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## Collaborative Public Health Investigation of Clenbuterol-Adulterated Heroin Outbreak—Richmond, Virginia, March-April 2015

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**Author note:** To represent the perspectives of all partners involved in the investigation who also contributed to the writing of this report, we have exceeded the 6-author norm. To convey an authentic voice for each stakeholder, we felt it prudent to include the aforementioned authors listed, and the rationale for each is as follows:

1. Brigette Gleason led the outbreak investigation and was the primary author.
2. Angela West provided guidance on how to conduct the investigation, took the lead when the lead investigator was unavailable, and assisted with writing the report.
3. Danny Avula facilitated collaboration with the local law enforcement and active surveillance in local hospitals, and assisted with writing the report.
4. Okey Utah, the epidemiologist who represented the local health district that was primarily affected by the outbreak, accessed medical records of affected patients, distributed messaging to the at-risk community, and assisted with writing the report.
5. Marshall Vogt, the epidemiologist of one of the affected health districts, assisted with patient interviews and medical record collection and review, and assisted with writing the report.
6. Kirk Cumpston identified the outbreak and brought it to the attention of the Virginia Department of Health (VDH), abstracted patient information from medical records, facilitated identification of clenbuterol in specimens from the first set of patients affected, and assisted with writing the report.
7. Michael Kelly provided clinical care for a majority of the patients in this outbreak, liaised with VDH to find a mechanism to prevent further cases, and assisted with writing the report.
8. Paul Brasler assisted with psychiatric and substance abuse care to patients involved in this outbreak, provided context for this report from both anecdotal evidence and literature review, and assisted with writing the report.
9. Shane Wyatt collaborated with VDH to process specimens at the state laboratory to identify clenbuterol and assisted with writing the report.
10. Laurie Forlano facilitated the public health response on behalf of the VDH, provided supervision to the lead investigator, and assisted with writing the report.

The authors declare no conflicts of interest.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

## Abstract

**Context:** In March 2015, the Virginia Department of Health (VDH) was alerted by the Virginia Poison Center of a 6-patient cluster treated for severe clinical presentations after using heroin. Patients' symptoms were atypical for heroin use, and concern existed that patients were exposed to heroin that had been adulterated with or replaced by another substance.

**Objective:** To understand the extent and characterization of the outbreak and implement response measures to prevent further cases. The purpose of this report is to highlight the collaborative nature of a public health investigation among a diverse group of stakeholders.

**Design:** Active surveillance and retrospective case finding.

**Setting:** Richmond metro area community and hospitals.

**Participants:** Regional poison centers, the Division of Consolidated Laboratory Services, the Department of Behavioral Health and Developmental Services, community partners, local law enforcement, and multiple VDH divisions.

**Intervention:** Outbreak investigation, communication to public health professionals, clinicians, and the community, and liaising with the local law enforcement.

**Main Outcome Measures:** Outbreak control.

**Results:** Laboratory confirmation of clenbuterol in clinical specimens implicated it as the heroin adulterant. Thirteen patients met clinical and epidemiologic criteria for exposure to clenbuterol-adulterated heroin. All patients were associated with a localized area within Richmond, and patient interviews elucidated heroin supplier information. VDH collaborated with local law enforcement agents who investigated and arrested the supplier, leading to cessation of the outbreak.

**Conclusion:** This outbreak highlights the value of policies and practices that support an integrated outbreak response among public health practitioners, poison center staff, laboratorians, clinicians, law enforcement agents, community groups, and other agencies. Collaboration enabled implementation of effective control measures—including those outside the purview of the health department—and should be standard practice in future outbreaks involving illicit substances.

## Keywords

adulterated; clenbuterol; collaboration; heroin; investigation

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Recreational use of heroin is dangerous in pure form, but further harm can occur from added chemicals. Adulterants are pharmacologically active additives, which may be added to improve profitability by “increasing product quantity, enhancing desired/expected drug effects, or mimicking other drug characteristics.”<sup>1,2</sup> The Drug Enforcement Administration has detected approximately 50 additives to heroin in the eastern United States.<sup>3</sup>

In 2005, the first reported clenbuterol-adulterated heroin outbreak led to a multistate investigation identified by atypical reactions after heroin use.<sup>4</sup> A similar scenario emerged in Richmond, Virginia, in March 2015. The Virginia Department of Health (VDH) received notification from the Virginia Poison Center (VPC) of a 6-patient cluster treated for atypical, severe clinical presentations after using heroin. Symptom onset occurred immediately after

use, but symptoms were uncharacteristic of heroin intoxication and raised concern that patients were exposed to heroin that was adulterated with or replaced by another substance. Outbreak control relied on collaboration between VPC, clinicians, the Division of Consolidated Laboratory Services (DCLS), the Department of Behavioral Health and Developmental Services (DBHDS), community partners, local law enforcement, and multiple VDH divisions.

## Methods

Investigation objectives were to understand outbreak extent and prevent further cases. Prevention mechanisms included informing the community of the risk and removing the causative agent from the community. The case definition from the 2005 multistate investigation was applied.<sup>4</sup> The investigation entailed active case finding with chart abstraction and retrospective surveillance including support from Virginia's Office of Chief Medical Examiner. VDH epidemiologists from the Division of Surveillance and Investigation (DSI) and poison center clinicians conducted interviews with hospitalized patients to collect details on symptoms and heroin exposure. Both VPC and DCLS facilitated chemical testing on patients' urine specimens.

VDH collaborated with DBHDS, which notified community service boards and opiate treatment programs. DSI worked with VDH's Office of Risk Communication and Education to create a palm card with messaging regarding symptoms and guidance for getting help. Cards were disseminated by DSI, VDH's Division of Disease Prevention (DDP), and local health departments targeting persons at risk. A key component of the public health response was coordination with law enforcement to remove the dangerous substance from the community. Frequent communication among partners facilitated rapid implementation of these measures.

## Results

On March 30, VPC confirmed (via the Virginia Commonwealth University toxicology laboratory) that 5 clinical samples were positive for clenbuterol, implicating it as an adulterant. Additional testing identified 13 patients who met the case definition (Figure). Patients' symptoms were consistent with clenbuterol exposure.<sup>1,4,5</sup> The most common clinical manifestations were hypokalemia, tachycardia, palpitations, chest pain, shortness of breath, nausea/vomiting, electrocardiogram with QT prolongation, and elevated anion gap. Ten patients required intensive care unit treatment, and 8 underwent cardiac studies to assess ischemia. No deaths were associated with this outbreak.

Ultimately, all cases could be linked to a localized area within Richmond. Interviews revealed that the majority of patients thought they received a bad batch of heroin because symptom onset occurred within seconds to hours after injecting or insufflating the presumed heroin. Patients reported they thought they were using heroin but did not feel the expected high. During the investigation, information regarding the potential supplier of the adulterated heroin was provided to VDH staff. Relevant details about this supplier were shared with

local law enforcement, but no patient information was provided. After law enforcement agents became involved with the investigation, the outbreak ended.

## Discussion

Adulterants added to heroin are common; heroin purity was approximately 35% in the United States during 2003–2007.<sup>2,6</sup> Of concern is that certain chemicals added to heroin (eg, clenbuterol) are undetectable with routine toxicology testing, which complicates clinical management.<sup>2</sup> Clenbuterol, a long-acting  $\beta_2$ -agonist, is a veterinary medication that is not approved by the Food and Drug Administration for human use.<sup>7</sup> Stimulation of  $\beta$ -receptors can cause refractory tachycardia, palpitations, hypokalemia, elevated lactate, metabolic acidosis, and hypotension.<sup>1,4,5</sup> Specific reasons for adding clenbuterol to heroin are unknown. Clenbuterol is “illegally sold in health food stores, by mail-order pharmacies, and on the Internet as a nutritional supplement” and is relatively inexpensive.<sup>5</sup> Given this accessibility, outbreaks related to clenbuterol misuse continue to pose risks.

VDH’s DSI routinely performs outbreak investigations, but this atypical outbreak warranted collaboration with partners external to this division. Information sharing among the health department, local clinicians, DCLS, and VPC was integral to characterizing the outbreak. Communicating with the population at risk and their health care providers was a priority for preventing and mitigating clinical effects. ORCE, DBHDS, and DDP were key partners in message development and community outreach.

This investigation posed a unique challenge of obtaining sensitive information regarding illicit substance use. Determining a balance that maintained trust of persons at risk, while providing protection from harmful products, was imperative. Law enforcement officers had a shared interest in removing the dangerous substance from the community and were able to act on information made available by the public health investigation.

Multiple limitations relevant to this investigation were encountered. Case detection was likely underestimated because of the following: clenbuterol detection in clinical samples required specialized laboratory equipment; most physicians are unfamiliar with clenbuterol, making clinical diagnosis difficult; patients with milder presentations might not have presented for care; clinical effects of other drugs used concomitantly by a patient might have affected the clinical presentation; and patients might have altered their histories because of the sensitive nature of the implicated substance. Furthermore, multiple anecdotal reports were provided to VDH, but these potential cases could not be corroborated with medical record review. Finally, no heroin used by patients in this outbreak underwent confirmatory environmental testing.

## Conclusion

Adulterants are common in illicit substances but often go undetected during routine toxicology screening. Physicians should consider adulterants in their differential diagnosis of patients presenting with atypical symptoms after illicit substance use. Poison centers have a vital role in detecting toxic exposures and are a valuable source of public health surveillance information. Because illicit substance use continues to rise, capacity to address

emerging outbreaks related to adulteration becomes more pressing. The unregulated nature of illicit substance distribution and use underscores the complexity in carrying out public health investigations. Educating those at risk for exposure, clinicians, and first responders about the myriad potential consequences of adulterated drugs should be a key focus of primary and secondary prevention efforts. The rapid and collaborative public health response was critical to preventing further morbidity during this outbreak.

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**Implications for Policy & Practice**

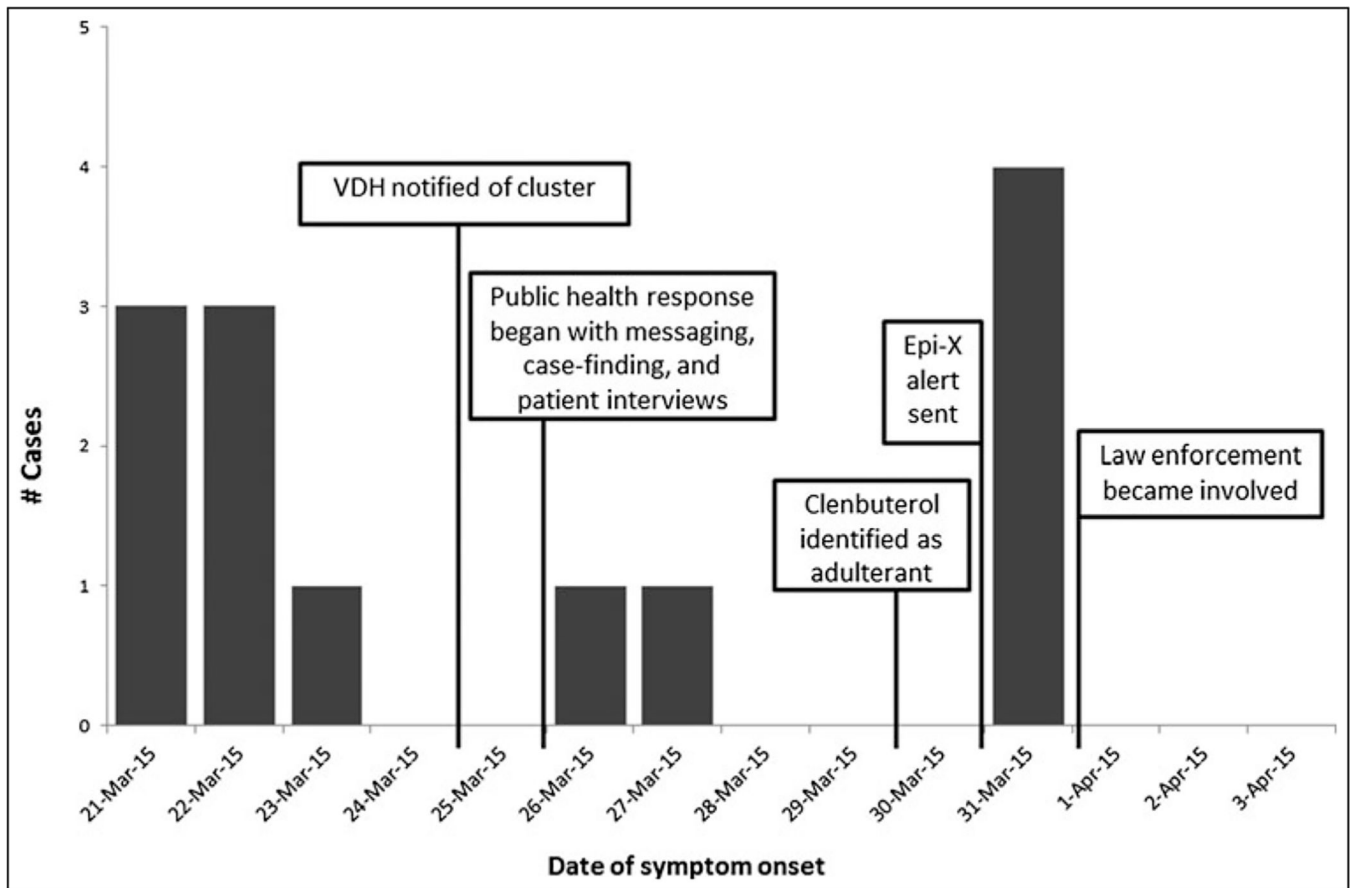
The complexity of this outbreak drew attention to the importance of policies and practices that support collaboration among a diverse group of stakeholders. Early communication between public health practitioners and poison center staff led to the initial identification and investigation of the outbreak. Due to involvement of an illicit substance, outbreak control relied on input from law enforcement agents. Strengthening relationships between health departments and other institutions that might be called upon during a public health emergency increases depth and breadth of expertise. Policies that promote advance coordination of interagency collaboration can also increase timeliness of a public health response. Public health practices that emphasize communication and integrated action beyond the traditional health department boundaries are increasingly important during complex outbreaks, such as those involving illicit substances.

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**FIGURE.** Epidemic Curve and Timeline of Outbreak Control Measures in the Clenbuterol-Adulterated Heroin Outbreak in Richmond, Virginia, March-April 2015  
 Abbreviation: VDH, Virginia Department of Health.