a good
23 foundation for the kind of methodology that
24 we're applying. At the end of the day it also
25 gives us tighter confidence intervals. We don't

1 have a wild. Wide range at the end of the day
2 because we're starting from a place of estimates
3 that is pretty close together, if you will.

4 Q So turning to trying to estimate figures of
5 individuals who use or were exposed to fentanyl
6 in Vancouver as a whole, could you describe how
7 you were able to move from this 25 -- or 2,561
8 individuals to -- which are eligible to the
9 cohort studies and how you were able to move
10 from that into a figure that would represent the
11 City of Vancouver as a whole?

12 A (MB) Yes. And that's something we spent a lot
13 of time on, looking at every piece of data that
14 we could find on how do we -- first how do we
15 characterize our 2,561. Like, who do they
16 represent. Do they represent the Downtown
17 Eastside as a whole? Do they represent a little
18 bit of Vancouver, a little bit of the Downtown
19 Eastside? Who are we missing, and are we
20 missing a lot of people. So we had to
21 understand our 2,561 really well first. And --
22 you know, and with this reflection, you know, we
23 came with two scenarios that were plausible.

24 And the first scenario we used data from the
25 cohort studies that ask people whether they

1 lived in the Downtown Eastside. And combined it
2 was around 70 percent. So most people, two
3 thirds of the people in the cohorts that we
4 observed reported living in the Downtown
5 Eastside. So that was one of the first
6 proportions we could use to say well, our 2,561
7 probably represents 70 percent of, you know,
8 Vancouver as a whole.

9 And then we're capturing with the cohort
10 studies a little bit of the population people
11 exposed to fentanyl that are in Vancouver but
12 not necessarily in the Downtown Eastside. So
13 that's our first -- what we call our first
14 scenario. And so --

15 Q And sorry, with that -- sorry to interrupt. But
16 with that first scenario when you say that it's
17 only 70 percent of people who are reporting
18 living in the Downtown Eastside, can you
19 describe -- or perhaps this is a question for
20 Dr. Milloy. Can you describe how it is that the
21 other individuals are being counted in the
22 cohort study? Is there something that is
23 bringing them into the Downtown Eastside? Or
24 why is it that they are participating in these
25 studies if they're not resident in the Downtown

1 Eastside?

2 A (MJM) I think that probably the simplest
3 explanation is that individuals would have been
4 recruited probably in the Downtown Eastside and
5 then moved outside of the Downtown Eastside
6 subsequent to their recruitment. The lion's
7 share of recruitment happened in the period from
8 2005 to 2010, although the cohorts are open,
9 which means we continue to recruit to refresh
10 the numbers to compensate for loss to followup,
11 in particular death.

12 The majority of folks were recruited in 2005
13 to 2010, and simply the 30 percent or so that
14 Dr. Bouchard refers to are individuals who would
15 have moved. Individuals remain eligible to
16 participate in the cohort no matter where they
17 are living provided that they were recruited --
18 the only residency requirement at recruitment is
19 that they were resident in the greater -- in the
20 GVRD. But the reality is almost all the
21 individuals are recruited either in the downtown
22 south or Downtown Eastside areas.

23 Q Are there other individuals who might be
24 visiting the Downtown Eastside for provision of
25 certain services that are located there?

1 A (MJM) When we asked people who are not living in
2 the Downtown Eastside why they go to the
3 Downtown Eastside, the number one response is
4 typically access harm reduction. Policies
5 around the distribution of harm reduction differ
6 between Vancouver Coastal Health and other
7 health authorities making it far easier to get,
8 for example, large numbers of sterile needles in
9 the Downtown Eastside rather than in other
10 places, for -- in fact they may be illegal, such
11 as in certain communities in the Fraser Valley.

12 And the other reason is drugs. Individuals
13 come to maintain a consistent supply with people
14 that they know, and so they travel the Downtown
15 Eastside to purchase drugs. Those are the two
16 big reasons people do it.

17 The third reason would be access to medical
18 care. So their GP, their doctor, that sort of
19 thing.

20 Q Right. And so that's -- would that explain why
21 you're seeing a 70 percent residency in Downtown
22 Eastside and not a hundred percent?

23 A (MB) Yes.

24 Q Okay. Sorry, I interrupted you, Dr. Bouchard.
25 Please continue.

1 A (MB) All good. No, that's important to
2 understand too. And it's important to
3 understand even these numbers for the second
4 scenario where we assume that we're estimating a
5 number that is applicable for the Downtown
6 Eastside specifically as opposed to a mix of
7 Vancouver and the Downtown Eastside. So that's
8 scenario 2.

9 There was no scenario that we thought was
10 more plausible than the other. We were happy
11 that those scenarios were giving us the kind of
12 range that we wanted, like a lower number, a
13 higher number based on different assumptions,
14 both reasonable. So yeah.

15 Q And so one of the assumptions, if I'm
16 understanding correctly, and I forget which
17 number scenario this is, but one of the
18 assumptions would be the 2,561 individuals that
19 are representing a hundred percent Downtown
20 Eastside and/or the second assumption being that
21 they represent 70 percent and that there are
22 other Vancouver residents that are also mixed
23 into that group. And first of all is that
24 correct, and what does that mean for the rest of
25 your study?

1 A (MB) That is correct. We -- for scenario -- I
2 guess scenario 2 is easier to understand and we
3 can scale back to scenario 1 after. But
4 scenario 2 says well our population is Downtown
5 Eastside, 100 percent of them. And so what
6 we're capturing is Vancouver, you know, centre
7 north. So one area of Vancouver Coastal Health.
8 And so -- and we had numbers of overdoses, fatal
9 overdoses, for this region compared to the rest
10 of Vancouver Coastal Health and this is what we
11 used as our foundation. So our 2,500 people,
12 Downtown Eastside 100 percent.

13 And then we can move to -- so how many of
14 those people -- how much do they represent
15 Vancouver as a whole? And the number of
16 overdoses in Vancouver centre north was
17 calculated to be 45 percent in 2017 by a study
18 using coroner's data. So 45 percent of
19 overdoses in Vancouver happened in the Downtown
20 Eastside. This means that our 2,500 can be
21 matched with the number of -- that represents
22 45 percent of overdoses, which means we're
23 missing 55 percent.

24 So we just -- we simply added 55 percent to
25 our estimate of 2,500 to represent the rest of

1 Vancouver. And we came up with a number that's
2 a little bit over double our estimate of 2,500
3 or 55 percent. So we're in the area of 5,500
4 people for Vancouver as a whole who were exposed
5 to fentanyl for the study period. So that's our
6 first sort of inference from the Downtown
7 Eastside to Vancouver as a whole.

8 And of course if we use scenario 1 where our
9 estimate of 2,500 is only a portion, 70 percent,
10 say, of Vancouver that is Downtown Eastside,
11 then we just need to start from a lower number.
12 So instead of the 2,500 people representing the
13 Downtown Eastside as a whole, they only
14 represent 70 percent. So we need to make an
15 estimate that's a little bit smaller for
16 Vancouver as a whole as a consequence. So --
17 because our estimate of 2,500 already captured a
18 little bit of Vancouver; right? As opposed to
19 the second scenario that I described first where
20 we captured none of Vancouver as a whole from
21 our estimate of 2,500. It was strictly Downtown
22 Eastside.

23 So that gave us a range between 3,500 to
24 5,500 people depending on the scenario that
25 you're comfortable with that were exposed to

1 fentanyl in Vancouver as a whole starting from
2 cohort studies and making an inference to the
3 rest of Vancouver Coastal.

4 Q And so am I correct in saying that the
5 extrapolation you're doing is compare
6 the percent of overdoses that are linked to the
7 geographic area that the cohort study is present
8 in, and then seeing what percentage that
9 constitutes and trying to use that same ratio
10 for the City of Vancouver as a whole?

11 A (MB) Absolutely. And that ratio would be, in
12 the case of 2017, 45 percent of fatal overdoses
13 happening specifically in the Downtown Eastside
14 compared to Vancouver as a whole.

15 MS. ROSE: And, Madam Registrar, could we please have
16 the report back up again. And I'd like to turn
17 to page 45 of the PDF, if possible. And scroll
18 down to table 8. We might need to zoom in just
19 a little bit. Thank you.

20 Q So if we're looking at this table, Dr. Bouchard,
21 can you sort of walk us through how this allowed
22 you to make an estimate for the entirety of
23 Vancouver. And I think we'll also want to
24 scroll down to table 9 as well, which may help
25 explain that for us.

1 A (MB) Yes. So this table help us to make an
2 inference for BC as a whole. So what we can see
3 here is each health authority in British
4 Columbia represented, in the first, I guess --
5 for each row and so the Interior Fraser,
6 Vancouver Coastal or -- I say six but it's five.
7 It's six within Vancouver but five for BC as a
8 whole.

9 And in that study published by the coroner's
10 service of BC they broke down the fatal overdose
11 counts and the percentage for the health
12 authorities for each of the specific delivery
13 area. So, for example, Vancouver Coastal is
14 made up of North Shore, Vancouver and Richmond.
15 And in Vancouver, the city as a whole, we had
16 86 percent of the Vancouver Coastal overdoses
17 for Vancouver as a whole. So that represented
18 25 percent of fatal overdoses happening in
19 Vancouver compared to the rest of the province
20 as a whole.

21 So we could say that if we have a good idea
22 of the number of people exposed to fentanyl in
23 Vancouver, we could multiply that number by 4,
24 if all else is equal. Which means, if the
25 number of fatal overdoses is a good anchor point

1 to make that inference, we can multiply that
2 number of people that we estimated in Vancouver
3 by 4 to get an idea of how many people are
4 exposed to fentanyl in the province as a whole.

5 So this is how we used this table in the
6 report.

7 MS. ROSE: And perhaps just for reference we could
8 also turn, Madam Registrar, to page 42 of the
9 report. Page 44 of the PDF.

10 Q And here we have the table, another table 8, and
11 this is what shows the Vancouver centre north at
12 a number of 45. Is the Vancouver centre
13 north -- does that -- how does that relate to
14 the Downtown Eastside?

15 A (MB) It basically is the Downtown Eastside for
16 all purposes. It's right in the middle.
17 Right -- it's the Downtown Eastside as we know
18 it. I don't know if M-J can provide the
19 streets -- the exact streets or geographical
20 area that it represents, but this is our region.

21 Q Is it -- just is it identical to the Downtown
22 Eastside or is it equidistant or is there some
23 discrepancy there?

24 A (MB) Minor discrepancies, if any. This is --
25 the Vancouver Downtown Eastside is located

1 entirely in Vancouver centre north.

2 Q And so when we look at this table here and we're
3 seeing the fatal overdose count of local health
4 areas and then the percentage, can you sort of
5 describe how you arrive at the -- or I think
6 you've already gone through this, but just --
7 maybe we can just spend a moment explaining what
8 this table shows.

9 A (MB) Yes. So this is from -- research from a
10 University of Victoria group called CISUR.
11 We -- they published this data. And we -- and
12 it's where -- it's basically where in Vancouver
13 are the overdoses happening, and in which local
14 health area. So those are the six from
15 Vancouver. And overdoses are happening, as you
16 can see, all across Vancouver but there's a
17 large concentration that's happening in
18 Vancouver centre north. 68 overdoses in 2017,
19 which makes for 45 percent for Vancouver as a
20 whole happening in that region specifically.

21 Q And so that's where you get the 45 percent
22 number is through this table?

23 A (MB) Exactly. And there were no data for 2018
24 to our knowledge that we could use as well.

25 Q And the study that you've -- or the data that

1 1,742 people from that estimate would be live in
2 the Downtown Eastside. So from that number our
3 inference to the rest of Vancouver would be
4 adding 55 percent to this based on our
5 45 percent overdose in the Downtown Eastside to
6 give us an estimate of 3,870 for Vancouver as a
7 whole.

8 From that estimate of 3,870 we're applying
9 another multiplier in order to make an inference
10 to the rest of British Columbia. And so in the
11 data that we had available, Vancouver
12 represented in 2017 25 percent of fatal
13 overdoses containing fentanyl. So our
14 multiplier in this case is 4. So we multiply
15 the 3,870 by 4 to give us an estimate of the
16 size of the population for BC as a whole.

17 In scenario 2 we repeat this exercise, but
18 we're assuming that our population in Vancouver
19 is a bit larger. Because our cohort studies
20 were capturing Downtown Eastside, we made an
21 inference to the rest of Vancouver that gave us
22 a larger estimate of 5,691. And then applying
23 the same multiplier for BC as a whole, we are
24 estimating, you know, four times that amount
25 would be the full estimate for the province at

1 22,764, and that gives us that range between
2 15,000 and 23,000 that we're talking about in
3 the report as the likely range for -- of people
4 who were exposed to fentanyl for those two years
5 in British Columbia.

6 Q So just to walk through that once more for those
7 of us less familiar with the math. The first
8 number at the top of both scenario 1 and
9 scenario 2, which is the lower bound of 2,484,
10 middle of 2,561 and upper of 2,638, that's the
11 capture-recapture estimate using the cohort
12 studies?

13 A (MB) Yes.

14 Q And then the -- in scenario 1 you assume that
15 that study is 68 percent of the Downtown
16 Eastside with a portion of non-Downtown Eastside
17 residents from Vancouver as well. So the
18 non-Downtown Eastside proportion would be the
19 32 percent.

20 A (MB) Yes.

21 Q And then in scenario 2 you're assuming that the
22 capture-recapture estimate using the cohort
23 studies was a hundred percent Downtown Eastside
24 residents without any additional Vancouver
25 residents added into that mix?

1 A (MB) That's correct.

2 Q Okay. And then the next line on both the
3 scenarios is the Vancouver estimate, and this
4 45 percent figure that you're included here,
5 that is the coroner's data on overdose deaths?

6 A (MB) Yes.

7 Q And so --

8 A (MB) That would be in Vancouver centre north,
9 yes. Specifically.

10 Q And so if the Vancouver centre north, the
11 Downtown Eastside area is 45 percent of those
12 overdose deaths, us use that figure to determine
13 how many users -- how many people who use or are
14 exposed to fentanyl might exist within the City
15 of Vancouver?

16 A (MB) Yes.

17 Q And so for the scenario 1 that gets you to a
18 middle bound number of 3,870?

19 A (MB) Correct.

20 Q And for the scenario 2 that gives you a figure
21 of 5,691?

22 A (MB) Yes.

23 Q And then for the BC estimate, to use -- to
24 expand that beyond the City of Vancouver into
25 the rest of BC, the 25 percent figure, what's

1 that figure again?

2 A (MB) It's the proportion of fatal overdoses
3 containing fentanyl that are attributable to the
4 City of Vancouver specifically compared to the
5 rest of the province. So 25 percent of
6 overdoses are happening in Vancouver in
7 British Columbia.

8 Q So you use that figure to give you a number for
9 the individuals who use or are exposed to
10 fentanyl for the entire province?

11 A (MB) Yes.

12 Q And what are those figures for each scenario?

13 A (MB) For the full province?

14 Q For the full province, yes.

15 A (MB) Yeah, in scenario 1 we have 15,480 as our
16 middle or point estimate for the province as a
17 whole, so the number of people exposed to
18 fentanyl over the course of that study period.
19 And it goes to 22,764 for the province as a
20 whole for those same people. So that gives us a
21 range where we think the actual number of people
22 may be contained.

23 Q And has this work been done before? Has anyone
24 attempted to estimate the total number of
25 individuals who use or are exposed to fentanyl

1 in the province of BC?

2 A (MB) To our knowledge -- and maybe M-J has seen
3 different studies, but to our knowledge there is
4 no fentanyl-specific study. But many studies
5 were involved in estimating the size of this
6 population of the people who use or inject
7 drugs, for example, as a whole. So whether it's
8 heroin or other drugs, people used or tried to
9 estimate these populations which is a bit, you
10 know, of a broader population than what we're
11 trying to estimate.

12 And then other studies estimated the number
13 of people who were likely to inject heroin as
14 well based on methadone treatment data. And
15 those studies are -- we can see a few of them on
16 the screen right now. So these studies have
17 been done before but for different populations
18 than ours. To our knowledge it was the first
19 time that a fentanyl-specific estimate was
20 attempted.

21 Q And so just below the table I believe you review
22 a couple of those studies. I'm probably
23 mispronouncing this but Janjua et al. and Jacka
24 et al. And there's a estimate there of 40,000.
25 What does PWID stand for?

1 A (MJM) PWID refers to people who inject drugs.
2 And so these estimates were made because of
3 course injecting drugs is a really potent risk
4 factor for not only overdose but also
5 acquisition of bloodborne pathogens like HIV and
6 Hepatitis C.

7 Q And what sort of -- I mean, would this be
8 focusing on opioids or would it include other
9 substances as well?

10 A (MJM) Well, in Vancouver it's notable that
11 there's always been what we call polysubstance
12 use especially around injection. Primarily
13 people will be injecting opioids and related
14 drugs, but a substantial proportion will also be
15 injecting cocaine. I believe, for example, at
16 Insite, North America's first supervised
17 injection facility, approximately three quarters
18 of the injections are opioids of some sort and
19 the other quarter are stimulants, primarily
20 cocaine but also methamphetamine.

21 Q And that might explain why the numbers that
22 these studies reach, you know, the \$40,000 --
23 not dollars, excuse me -- 40,000 individuals
24 listed in this study is larger than your
25 estimate because it is incorporating use of

1 other substances beyond fentanyl?

2 A (MJM) That's correct. And if I can jump in, the
3 other consideration I would suggest is the
4 specific definition of what is a person who
5 injects drugs. Is this an individual who
6 injects drugs once over a 12-month period;
7 someone who injections every six months; someone
8 who injects every day. These definitions vary
9 obviously and will obviously have an important
10 impact on the estimate size.

11 Q And how does that impact the figures that your
12 study arrives at? Is your study likely to be on
13 the conservative end as a result of that
14 consideration or is it likely to be on the
15 larger side?

16 A (MB) Well for us the question of whether we're
17 on the conservative side or not should not be
18 taken in comparison to these studies
19 specifically but in comparison to just our
20 internal study design and what we're using. So
21 our foundation are the cohort studies. The
22 cohort studies are now recruiting just about
23 every type of people who inject drugs or who use
24 drugs because they're also going beyond
25 injection for some of them. They're also -- so

1 they're not recruiting every type of people that
2 we could capture. They're also not recruiting
3 much outside of the Downtown Eastside of
4 Vancouver, as M-J explained earlier. And so
5 we're really narrowed down into a very specific
6 region, a very specific type of user who is
7 susceptible to be recruited in those cohort
8 studies. So it's our starting point for me that
9 gives us this little bit of a narrower scope.

10 In addition -- if you want to compare to
11 these studies, in addition to the type of
12 substances that we consider which is strictly
13 focused on down in this case, exposure to
14 fentanyl over the course of the year. But for
15 me the fact that the cohort studies have a
16 recruitment process that is -- it's a bit more
17 narrow. It's quite wide, you know, for a study.
18 It's quite amazing the cohort studies, the range
19 of people recruited. But overall there are
20 other people that we not susceptible to
21 participate in these cohort studies that we are
22 not capturing in our estimates.

23 MS. ROSE: And, Madam Registrar, if we could just
24 scroll up slightly. I just want to see the
25 sentence that's just above this table.

1 Q So here you state:

2 "We deem this range to be conservative,
3 representing the floor estimate for
4 fentanyl prevalence of use/exposure within
5 the province."

6 And is that why -- is this reason that you've
7 just described, is that why you consider this to
8 be the floor?

9 A (MB) Yes, that's correct. There are -- we found
10 more ways in which our scope was narrow than it
11 was broad. And we also didn't try to compensate
12 for the fact that the survey were not capturing,
13 you know, every type of participants possible
14 who were exposed to fentanyl. We kept the data
15 as is, as we found it, and we applied the models
16 on these data as is. And of course in another
17 study where we would try to get at just about
18 everyone exposed to fentanyl, including people
19 outside of the Downtown Eastside, including
20 people who were not using Insite and those other
21 supervised injection facilities, then we would
22 have what we call corrections to our estimate,
23 you know.

24 And many, many studies that are trying to
25 capture the full size of a population will have

1 those corrections. Because we're missing the
2 people in this region where the survey was not
3 available and we didn't attempt these sorts of
4 corrections in that case. What we did is we
5 made inferences from a number that we didn't try
6 to correct for, for example, the fact that we
7 think is only capturing a portion of the people.

8 Q And what do you mean by "correction"? Is that,
9 you know, an assumption that would be
10 incorporated there, or what do you mean by the
11 word "correction"?

12 A (MB) Yes, absolutely. So in any size of hidden
13 population estimates, the data that you use as a
14 baseline, as a foundation, will be imperfect.
15 One way or the another. It will be biased
16 towards recruiting certain types of people at
17 the expense of others. If you think, for
18 example, of survey studies who are -- or using
19 telephone surveys, you know, the baseline and
20 the foundation of the study is only for people
21 who can answer the phone for that specific
22 study. So maybe it's very good to estimate the
23 size of the cannabis market or the drugs
24 where -- you know, that are a little bit more
25 widespread in the population who have a phone

1 number and can answer these sorts of surveys.
2 But these sorts of surveys were not as good as
3 capturing the proportion of people who are using
4 these drugs like opioids who may not answer the
5 phone for these types of surveys. So that's why
6 we were very fortunate to have these cohort
7 studies that are located in the Downtown
8 Eastside where participants who are using these
9 drugs daily can be recruited.

10 So the corrections that other studies, just
11 to come back to your question, could be making
12 is -- for example, many studies in the US would,
13 just like us, have a cohort study or a type of
14 study where daily users very -- you know,
15 regular users are being recruited, and then they
16 would say well, we don't have the people who are
17 using this once a week or once a month. So what
18 do we do in order to incorporate their expenses
19 or their use. So they will use a multiplier, a
20 correction. Say, well -- for example, the one
21 study that we used by RAND Corporation authors
22 who used a factor of 1.03 to correct for the
23 fact that they had a population of daily users
24 as their foundation. We're also missing, you
25 know, people that are in hospitals sometimes.

1 We're missing people that are not recruited for
2 one reason or another, people who are not
3 injecting drugs. They don't fit the criteria
4 in -- specifically in the study but they are
5 still buying down.

6 So all kinds of reasons where we could think
7 of a way to correct the -- I guess the raw
8 estimates that we have, and we didn't do that
9 for the purpose of this report specifically. We
10 don't think it's a bad idea, but we just didn't
11 do it and sort of settled on the fact that this
12 is probably a floor estimate based on these
13 reasons.

14 Q So conducting the study in the way that you have
15 for this report, the downside of this approach
16 might be that the estimate is overly
17 conservative; is that fair?

18 A (MB) That would be fair.

19 Q And what would be the downside of applying
20 additional corrections to try to capture a
21 fuller scope of exposure or use?

22 A (MB) That is a good question. We -- I think it
23 can be summarized by how many additional
24 assumptions are you ready to add to your
25 estimate beyond what the raw data and the

1 equation or the model that you are applying is
2 giving you. So how much are you ready to add
3 because each time you add an assumption, you add
4 uncertainty.

5 And the things -- and we wanted to rely on
6 what was most certain, and what was most certain
7 was the patterns of capture and recapture that
8 we had in the cohort studies. And so to add a
9 correction to the estimates -- it's something
10 that I would -- you know, I would probably do,
11 you know, if you ask me if I wanted to have the
12 final answer on this. But the downside would be
13 more uncertainty because you're going beyond
14 your data set. You're using other people's data
15 or you're using, you know, data that is less
16 grounded in a solid pattern such as the one that
17 you have for your foundational estimate.

18 So you're just going a little bit beyond, a
19 little bit more uncertain and your level of
20 tolerance for this may vary. And in this case
21 we just didn't go there, but it doesn't mean
22 that it's a bad idea. But that's what gives us
23 a little bit more confidence in our conclusions
24 of a conservative estimate for prevalence.

25 (MJM) And, Martin, correct me if I'm wrong,

1 but one cost or one result of, you know, adding
2 in those other assumptions and other variables
3 would be larger confidence intervals, I imagine;
4 right?

5 (MB) Yeah, that's what I mean by uncertainty
6 too; right? And, you know, if the scenarios
7 that we have from 15,000 to 23,000 seems large,
8 it would get even larger and larger as we add
9 corrections to our estimates, like, it trickles
10 down the board.

11 MS. ROSE: And, Madam Registrar, could we just scroll
12 down a little bit just so that we can see the
13 entirety of table 9. Thank you.

14 Q And so this range for the province of BC, the
15 lower bound of the smaller scenario is 15,014?

16 A (MB) Yes.

17 Q And the upper bound for the larger scenario is
18 23,448?

19 A (MB) That's our full range.

20 Q And so could you explain to me what a confidence
21 interval is?

22 A (MB) Yes. Well, it's a strictly statistical
23 term for the model applying, you know, the
24 equation to the data, if you will, or -- and
25 trying to estimate -- a point estimate. We'll

1 create this point estimate through running maybe
2 I -- I don't know how to compare this, but
3 simulations of the data if you will, where we
4 would try to get it right at least 95 percent of
5 the time. And in order to get it right, this
6 point estimate 95 percent of the time, we're
7 going to accept a certain range that would be
8 true 95 percent of the time. So saying, for
9 example, that the population in scenario 1 of
10 people who are exposed to fentanyl based on the
11 data that we had is found between 15,014 and
12 then 15,948 would be correct based on these data
13 and this model 95 percent of the time.

14 So I think that's the way to understand
15 this. It's a pure statistical confidence
16 interval. It gives us statistically some
17 confidence but in practice if the estimate is
18 20,000 and beyond the range of the confidence
19 interval, it's also plausible and the fact that
20 it's fairly tight, it's only 1,000 difference
21 between the lower bound and the upper bound,
22 it's a function of the data too. The fact that
23 we have so many interviews and re-interviews.
24 When you apply a capture-recapture model to
25 these data, we're seeing the same people over

1 and over again.

2 So the estimate doesn't go wild, and the
3 confidence interval and the simulations of what
4 the estimate could be stay within a range that's
5 very close to each other but it's a function
6 of our capture patterns more than a real
7 confidence in the data, if you will. It's a
8 statistical confidence.

9 Q So in this scenario 1 that you were just
10 describing with the BC estimate, the number is
11 15,480 plus or minus about 460; is that a fair
12 representation?

13 A (MB) Yes. Correct.

14 Q Okay. And are you aware of any studies with
15 respect to fentanyl in Canada that do attempt to
16 provide the full scope by introducing additional
17 corrections, as you say?

18 A (MB) In terms of fentanyl I'm unaware.

19 Q And, Dr. Milloy, I see you're shaking your head.

20 A (MJM) I'm also unaware of similar work from
21 across Canada. There have been some other
22 smaller cross-sectional studies, so studies that
23 only operate on a specific single time point,
24 which have investigated sort of fentanyl
25 prevalence in different populations outside the

1 Downtown Eastside, but none to my knowledge that
2 have done capture-recapture work in the same
3 sort of way.

4 Q And is there data on the size of the population
5 of individuals who use are or exposed to
6 fentanyl in other North American cities?

7 A (MJM) None that I am aware of. Maybe Martin has
8 seen them, but none that I've seen.

9 (MB) It's extremely rare. It's -- and the
10 hurdle, the main hurdle is -- and this also
11 comes back to what the cohort studies were
12 allowing us is to -- by the urine screening
13 allowing us to see even people who are unaware
14 that they use fentanyl and they would answer no
15 to the self-report question, then we could
16 include them in the study. So that's one of the
17 reasons is it's a unique aspect of this study
18 that allow us to do that.

19 And at the same time you have other ways of
20 getting at a full population based on
21 proportions and multiplier methods. And I'm
22 pretty sure even if we're unaware of these
23 studies that they could be attempted one way or
24 another, but we are not aware of a
25 fentanyl-specific study on prevalence done in

1 that way.

2 Q And this trait that you describe as being a
3 unique one to your study of being able to use
4 the urine screening in addition to
5 self-reporting, that's important because, as you
6 say, it was perhaps 90 percent or more of
7 individuals who were unaware that they were
8 exposed to fentanyl?

9 A (MB) Yes. And 90 percent or more in the cohort
10 studies. And if you look at the literature,
11 there were many drug-screening studies and
12 drug-checking studies done by various
13 researchers in Vancouver and our numbers
14 converge. Like, if you test at Insite for
15 individuals who accept that a part of the
16 substance that they bring is tested for fentanyl
17 content, you get the same types of numbers too.
18 The vast, vast majority of the substances that
19 are tested in Vancouver during those years
20 contain fentanyl. It's -- and more rarely do
21 they contain heroin. Like, it's -- the more
22 rare phenomenon is that it actually contains
23 heroin. And so as Dr. Milloy said, it replaced
24 fentanyl -- heroin almost entirely in the
25 content of these mixtures that people are using

1 in the Downtown Eastside.

2 So to use, for example, most of the surveys
3 relying solely on self-report, we would have
4 been unable to do that study unless you make an
5 assumption about people who report using heroin
6 than being also fentanyl, people who were
7 exposed to fentanyl. You have to make that
8 assumption. And in our case we didn't have to
9 because literally almost everyone who reported
10 either heroin and fentanyl use from a
11 self-report point of view also tested positive
12 for fentanyl.

13 MS. ROSE: And, Madam Registrar, I think we can take
14 down the report now. Thank you.

15 Q So as you say, Insite has, you know, some data
16 on this. Are there are other sources of data
17 that exist in BC that could be brought to bear
18 on this study to improve your estimates?

19 A (MJM) There probably are some other data sources
20 which might be useful. As Dr. Bouchard has --
21 you know, has mentioned, we use the provincial
22 distribution of overdose deaths from the coroner
23 as a multiplier to try and extrapolate the
24 number of people who use or are exposed to
25 fentanyl throughout the province. And there

1 are, you know, similar sort of administrative
2 data sources which might be useful.

3 For example, PharmaNet of course is the
4 database of prescribed drug dispensation in the
5 province which captures, I think, almost all of
6 the prescribed drugs that are dispensed on a
7 daily basis to individuals. With access to that
8 we would be able to estimate in quite fine
9 detail the number of people per day or per
10 six-month period who would be accessing
11 pharmacotherapies for opioid use disorder, which
12 is obviously a similar population as to people
13 who are used or exposed to fentanyl.

14 So this might be similar to the overdose
15 numbers, this might be another sort of
16 administrative data source which would, you
17 know, maybe provide a multiplier. And I do know
18 in other settings people have used sort of those
19 treatment details as a multiplier for population
20 estimates.

21 A similar one would be sort of healthcare
22 exposure data. And here I'm thinking ambulance
23 data and hospitalization data for overdoses.
24 Non-fatal overdoses are obviously quite a lot
25 more common than fatal overdoses. You would

1 have to assume certain things about why people
2 were overdosing, but that would probably give
3 you a much more fine-grained multiplier to
4 enable a similar estimate. So PharmaNet data
5 and sort of healthcare access data are probably
6 the two sort of province-wide data sources which
7 might be used in this study.

8 Q And with the PharmaNet data, I take it that that
9 would evidence individuals who have a
10 prescription for either fentanyl or a similar
11 opioid?

12 A (MJM) You could look at that, but you'd -- in
13 that case you would be looking at people who
14 were receiving fentanyl for pain most likely.
15 What you would want to be looking at are
16 individuals who are receiving a prescription for
17 methadone, buprenorphine-naloxone, slow-release
18 oral morphine and other pharmacotherapies that
19 treat opioid use disorder.

20 So that -- so in common terms you would be
21 looking at the number of people who are addicted
22 to heroin and fentanyl. And so that would be --
23 you know, that data would be available in
24 PharmaNet. And certainly I'm aware of, you
25 know, other settings which have used that sort

1 of dispensation data to come up with population
2 estimates.

3 Q And what would be the metrics that you would be
4 pulling from that data? Is it, you know,
5 frequency of use per day? Is it the amount?
6 What would be enlightening about the use of that
7 data?

8 A (MJM) What you would get is the number of people
9 in a given geographic area who have accessed
10 that medication, say, at least once in the past
11 year, which would give you -- and Professor
12 Bouchard, please jump in if I'm, you know,
13 wandering too far from where I should be. But,
14 you know, I think what it would do is it would
15 allow you by health authority or by a smaller
16 jurisdiction to understand the number of people
17 in the total population who have accessed these
18 medications and therefore likely have a
19 diagnosis of opioid use disorder. And so that
20 would give you a population proportion for each
21 area which could serve as a multiplier from
22 other data sources similar to how the overdose
23 data works.

24 Q It would allow you to do a bit of a correction,
25 as Dr. Bouchard was explaining.

1 A (MJM) It is. Because the other thing of course
2 you could do is we could go back into the cohort
3 data, and we also collect data -- self-reported
4 data on people's exposure to these medications,
5 and so then we could do a similar sort of
6 exercise to take -- to go from the cohort data
7 using these multipliers to extrapolate to a
8 province-wide estimate.

9 Q And would that be worth doing in your view?

10 A (MJM) In my view, yes, that would be worth
11 doing.

12 Q And could you just expand on why that might be.

13 A (MJM) Well, I mean, Professor Bouchard should
14 jump in here, as he is the expert in this
15 matter. But in my view it would be valuable
16 because this administrative data, you would
17 be -- it would be consistent across the
18 province, for one. There would be obviously
19 some people who are living with opioid use
20 disorder who are not diagnosed who are in
21 treatment, but those proportions can be
22 estimated with some certainty. And so it
23 would -- you know, it would allow you to, at the
24 very least, see the convergence between the
25 different estimates which would give you sort of

1 more of an indication of the -- of where the
2 truth ultimately lies.

3 (MB) That's a great answer, and if I may
4 just add. The main multiplier that we used, we
5 were looking for something consistent across the
6 province for, you know, health authorities, and
7 it was the number of fatal overdoses. And the
8 data that Dr. Milloy is talking about would be
9 another alternative way of trying to get a sense
10 of the proportion of, you know, people using or
11 exposed to fentanyl in the Downtown Eastside
12 compared to other regions in British Columbia.
13 Is all else equal or are there patterns that
14 vary for some other regions. And they vary in
15 ways that the fatal overdoses data do not
16 capture. And this would be valuable also for
17 that reason to give us another type of anchor
18 point that we trust where there's some level of
19 consistency across regions and that we can apply
20 to make those inferences.

21 Q Right. So to better understand whether the
22 incidence of overdose deaths that are
23 attributable to fentanyl use or exposure are
24 consistent from the Downtown Eastside to other
25 areas of the province?

1 A (MB) Right.

2 Q I see you are both nodding your head. Is that a
3 yes?

4 A (MB) Yes.

5 (MJM) Yes.

6 Q Okay. So I'd like to turn now to the reason why
7 the commission is interested in this, of course,
8 which is the revenue that is derived from these
9 estimates. So can you describe the sources of
10 data both from the cohort study and others for
11 how you learned about the price of use of
12 fentanyl and/or down and the revenue that's
13 being generated from that.

14 A (MB) Yes. So we -- what is critical in trying
15 to get an estimate of retail expenditures is to
16 get a proportion of individuals who use the
17 drugs daily, so how many people are there,
18 because they spend the most -- of course the
19 most money on these substances compared to
20 others. And a small variation in the proportion
21 of those daily users will have, you know, a
22 significant impact on the estimates at the end
23 of the day.

24 So we wanted to have a good proportion of
25 daily and non-daily users, and the cohort data

1 allowed us to do this because there are specific
2 and detailed questions on the amount of days
3 that people used over the course of a month. So
4 we broke down our estimates into daily; near
5 daily, so four or five times a week; and
6 frequent users, which is about once to twice a
7 week, our estimate. So that's the first thing
8 that we did.

9 And then we attributed a certain pattern of
10 use per day of use for these three categories of
11 people using the literature for the most
12 part and using price data from the Vancouver
13 Police Department. We used the literature
14 because the cohort data asked a general question
15 of the participants in the cohorts based on the
16 number of dollars spent per day of use, which is
17 either over or under \$50. And it was not
18 necessarily fentanyl specific. As you know, few
19 people first, you know, reported using fentanyl.
20 So they would answer this for probably their
21 drug of choice, but at the same time were not
22 asking for which drugs. You know, the cohort
23 studies were interested in how much are people
24 spending, and the very specific amount that they
25 are spending may not be as material as knowing

1 that at least \$50 of their money is spent on
2 drugs in a day.

3 But for the purpose of, you know, estimating
4 the size of retail expenditures we want to be as
5 specific as possible. So looking at the
6 patterns of use, so how many -- what's the
7 quantity of down per day of use for daily users.
8 How many times are they using and how many --
9 what's the quantity per use. And there are
10 studies on this of course in the literature.

11 And because we have the price per, I guess,
12 dose, you know, a half a point would be about
13 \$10 and then a point, which could be seen as a
14 dose, is about \$20 in Vancouver. And people who
15 are daily users would use at least four times
16 maybe a day to maintain a high. So of course
17 heroin as a high can last a bit longer than
18 fentanyl. But for all purposes that's what our
19 basic assumption of frequency of use was and
20 there was convergence, again, from the
21 literature on, you know, what that might be.

22 So we came up with a quantity per type of
23 user per month of use. So if you use .4 grams
24 per day and you're a daily user times 30 days --
25 you are going to use 12 grams in a month, if you

1 are a daily user. And a study from ten years
2 ago, you know, the cohort studies, US studies,
3 those amounts come back over and over. So that
4 seemed to be consistent across the board.

5 And then we also had specific price data
6 from VPD. And a price per gram is estimated to
7 be \$160 in Vancouver for a gram of down.
8 Whether it's considered to be heroin or
9 fentanyl, it's the same price. And these
10 substances are mixed together, as you know. So
11 we were able to multiply this 12 grams per month
12 times \$160 per gram in order to get the retail
13 expenditures for daily users in a month in
14 Vancouver Because we had the -- or in British
15 Columbia because we had that prevalence estimate
16 from before.

17 And then we calculated this over the course
18 of a year for these users and we repeated this
19 process for frequent users or near daily and
20 infrequent users, those users that was -- those
21 people who used, you know, once a week or a bit
22 less than near daily. And overall by, you know,
23 combining these estimates we came up with this
24 range of 200 million -- 2-, \$300 million of
25 retail expenditures for people who were exposed

1 to fentanyl in British Columbia in 2017, 2018.

2 Q And so you described the fact that the cohort
3 study only asked the question of do you spend
4 more or less than \$50 a day, but you nonetheless
5 were able to use previous studies on patterns of
6 heroin use. What was the study that was used
7 for that purpose?

8 A (MB) We used RAND Corporation study by authors
9 Greg Midgette, Jonathan Caulkins, Beau Kilmer
10 and Steven Davenport, if I recall. And this is
11 a major study that's published every few years
12 in the US. It's called "What America's Drug
13 User Are Spending on Illegal Drugs." And so
14 that's one of the studies we use.

15 There is a study by Stockwell, University of
16 Victoria, which in 2010 was called "The Price of
17 Getting High in BC." Extremely consistent with
18 those American data, you know, because the
19 pattern of use for a daily heroin user is the
20 same across the world.

21 The price data that was used in the US study
22 was 152 per gram and for Vancouver we just used
23 the Vancouver data, which was 160. Extremely
24 consistent again. So --

25 Q When you say "the Vancouver data," you mean the

1 data from the Vancouver Police Department on
2 street price?

3 A (MB) Yes. Yeah, those are the data that we used
4 for prices.

5 Q And you're able to be confident that the -- this
6 Midgette study will be the same as in Vancouver
7 or in BC because this pattern of opioid use is
8 so consistent throughout the world, or are there
9 other reasons for why you're able to be
10 confident in using that data point?

11 A (MB) Well, the consistency goes beyond the
12 Midgette study or the Stockwell study in
13 British Columbia or all of the studies from the
14 BCCSU Centre, UBC, SFU researchers;
15 San Francisco, Dan Ciccarone. All of those
16 studies that report frequency of use per day for
17 daily users speak in terms of at least three to
18 five times a day for a heroin user. It's
19 extremely consistent in terms of patterns of
20 use. So there's that consistency as well.

21 The Midgette study in particular was
22 interesting because it used also urinalysis from
23 the original study called the ADAM study. But
24 it's based on a very specific population of
25 heavy users in the United States but with very

1 detailed questions. So on each occasion of use
2 how much was there, what was the dose, the
3 quantity, the price paid. So the data that they
4 used was fairly specific and that's why they
5 used it over and over in their studies in the
6 US. So that gave us also a fair bit of
7 confidence. But the amount of convergence was
8 extremely high across the board.

9 Q Right.

10 MS. ROSE: Madam Registrar, could we please refer to
11 the report at page 60, which is page 62 of the
12 PDF. I'm looking for table A6. Yes, that's the
13 one.

14 Q So could either of you explain what this table
15 shows.

16 A (MB) Well, I can start. Those are the data
17 provided by the Vancouver Police Department.
18 This is what they use to -- as a dollar value
19 for different quantities of fentanyl and heroin
20 for three years. So you can see, for example,
21 that you may find a packet that is, you know, a
22 1 point or a half point for \$10 or 20, which is
23 a number that is also reported in the cohort
24 studies as what people pay for down on the
25 street.

1 The data also show the price increase for
2 different quantities. So if you go up to 1
3 gram, which is a quantity that we used, it's
4 \$160 per gram whether it's heroin or fentanyl,
5 it doesn't vary. And then it goes to --

6 Q The street price is the same for both?

7 A (MB) For both. And it goes up to the kilogram
8 level, which are data that we didn't use because
9 we were interested in retail expenditures. But
10 this is what -- the dollar value that I guess
11 the Vancouver Police Department are observing in
12 their line of work for the wholesale-level
13 prices.

14 Q And are you able to comment on the -- are these
15 the domestically manufactured prices of
16 fentanyl, or is this imported prices of
17 fentanyl?

18 A (MB) Yeah, for the -- it doesn't matter for the
19 retail level, it's the same price. Each packet
20 will contain just a small, small amount of
21 fentanyl, which can be unfortunately enough to
22 produce -- to overdose. But at the wholesale
23 level what these data seem to show is a
24 different price for what would be domestically
25 manufactured fentanyl in a lab here in

1 British Columbia, which I assume would be, you
2 know, a quantity of fentanyl that is more pure
3 or closer to the sort of pure fentanyl substance
4 for the kilogram. So much more potent. And
5 they report a price of \$280,000 for a kilogram
6 of domestically produced fentanyl, which I
7 assume it high purity. And as far as the
8 kilograms of fentanyl that they find at the
9 border, so imported here in British Columbia,
10 the price for those has been fairly consistent
11 around \$70,000 for a kilogram of fentanyl or
12 heroin. That would be the imported price. So
13 already adulterated with other substances.

14 Q And so -- just so I can track this, the
15 domestically manufactured price is listed at
16 footnote A in this table; is that right?

17 A (MB) Yes.

18 Q And you mentioned that the adulterated fentanyl
19 that might be found at the border is between 70-
20 and \$80,000?

21 A (MB) According to these data, yes.

22 Q And what about the unadulterated imported value?

23 A (MB) There is no value reported for this sort of
24 situation in these data.

25 Q Okay. Are you aware of any other sources that

1 might list this data point?

2 A (MB) I certainly did not have access to any
3 other sources, and I'm unaware personally of a
4 price list that would be an alternative to this.
5 I'm not sure if M-J knows any other.

6 (MJM) I would imagine the RCMP would have a
7 similar list, but certainly that's not something
8 I've ever seen or had access to.

9 Q Right. Turning to page 47 of the report, which
10 is table 11. Could either of you walk through
11 this table and describe what we see here.

12 A (MB) Yes, I can. Certainly. So we have -- we
13 find our two scenarios that we had earlier and
14 then -- so in scenario 1, for example, in the
15 first row if you follow to the end for the
16 column total, you have our 15,480 middle point
17 estimate for the number of people exposed to
18 fentanyl in scenario 1. And you have that same
19 number in scenario 2 at 22,764.

20 The difference with this table is now we
21 broke down the number of users between daily,
22 frequent and infrequent users. So you can see
23 here that we had 34 percent or -- in the cohort
24 studies of the people who reported using every
25 day. We had 30 percent who were near daily

1 users, so four or five times a week. And we had
2 36 percent who were infrequent users who were
3 reporting to use opioids less than that. So
4 those proportions are the same across the board
5 whether we use one scenario or another.

6 So based on this we were about to apply what
7 we discussed earlier, which was the dollar
8 amount that is spent per month and per year for
9 each of these types of participants. So
10 starting from scenario 1, 5,263 daily users, we
11 were able to estimate the retail expenditures
12 for this group to be \$124 million, or close to
13 125- to round it up. So those 34 percent daily
14 users in our data accounted for 61 percent of
15 retail expenditures, which is a typical pattern
16 of course because they use so much more than
17 others, so even a small number of them will
18 account for a large proportion of expenditure.

19 So we repeated this for every type of users.
20 So our range of 200- to 300- comes from scenario
21 1 and scenario 2 creating that range between
22 200 million -- or 203- in the last column for
23 total when we add up for each category of users
24 their own retail expenditure. So in scenario 1
25 we have 203 million. In scenario 2, we have

1 299-. So this is what this table is showing.

2 Q So that's the ultimate range that your study
3 arrives at is this between the 200- -- in
4 scenario 1, \$203,601,000 and the upper end is
5 close to \$300 million?

6 A (MB) Yes.

7 Q And this is Canadian dollars?

8 A (MB) Yes.

9 MS. ROSE: And let's just briefly, Madam Registrar,
10 turn to page 45 of the study just to see
11 table 10, which I believe is the -- where some
12 of the data in table 11 comes from.

13 Q This the patterns of use that you were
14 describing before?

15 A (MB) Yes, exactly.

16 Q And so could you walk through what this is
17 showing us?

18 A (MB) Yes. So we broke down -- so the daily,
19 frequent and frequent users are broken down
20 here, and then -- now you can see how many days
21 they needed to use in order to qualify to be in
22 one category or another. And then the important
23 number may be for a daily user, for example, is
24 that they use 12 grams per month. And that
25 12 grams per month multiplied by \$160 gives us

1 the amount of dollars spent by this category for
2 each month of use which is the second row,
3 called "expenditures (\$CAD), by month," which is
4 1,979. So each month if you are a daily user of
5 down you will spend close to \$2,000 on these
6 drugs. Over the course of a year it gives us an
7 estimate of around \$23,000 spent on this
8 substance for this group.

9 And we repeat the same process for frequent
10 and infrequent users. Of course they use a
11 little bit less than others per month overall
12 and what was -- you know, we capture, for
13 example, that near daily users use just under
14 half of what the daily users are using. So
15 5.5 grams per month multiplied by 160, so they
16 spent 10,000 on these substances per month. And
17 then 5,000 for the infrequent users.

18 So that's what this table is giving us, and
19 we also have that comparison with the US study
20 in US dollars, what they used.

21 Q And so if we turn back to table 11 which is at
22 page 47, two pages down. We can see these
23 numbers showing up in the "daily," "frequent"
24 and "infrequent" columns there.

25 A (MB) Yes.

1 Q And so this range of 200 to 300 million, can you
2 explain a little bit about why this range is as
3 large as it is and whether in your view the
4 range is either conservative or on the higher
5 end?

6 A (MB) Yeah, so it's as large as it is based on
7 the two scenarios. We wanted to make sure that
8 we had the two scenarios represented because we
9 didn't want to have to necessarily decide on the
10 two scenarios because there was no basis to
11 decide. We wanted to make sure we had a range.
12 And so the 200 to 300 million we think is
13 conservative based on two reasons. The first
14 reason is, again, we think we were capturing a
15 narrow-ish proportion of the people exposed to
16 fentanyl over the course of a year. So that
17 remains, right, because these numbers are
18 following us across the board. If it's
19 conservative on a prevalent side it may be also
20 conservative, you know, in calculating retail
21 expenditures.

22 The other reason that is added just for this
23 exercise, this table, that we think is also a
24 bit conservative is the proportion of daily
25 users that we have. Which is in this case, as

1 you can see in this table, 34 percent, which is
2 lower than many, many studies of opioid user
3 populations where the proportion of daily users
4 would be much larger.

5 In the American study, for example, it's
6 90 percent of daily users. And so combining
7 frequent and daily users could give us, you
8 know, about 85 percent, closer to that
9 90 percent that they have and maybe our data is
10 a bit more specific. Maybe it's Vancouver and
11 it's a bit different. But in this case the
12 34 percent daily users which, you know, gives
13 us -- which takes a very significant amount of
14 expenditures, the fact that it's so low, you
15 know, produces an estimate that we think is also
16 on the conservative side.

17 And so in the report, for example, we
18 conducted sensitivity analyses. So what if this
19 number of 34 percent is brought up to
20 50 percent. How much does that change our
21 estimates? And of course from an estimate of
22 200 to 300 million we would add 30- to
23 \$40 million if that proportion of 34 is in fact
24 50 percent, so much higher than we think. So
25 that is one way in which we think it's also on

1 the conservative side is that our proportion of
2 daily users seemed to be on the lower side in
3 terms of proportions compared to other studies.

4 Q And the American study that you are referring
5 to, is that the STRIDE report in 2016?

6 A (MB) it's the Midgette report in 2019 based on
7 the ADAM data. That was the last ADAM study
8 that was detailed enough for them to assign
9 dollar amounts per type of user for every day of
10 use. And this ADAM data is capturing a large,
11 large proportion of daily users.

12 So what they do in the end is they apply a
13 correction factor. What they call -- in that
14 report they call them chronic drug users, CDUs.
15 Those are the daily users that we have here.
16 And they say well, we have 90 percent of CDUs,
17 we apply a correction factor in order to account
18 for the use of the infrequent users that we're
19 not capturing with this data.

20 So that's one correction factor that they
21 apply, for example, to their own data that we
22 didn't apply here. We just basically used the
23 proportions as they were in the cohort studies.

24 Q Right.

25 MS. ROSE: And, Madam Registrar, could we turn to

1 page 15 of the report, so 17 of the PDF. And if
2 we scroll down just a little.

3 Q So in the second-to-last paragraph here your
4 report states:

5 "After calculating consumption from total
6 expenditures (per year) and street prices
7 for heroin reported by System to Retrieve
8 Information from Drug Evidence (STRIDE),
9 the nation-wide estimate for heroin
10 expenditures was \$USD 43 Billion."

11 Is that the same report as the Midgette study
12 which is described in the paragraphs preceding
13 this one?

14 A (MB) Yes, it is. The STRIDE portion is the name
15 of a data set just like ACCESS, VIDUS, ARYS, and
16 it's specifically on prices in the US. So
17 that's what it refers to. But in the Midgette
18 report, which we describe in that section, they
19 come up with an estimate for heroin retail
20 expenditures of 43 billion.

21 Q And the reason that that is so much larger than
22 the figure you arrived at, is that, as you say,
23 because of the proportion of daily users
24 captured in the study?

25 A (MB) That's part of it. Well, the first thing

1 is of course the population of the US. So their
2 estimate is for all the States in the US, so it
3 covers the population of United States as a
4 whole, and our study covers British Columbia.
5 So I think is it would be -- the order of
6 magnitude would be 70 times the number of people
7 that is -- that are covered by their estimate
8 compared to us. So 5 million for BC, 4.5 give
9 and take, and 330 million people in the US. So
10 it's a ratio of about 70, 75 depending.

11 So, for example, you could take our dollar
12 amounts of 200 million and 300 million and
13 multiply by 70 or 75 in order to be on the same
14 level to compare, I guess, apples with apples.
15 And in that case our estimate would be what is
16 at the lower end of their estimate. So around
17 15 to 20 billion would be the equivalent of
18 200 million to 300 million in British Columbia
19 compared to that estimate. So if it would be
20 the United States, we would multiply by 70, 73.
21 We would get right at the lower end of their
22 estimate.

23 So if you read the report I think their
24 lower bound is 17 billion and their upper bound
25 is 85. So the 43 sits in the middle of this.

1 And using our 300 million, which is our upper
2 bound, multiplying by 73 to account for the
3 population difference, all else equal, gets us
4 at the lower bound, around 20 billion for that
5 estimate. And so if you factor after this the
6 fact that they had correction factors for
7 infrequent users and they had a larger
8 proportion of daily users that they accounted
9 for than us, then that brings us right in the
10 range of what they estimated.

11 So that's also another reason we think ours
12 is conservative, but it's conservative to the
13 extent that our upper bound estimate at a
14 constant population, what gets us on the lower
15 bound of their estimate but still within the
16 bound of their estimates of their study.

17 Q And so in comparing your numbers to this study,
18 it lends further credence to your conclusion
19 that your study is quite conservative and
20 perhaps a floor to estimates; is that right?

21 A (MB) That would be correct. Although, you know,
22 I would be remiss if I didn't mention that they
23 use a different methodology, different data set,
24 different context and it's also for heroin as a
25 whole. You know, it's all kinds of differences

1 that I would provide nuances, but on the whole
2 this contributes to our impression that our
3 estimate is conservative indeed.

4 Q And on this page as well, in the middle
5 paragraph that we have on the screen here,
6 there's a description of an inflation factor
7 that was added in this US study to factor in
8 non-cash transfers. Can you describe why that
9 study would have included that correction factor
10 and what it's role might be with respect to your
11 study.

12 A (MB) Yeah, it's a very good point. It's
13 something that -- you know, because we didn't
14 apply any correction factors, we also did not
15 apply a correction factor for non-cash
16 transfers. So when you're given, you know,
17 down, when you're trading down and there's no
18 money exchanged between hands and -- those
19 things exist. And so the way that we proceeded
20 and one of the assumptions of our report is that
21 for every person who was exposed to fentanyl
22 over the course of that study period we multiply
23 every one of their transactions. Like daily
24 they spent a certain amount, monthly they spent
25 a certain amount, every one of those has a

1 dollar value attached to it. So -- and that's
2 an assumption that inflates to the extent that
3 there are, you know, a significant proportion of
4 gifts or non-cash transfers, then we would
5 exaggerate the dollar amounts. Even with our
6 conservative estimates that's one way in which
7 our estimates may not be conservative is if
8 non-cash transfers are so common that it changes
9 the sort of big picture estimates that we have
10 at the moment. So that's what they did there
11 with that non-cash transfer factor.

12 So in this case just to -- in this case it
13 inflated their estimates because they said well,
14 this is a quantity of heroin that exists that
15 we're not accounting for, but it exists. And if
16 we're thinking in terms of, you know, the amount
17 of money that is available, say, for money
18 laundering down the road when it transfers to
19 dealers, then it's a way in which you're
20 inflating because that amount of money was not
21 exchanged. So it was product for product. So
22 depending what you want to consider, it's either
23 an inflation or a deflation factor because --
24 yeah.

25 Q And do either of you have a sense of the

1 think that it's going on, but the extent to
2 which it may have affected the estimates I
3 think, in my view, are -- can't really be
4 quantitatively considered without more data.

5 Q And are there other studies that seek to
6 evaluate the amount of money British Columbians
7 or Canadians are spending on fentanyl or on
8 opioids generally, either licit or illicit?

9 A (MJM) I'm not aware of any. Certainly, you
10 know, licit fentanyl use would be gathered and
11 collected and reported through various
12 pharmacoeconomic studies. As for illicit use,
13 again I'm not aware of any studies that have
14 attempted to do that, but Professor Bouchard may
15 be more informed than me.

16 (MB) In terms of what is published at the
17 moment and what we could find when we were
18 writing the report, we didn't find anything
19 specific enough to answer that question. And it
20 doesn't mean that it's not part of surveys, but
21 it may not have been published in that form.
22 And sometimes, you know, the studies that are
23 really useful for this or, you know, may have
24 the question but they may not have published an
25 article yet that would be available to us to

1 figure that out.

2 So nothing very specific in terms of that --
3 where we could tell apart the bartering and the
4 gifts in ways that would be quantifiable. It
5 would be qualitative. It would be reported in
6 an article as existing but not necessarily
7 something that could be quantified for our
8 purposes. That's the difference.

9 Q So in terms of seeking to quantify the amount of
10 money that is spent by British Columbians or
11 Canadians on down or products that contain
12 fentanyl, have either of you been asked to
13 perform this type of estimate before?

14 A (MB) I haven't personally.

15 Q And Dr. Milloy?

16 A (MJM) No, I've not been asked.

17 Q And do you have -- do either of you have any
18 sense of why not?

19 A (MB) Maybe I can start. The question of amount
20 of dollars spent in the cohort studies being 50
21 over and under, you know, one reason is it may
22 be difficult for people to recall exactly how
23 much is spent or not. It's also a sensitive
24 question to some extent. So in that way, you
25 know, it limits some of that methodology being

1 available. And then it's based on the interests
2 of researchers and the availability of a study
3 like the cohort study, for example, in order to
4 tap into a significant proportion of people who
5 are using these substances to get us a good idea
6 and something that would be then published in
7 that form. So it takes a number of steps.

8 And of course we come back to the hurdle
9 specific to fentanyl which is people may not be
10 aware. They may not buy fentanyl per se but a
11 mixture called down. And purity data may be
12 available for some seizure, you know, in police
13 or health, you know, Canada-based databases that
14 we didn't have access to certainly for the
15 study.

16 So there's a combination of data that needs
17 to be available, and then there's the recency of
18 fentanyl as a crisis that comes into play. So
19 by the time that we realized that fentanyl is
20 there to stay and that studies need to be
21 conducted, you know, we're just five years into
22 the first few years where we'd accelerated in
23 terms of -- in the province here. So we're
24 still in the early stages in a way,
25 unfortunately, so we don't have this sort of raw

1 data available just yet, but I think that's a
2 step in that direction today.

3 MS. ROSE: And, Madam Registrar, I forgot to request
4 earlier that we take down the report now. I
5 don't think we need it in front of us right now.
6 Thank you.

7 Q And, Dr. Milloy, you know, I appreciate this
8 question involves a bit of speculation, but do
9 you have a sense of why it is that this sort of
10 study has not been done before, why you've not
11 been asked to perform this type of work before?

12 A (MJM) Yeah, it does involve a bit of
13 speculation. What I would offer, though, is
14 first of all the fact that the cohort studies
15 are not designed as economic studies. And as,
16 you know, Dr. Bouchard has pointed out, there
17 are a number of, you know, scientific challenges
18 around generating sort of robust and accurate
19 data around expenditures. And to be frank, you
20 know, because of the objectives of the cohorts,
21 we have not invested sort of the time and effort
22 required to overcome those difficulties.

23 Chief among them is just the question of
24 recall. You know, Dr. Bouchard has mentioned of
25 course that this sort of data is sensitive, and

1 so people may not want to tell us accurately how
2 much they're spending on drugs. But I think the
3 larger question is simply people are unable to
4 correctly remember. To be honest I can't
5 remember what I had for lunch last Tuesday.
6 Certainly I think if you ask the typical person
7 in our study how much they spent on drugs two
8 months ago, I think they would probably have a
9 difficult time coming up with that.

10 These cohorts do a lot of things well but
11 are really focused originally on HIV prevention
12 and treatment, and then more recently on
13 overdose prevention and especially sort of
14 uptake of treatments for substance use
15 disorders. Obviously how much people are using
16 and how much they're spending is a relevant
17 factor there, but it's not the primary concern
18 of ours.

19 So we're very pleased that we were able to
20 use this data and that Dr. Bouchard was able to
21 generate such a good report off of this data,
22 but it's not the central activity of the
23 cohorts.

24 Q Right. And I already asked you this question
25 with respect to arriving at an estimate for the

1 persons who use or are exposed to fentanyl but
2 I'll ask it again with respect to that data as
3 well as the price and revenue data. What other
4 data sources would you need to improve the
5 study, you know, to the extent that you're aware
6 of those data existing or not existing. What
7 data would you need to really improve your
8 estimates here?

9 A (MB) Yeah. Maybe I can start. A little bit
10 more specific spending behaviour data would be
11 helpful, as Dr. Milloy mentioned. There are
12 challenges but that's certainly a way forward.
13 Data points and survey data from other regions
14 in British Columbia. You know, it was a
15 partnership between, you know, myself and the
16 research assistants who worked on this, like
17 Mitch Macdonald, Carlos Ponce and then the other
18 PIs from the other cohorts that are part of the
19 report. It's not that easy to put this
20 together, so that was really productive for
21 everyone.

22 But then to the extent that studies exist in
23 other parts of British Columbia, you also have
24 to bring all of these people in, and the data's
25 a little bit different. So that would be --

1 that's one of the challenges but ideally you
2 would try to take into account not just the
3 patterns of use in the Downtown Eastside for the
4 cohorts but what are the patterns of use in
5 Victoria, what are the patterns of use in the
6 Okanagan, and then, you know, factor that into
7 the estimates instead of assuming that everyone
8 uses in the same way.

9 You would also need purity data on fentanyl
10 and then -- so instead of assuming that all else
11 is constant and that the mixture of down has
12 fentanyl -- so that's what we did, right; we
13 just stopped there -- you could also break it
14 down for -- in more specific ways with more
15 granular data. So how much fentanyl is there.
16 Is it two milligrams. Is it .05. What is it on
17 average. What is the distribution of those
18 quantities. And I believe Health Canada would
19 have some of these data available.

20 So what is the actual proportion of fentanyl
21 in those mixtures would be extremely helpful.
22 And does it vary across the province. So the
23 fact that we have 45 percent overdoses in the
24 Downtown Eastside compared to the rest of
25 Vancouver, is that a high number or should we

1 expect a lower number, you know, based on the
2 services, the harm reduction, the sort of
3 attention to harm reduction in the Downtown
4 Eastside compared to other regions. Are people
5 using a lot more in other regions and then
6 creating situations where more overdoses are
7 happening because of this compared to the
8 Downtown Eastside, or is the product more
9 volatile here. And those variations in the
10 proportion and traces of fentanyl in those
11 mixtures would be an extremely helpful piece of
12 the data that we would need.

13 So as far as our estimates, this is what I
14 would mention. And as far as future studies,
15 well, then we're getting to the other side in
16 terms of money laundering. What are dealers
17 doing with the revenues that they're generating.
18 How much is spent on, you know, just basic
19 living, subsistence, and how much are they using
20 some of these revenues for buying money
21 laundering services. And so we have absolutely
22 no data on this, so that's why our report was
23 stopping where we stopped. We're fairly
24 confident that we can capture retail
25 expenditures for this population.

1 Now, what about the other side. And that
2 other side is a whole different ball game.
3 There's no cohort study that can help you to
4 capture what dealers are doing and their
5 behaviour in terms of spending. These data
6 don't exist; they have to be created.

7 Q And one thing we haven't spent that much time
8 talking about today is the purity issue that you
9 mentioned.

10 MS. ROSE: And so I might take us -- Madam Registrar,
11 if you could take us back to page 60 of the
12 report, which is page 62 of the PDF at table A6.
13 And so I see -- you might need to zoom in just
14 once.

15 Q I see that there's a note underneath the table
16 which say that the lethal dose range for
17 fentanyl use/exposure is approximately 0.05 to
18 2 milligrams, and there's variation in
19 street-level purities. So could either of you
20 expand on this and just explain how there might
21 be a range in the adulteration and fentanyl and
22 how that would impact the price data and the
23 patterns of use that you've reported on in this
24 report.

25 A (MB) Dr. Milloy, are you able to comment on

1 lethal dose range for fentanyl maybe to start
2 the discussion.

3 (MJM) Yeah, so lethal dose is a measure of
4 toxicity. And so it's commonly expressed as
5 LD50, which is the dose required to kill half of
6 the subjects. Obviously typically it's
7 expressed in -- using rats or other small test
8 mammals. And so -- and it exists for, you know,
9 most substances, certainly for fentanyl as well
10 as diacetylmorphine.

11 As I mentioned previously, the challenge
12 with estimating the lethal dose for substances
13 from the unregulated market is that they are of
14 varying purity and varying potency. Here it
15 suggests that the lethal dose for fentanyl is
16 .05 to 2 milligrams. This isn't very useful
17 because lethal doses are typically expressed per
18 kilogram of body weight, so I'm not really sure
19 how they arrived at these estimates.

20 The lethal dose in -- for pharmaceutically
21 pure preparations of fentanyl is estimated --
22 for a human is estimated to be approximately
23 2 milligrams per kilogram of body weight, so I'm
24 not sure what relationship it is here. So that
25 is lethal dose. And obviously it would be --

1 there would be similar values for heroin, which
2 would be smaller, I would imagine, than the
3 values here for fentanyl.

4 (MB) I think that answers the question from
5 my end. And those were the proportions reported
6 in the VPD data that we obtained. And to see
7 this as a per kilogram quantity would be
8 probably useful, but then we would be
9 speculating on what the intent was for -- from
10 the VPD.

11 Q And I take it that the reason or one of the
12 reasons why this discrepancy has salience is
13 that -- if you're seeking to purchase down and
14 you're purchasing a half point, for example, and
15 according this table, you know, you're paying
16 \$10 for that, you can't be sure how much
17 fentanyl is contained within that half point.
18 It might be -- it might vary significantly. And
19 I don't know if either of you have a sense of
20 how much it might vary.

21 A (MJM) Unfortunately I've never seen data of that
22 nature for the simple reason to my understanding
23 that typical sort of street-level drug-checking
24 services typically are qualitative. That is
25 they assess whether or not a substance is in a

1 drug. But they don't report, because it's much
2 more difficult to do so, the concentration of
3 substances within a given sample. So I've never
4 seen reports of, you know, the concentration of
5 fentanyl within given samples.

6 (MB) That's right. And these data if they
7 exist, if I may add, would be on the coroner's
8 side of things in these analyses, and those are
9 not necessarily published. That's why we can't
10 speak to these data specifically. But I'm
11 certain that these data exist at the
12 BC coroner's office.

13 Q Right. And, Dr. Milloy, when you discussed
14 drug-checking services, I understand that that's
15 a service that's provided by Insite in that if a
16 user of a street drug such as down were
17 concerned about what the product they purchased
18 might contain, they would be able to take that
19 to Insite and Insite would test the drug for
20 them; is that right?

21 A (MJM) Yeah, the services -- that's the general
22 way one of the services operates, and these
23 services are operated by both public and private
24 entities. Vancouver Coastal Health, BC Centre
25 on Substance Use, Insite has a drug-checking

1 service.

2 At its crudest form, drug-checking services
3 are test strips, so little paper strips that
4 individuals can dip into their drug solution
5 which will -- based on the colour the strip
6 turns will tell the individual if the solution
7 contains fentanyl or not.

8 More comprehensive services involve
9 quantitative -- sorry, qualitative testing using
10 an FTIR device -- that's the one we have at
11 Insite -- which will report the specific
12 substances that are in that sample. Not also
13 fentanyl but also adulterants and other
14 contaminants. But, again, they don't contain --
15 they don't estimate the concentration of the
16 sample or the concentration of the drugs in the
17 sample; they only estimate a presence or
18 absence.

19 Q Right. And so if you are trying to deduce the
20 exact price of fentanyl that data would not
21 allow you to arrive at a figure for that?

22 A (MJM) No, not using those sorts of test services
23 which are -- I mean, they are set up to alert
24 people to the presence or absence of fentanyl.
25 And so the question of well, how much fentanyl

1 is in it is certainly useful for these sorts of
2 economic activities but less useful on the --
3 sort of the harm-reduction level. And also
4 difficult to do. I mean, for sort of these
5 user-based services you would obviously want to
6 provide an answer as quickly as possible and not
7 spend hours trying to figure out what is in the
8 sample.

9 Q Right. Understood. And, Dr. Bouchard, when
10 you're referring to the coroner's data, I take
11 it there might be some concerns with the data
12 that is found in, for example, blood levels upon
13 an overdose because it might be difficult to
14 ascertain how long the substance had been in the
15 individual or how broken down, if I can use a
16 non-scientific term. How much the body had
17 broken down the substance before they arrived at
18 the facility that could test the levels.

19 A (MB) I think that's a fair representation of
20 what would be the difficulties also in using
21 this. I don't think it's insurmountable but --
22 and I would be very curious to see these data
23 and how to make them comparable across
24 individuals and across different situations and
25 contexts and also the variations in the other

1 substances that are found. Because when the
2 BC coroner is saying that we have overdoses that
3 are -- in which the individual -- the traces of
4 fentanyl have been found, there are other
5 substances that are found often at the same
6 time. But it means that at least at a minimum
7 fentanyl or, you know, in the family of fentanyl
8 was found in this individual. But there are,
9 you know, other substances as well that are
10 included if you look at these reports. So it's
11 another difficulty with these data.

12 Q And so this table that we have before us that
13 lists prices that -- they're really prices of
14 down rather than prices of the pure fentanyl.
15 And the data source that you describe of the
16 BC Coroner Service might not be perfect but
17 might nonetheless advance the research and
18 better understanding what the price of a pure
19 gram of fentanyl might be. Is that right?

20 A (MB) Yes. As well as Health Canada analyses of
21 purity from seizure data or, you know, from
22 these sorts of -- when a certain amount of down
23 or fentanyl is seized at the border or by a
24 police service, part of that substance is sent
25 to Health Canada for analysis as well and that's

1 used in court data as well for specific cases.

2 So these data also exist and may be amenable
3 to answer that question. So when we seize a
4 certain package at the border, how much fentanyl
5 is there and what else is present in those
6 packages. And when we seize drugs on the
7 street, you know, what kind of adulteration is
8 there. What's the proportion or the quantity of
9 fentanyl per packet. So those questions can
10 be -- can certainly be answered in the future
11 using these other sources of data.

12 Q Great. And I -- we took a bit of a tangent
13 here, but I'll just make sure I give Dr. Milloy
14 an opportunity to answer the same question that
15 I posed to you, Dr. Bouchard, which was what
16 other data might you need in order to improve
17 the study, if anything, that hasn't been already
18 covered?

19 A (MJM) Yeah, I would echo what Dr. Bouchard said
20 in terms of improvements. The only one I might
21 add would be, you know, obviously better
22 measures of drug consumption. And certainly
23 there are approaches that are used in other
24 studies which would be valuable. Probably the
25 most well known is sort of an approach called

1 the timeline followback, which is an
2 interviewer-administered procedure where
3 individuals report their drug use per day over
4 the last seven days. And this obviously, you
5 know, generates much more detailed and probably
6 much more accurate data on drug consumption and
7 spending patterns than we have currently in the
8 cohorts.

9 You know, our recall period is six months,
10 which obviously, you know, precludes being able
11 to do that timeline followback for that entire
12 length of time. But certainly I think doing it
13 for the seven days prior to the interview
14 assuming that the pattern would be similar for
15 the rest of the six months I think is plausible
16 and would certainly add to the quality of the
17 data generated by the cohorts.

18 MS. ROSE: And, Madam Registrar, I think we are done
19 with the report for now. Thank you.

20 So, Mr. Commissioner, those are the
21 questions from me. And I'm not sure if there
22 are any -- if there's any interest in
23 cross-examination from any of the other
24 participants.

25 THE COMMISSIONER: Thank you, Ms. Rose. I gather

1 that none of the other participants have
2 indicated they wish to cross-examine either
3 Dr. Bouchard or Dr. Milloy, but I'll leave it
4 open at this point for anyone to identify
5 themselves if they wish to.

6 All right. Hearing nothing, then I think
7 what remains, then, is to thank both
8 Dr. Bouchard and Dr. Milloy for their very
9 helpful evidence and very helpful report which
10 will contribute to the body of work that the
11 commission has to draw on in coming to its
12 conclusions and recommendations. So thank you
13 both very much for your time and expertise.

14 I think we will adjourn now until tomorrow
15 morning at 9:00, Ms. Rose; is that correct?

16 MS. ROSE: Yes, Mr. Commissioner. I did want to flag
17 that the hearings tomorrow are scheduled to
18 resume at 9 a.m. so a little earlier than our
19 usual time.

20 THE COMMISSIONER: Thank you. All right. We will
21 adjourn.

22 THE REGISTRAR: The hearing is adjourned to
23 December 8, 2020 at 9:00 a.m. Thank you.

24 **(WITNESSES EXCUSED)**

25 **(PROCEEDINGS ADJOURNED AT 12:35 P.M. TO DECEMBER 8, 2020)**