

Drug checking technologies overview

While several technologies are used to check drugs both onsite in the community and offsite in the laboratory setting, it is important to understand that:

1. The field of **drug checking for overdose prevention is in its infancy**, with Canada leading the way.
2. **Drug checking for overdose prevention is incredibly challenging**. This is because: (i) the unregulated opioid supply is constantly changing, (ii) opioid samples tend to be composed of complex drug mixtures, and (iii) the drugs most likely to result in harms or overdose are often found in trace amounts or can be chemically similar, making them difficult to differentiate (e.g., fentanyl and carfentanil).
3. Currently, **there is no perfect drug checking model or technology for checking opioids**: all are balancing trade-offs between quality of results, turnaround times for results, and cost.

For those looking to offer drug checking services in community settings, choosing a technology can be overwhelming. **The purpose of this resource is to share what we know about technologies that are currently in use – or may be forthcoming – for drug checking for overdose prevention. We also encourage you to consult our [Onsite drug checking technology purchase and partnership considerations resource](#)** for a list of questions to inform purchasing a drug checking technology.

Overview of available technologies

- Aasen J, Sage, C, Meeson, JS. [The drug resource and education project, chapter three: Drug checking technologies and procedures](#). 2022 September.
- British Columbia Centre on Substance Use (BCCSU). [Drug checking implementation guide: Lessons learned from a British Columbia drug checking project](#). 2022 June.
- British Columbia Centre on Substance Use (BCCSU). [Evidence review report: Drug checking as a harm reduction intervention](#). 2017 December.
- Gozdziński L, Wallace B, Hore D. [Point-of-care community drug checking technologies: an insider look at the scientific principles and practical considerations](#). Harm Reduct J. 2023 Mar 25;20(1):39. PMID: 36966319.
- University of Victoria Substance Project. [Technology benefits and limitations](#). 2023.
- Trans European Drug Information (TEDI). [TEDI guidelines: Drug checking methodology](#). 2022 March.

Mass spectrometry: 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 compounds in a sample and determine what they are based on their unique weight.

- University of Victoria Substance Project. [Paper spray mass spectrometer \(PS-MS\): What does it do and how does it work?](#) 2023.
- Toronto's Drug Checking Service. Offsite drug checking using gas chromatography- and high-resolution liquid chromatography-mass spectrometry (GC- and HR-LC-MS). 2023. [Enclosed](#).

Fournier transform infrared spectroscopy (FTIR): 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 compound's chemical fingerprint.

- British Columbia Centre on Substance Use (BCCSU). [Drug checking operational technician manual](#). 2022 March.
- University of Victoria Substance Project. [Fournier transform infrared spectrometer \(FTIR\): What does it do and how does it work?](#) 2023.
- Toronto's Drug Checking Service. Onsite drug checking using Fournier transform infrared spectroscopy (FTIR) and test strips (fentanyl and benzo). 2023. [Enclosed](#).

Raman spectroscopy: Raman spectroscopy shines light at a substance. The scattered light indicates a compound's chemical fingerprint.

- University of Victoria Substance Project. [Raman spectrometer: What does it do and how does it work?](#) 2023.

Test strips

- BTNX. [Harm reduction: Test strips](#). 2023.
- DanceSafe. [Introducing a new and improved fentanyl test strip for the harm reduction community](#). 2023.
- University of Victoria Substance Project. [Fentanyl and benzo test strips: What do they do and how do they work?](#) 2023.
- Toronto's Drug Checking Service. [Fentanyl test strips](#). 2023.

Health Canada's Drug Checking Technology Challenge

In October 2018, Health Canada launched a [Drug Checking Technology Challenge](#). The Challenge asked for-profit and not-for-profit companies to propose drug checking technologies that would provide rapid and accurate results, were low cost, and could be used with minimal training and preparation work. Prizes were awarded to semi-finalists throughout the competition, and \$1 million was awarded to the winner to further develop and build their product. The three finalists – [DoseCheck](#), [Scatr](#), [Spectra Plasmonics](#) – have proceeded with developing what may be promising advancements in the field of drug checking for overdose

prevention. **Note that each of these technologies is still in the research and development stage.** The drug checking community is anxiously awaiting information on their validity.

Confirmatory testing: Access to sophisticated instruments, like mass spectrometers, is vital for any onsite drug checking program for overdose prevention. Often known as confirmatory testing, further analysis by highly sensitive technologies may confirm results reported using an onsite instrument and identify “new”, rare, or trace amounts of compounds that are more likely to be missed by onsite technologies. Ideally, all onsite drug checking programs would have access to some confirmatory testing.

Types of drug checking results: There are four types of drug checking results, ranging from least to most specific.

1. Binary results (aka + or -): Report whether a specific compound is found in a sample with a simple Yes or No.
2. Qualitative results (aka drugs found): Report the names of the compounds found in a sample.
3. Semi-quantified results (aka relative % for a compound found): Report whether there is more or less of a compound than other compounds in a sample. Answer the question: is there more of compound X than compound Y in this sample?
4. Quantified results (aka amount or concentration of a compound found): Report the precise amount of a compound in a sample. Answer the question: how much of the total sample checked is compound X?

We are here to help! We appreciate this is a lot of information. We are learning too but are a resource to the community and are here to help. You can reach us at hello@drugchecking.community.

Toronto's Drug Checking Service is a free and anonymous 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 collated and analyzed to perform unregulated drug market monitoring, then translated and **publicly disseminated every other week** to communicate unregulated drug market trends to those who cannot directly access the service, as well as to inform care for people who use drugs, advocacy, policy, and research. **Sign up** to receive reports, alerts, and other information on Toronto's unregulated drug supply.

(email) hello@drugchecking.community | (X) [@drugcheckingTO](https://twitter.com/drugcheckingTO) | (IG) [@drugchecking](https://www.instagram.com/drugchecking)





Offsite drug checking using GC-MS and HR-LC-MS

Toronto's Drug Checking Service | Ontario, Canada

Benefits:

- Can analyze substances and used equipment
- Highly sensitive (can detect drugs in very trace amounts)
- Can break apart the most complex drug mixtures and differentiate between drugs that are chemically similar
- Comprehensive libraries to detect rare and “new” drugs
- Able to provide precise quantification information

Limitations:

- Not portable
- Destroys the sample
- Turnaround time for results (1 – 2 business days)
- Cannot identify non-drug fillers
- Expensive and requires extensive training to operate



Onsite drug checking using FTIR and test strips (fentanyl and benzo)

BCCSU Drug Checking Project | British Columbia, Canada

Benefits:

- Portable
- Doesn't destroy sample (although test strip does)
- Turnaround time for results (5+ minutes)
- Can identify many compounds, including non-drug fillers
- Is relatively easy to teach people how to use (don't have to have chemistry degree)

Limitations:

- 5% limit of detection (hence, pairing with test strips)
- Quantified results are wide ranges and not always reliable
- Challenged by complex drug mixtures
- Relies on human interpretation of results