

## Service and technology limitations

It is important to remember that drug checking as a response to North America's toxic drug supply crisis is in its infancy. Incredibly sophisticated and sensitive technologies continue to be required to effectively check highly contaminated unregulated opioids that are most likely to contribute to overdose. **At this time, there is no perfect drug checking model or technology.** All have trade-offs in terms of quality of results, turnaround times for results, and cost (learn more from our [Drug checking technologies overview](#)).

Samples collected in the community as part of Toronto's Drug Checking Service are analyzed offsite at participating analysis sites using technologies validated for drug checking for opioid overdose prevention, including gas chromatography-mass spectrometry (GC-MS), liquid chromatography-mass spectrometry (LC-MS), or Fourier transform infrared spectroscopy (FTIR) in combination with fentanyl test strips. It is critical that service providers and service users understand the unique limitations of each technology.

### General drug checking limitations

1. Checking your drugs **cannot guarantee that a drug is safe to use.**
2. Results for the sample you are having checked **may not represent the rest of the drugs you took the sample from** (this is known as **the Chocolate Chip Cookie Effect**). Imagine your drugs as a chocolate chip cookie. If you check a piece of the cookie that is only dough, chocolate may not be found. Mixing a powder or crushing crystals, rocks, and pills during sample collection can improve the representativeness of your sample.
3. Due to technological limitations and/or samples not fully dissolving during the preparation for analysis process, some **substances may be missed or inaccurately quantified.**
4. **Some human interpretation is required** by skilled technical staff, meaning there could be some variation in results.

### Mass spectrometry limitations

Considered the gold standard for chemical analysis, and routinely used in clinical settings to analyze biological specimens, like blood and urine, mass spectrometers separate the substances in a sample and determine what they are based on their unique weight. We use GC-MS and LC-MS.

1. Sample type: Drug and used equipment samples can be checked using GC-MS and LC-MS. However, **checking drugs instead of used equipment is preferred** because:
  - Drug equipment, like cookers, are often re-used. GC-MS and LC-MS are so sensitive that very trace amounts of substances may be found. This means that **when equipment is re-used, substances from past use may present in the results for the sample that is being checked**. This can interfere with current drug market monitoring, which is why we rely only on drug samples when reporting trends.
  - Fatty acids are more commonly found in samples that are taken from used equipment, most likely from oils on skin. These **fatty acids can interfere with the mass spectrometry analysis**. It may be difficult to see past them to determine which substances are present.
2. Drug detection: The GC-MS and LC-MS libraries we use contain hundreds of drugs, including those that are “new” or rare. These libraries are constantly updated, limiting the likelihood we will miss drugs. To date, these instruments have identified more than 450 unique drugs in the samples we have checked.
3. Non-drug filler detection: Our current GC-MS and LC-MS techniques **do not identify or report non-drug fillers**. This could include non-drug fillers that may be dangerous, such as bacteria, metals, pesticides, or inorganic salts. Other non-drug fillers may not be dangerous, such as sugar or laxatives.
4. Limit of detection (i.e., the smallest amount of a substance that can be detected with confidence): 0.1%. We use LC-MS to report the precise amount of some substances found in some samples. We have found substances, like fentanyl, accounting for as little as 0.1% of the sample checked. This implies the limit of detection for our LC-MS is 0.1%, meaning **substances that account for less than 0.1% of the sample are likely to be missed by LC-MS**. This limit of detection was determined based on the information we have from checking thousands of samples. That said, the limit of detection may differ between substances found and from sample to sample.
5. Results type: Semi-quantified or quantified.
  - Semi-quantified results (aka relative % for a substance found) report whether there is more or less of a substance than other substances in a sample. They answer the question: is there more of substance X than substance Y in this sample? Semi-quantified substances found are listed from most to least present.
  - Quantified results (aka amount or concentration of a substance found) report the precise amount of a substance in a sample. They answer the question: how much of the total sample checked is substance X? Quantified results are reported for select substances in drug samples that are powder, crystals, rocks, or a crushed bit of a pill. Quantified substances found are listed as a % of the total sample checked and in mg of a standard 10 mg sample.
6. Turnaround time for results: 1 – 2 days.

## FTIR limitations

We use a Bruker Alpha II. Considered the benchmark for onsite drug checking for overdose prevention, FTIR shines light at a substance – some of the light is absorbed, while the rest of the light is reflected. The reflected light indicates a substance’s chemical fingerprint.

1. Sample type: Drug samples can be checked using FTIR.
2. Drug detection: The FTIR libraries we use contain hundreds of drugs. Many of these libraries are updated regularly to include drugs that are “new” or rare.
3. Non-drug filler detection: The FTIR libraries we use contain hundreds of non-drug fillers. Many of these libraries are updated regularly to include non-drug fillers that are “new” or rare.
4. Limit of detection (i.e., the smallest amount of a substance that can be detected with confidence): 5%. This means **substances that account for less than 5% of the sample are likely to be missed by FTIR**. For this reason, FTIR is paired with test strips, which are more likely to detect certain drugs in trace amounts.
5. Results type: Semi-quantified. Semi-quantified results (aka relative % for a substance found) report whether there is more or less of a substance than other substances in a sample. They answer the question: is there more of substance X than substance Y in this sample? Semi-quantified substances found are listed from most to least present.
6. Turnaround time for results: Less than 15 minutes (as part of our offsite drug checking model, FTIR results are reported within 1 – 2 days).

## Fentanyl test strip limitations

We use BTNX Rapid Response strips with an advertised sensitivity of 200 ng/mL.

1. Sample type: Drug and used equipment samples can be checked using fentanyl test strips.
2. Drug detection: Fentanyl and certain fentanyl-related drugs.
3. Limit of detection (i.e., the smallest amount of a substance that can be detected with confidence): Well below 0.1%, as advertised by BTNX. This means **fentanyl and certain fentanyl-related drugs are unlikely to be missed by the fentanyl test strips we use**.
4. Results type: Binary. Binary results (aka + or -) report whether a specific substance is found in a sample with a simple Yes or No.
5. Turnaround times for results: Less than 5 minutes (as part of our offsite drug checking model, fentanyl test strip results are reported within 1 – 2 days).

## LSD test strip limitations

We use BTNX Rapid Response strips with an advertised sensitivity of 50 ng/mL.

1. Sample type: Drug samples can be checked using LSD test strips.
2. Drug detection: LSD.

3. Limit of detection (i.e., the smallest amount of a substance that can be detected with confidence): Well below 0.1%, as advertised by BTNX. This means **LSD is unlikely to be missed by the LSD test strips we use.**
4. Results type: Binary. Binary results (aka + or -) report whether a specific compound is found in a sample with a simple Yes or No.
5. Turnaround times for results: Less than 5 minutes (as part of our offsite drug checking model, LSD test strip results are reported within 1 – 2 days).

## Drug market monitoring limitations

1. The unregulated drug market monitoring we share is based on samples checked by Toronto's Drug Checking Service only. This means **our data may not be completely representative of drugs circulating in Toronto, Ontario, or elsewhere.** Our data should therefore be used with caution when determining trends or drawing conclusions about the unregulated drug supply.
2. We sometimes share the colour and texture of a sample when describing it, particularly when communicating to the public about a new drug trend. **The way a sample looks should not be used to determine its composition.** Colour and texture do imply similar drug checking results.

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**About this resource:** These are the limitations associated with the technologies used by Toronto's Drug Checking Service.

**About Toronto's Drug Checking Service:** Toronto's Drug Checking Service is a free and anonymous community-based public health service that aims to reduce the harms associated with substance use and, specifically, to prevent overdose by offering people who use drugs timely and detailed information on the contents of their drugs. Beyond educating individual service users, results for all samples are combined and analyzed to perform unregulated drug market monitoring, then translated and publicly disseminated every other week to communicate unregulated drug market trends and drug education to those who cannot directly access the service, as well as to inform care for people who use drugs, advocacy, policy, and research.

Participating collection sites: Casey House | Parkdale Queen West Community Health Centre (Parkdale and Queen West sites) | Regent Park Community Health Centre | South Riverdale Community Health Centre (KeepSix and Moss Park sites) | Street Health | The Neighbourhood Group (Kensington Market Overdose Prevention Site) | The Works at Toronto Public Health | Toronto Shelter and Support Services (Seaton House Overdose Prevention Site)

Participating analysis sites: Centre for Addiction and Mental Health (Clinical Laboratory and Diagnostic Services) | St. Michael's Hospital (Department of Laboratory Medicine and Drug Checking Unit)

Toronto's Drug Checking Service is coordinated by a small central team that operates from within the Drug Checking Unit at St. Michael's Hospital. The central team is also responsible for conducting unregulated drug market monitoring and developing and disseminating relevant drug information.

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