

# Temporal Correlation Between Opiate Seizures in East/Southeast Asia and B.C. Heroin Deaths

## A Transoceanic Model of Heroin Death Risk

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### ABSTRACT

**Background:** Because heroin supply changes cannot be measured directly, their impact on populations is poorly understood. British Columbia has experienced an injection drug use epidemic since the 1980s that resulted in 2,590 illicit drug deaths from 1990-1999. Since previous work indicates heroin seizures can correlate with supply and B.C. receives heroin only from Southeast Asia, this study examined B.C. heroin deaths against opiate seizures in East/Southeast Asia.

**Methods:** Opiate seizures in East/Southeast Asia and data from two B.C. mortality datasets containing heroin deaths were examined. The Pearson correlation coefficient for seizures against each mortality dataset was determined.

**Results:** Opiate seizures, all illicit drug deaths and all opiate deaths concurrently increased twice and decreased twice from 1989-1999, and all reached new peak values in 1993. Three B.C. sub-regions exhibited illicit drug deaths rate trends concurrent with the three principal datasets studied. The Pearson correlation coefficient for opiate-induced deaths against opiate seizures from 1980-1999 was  $R=0.915$  ( $p<0.0001$ ), and for illicit drug deaths against opiate seizures from 1987-1999 was  $R=0.896$  ( $p<0.0001$ ).

**Conclusions:** From 1980-1999, opiate seizures in East/Southeast Asia were very strongly correlated with B.C. opiate and illicit drug deaths. The number of B.C. heroin-related deaths may be strongly linked to heroin supply. Enforcement services are not effective in preventing harm caused by heroin in B.C.; therefore, Canada should examine other methods to prevent harm. The case for harm reduction is strengthened by the ineffectiveness of enforcement and the unlikelihood of imminent eradication of heroin production in Southeast Asia.

*La traduction du résumé se trouve à la fin de l'article.*

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Death due to overdose remains the largest mortality risk for heroin users.<sup>1-3</sup> B.C. has been experiencing a heroin and cocaine injection epidemic for about 15 years,<sup>4</sup> during which substantial annual variation of the illicit drug deaths rate has occurred. Local temporal clusters of deaths have been attributed anecdotally to abrupt increases in the 'street' purity of heroin or cocaine, but causes of the wide annual variation in overdose deaths are not documented. Heroin supply changes could impact both the purity and availability of heroin, but because heroin supply cannot be measured directly, the impacts of supply changes on populations is imperfectly understood. Heroin or its opiate precursors that are *seized* by authorities, including police and customs agents, can provide some indication of trafficking patterns, and also can be an indicator of the volume (amount) of heroin trafficked. The purpose of this paper is to examine the temporal relationship between opiate seizures in East/Southeast Asia and B.C. heroin mortality, and to identify implications of that relationship.

The B.C. Coroners Service began tracking basic information on illicit drug deaths in 1987 in response to an apparent increase, and the annual number increased from 26 in 1987 to 361 in 1993, remaining above 220 with substantial variation since then.<sup>4</sup> From 1990-1999, there were 2,590 B.C. illicit drug deaths. B.C. represented only 13% of the 1996 Canadian Census population, but recorded 32% of Canadian illicit drug deaths in 1995,<sup>5</sup> and the highest absolute number (225) and rate among Canadian provinces that year.

Determination of the causative role of heroin in a death can be complicated by many factors. Overdose can be unintentional or intentional. Heroin-related deaths frequently involve other drugs and/or alcohol, some of which have synergistic effects with heroin in causing death.<sup>6-8</sup> Cause of death classification contains multiple sources of error, including lack of standardization of toxicological testing and the definition of overdose.<sup>9</sup> In addition, unknown tolerance of the decedent to opiates at time of death complicates accurate determination of whether heroin toxicity was the principal or a major cause of death.<sup>10,11</sup>

**Opium production, heroin trafficking and seizures, and drug-related deaths**

The United Nations Office on Drugs and Crime (UNODC) has determined that over longer time periods and broader geographical units, trends in opiate seizures tend to correlate positively with indicators linked to trafficking, including drug supply. From 1980-1998, global opium production and heroin seizures by authorities were correlated very strongly ( $R=0.95$ ).<sup>12</sup> Heroin seizures also can correlate with drug-related deaths. In the European Union (EU) from 1985-1997, the number of drug-related deaths and annual heroin seizures correlated very strongly ( $R=0.97$ ).<sup>12</sup>

Most Canadian heroin currently originates from Southeast Asia,<sup>13-15</sup> as has almost all B.C. heroin since the early 1980s (personal communication – Mr. John Ladds, Manager, Drug Analysis Laboratory, Healthy Environments and Consumer Safety Branch, Health Canada, June 10, 2002). The existence of an opiate seizure time-series from East/Southeast Asia (data from Myanmar, China and Thailand) over a 20-year time period provided a basis for examining the relationship between these opiate seizures and B.C. heroin mortality.

**METHODS**

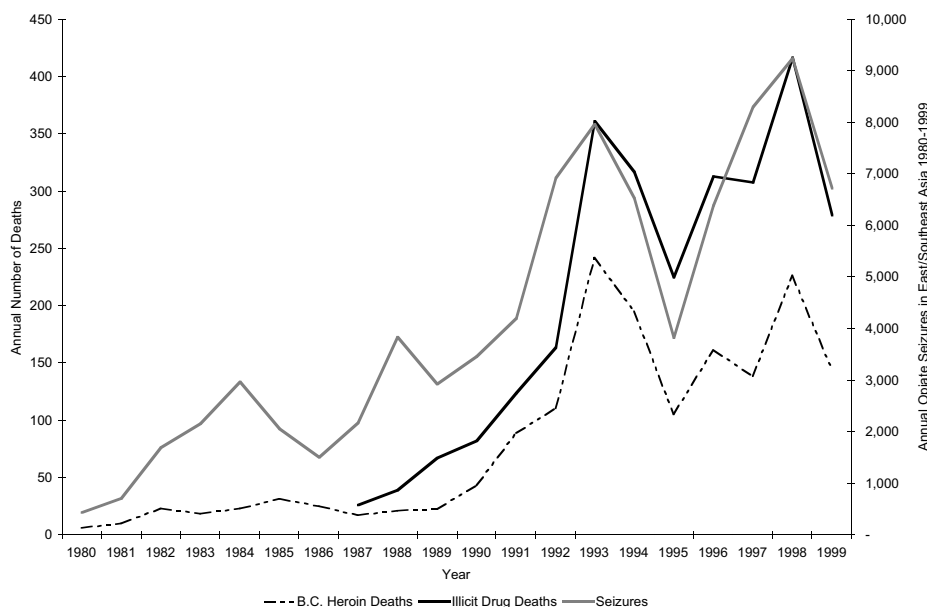
The B.C. Vital Statistics Agency provided annual data from 1980-1999 on ‘opiate-induced’ deaths, which include illicit and prescription opiate-caused deaths in B.C. Data on illicit drug deaths in B.C. from 1987-1999 were provided by B.C.’s Office of the Chief Coroner and include deaths caused by all illicit drugs occurring in B.C.<sup>16</sup> Annual data on seizures of opiates in East/Southeast Asia from 1980-1999, represented in units of their heroin-equivalent (as if they were converted to heroin), were obtained from UNODC.

Descriptive statistics for all datasets were determined. Temporal trends of mortality and seizure data were compared. The Pearson correlation coefficient was calculated for opiate seizures against each mortality dataset and the level of statistical significance was determined. Regional (sub-provincial) illicit drug death trends from 1992-1999 were examined. Mortality data subsets were examined to determine the

**TABLE I**

**Descriptive Statistics for Annual Opiate Seizures in East/Southeast Asia, B.C. Opiate-induced Deaths and Illicit Drug Deaths**

Dataset	Mean	Standard Deviation	Lowest Value	Highest Value
Total Annual Opiate Seizures in East/Southeast Asia 1980-1999	42,000 kg	26,900 kg	4,000 kg	749,000 kg
Number of Opiate-induced Deaths in B.C. 1980-1999	82.5	77.7	6	242
Number of Illicit Drug Deaths in B.C. 1987-1999	209.4	132.8	26	416



**Figure 1.** Opiate seizures in East/Southeast Asia, B.C. illicit drug deaths and B.C. opiate deaths 1980-1999

proportion in each that was classified as suicide, and the proportion of illicit drug deaths involving heroin, alone or in combination with cocaine, alcohol and other drugs.

**RESULTS**

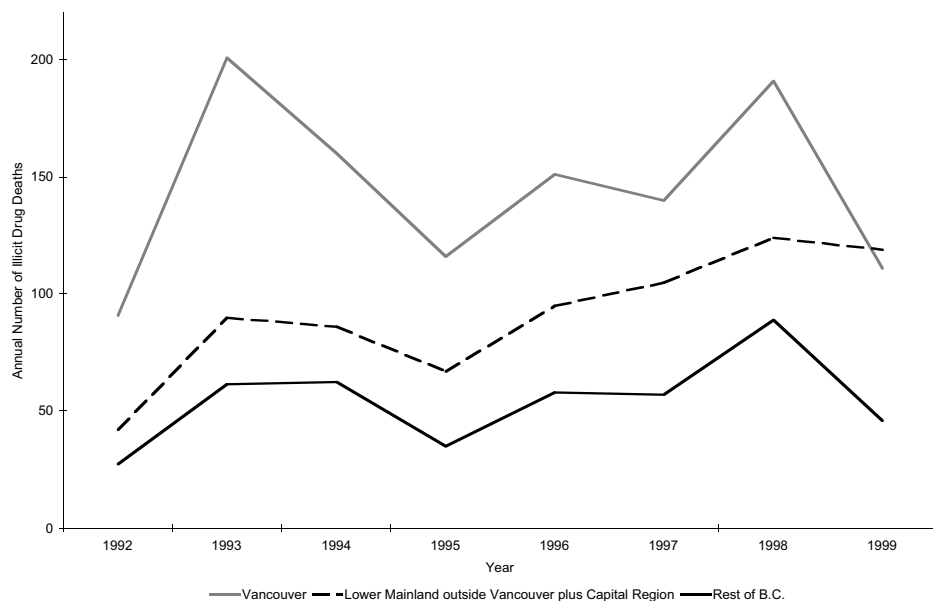
Descriptive statistics for each dataset are found in Table I. Opiate seizures in East/Southeast Asia, B.C. illicit drug deaths and opiate-induced deaths all increased from 1989 to new peak values in 1993, decreased until 1995, increased again until 1998, and decreased again in 1999 (Figure 1). Annual illicit drug deaths in three B.C. sub-regions followed a similar temporal pattern, each exhibiting substantial variation with higher rates in 1993 and 1998, and lower rates in 1995 and 1999 (Figure 2).

The Pearson correlation coefficient for B.C. opiate-induced deaths against opiate

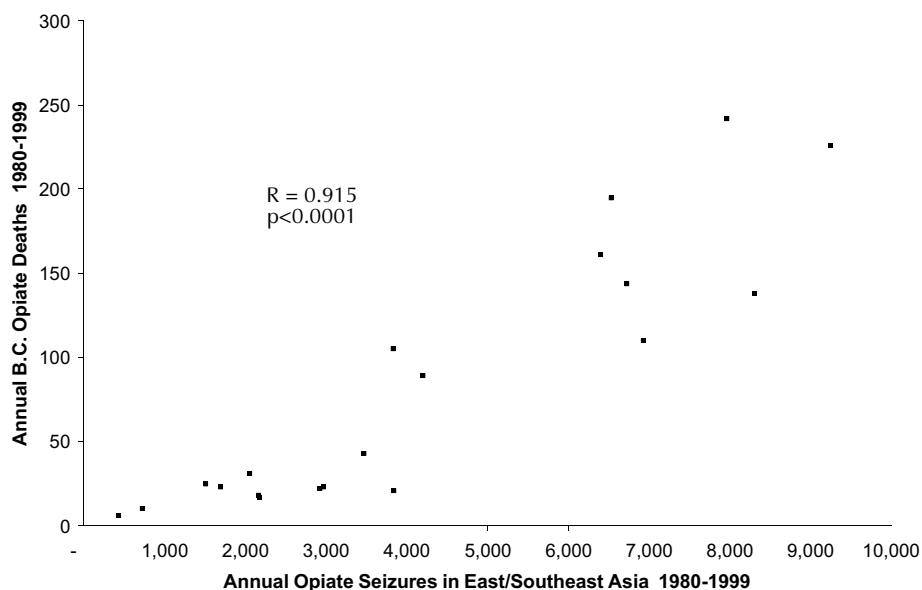
seizures in East/Southeast Asia from 1980-1999 was  $R=0.915$  ( $p<0.0001$ ), while that for B.C. illicit drug deaths against the same opiate seizures from 1987-1999 was  $R=0.896$  ( $p<0.0001$ ). Scatter plots of each of these relationships are shown in Figures 3 and 4.

From 1990-1999, 87.3% of opiate-induced deaths were determined accidental, 7.6% were suicides and 1.9% were undetermined as to intent, whereas from 1997-1999 only 3.1% of illicit drug deaths were classified as suicides. Both unintentional opiate-induced deaths and opiate-caused suicides correlated positively with opiate seizures in East/Southeast Asia over the 20-year study period ( $R=0.91$  and  $R=0.81$ , respectively).

Of the 990 coroners files of illicit drug deaths from 1997-1999, 74% involved heroin, 50% involved cocaine and 17% involved alcohol. Forty-three percent of heroin-involved deaths also involved cocaine (Figure 5).



**Figure 2.** Annual illicit drug deaths in three provincial sub-regions of British Columbia 1992-1999



**Figure 3.** Scatter plot of annual opiate seizures in East/Southeast Asia (in kg - heroin equivalent) against annual B.C. opiate deaths

**DISCUSSION**

From 1980-1999, annual opiate seizures in East/Southeast Asia were very strongly correlated with annual mortality in B.C. attributed to all opiates and illicit drugs. B.C. heroin is of Southeast Asian origin and was trafficked mostly through China and also Thailand during the period studied. The findings correspond to results of similar research using EU data,<sup>12</sup> and illustrate how heroin supply may be an important determinant of the B.C. illicit drug death rate. They should prompt further

investigation, appropriate public health action and international diplomatic intervention.

It is commonly believed that seizures of opiates are protective, and therefore, that a negative correlation between opiate seizures and heroin deaths should exist. While over shorter time periods large heroin seizures may be temporarily protective, over longer periods a positive correlation between opiate seizures and heroin deaths can result if a fairly consistent proportion of opiates are seized. Globally, the average annual proportion of opiates seized as a

percentage of production from 1990-1999 was 12.6% and ranged from 9-17%.<sup>17</sup> In Canada, annual heroin seizures averaged 102 kilograms from 1995 to 1999 and in 2000 the RCMP estimated Canada's annual consumption of heroin at 1-2 metric tons<sup>14</sup> – putting the proportion seized at about 5-10%.

Because B.C. heroin has been almost exclusively of Southeast Asian origin since the early 1980s, the opiate seizure data are relevant to the B.C. context. The two routes identified by UNODC for trafficking of Southeast Asian heroin to North America were: i) overland through China (including Hong Kong and Taiwan) and ii) via Thailand and Hong Kong.<sup>12</sup> Myanmar produced on average 91% of Southeast Asian opium annually from 1994 to 1999,<sup>17</sup> and likely was the source of most B.C. heroin in the 1990s. Whereas a time lag would be expected between changes in opium production and deaths, the time between trafficking in East/Southeast Asia and consumption in British Columbia could be short – perhaps measured in weeks – so no time lag was incorporated to alter the model's synchronous annual basis.

The existence of concurrent increasing and decreasing illicit drug death trends in three provincial sub-regions concurs with regional synchronicity observed elsewhere,<sup>18</sup> and suggests some factor likely impacted the entire province with varying intensity over time. Varying heroin supply has such potential. Using overdose deaths as the health outcome of interest facilitated detection of any temporal association with opiate seizures, especially since heroin likely is consumed soon after its arrival in B.C. The wide annual variation in all datasets also enabled detection of a relationship.

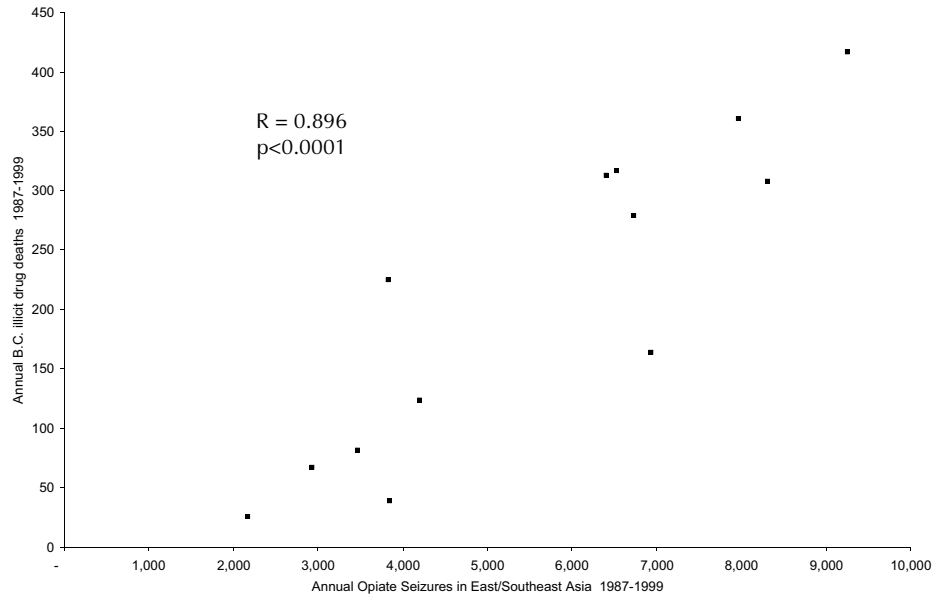
Global seizures of heroin and morphine also correlated strongly with B.C. illicit drug deaths and opiate-induced deaths during the time periods studied (R=0.86 and R=0.78, respectively), but the correlations are stronger with East/Southeast Asian opiate seizure data. Aggregated Canadian heroin seizures from 1992-1999 did not correlate well with either illicit drug or opiate deaths (R=0.21 and R=-0.03, respectively), but these data include Southwest Asian heroin seized in other provinces. An analysis restricted to B.C. heroin seizures should be performed, but data were not available.

More investigation about how illicit drug consumption patterns are affected by heroin supply changes is required. Although in 1993 the peak in B.C. illicit drug deaths was concurrent with increased availability of high-purity/low-cost heroin,<sup>4</sup> it is likely that variations in heroin purity are a more important determinant of the overdose death rate than average purity.<sup>19</sup> Opioid overdose deaths can be an indicator of underlying rates of heroin use,<sup>20</sup> and since purity variations would probabilistically cause heroin overdose, the availability of heroin may be a more important supply-based determinant of the illicit drug death rate. Increased heroin availability would lead to more heroin-containing injections in the population, meaning more chances for deaths to occur.

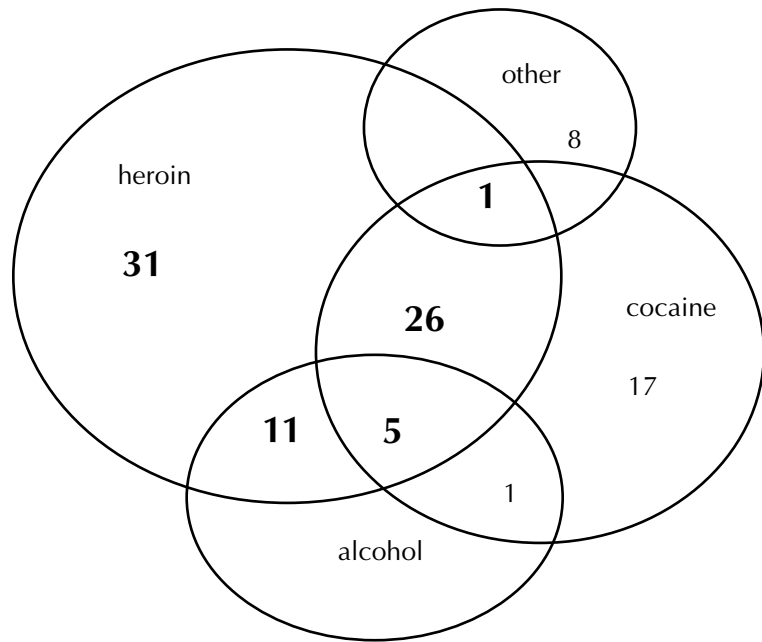
In B.C., frequent cocaine co-injection and variations in use of cocaine and other drugs complicate the picture; however, when frequent cocaine injection was identified as a major risk factor for HIV infection in Vancouver in the mid-1990s,<sup>21</sup> the number of illicit drug deaths actually had decreased from 1993-1995.<sup>4</sup> Since then, the number of illicit drug deaths increased and peaked in parallel with opiates intercepted in East/Southeast Asia, while the number of newly identified HIV cases associated with IDU has decreased concurrently with the expansion of needle-exchange services.<sup>4</sup>

The correlation between seizures and deaths was very strong using either mortality dataset. Coroners Service data may have had higher sensitivity due to inclusion of deaths involving but not attributed to heroin. From 1997-1999, 74% of illicit drug deaths in B.C. involved heroin. Both mortality datasets include non-residents, which also would increase sensitivity. The specificity of B.C. Vital Statistics Agency data is decreased by inclusion of other (especially prescription) opiate deaths, but is increased by exclusion of non-heroin illicit drug deaths. Both datasets exclude deaths due to intoxication-associated unintentional injuries and those attributed to HIV/AIDS contracted through IDU.

The inclusion of intentional deaths in both mortality datasets did not distort the findings significantly, mainly because their numbers are relatively small. Only 3.1% of illicit drug deaths from 1997-



**Figure 4.** Scatter plot of annual opiate seizures in East/Southeast Asia (in kg - heroin equivalent) against annual B.C. illicit drug deaths



**Figure 5.** Percentages of B.C. illicit drug deaths grouped by drug-specific cause of death for 1997-1999.

Note: Heroin was involved in 74% of illicit drug deaths.

1999 were classified as suicides, and whereas the percentage of suicides (7.6%) recorded in Vital Statistics data was higher due to inclusion of prescription opiate suicides, the relationship was robust. Of note, the choice of heroin as a vehicle for intentional death might correlate with heroin availability. From 1980-1999, the number of opiate-induced suicides in B.C. also correlated strongly with opiate seizures in East/Southeast Asia (R=0.81).

**Implications of the findings**

Causation cannot be inferred solely from existence of a correlation, but these findings are evidence that the number of opiate and illicit drug deaths in B.C. could be strongly influenced by heroin supply, and that enforcement does not substantially alter the flow of heroin into B.C. Since the harm caused by heroin is not effectively prevented by enforcement, Canada should examine whether it can be prevented better by other means. Influencing opium pro-

duction should be considered and harm reduction measures should be implemented.

Canada supports UNODC alternate crop development programmes in Southeast Asia, but its participation is limited because it also supports international sanctions against Myanmar's State Peace and Development Council.<sup>22</sup> The importance of both the sanctions and the harm caused by Southeast Asian heroin in Canada should synergistically stimulate further Canadian diplomacy on those issues, but over the short term Myanmar's production of heroin is likely to continue. B.C.'s health system needs to recognize this, and also recognize that enforcement likely will continue to intercept only a small proportion of the heroin supply. Further variations in the illicit drug overdose rate that correspond to heroin supply variations likely will continue. Harm reduction interventions are needed that include a focus on dealing with the potential harmful acute effects of illicit drug injection, especially overdose.

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## RÉSUMÉ

**Contexte :** Vu l'impossibilité de mesurer directement l'évolution de l'offre d'héroïne, on en comprend mal les incidences sur la population. Depuis les années 1980, la Colombie-Britannique est aux prises avec une épidémie d'utilisation de drogues injectables qui a entraîné 2 590 décès attribuables aux drogues illicites entre 1990 et 1999. Des études antérieures ont montré que les saisies d'héroïne peuvent présenter une corrélation avec l'offre, et que l'héroïne sur le marché britanno-colombien provient exclusivement d'Asie du Sud-Est. Nous avons donc comparé les décès causés par l'héroïne en C.-B. aux saisies d'opiacés en Asie de l'Est et du Sud-Est.

**Méthode :** Après examen des renseignements sur les saisies d'opiacés en Asie de l'Est et du Sud-Est et des données de deux fichiers britanno-colombiens sur la mortalité incluant les décès causés par l'héroïne, nous avons appliqué le coefficient de corrélation de Pearson pour comparer les saisies avec chacun des fichiers sur les mortalités.

**Résultats :** Les saisies d'opiacés, tous les décès attribuables aux drogues illicites et tous les décès attribuables aux opiacés ont augmenté deux fois et diminué deux fois en simultanéité entre 1989 et 1999, et tous ont atteints des sommets en 1993. Dans trois sous-régions de la C.-B., les tendances des taux de décès attribuables aux drogues illicites ont évolué en simultanéité avec les trois principaux fichiers étudiés. Le coefficient de corrélation de Pearson pour les décès causés par les opiacés comparés aux saisies d'opiacés entre 1980 et 1999 était de  $R=0,915$  ( $p<0,0001$ ), et pour les décès attribuables aux drogues illicites comparés aux saisies d'opiacés entre 1987 et 1999, de  $R=0,896$  ( $p<0,0001$ ).

**Conclusions :** Entre 1980 et 1999, les saisies d'opiacés en Asie de l'Est et du Sud-Est présentaient une très forte corrélation avec les décès attribuables aux opiacés et aux drogues illicites en C.-B. Le nombre de décès liés à l'héroïne en C.-B. pourrait présenter une forte corrélation avec l'offre d'héroïne. Comme les services policiers ne réussissent pas à prévenir les méfaits de l'héroïne en C.-B., le Canada devrait envisager d'autres méthodes de réduction des méfaits. Celle-ci est d'autant plus nécessaire que les services policiers sont inefficaces, et qu'il est peu probable que la production d'héroïne en Asie du Sud-Est soit éradiquée prochainement.