



Full length article

Fentanyl and heroin contained in seized illicit drugs and overdose-related deaths in British Columbia, Canada: An observational analysis

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ABSTRACT

Background: Due to the alarming rise in opioid-related overdose deaths, a public health emergency was declared in British Columbia (BC). In this study, we examined the relationship between illicit fentanyl and heroin found in seized drugs and illicit overdose deaths in BC.

Methods: An observational cross-sectional survey was conducted using BC data from Health Canada's Drug Analysis Service, which analyzes drug samples seized by law enforcement agencies, and non-intentional illicit overdoses from the BC Coroner's Service, from 2000 to 2016. Initial scatter plots and subsequent multivariate regression analysis were performed to describe the potential relationship between seized illicit fentanyl samples and overdose deaths and to determine if this differed from seized heroin and overdose deaths. Fentanyl samples were analyzed for other drug content.

Results: Fentanyl is increasingly being found combined with other opioid and non-opioid illicit drugs. Strong positive relationships were found between the number of seized fentanyl samples and total overdose deaths ($R^2 = 0.97$) as well as between seized fentanyl and fentanyl-detected overdose deaths ($R^2 = 0.99$). A positive association was found between the number of seized heroin samples and total overdose deaths ($R^2 = 0.78$).

Conclusion: This research contributes to the expanding body of evidence implicating illicit fentanyl use (often combined with heroin or other substances) in overdose deaths in BC. Policy makers and healthcare providers are urged to implement drug treatment and harm reduction strategies for people at risk of overdose associated with current trends in illicit opioid use.

1. Introduction

Misuse of opioids from both diverted prescriptions and illicitly manufactured sources is a well-documented and rising phenomenon in North America, and numerous studies report increasing opioid-related deaths in both Canada and the United States (Fischer and Argento, 2012; Lake et al., 2015; Manchikanti et al., 2012; Paulozzi et al., 2006; Suzuki and El-Haddad, 2017). Fentanyl, a synthetic opioid 50–100 times more potent than morphine with significantly cheaper production costs than heroin, has come under considerable scrutiny as a prominent contributor to the recent surge in overdose (OD) deaths seen across North America (Frank and Pollack, 2017). British Columbia (B.C.) has historically been the Canadian province with the highest rates of opioid use and opioid-related deaths (Canadian Centre on Substance Abuse,

2015; CBC News, 2018; Dauvergne, 2009; Health Canada, 2014). In B.C., total illicit drug overdose deaths increased from 269 in 2012–931 in 2016 (B.C. Coroner's Service, 2017a). Furthermore, recent studies and anecdotal reports suggest that many people who use drugs are unaware that their opioid source may be contaminated with fentanyl, either because the drugs are intentionally mislabeled as a different substance or because fentanyl may be surreptitiously assimilated into the primary drug of consumption (Amlani et al., 2015; Klar et al., 2016; McKee et al., 2015). The overall escalation in opioid-related unintentional deaths has led to a public health emergency being declared in B.C. by the Provincial Health Officer (B.C. Gov. News, 2016).

While the relationship between illicit fentanyl (synthesized from clandestine laboratories or diverted prescribed fentanyl) and fentanyl-related¹ OD deaths has been well established in certain American

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¹ "Fentanyl-related" OD death is the term typically used in the US and elsewhere in Canada to indicate fentanyl found on biologic testing, and attributes the cause of death to fentanyl.

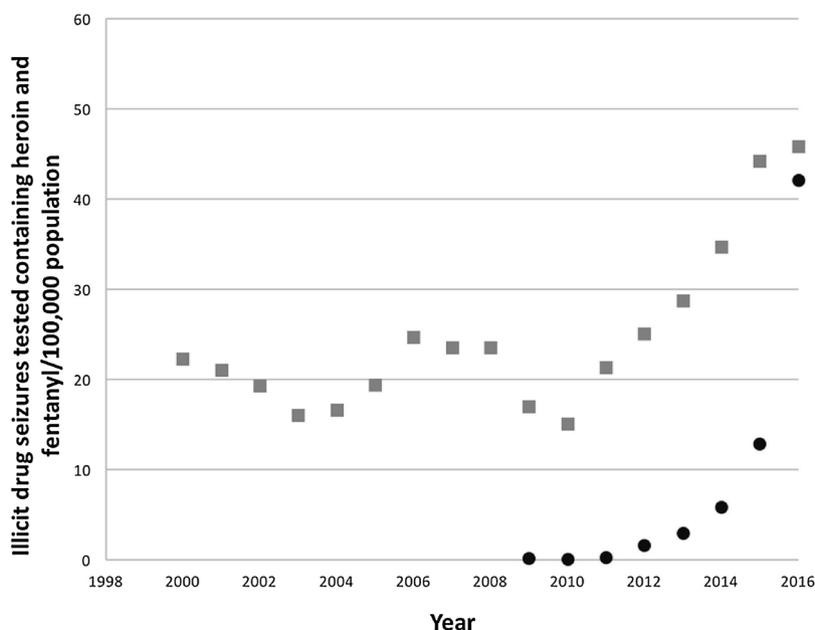


Fig. 1. Illicit drug seizures tested and containing heroin and fentanyl in British Columbia from 2006 to 2016.

*Data obtained from the Health Canada Drug Analysis Service. Circle = Fentanyl, square = heroin.

reports (CDC, 2008; Denton et al., 2008; Gladden, 2016; Hull et al., 2007; Suzuki and El-Haddad, 2017), Canadian data is limited. Although there have been studies suggesting that fentanyl use and fentanyl-related deaths are both increasing across Canada (B.C. Gov. News, 2014; B.C. Coroner's Service, 2017b; Canadian Centre on Substance Abuse, 2015), there are currently no studies examining a possible association between the prevalence of illicit fentanyl on the black market and either the overall rate of OD deaths or of fentanyl-detected² OD deaths. Though there is considerable data detailing the past association between non-fentanyl opioids, such as heroin, and total OD deaths in B.C., there are no data on the relationship with illicit drug seizure (Dauvergne, 2009; Fischer and Argento, 2012; Health Canada, 2014; Lake et al., 2015).

The purpose of the current study is to examine the relationship between seized fentanyl samples (including illicitly manufactured fentanyl along with prescribed fentanyl that is distributed/diverted) and total as well as fentanyl-detected unintentional OD deaths in B.C. Also examined is the relationship between seized heroin and total unintentional OD deaths in the province.

2. Methods

Publicly available data detailing the number of fentanyl and heroin exhibits seized by law enforcement in B.C. per year, from January 1, 2000 to December 31, 2016, were obtained from the Canadian Drug Analysis Service (DAS). The DAS is a federal laboratory that determines the chemical content of non-marijuana samples seized by Canadian law enforcement agencies when a not guilty plea is entered by an accused. Seized drugs are not tested if the accused pleads guilty. Fentanyl and fentanyl free-base were included in the analysis, but fentanyl analogues were not. Detection threshold using liquid chromatography mass spectrometry (LC/MS) was 1 µg/ml. The fentanyl data were further stratified to elucidate the number of exhibits that also contained other illicit drugs (morphine, oxycodone, hydromorphone, cocaine/crack, methamphetamine, but excluding cannabis). We used data detailing seizures of fentanyl and heroin exhibits by law enforcement in B.C. as a

² "Fentanyl-detected" OD death is the term typically preferred by the B.C. coroner service (instead of "fentanyl-related") since it does not presume definitive attribution of the cause of death.

surrogate marker for the prevalence of these substances on the black market.

Data regarding the number of illicit drug unintentional OD deaths in B.C., from January 1, 2000 to December 31, 2016, were obtained from the B.C. Coroners Service (BCCS). These data include accidental overdose deaths attributed to street drugs, deliberate misuse of prescription medications including those obtained by diversion, drugs of unknown origin, and any combination of these sources. These data exclude overdose deaths deemed by the coroner to be intentional from history or circumstance (e.g., note found). Data detailing the number of fentanyl-detected unintentional overdose deaths in B.C., from January 1, 2012 (the first year fentanyl-detected OD deaths were identified in BC) to December 31, 2016, were also obtained from the BCCS (B.C. Coroner's Service, 2017a,b). Fentanyl-detected deaths reported included the metabolite norfentanyl, but fentanyl analogues were not tested for. Detection threshold for both fentanyl and norfentanyl using LC/MS was 1 µg/ml. Because both of the data sources used in this study (DAS and BCCS) were publicly available, ethics approval was not required for this project.

Scatter plots were first utilized to establish temporal trends for seized fentanyl, seized heroin, overall OD deaths, and fentanyl-detected OD deaths. A regression analysis was then performed using R^2 as a measure of association to determine if there was an association between the number of seized fentanyl samples and total OD deaths, seized fentanyl and fentanyl-detected OD deaths, and seized heroin and total OD deaths. All calculations were performed using Microsoft Excel for Macintosh, version 15.32.

3. Results

The number of seized heroin exhibits in B.C. fluctuated between 2000 and 2010, but it has been increasing steadily since then and tripled from 2010 to 2016 (Fig. 1). Since seized illicit fentanyl in B.C. was first reported by the DAS in 2009, the number of samples has increased exponentially from 6 samples reported in 2009–1,997 in 2016 (Fig. 1). Similarly, the number of seized fentanyl exhibits that are combined with other illicit drugs has been increasing since 2009, as has the variety of different illicit drug types with which fentanyl has been found, primarily mixed with heroin (Table 1). In addition, there is a notable rise in the finding of fentanyl mixed with stimulants (cocaine/

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