Wastewater analysis suggests that consumption of fentanyl, cannabis and methamphetamine increased in the early pandemic period

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Results from Statistics Canada's Canadian Wastewater Survey (CWS), which is collected in five major Canadian cities, suggest that these cities have seen an increase in drug consumption since the start of the pandemic. The analysis also indicates that estimates for drug use vary significantly from city to city, suggesting that different cities have distinct drug use profiles.

Moreover, these results signal that the increase in drug consumption may be a contributing factor to the increase in overdose-related deaths. This information will help inform decision makers on public health strategies, allowing public health authorities, law enforcement agencies, and other organizations to target their approach.

The CWS has been testing wastewater samples from various wastewater treatment plants in five cities across Canada (Halifax, Montréal, Toronto, Edmonton, and Vancouver) since March 2019. Analyses of wastewater samples produce estimates of the amount of a given drug metabolite (a chemical made when the body breaks down a drug) entering the wastewater system, which is generally expected to reflect the overall quantity of the drug consumed by the population within a given area (the catchment).

The latest CWS data provide monthly estimates of drug metabolites in wastewater for 14 drugs of concern based on samples collected from March to July 2019 and from January to July 2020. The estimates are based on the amount of drug measured in wastewater (i.e., grams) and presented on a load per capita basis, per day, or levels.
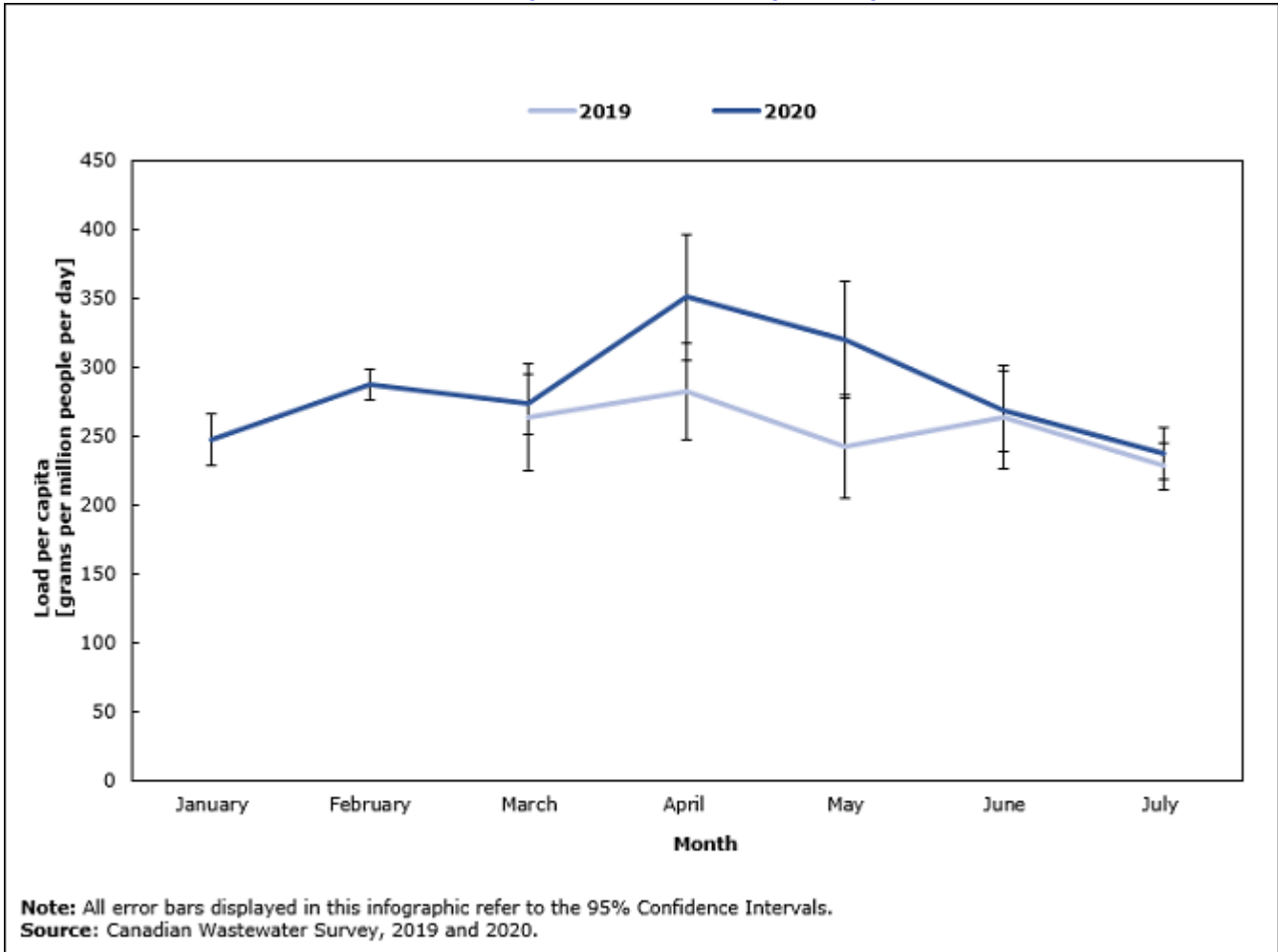
Drug use and the COVID-19 pandemic

Statistics Canada's Canadian Perspectives Survey Series: Alcohol and Cannabis use during the pandemic found that more than one-third of those who had previously consumed cannabis reported that their consumption increased during the pandemic. Furthermore, using data from the provincial and territorial offices of the Chief Coroners and Chief Medical Examiners, the Public Health Agency of Canada recently reported that apparent opioid-related deaths—the majority of which involved non-pharmaceutical fentanyl—were at their highest from April to September 2020, following the introduction of COVID-19 prevention measures. Additionally, recent results from Statistics Canada's Provisional death counts and excess mortality for the period of January 2020 to April 2021, show an increase in deaths caused by unintentional poisonings (including accidental drug overdoses). Results from the CWS are further contributing to this evidence, suggesting that drug consumption increased following the start of the COVID-19 pandemic. Of the 14 drugs measured, the levels of cannabis, fentanyl and methamphetamine were found to have significantly increased early in the pandemic.

Cannabis, which was legalized in Canada in October 2018, is a recreational drug, and by the end of 2020, was consumed by 20% of Canadians aged 15 or older (Statistics Canada's National Cannabis Survey). Results from the wastewater show that the levels of cannabis metabolite (THC-COOH) in wastewater increased in the initial months of the pandemic compared with early 2020 (April and May compared with March), before reverting to pre-pandemic levels (Infographic 1). In April 2020, the load of cannabis metabolite in wastewater was 28% higher than in March 2020.
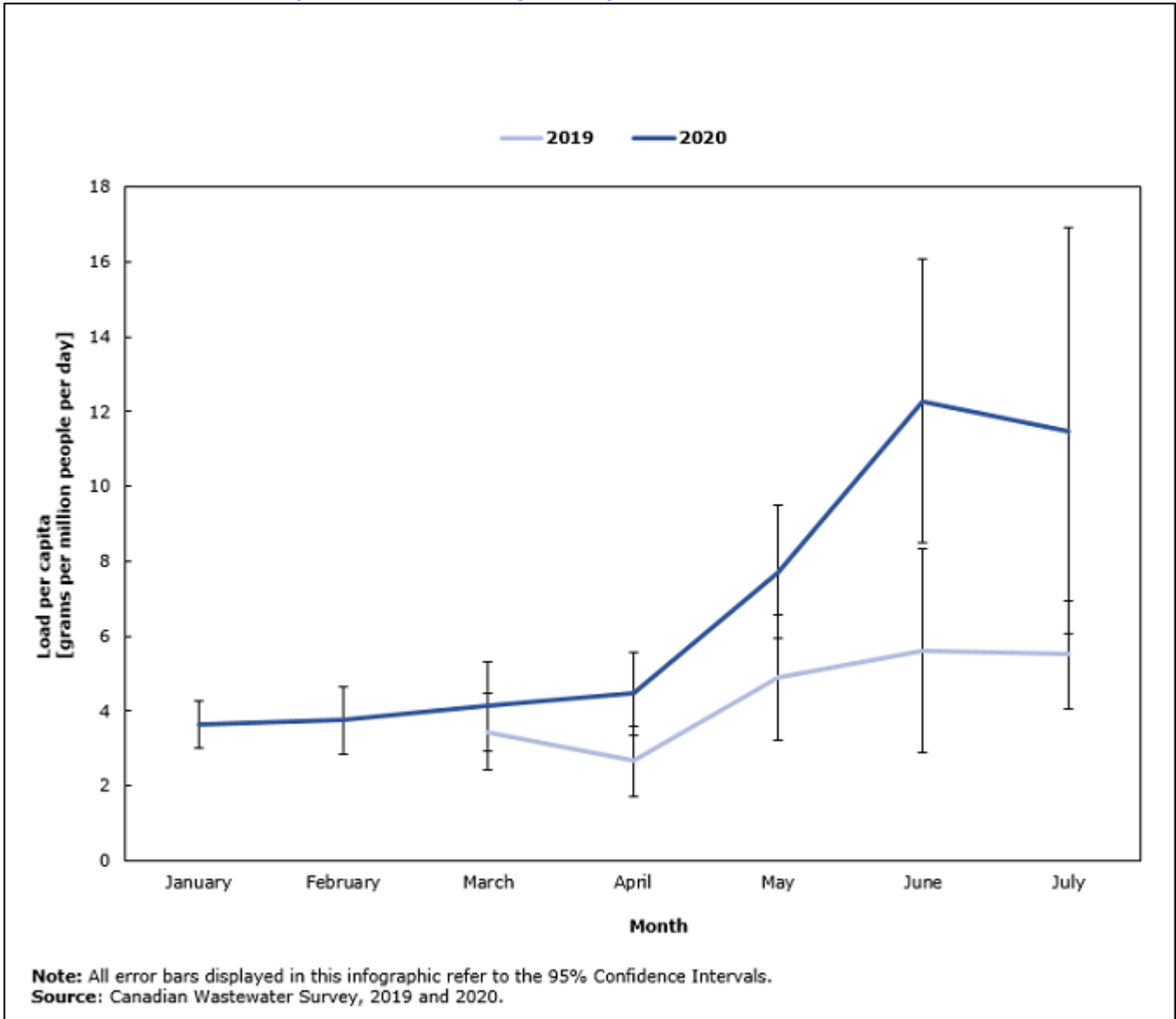
Infographic 1 – Combined cannabis metabolite load per capita for Halifax, Montréal, Toronto, Edmonton and Vancouver, March to July 2019 and January to July 2020

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
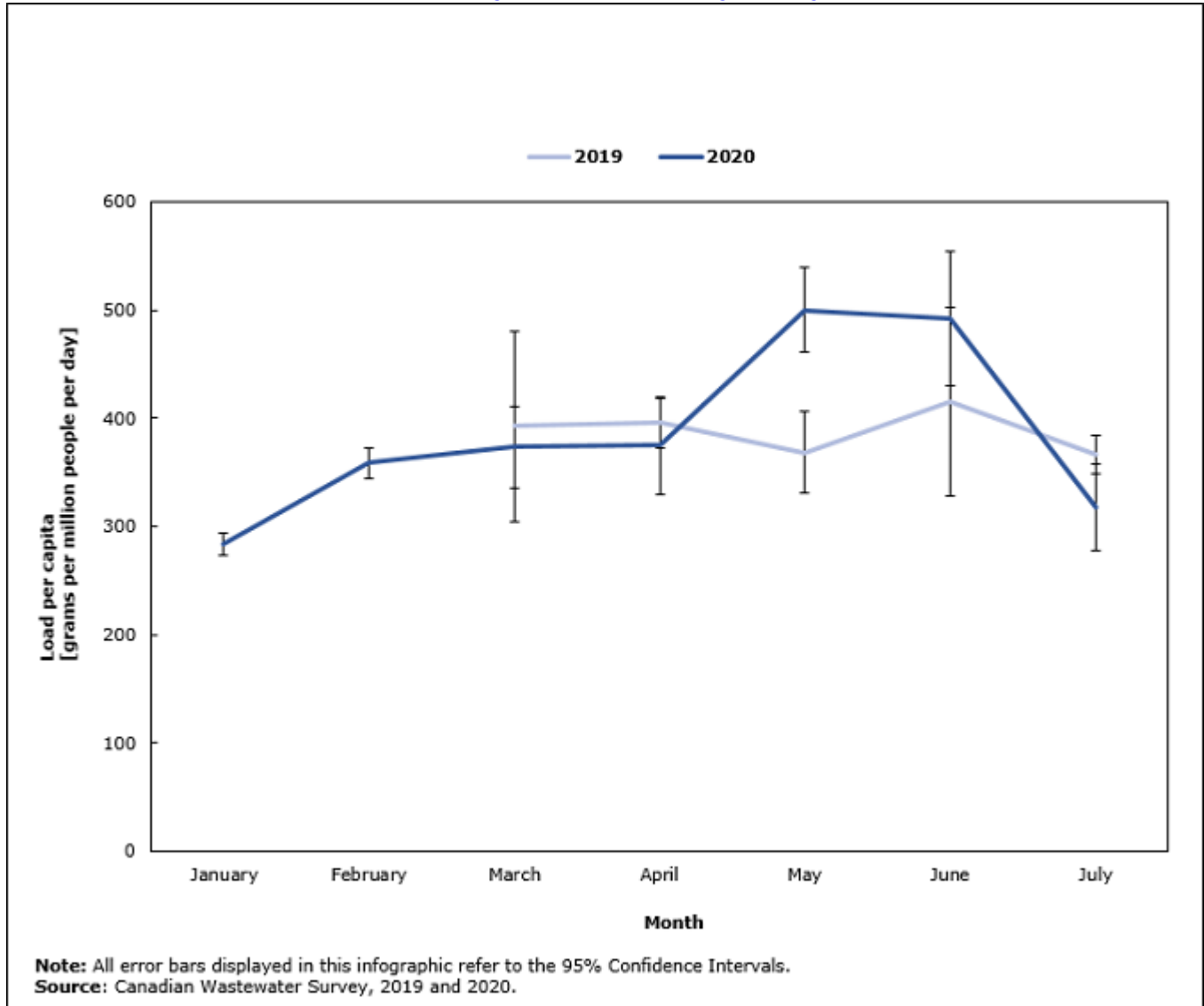**Source:** Canadian Wastewater Survey, 2019 and 2020.

Compared with cannabis, the increase in the wastewater was even more notable for fentanyl (Infographic 2). Fentanyl is a synthetic opioid painkiller that can be medically prescribed to control severe pain, but is also often obtained illegally and misused. Fentanyl is highly potent and can result in death, even in trace amounts. Consequently, its presence in other drugs, sometimes unknown to the user, significantly increases the risk of overdose. On average, wastewater loads of fentanyl in April 2020 were similar to those observed in the months preceding the pandemic, but were almost twice as high in May, and close to three times higher in June and July.

Infographic 2 – Combined Fentanyl load per capita for Halifax, Montréal, Toronto, Edmonton and Vancouver, March to July 2019 and January to July 2020

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
Source: Canadian Wastewater Survey, 2019 and 2020.

Methamphetamine is a potent stimulant known for its psychoactive effects. Methamphetamine levels also rose following the onset of the pandemic, although the increase occurred later (May and June), and dropped below pre-pandemic levels by July (Infographic 3). However, when comparing the early pandemic months with their 2019 equivalents, there appears to be an increase in the loads of methamphetamine in wastewater early in the pandemic.
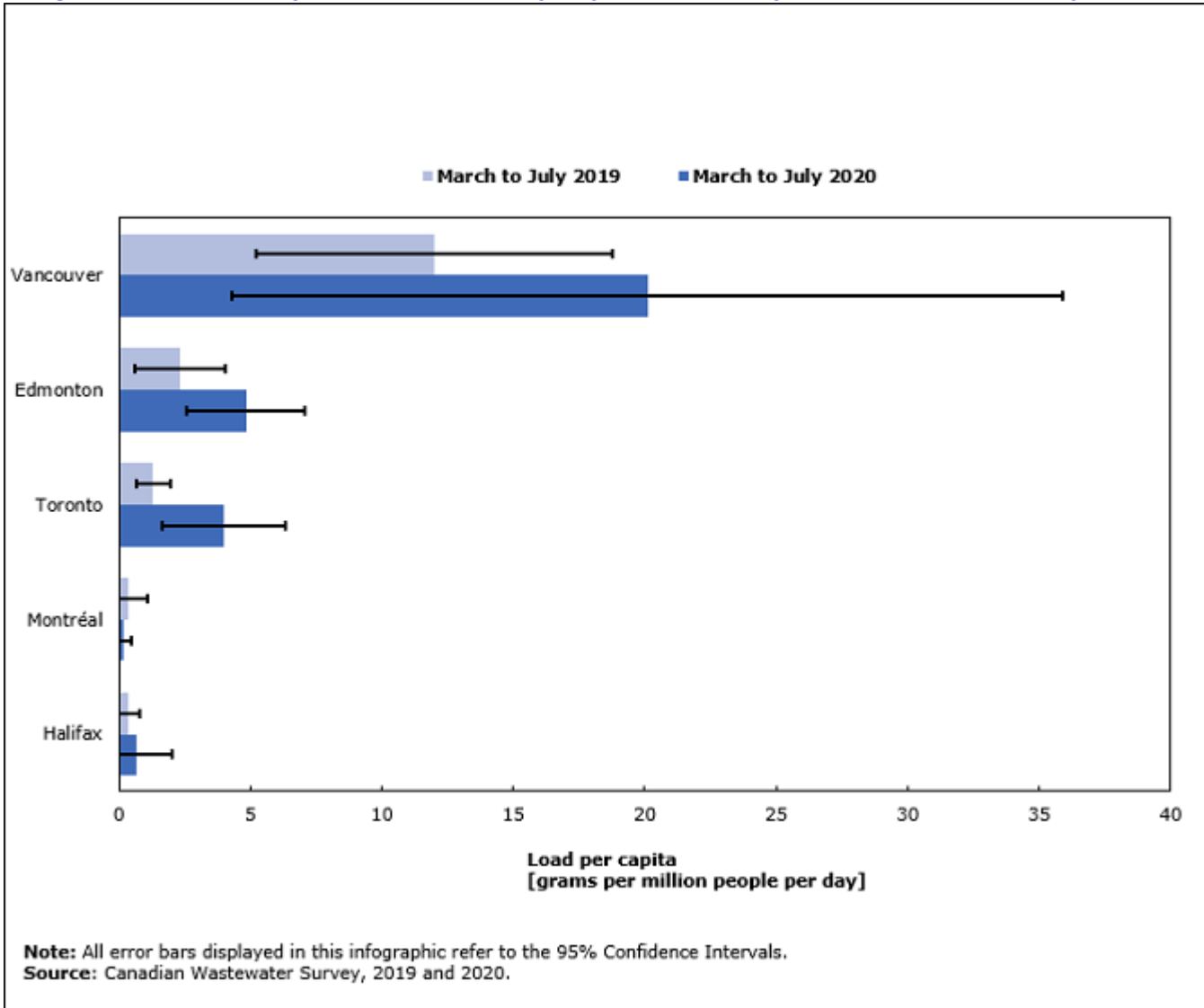
Infographic 3 – Combined Methamphetamine load per capita for Halifax, Montréal, Toronto, Edmonton and Vancouver, March to July 2019 and January to July 2020

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
Source: Canadian Wastewater Survey, 2019 and 2020.

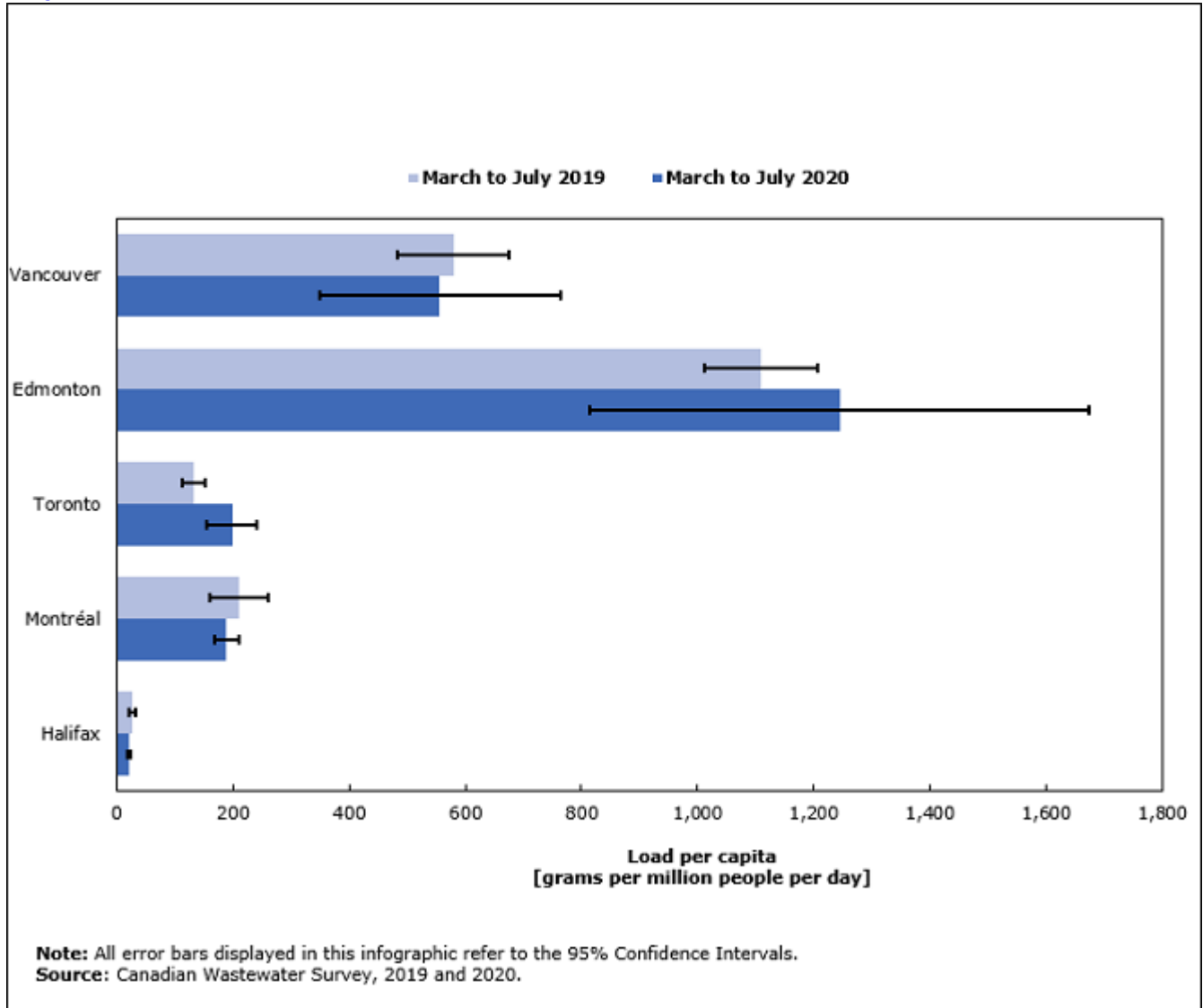## Fentanyl loads highest in Vancouver; Methamphetamine loads highest in Edmonton

While we have seen increases in the loads of certain drugs appearing in wastewater over the period of the pandemic, it continues to be the case that these differ by city. In both 2019 and 2020, per-capita loads of fentanyl in Vancouver were more than four times higher than in any other city (Infographic 4). Edmonton had the next highest levels, followed by Toronto; Halifax and Montréal had the lowest levels.

Infographic 4 – Fentanyl load per capita, by city, March to July 2019 and March to July 2020
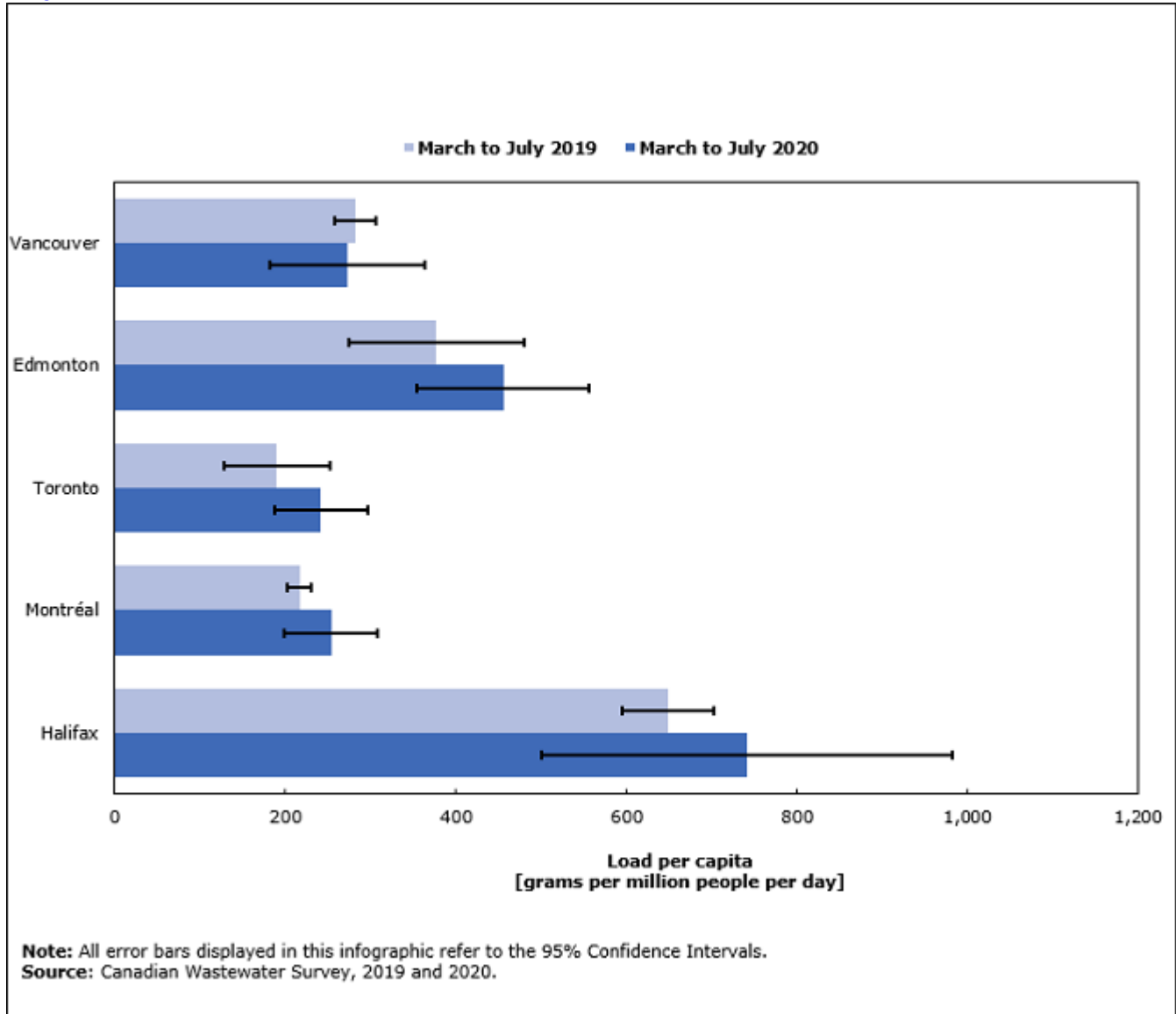

■ March to July 2019   ■ March to July 2020

Vancouver

Edmonton

Toronto

Montréal

Halifax

0   5   10   15   20   25   30   35   40

**Load per capita
[grams per million people per day]**

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
Source: Canadian Wastewater Survey, 2019 and 2020.

In addition, although data from the 2015 Canadian Tobacco Alcohol and Drugs Survey reveal that overall methamphetamine use in Canada is low (0.2%), results from the CWS indicate that methamphetamine loads were highest in Edmonton in both 2019 and 2020, and that per capita, there was approximately twice as much methamphetamine entering the sewers than in Vancouver (Infographic 5). When considering previous data from 2018, results show that the trends remain consistent from year to year and that different cities have different drug profiles (i.e., the types and levels of drugs consumed). Interestingly, this is further supported by data on methamphetamine possession offences. The "2018 Incident-based crime statistics by province" (Statistics Canada 2019) showed that methamphetamine possession offences were highest in Edmonton, followed by Vancouver, Montréal, Toronto, and Halifax; a similar trend by city was observed in this analysis.

Infographic 5 – Methamphetamine load per capita, by city, March to July 2019 and March to July 2020

■ March to July 2019   ■ March to July 2020

Vancouver

Edmonton

Toronto

Montréal

Halifax

0   200   400   600   800   1,000   1,200   1,400   1,600   1,800

Load per capita
[grams per million people per day]

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
Source: Canadian Wastewater Survey, 2019 and 2020.

In contrast, wastewater-based estimates of THC-COOH were highest in Halifax in both 2019 and 2020 (Infographic 6). Edmonton had the next highest levels, followed by Vancouver; in contrast, Montréal and Toronto had the lowest levels. These intercity differences are also consistent with provincial and territorial trends from Statistics Canada's 2019 National Cannabis Survey, which showed that the percentage of people reporting cannabis use in the third quarter of 2019 was highest in Nova Scotia (32.8%) and lowest in Ontario (16.9%) and in Quebec (11.5%).

Infographic 6 – Cannabis metabolite load per capita, by city, March to July 2019 and March to July 2020

■ March to July 2019   ■ March to July 2020

Load per capita
[grams per million people per day]

Note: All error bars displayed in this infographic refer to the 95% Confidence Intervals.
Source: Canadian Wastewater Survey, 2019 and 2020.

Analysis of the remaining 2020 CWS samples, as well as the ongoing collection, will contribute to a better understanding of the progression and the shifting landscape of drug consumption across Canada during and beyond the pandemic. This could help public health officials, law enforcement agencies and other organizations to adapt their public health approach and strategies.

Note to readers

Wastewater-based drug epidemiology is a rapidly evolving scientific discipline that applies analytical techniques to wastewater in order to estimate drug usage at the population level. Wastewater analysis complements other indicators of drug use, and has the added advantage of generating near real-time data on geographical and temporal trends.

A pilot study was conducted by Statistics Canada between March 2018 and February 2019, and following its success, the Canadian Wastewater Survey (CWS) was launched. Wastewater samples were collected from the influent of 15 wastewater treatment plants (serving close to 8.7 million Canadians) for seven consecutive days in the second week of every month. The daily samples were analyzed at the Health Canada Regulatory Operations and Enforcement Branch laboratory in Toronto. Laboratory results and population estimates for each region were then combined to estimate drug loads per capita in each city.

The table published with this release includes the estimates of daily load per capita, detection rate, and imputation rate by drug and by municipality for wastewater samples collected by the CWS from March to July 2019 and from January to July 2020. Results for the periods of August to December for 2019 and 2020 will be made available at a later date, together with a more in-depth analysis. Across the world, wastewater is also being used for a wide range of activities, including the surveillance of COVID-19. Statistics Canada collaborated with the Public Health Agency of Canada on a pilot initiative to measure SARS-CoV-2 in wastewater. Based on the results of this initiative, work is underway to monitor SARS-CoV-2 levels in five cities.

Limitations of the CWS

Wastewater-based epidemiology is an inexpensive and powerful tool for estimating city-level drug consumption without the need for self-reported drug use surveys. However, there are some limitations in the analysis and interpretation of estimates from wastewater samples (many of which have been previously described in the report "Wastewater-based Estimates of Cannabis and Drug Use in Canada: Pilot test Detailed Results"), and as such, these results should be interpreted with caution. The effects of certain other factors, such as the time samples spent in storage, which may affect comparability of the results between 2019 and 2020, are currently being investigated. It should also be noted that raw numbers are not comparable to the pilot study due to a change in methodology and analytical labs.

Interpretation of Fentanyl analysis

Fentanyl is excreted as fentanyl (up to 4% of total excretion) and nor-fentanyl (77% of total excretion). In the 2019 and 2020 CWS, fentanyl load was estimated by measuring fentanyl, while other countries measure the more abundant metabolite, nor-fentanyl. While the current results align with other findings, the CWS will start to measure nor-fentanyl in future cycles to further strengthen the reliability of both metabolites as indicators of fentanyl use.

Definitions, data sources and methods: survey number 5280.

Available tables: table 13-10-0820-01.

For more information, or to enquire about the concepts, methods or data quality of this release, contact us (toll-free 1-800-263-1136; 514-283-8300; **STATCAN.infostats-infostats.STATCAN@canada.ca**) or Media Relations (613-951-4636; **STATCAN.mediahotline-ligneinfomedias.STATCAN@canada.ca**).