

Drug Checking as Market Surveillance

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Method Article

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Abstract

Background:

Drug checking has increasingly been promoted as a harm reduction intervention that provides people who use drugs (PWUD) with information about the chemical

composition of substances obtained through unregulated markets. Although research demonstrates that drug checking can produce individual-level changes in drug use and risk behavior, important limitations remain, including low uptake, delays between testing and dissemination of results, and limited evidence of population-level effects on overdose mortality. This article argues that these limitations are partly attributable to an overly narrow conceptualization of drug checking as a consumer intervention.

Methods:

Drawing on approximately 500 Fourier Transform Infrared (FTIR) analyses conducted in the South Bronx, New York, and ethnographic observations of people who use drugs and street-level drug sellers, we examine drug checking as a form of active market surveillance.

Results:

Repeated testing of stamped bags sold in close geographic proximity demonstrates that the composition of products can change rapidly and that stamps, while no longer reliable indicators of organizational control or consistent potency, can provide recognizable product identities through which chemical information can circulate. We show how information generated through drug checking was incorporated into the decisions of people who use drugs and, in some cases, into the behavior and marketing strategies of street-level dealers.

Conclusion:

These findings suggest that the value of drug checking extends beyond informing individual consumption decisions. In dynamic street-level opioid markets, where consumers may have limited control over drug composition and may need to use to avoid withdrawal, chemical information can alter the information environment in which consumers, sellers, and service providers operate. We therefore propose that drug checking be understood and evaluated not only as an individual-level harm reduction intervention but also as a method of monitoring and responding to rapidly changing unregulated drug markets.

Background

The limitations identified in the existing drug checking literature suggest the need to reconsider what drug checking is intended to accomplish. Although the volume of research on drug checking has

increased dramatically in recent years, the field has yet to fulfill its initial promise (Maghsoudi et al., 2022). Much of the existing evidence remains observational, qualitative, or based on self-reported intentions and behaviors. Studies by Goldman et al. (2019), Park et al. (2020), and Karamouzian et al. (2018), for example, provide important evidence that drug checking can influence individual behavior, but none establishes that drug checking produces reductions in population-level overdose mortality. Even where behavioral changes are associated with reduced risk, the pathway from individual behavior to population-level outcomes remains uncertain. Engagement also remains a significant limitation. The fact that people can access drug checking services does not mean that they will use them: Karamouzian et al. (2018), for example, reported utilization of approximately 1%, while the low return rate documented by Kaskela et al. (2025) illustrates how service design can further limit the usefulness of test results. Moreover, the literature has not sufficiently addressed differences between drug markets. As Beaulieu et al. (2021) demonstrate, people behave differently when checking opioids and stimulants, suggesting that drug checking cannot necessarily be understood as a uniform intervention operating through the same mechanisms across substances and populations. Finally, although Wallace et al. (2021) and Betsos et al. (2021) have begun to explore drug checking as a market-level intervention, the implications of this perspective have not yet been fully developed.

Drug checking is typically conceptualized as a consumer intervention: an individual submits a sample, receives information about its chemical composition, and uses that information to make a safer decision about consumption. Our argument is that this model captures only one possible function of comprehensive, quantitative chemical analysis. Repeated drug checking can also be used to observe the unregulated drug supply as it changes in response to chemistry, economics, policing, scheduling, competition, and consumer behavior. If drug checking can alter information flows among consumers, sellers, service providers, and public health agencies, then measures such as drug disposal and individual consumption behavior may represent only a small part of its potential impact. The limitations identified in the existing literature therefore point not simply to the need for more drug checking, but to the need to reconsider what should be measured and what drug checking is capable of accomplishing.

This paper examines drug supplies as dynamic rather than static environments. We use data collected in the South Bronx to document repeated assays of different “stamped” bags sold in close geographic proximity to one another. By testing these products over time, we are able to examine the magnitude and frequency of changes in the local drug supply and consider how people who use drugs (PWUD) and street-level dealers respond when timely information about the composition of those products becomes available. Particular attention is paid to the changing significance of branding, including the extent to which stamps distinguish competing products, as well as to the availability and use of locally sourced adulterants and diluents¹ that can alter the composition and effects of individual bags.

This approach shifts the unit of analysis from the individual drug sample to the drug supply in which that sample circulates. A single test tells us what is in a particular bag at a particular moment. Repeated testing of multiple products, however, can reveal patterns that are invisible at the level of the individual transaction. It can show how products change, how quickly those changes occur, and how consumers

and dealers respond to information about them. In this sense, drug checking becomes not simply a means of informing consumers but a method for producing knowledge about the organization and evolution of the unregulated drug supply.

Dope Stamps and the Evolution of the South Bronx Drug Supply

Dope stamps were once ubiquitous in New York's heroin supply (Wendel & Curtis, 2000). They served simultaneously as brands and as markers of organizational control: a stamp identified a product with a particular organization and provided consumers with a means, however imperfect, of distinguishing among competing products. In 1991, for example, a stamp called “No Joke” was sold near the intersection of Burnside and Jerome Avenues in the Bronx. The organization associated with the stamp promoted it with adhesive stickers placed on utility poles, mailboxes, and telephone poles, instructing users to “ask for it by name.” During this period, unstamped bags were relatively uncommon. Organizations generally restricted independent selling within the territories they controlled, and PWUD could treat an unstamped bag with suspicion because it lacked an established identity.

The relationship between branding and drug effects was not always benign. In Mott Haven, in the South Bronx, the “C&C” organization marketed a stamp called “Tango and Cash” in 1991 (Faison, 1994, Rivera, 2025; Nieves, 1991). The bags reportedly contained fentanyl, which was unusual in the local heroin supply at the time, and were associated with a series of overdose deaths. Yet the notoriety of the product did not necessarily deter consumers. Contemporary accounts indicate that some PWUD continued to seek out the bags because their unusual potency was interpreted as a desirable characteristic. The episode illustrates an enduring feature of the unregulated drug supply: information about risk does not necessarily produce avoidance when the same characteristic that creates risk is also understood as evidence of drug quality and potency.

During the 1990s, law enforcement increasingly treated stamps as evidence of organizational structure and hierarchy. A distinctive stamp could connect a street-level dealer to the organization whose name or symbol appeared on the package and could therefore become evidence in prosecutions involving organized drug distribution. Racketeer Influenced and Corrupt Organizations Act (RICO) prosecutions were particularly consequential because they allowed prosecutors to characterize relationships among multiple dealers and suppliers as evidence of a continuing criminal enterprise rather than as a series of independent retail transactions.

The sustained law enforcement campaign against large heroin-dealing organizations altered the organization of New York's retail markets. By the late 1990s, heroin continued to be sold in stamped bags, but the organizations behind those stamps were generally smaller and less vertically integrated. Increasingly, suppliers adopted arrangements that resembled franchising: they provided independently operating retailers with branded products without maintaining the same degree of direct control over street-level dealers.

This restructuring changed the meaning of the stamp. A dealer could carry products associated with several organizations, and the relationship between the person selling a bag and the organization represented by the stamp became increasingly attenuated. Stamps continued to provide products with recognizable identities, but they no longer necessarily identified a particular territory, dealer, or vertically integrated organization.

At the same time, the risks associated with visible branding increased. As law enforcement used stamps to establish organizational relationships, dealers had an incentive to reduce the visibility of those relationships. There were also practical reasons for abandoning stamps. Individual sellers did not always have access to the appropriate equipment, and stamping large numbers of bags required time and labor. For increasingly independent retailers, the benefits of branding could therefore be outweighed by its costs.

The result was a gradual coexistence of stamped and unstamped products. Stamps did not disappear, but their meaning changed. They became less reliable indicators of organizational control and increasingly functioned as product brands. A stamp could give a product a recognizable identity and allow consumers to distinguish one product from another, while offering considerably less reliable information about where the product originated or who ultimately controlled its production.

Fentanyl and the Changing Meaning of Drug Quality

The introduction of fentanyl into New York's opioid supply produced another profound transformation in the relationship among branding, reputation, and drug effects. When fentanyl first became established in the local opioid supply, many people who used opioids viewed it as something to avoid. Over time, however, perceptions changed. As fentanyl became increasingly associated with potency, some consumers began actively seeking it rather than avoiding it (Curtis et al., 2017).

This transformation is important because it altered the meaning of information about a drug's chemical composition. Knowing that a product contained fentanyl no longer necessarily constituted a warning that would cause a consumer to reject it. For some consumers, fentanyl became evidence that a product was likely to be strong. A stamp could continue to identify a product, but it could no longer reliably communicate its pharmacological properties. The name on a bag might remain unchanged while the substances inside it changed substantially.

Fentanyl also introduced a new set of market pressures. PWUD commonly describe fentanyl as having “short legs”—that is, producing powerful effects that do not last as long as the effects traditionally associated with heroin. If consumers must purchase and consume more frequently, dealers and suppliers have incentives to modify products in ways that alter the duration or character of their effects. The increasing appearance of substances such as xylazine and, more recently, medetomidine in some fentanyl-dominant products can be understood partly within this broader process of experimentation and adaptation.

These changes should not be understood as a simple linear progression from heroin to fentanyl to fentanyl plus adulterants. Rather, they represent an ongoing process of market adaptation. As the pharmacological properties of the dominant drug change, dealers and suppliers respond to consumer preferences, perceived problems, competition, and economic incentives. Other substances may then be introduced to modify the product, creating new effects and new risks. Drug markets therefore evolve through an ongoing interaction between chemistry and commerce.

Methods: FTIR Findings from the South Bronx

Our use of Fourier Transform Infrared (FTIR) spectroscopy provides a means of documenting these changes at the level of the individual product. FTIR spectroscopy identifies substances by measuring the ways in which they absorb infrared radiation. In approximately 500 samples analyzed in the South Bronx, we identified a wide range of drugs, adulterants, and diluents, including fentanyl and its analogues, heroin, benzodiazepines, medetomidine, lidocaine, procaine, mannitol, lactose, inositol, caffeine, quinine, phenacetin, tramadol, tianeptine, and other substances.

Findings

The significance of these findings is not simply that the local drug supply contains a large number of unexpected substances. More importantly, repeated testing demonstrates that the composition of individual products can change over relatively short periods. The FTIR therefore provides a form of market surveillance: it allows us to observe not merely what is present in the drug supply, but how the supply changes over time.

The presence of stamped bags makes this particularly useful in the South Bronx. Although a stamp can no longer be assumed to identify a single organization or a stable source, it can still provide a recognizable product identity. This allows harm reduction workers to communicate information about particular products without identifying individual dealers. Rather than telling people simply that “medetomidine has been found in the local drug supply,” for example, information can be associated with a recognizable product that people may encounter on the street.

This distinction is important because drug checking programs have traditionally relied heavily on passive sampling. Individuals bring samples to a service, the samples are tested, and the results are communicated back to the person who submitted them. Such a system can produce useful information, but it may be poorly suited to a rapidly changing retail market in which potentially hazardous products can circulate widely before they are tested.

Three Limitations of the Conventional Model

Our observations suggest three related limitations in the conventional model of community drug checking.

First, the interval between testing and communicating results can be too long to influence immediate consumption decisions. When results are available only hours, days, or weeks after a sample is submitted, the information may arrive after the substance has already been consumed. Drug checking then becomes primarily a retrospective harm reduction intervention rather than a mechanism for preventing immediate exposure.

The problem is compounded when programs wait for consumers to identify and submit potentially problematic samples. By the time an unusual product is brought to a testing service, it may already have caused multiple overdoses or other medical complications. Our fieldwork suggests that a more active form of surveillance—one in which harm reduction programs deliberately seek samples of products circulating in local markets—can reduce this delay.

One incident illustrates the problem. In October 2025, several people at our program experienced serious reactions after using a small red bag that was being sold locally. When we obtained and tested a sample, FTIR analysis indicated that it consisted predominantly of medetomidine. The bags were unusually small and inexpensive, creating the possibility that consumers would consume the entire bag at once. We subsequently attempted to speak with the dealer about the results and the risks associated with the product. The incident illustrates both the value and the limitations of reactive drug checking: chemical analysis identified an unusual and potentially harmful composition, but the information became available only after several adverse events had already occurred.

Second, results are commonly communicated to the individual who submitted the sample rather than to the wider community of people who may obtain the same product. This approach protects confidentiality and is appropriate in many circumstances, but it also limits the speed with which information can circulate through a drug market. A warning that a particular product contains an unexpected substance is potentially much more useful when it reaches other people who possess or are considering purchasing the same product.

Our experience suggests that branded products provide an unusual opportunity to expand the information that circulates in the community. We began producing flyers that reported the results of our analyses and distributed them directly to PWUD and to street level dealers. The response was striking. People frequently requested copies, and some recognized particular bags by their colors, symbols, or names. In this setting, the stamp became more than a brand: it became a mechanism through which chemical information could be attached to a recognizable product and circulated through the market.

Fieldnotes from December 2025 illustrate this process. PWUD approached outreach workers for copies of the results and asked about particular stamped bags. Some were interested in finding products that appeared to contain fewer unexpected substances; others were interested in products that contained heroin or fentanyl without additional active ingredients. The significance of these responses is not that consumers necessarily stopped using drugs. Rather, they demonstrate that people were actively incorporating chemical information into their assessments of competing products.

Third, drug checking programs have generally focused their outreach on PWUD while paying considerably less attention to dealers. This is understandable given the legal and ethical concerns surrounding drug distribution. Nevertheless, it may represent a missed harm reduction opportunity. Retail dealers occupy a strategically important position between suppliers and consumers, and some may have limited knowledge of the chemical composition of the products they distribute.

Our observations suggest that dealers can also respond to drug checking information. In January 2026, one dealer complained that consumers were avoiding his product because information from our drug checking flyers indicated that it contained substances that consumers considered undesirable. In another instance, a dealer reportedly showed customers the drug checking flyer and used the results to promote the relative quality of his own product. Rather than rejecting the information because it came from a harm reduction program, he incorporated it into his sales pitch.

These observations do not suggest that dealers are uniformly motivated by harm reduction. Rather, they demonstrate that drug dealers, like consumers, operate within an information-rich and competitive market. Information about the chemical composition of products can affect reputation, demand, and therefore economic behavior. This makes dealers potentially important participants in the circulation of drug checking information.

Drug Checking as an Intervention in a Dynamic Market

The implications of these observations extend beyond the question of whether an individual consumer changes behavior after receiving a test result. Drug checking can provide information about the changing relationship among product composition, consumer demand, dealer behavior, and market competition. This is particularly important when considering the finding from previous research that stamped bags are poor predictors of potency. Such a finding may be accurate if it is interpreted to mean that a particular stamp does not consistently contain the same concentration or composition of drugs. But inconsistency does not necessarily mean that stamps have no market significance. In a competitive market, potency can change precisely because dealers and consumers respond to information about potency.

A particularly potent product may initially attract consumers away from competing products. Increased demand can subsequently create incentives to dilute later batches or modify the product in other ways. As consumers perceive a decline in quality, they may shift toward another product believed to be stronger. From this perspective, variation within a stamp is not necessarily evidence that branding is meaningless. Instead, it may reflect the dynamic relationship between reputation, competition, consumer demand, and product modification.

PWUD frequently participate in these information networks. They exchange information about which products are currently perceived as strong, weak, desirable, or dangerous. The information is inherently temporal: a product that is considered desirable today may be viewed differently a week later.

Conventional drug checking, which often treats each sample as an isolated observation, can therefore miss an important characteristic of the unregulated drug supply—the fact that the meaning of a product is continually being renegotiated.

Conclusion

Drug checking has been promoted as a promising harm reduction intervention because chemical information can, in principle, allow people to make safer decisions about drugs obtained from unregulated markets. The literature reviewed above provides evidence that this can occur. People who receive unexpected results sometimes reduce their dose, change how they consume a substance, avoid using alone, increase their access to naloxone, or otherwise modify their behavior. Drug checking can also identify emerging substances, engage people who might not otherwise use harm reduction services, and provide valuable information about the composition of local drug supplies.

At the same time, the literature reveals important limitations. Uptake can be modest; people frequently do not dispose of drugs after receiving unexpected results; test results may arrive too late to affect immediate consumption; and there remains little evidence that existing drug checking programs have produced measurable reductions in population-level overdose mortality. These limitations become more consequential when an intervention originally developed in festival and nightlife settings is applied to street level opioid markets characterized by physiological dependence, rapid turnover, economic competition, criminalization, and limited consumer control over the composition of drugs.

Our argument is not that drug checking has failed. Rather, we suggest that the conventional model of drug checking is too narrow for the markets in which it is now being deployed. In a dynamic street level opioid supply, the relevant question is not simply whether an individual receives information about a particular sample and changes their behavior. It is also how quickly information is produced, how it travels through the market, who receives it, and how consumers and dealers respond to it.

The South Bronx findings point toward a different model. Repeated chemical analysis can transform drug checking from a passive, consumer-initiated service into a form of active market surveillance. Testing multiple products over time makes it possible to identify changes in the local drug supply before they become generalized warnings. Associating results with recognizable products allows information to circulate beyond the individual who submitted a sample. And engaging street level sellers creates the possibility that information can travel upstream as well as downstream, potentially influencing the products that reach consumers.

This perspective also raises an unconventional but potentially important implication for harm reduction practice: harm reduction programs should consider encouraging dealers to use consistent stamps or other recognizable identifiers on their products. Such an approach may initially appear counterintuitive because branding has historically been associated with drug marketing and organizational control. Yet in a fragmented retail market, a recognizable product identity can make chemical information substantially more useful. If a particular stamped product is repeatedly tested, harm reduction workers can

communicate information about its composition to people who may encounter it without needing to identify the individual dealer or organization responsible for its distribution. Stamps can therefore function as a form of market-level identification that allows information about drug composition to travel with the product. Encouraging consistent product identification would not make a drug safer or imply endorsement of its sale; rather, it could create a more stable target for surveillance and a more effective mechanism for communicating timely information about changing drug contents. In this sense, a practice historically associated with the commercial organization of illicit drug markets could potentially be repurposed as an infrastructure for harm reduction.

Seen in this way, the principal contribution of drug checking may not be to persuade PWUD to make any particular decision about an individual sample. In many street level opioid markets, there may be no safe or realistic decision available: the person may need to use the drug to avoid withdrawal, may not have another source, and may have little control over what is actually in the bag. Chemical information nevertheless has value because it can alter the circulating information about an operating market.

This reconceptualization also changes how drug checking should be evaluated. Measures such as the percentage of people who discard drugs after testing or report an intention to reduce their dose remain useful, but they should not be the only measures of success. Drug checking in dynamic street markets should also be evaluated in terms of how rapidly emerging hazards are identified, how widely information about those hazards circulates, whether consumers and dealers alter their behavior in response, and whether repeated testing can reveal changes in the market that would otherwise remain invisible.

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials:

The data that support the findings of this study are not publicly available. Upon reasonable request and with the permission of the New York State Department of Health and Mental Hygiene, data used in the preparation of this article is available from the authors.

Competing Interests:

The authors declare that they have no competing interests.

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Authors' Contributions:

All the authors read and approved the final manuscript

RC acquired and analyzed samples, and wrote and edited drafts of the manuscript

AJ acquired and analyzed samples, and edited drafts of the manuscript

EMM analyzed samples, conducted literature review and edited drafts of the manuscript

JR edited drafts of the manuscript

TM edited drafts of the manuscript

SH edited drafts of the manuscript

KM edited drafts of the manuscript

KSR edited drafts of the manuscript

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Footnotes

1. Adulterants and diluents are not mutually exclusive categories, but generally speaking, diluents primarily increase the volume of a drug product, whereas adulterants alter its pharmacological, physical, or sensory properties.

Figures



Figure 1 "No Joke" heroin

Figure 1

See image above for figure legend

 G.O.A.T.	<u>8/31/2026</u> Caffeine Crack Fentanyl	<u>8/17/2026</u> Mannitol Fentanyl	<u>8/3/2026</u> Fentanyl Mannitol Procaine	<u>7/28/2026</u> Fentanyl Mannitol Procaine
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Figure 2

FTIR results for "G.O.A.T."

 Exit 4	<u>8/31/2026</u> Mannitol Fentanyl Caffeine	<u>8/10/2026</u> Mannitol Fentanyl	<u>8/3/2026</u> Mannitol Fentanyl	<u>7/27/2026</u> Mannitol (+) Fentanyl
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Figure 3

FTIR results for "Exit 4"

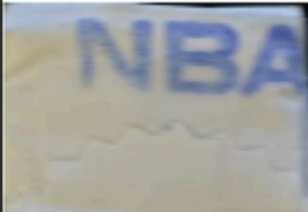
 NBA	<u>9/3/2026</u> Mannitol Fentanyl	<u>8/10/26</u> Mannitol Caffeine Lidocaine Fentanyl	<u>8/7/2026</u> Mannitol Caffeine Lidocaine Fentanyl	<u>7/28/2026</u> Mannitol Caffeine Fentanyl
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Figure 4

FTIR results for "NBA"

 Monster High	<u>9/2/2026</u> Mannitol Fentanyl	<u>8/7/2026</u> Caffeine Mannitol Lidocaine Fentanyl	<u>7/28/2026</u> Mannitol Caffeine Lidocaine Fentanyl	<u>4/13/2026</u> Mannitol Fentanyl Caffeine Lidocaine Cocaine
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Figure 5

FTIR results for "Monster High"