ORIGINAL ARTICLE

A public health outbreak management framework applied to surges in opioid overdoses

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ABSTRACT

Objective: *Over the past decade, Canada and the United States have been facing an epidemic of harms from prescription opioids. More recently, opioid-naïve individuals have been exposed to illicit opioids through adulterated combination products. This has resulted in sudden surges of opioid-related mortality. A proactive public health solution is needed to prevent further death. We propose examining these surges in opioid overdoses as outbreaks and investigating them in a similar way to an outbreak of an infectious disease. An epidemiologic investigation model for opioid overdose outbreaks, that could be modified by other public health agencies, is discussed.*

A PROACTIVE PUBLIC HEALTH MODEL FOR OPIOID OVERDOSE OUTBREAKS

The prescription opioid epidemic is a serious and ongoing problem for communities and health systems across Canada and the United States. Over the past decade, the concurrent increases in rates of opioid prescribing alongside opioid-related morbidity and mortality have been well-documented.[1,2] Recently, local outbreaks of illicit opioid overdoses have threatened to overwhelm established emergency response mechanisms. This paper offers a public health framework to address opioid overdose outbreaks. We propose framing surges of opioid-related overdoses as outbreaks ("opioid overdose outbreaks"), which allows the familiar framework of an epidemiological outbreak investigation to be applied.[3] This approach can help public health agencies and community partners detect and respond to opioid overdose outbreaks in an effective and timely manner. The key components of this framework are outlined in Figure 1. A similar strategy could be adopted and modified by any jurisdiction to prepare and develop sustainable solutions for opioid overdose outbreaks.

Provisional data suggest that these outbreaks may be related to the increased availability of illicit fentanyl, a drug 50-100 times more potent than morphine.[4] Though pharmaceutical fentanyl can be diverted for misuse, most cases of fentanyl-related morbidity and mortality have been linked to illicit fentanyl and fentanyl analogs.[5] These illicit varieties are often sold as adulterated combination products, such as with cocaine and marijuana, without the user's knowledge. The potency of fentanyl makes unintentional exposures particularly dangerous. In some events involving adulterated opioids, individuals required up to 3-4 mg of the opioid antidote naloxone (usual initial dose being 0.1-0.2 mg).[6,7] It is worth noting that home naloxone kits contain only 0.8 mg of the drug, and that such large dose requirements risk emptying regional stores.

Outbreaks of opioid overdoses have recently been reported in Surrey, British Columbia (43 overdoses in 4 days); New Haven, CT (12 overdoses in 8 hours); Louisville, KY (52 overdoses in 32 hours); and Cincinnati, OH (174 overdoses in 6 days).[6-9] Harms associated with the outbreaks were limited by rapid notification of public health and enforcement agencies, tracing and limiting of further use of the drug, accelerated naloxone distribution, augmentation of emergency medical services, and risk communication to the public.[7] These events demonstrate the need for rapid responses and thereby

Key components	Description
1.Develop a task force	Public health professionals should establish or join a local task force to share information and develop standardized protocols for responding to opioid overdose outbreaks. Membership could include officials from: public health, acute care, community health, mental health and addiction services, first responders, community emergency management coordinators, post-secondary education institutions, school boards, and the regional coroner's office.
2.Develop community partnerships	Partnerships within the community can be utilized to determine if there is a need for enhanced capacity (e.g., naloxone, pre-hospital or hospital services), and help disseminate evidence-based information to frontline partners and the public.
3.Ensure surveillance systems are in place	Local public health agencies, as part of their task force responsibilities, should conduct surveillance of hospital admissions, paramedic services, coroner, and naloxone distribution/usage data as well as real-time syndromic surveillance of overdoses in emergency departments to detect surges in baseline opioid-related overdoses.

Figure 1. Key steps for addressing opioid overdose outbreaks.

a proactive approach that uses an outbreak management framework. Key public health principles, including prevention, treatment, surveillance and harm reduction are critical in managing the long-term opioid epidemic; however, strategic action is required to prepare for sudden increases in opioid overdose events.

Given the growing severity and scope of the problem in South Eastern Ontario, regional public health officials hosted an emergency management workshop, bringing together over 95 participants to form a regional opioid task force.[10] The task force includes representation from emergency first responders, acute care and health service providers, community, mental health, and addictions services, and local, provincial, territorial, and federal public health agencies. The summarized information, feedback, and best-practices derived from the meeting have been used to develop a public health approach to opioid overdose outbreaks.

STEPS OF AN OPIOID OVERDOSE OUTBREAK INVESTIGATION

1. Identify investigation team and resources

Public health professionals should establish or join a local task force to share information and develop standardized protocols for responding to opioid overdose outbreaks. Membership could include officials from: public health, acute care, community health, mental health and addiction services, emergency first response agencies, community emergency management coordinators, postsecondary education institutions, school boards, and the regional coroner's office. Specifically for public health agencies, the emergency response team could include: medical officers of health, nursing, and environmental health teams, as well as experts in surveillance and epidemiology. Additionally, it will be important to engage with those who work on the front-lines, including at harm reduction sites, and seek up-to-date information from them regarding potential outbreaks.

Regular task force meetings will help to ensure that members, and by association, the agencies they represent, stay up-to-date on the new and emerging opioid-related trends, best practices, and initiatives. A clear list of deliverables for the task force would help ensure efficiency, as well as time for follow-up and review of implemented control measures. Meetings may also serve as a forum for communication, collaboration, and coordination in line with a process of continuous quality improvement. The primary purpose of the task force, however, should be to develop an opioid overdose outbreak response plan. The plan should describe:

a. The various roles and responsibilities involved in the response of each sector.

b. Plans to share information including a list of key contacts, and the point or trigger

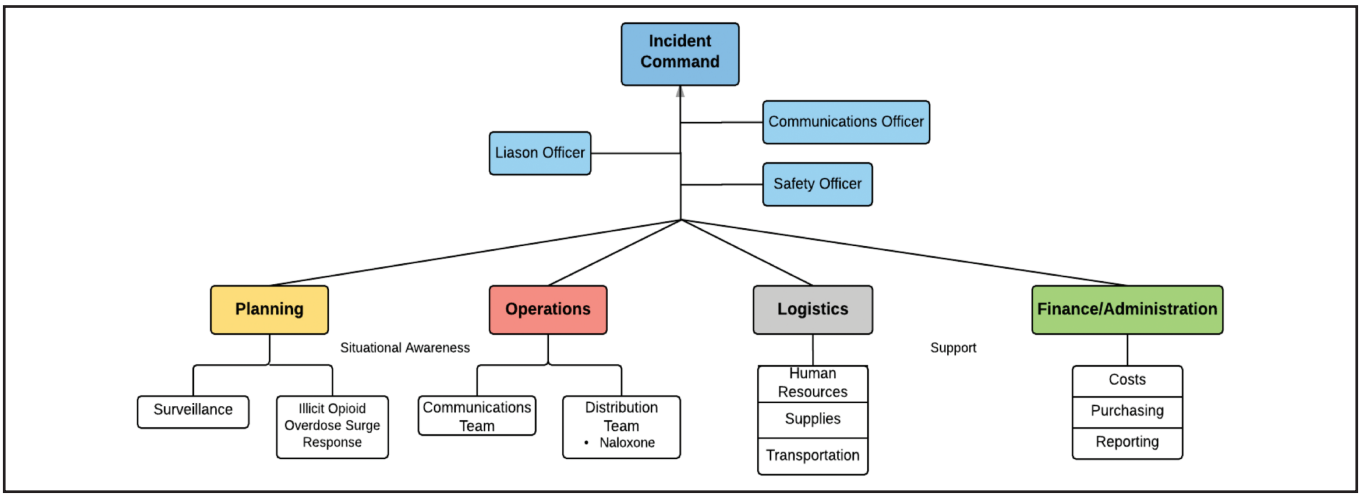

Figure 2. Public health opioid overdose surge response utilizing an Incident Management Structure.

at which specific agencies and officials at various levels of government should be contacted and informed of the opioid overdose outbreak.

c. Plans to acquire additional support and resources should there be a need for enhanced capacity (ie, prehospital response, treatment supplies, patient transfers).

Coordination and planning, particularly knowing who should be contacted and at what point in the response they should be contacted, is an integral part of responding to an opioid overdose outbreak. Developing a response plan provides opportunity to organize an effective, efficient, and coordinated response to an opioid overdose outbreak. A strength of this model is that by establishing a task force proactively, they will be prepared to respond to outbreaks which are, by nature, unpredictable. An incident management structure could be applied for responding to opioid overdose outbreaks (Figure 2).

2. Establish existence of an outbreak

Regional surveillance partners, such as acute care, paramedics, fire and police services, should have knowledge of baseline opioid overdose trends in their communities or service provision jurisdiction. Upon recognizing a significant rise from this baseline, which task force members may choose to determine statistically, notification can be made to public health. In the case of the Kingston, Frontenac, Lennox & Addington (KFL&A) regional task force, the Medical Officer of Health on-call is notified when such incidents occur (Figure 3). A decision-making tool to assist partners in determining when to respond to opioid-related overdose events has been developed (Figure 4). When local surveillance partners determine that there is a need for enhanced capacity (eg, naloxone, prehospital or hospital services), they can utilize communication pathways within the task force to notify municipal and regional leaders as needed (Figure 5).

3. Construct a case definition

Definitions for possible, probable, and confirmed cases should be predetermined by the task force. The following case definitions are proposed (Figure 6).

4. Verify the diagnosis

Once the existence of an opioid overdose outbreak has been confirmed, the toxicological cause should be determined and documented for each case. The specific toxicological cause can help guide communication strategies and make hypotheses about spread and impact. The KFL&A regional task force has created a model decision support tool for enhanced clinical laboratory testing of opioids in the case of overdose outbreaks (Figure 6).

5. Find cases systematically and develop line listing

The organizations within the task force must be diligent in looking for additional cases and individuals at risk following the initial overdose cases. This

Opioid Presentation	Relevant Task Force partner and their responsibilities	Contribution to Task Force
Drug confiscated	Regional police • Initiate investigation to determine source • Arrange expedited toxicological testing	Inform task force of potentially contaminated drugs present in the community
Surge in opioid overdose syndrome patients presenting to health system	Emergency medical services • Communicate increased naloxone usage • Collect and share data with other emergency first response partners, public health, and task force	Patient demographics, amount of naloxone used (if provided), and the drug used (if known)
	Emergency department • Patient data sent to public health while acute care sends specimen for testing	Patient demographics, amount of naloxone used (if provided), and the drug used (if known)
Surge in deaths	Coroner • Initiate investigation • Request expedited toxicological testing • Report the death to public health and task force	With confirmed opioid toxicology the cause of death is reported to the Regional Coroner who in turn could share the information with the regional task force (so they can limit further harms)
Data sharing and Surveillance	Public health • Surveillance (health system and drug-using community) • Deliver risk communication to public • Coordinate response • Provide enhanced naloxone capacity	Share information among task force partners

Figure 3. Communication pathway for notifying the health system during an opioid overdose surge.

will involve operationalizing the public health emergency response team, which was formed as part of the regional task force. This team should engage in active surveillance to determine the true extent of the affected population. A detailed line listing (Figure 7) can be a helpful tool for documenting and organizing cases. Direct response to an opioid overdose outbreak should involve case and contact investigations, and increased street health monitoring. In addition to standard clinical information, it will be important to assess what drug was involved, where the drug was distributed, and how much of the drug is available in the community.

6. Perform descriptive epidemiology/develop hypotheses

Hypotheses on the spread and impact of the outbreak should be developed. These will depend on the nature of the adulterated drug/opioid involved as well as the exposed population. For example, we would expect higher morbidity and mortality in an opioid naïve population, such as those exposed when consuming other illicit drugs adulterated with fentanyl. Much the same, we would expect higher morbidity and mortality when a new drug is exposed to IV drug users who are unaccustomed to its potency.

7. Evaluate hypotheses/perform additional studies as necessary

As in traditional outbreak scenarios, case-control and cohort studies can serve as valuable means for formulating and evaluating hypotheses in absence of toxicological analyses. In elucidating the offending agent, considerations may include: the apparent half-life of the drug, the need for resuscitation, milligrams of naloxone provided, need for prolonged naloxone drip, and lack of response to naloxone.

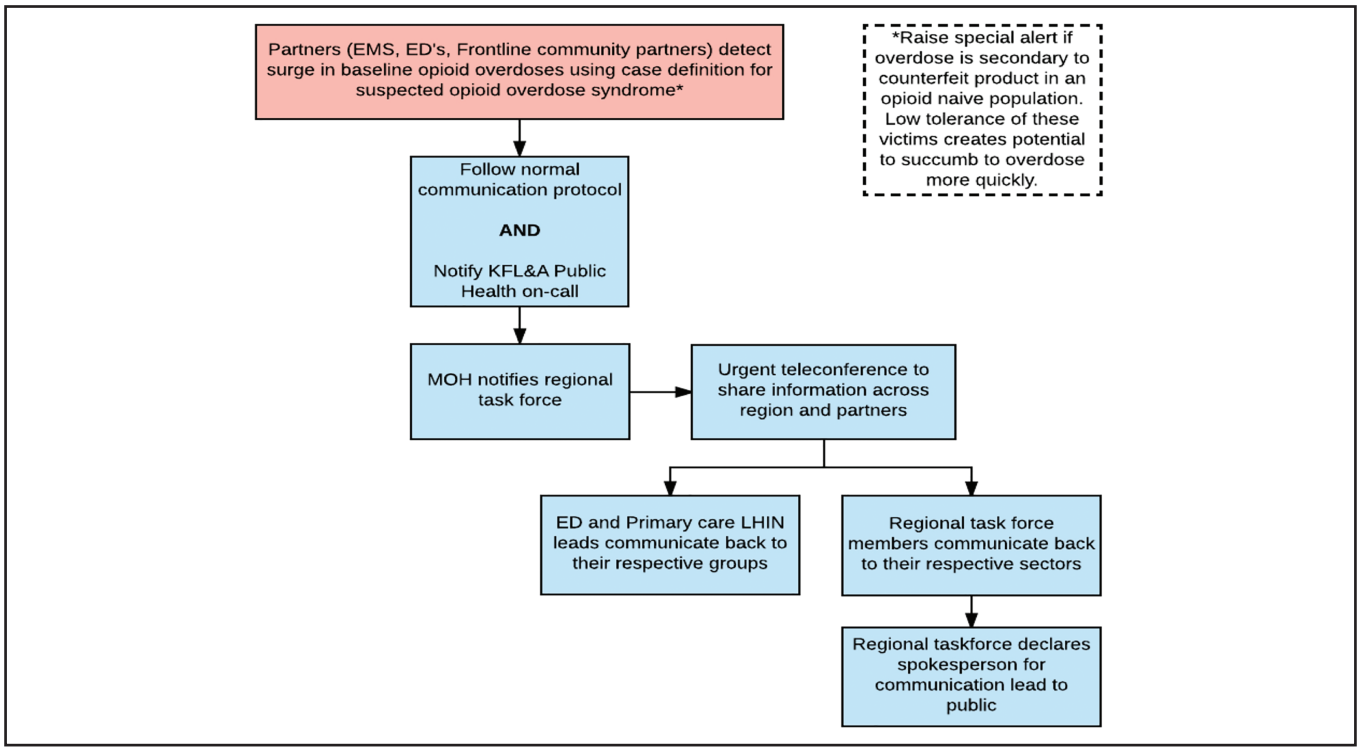

Figure 4. Decision instrument to activate municipal/community control group and IMS. Adapted from the WHO (2008) International Health Regulations (2005) 2nd ed.[11]

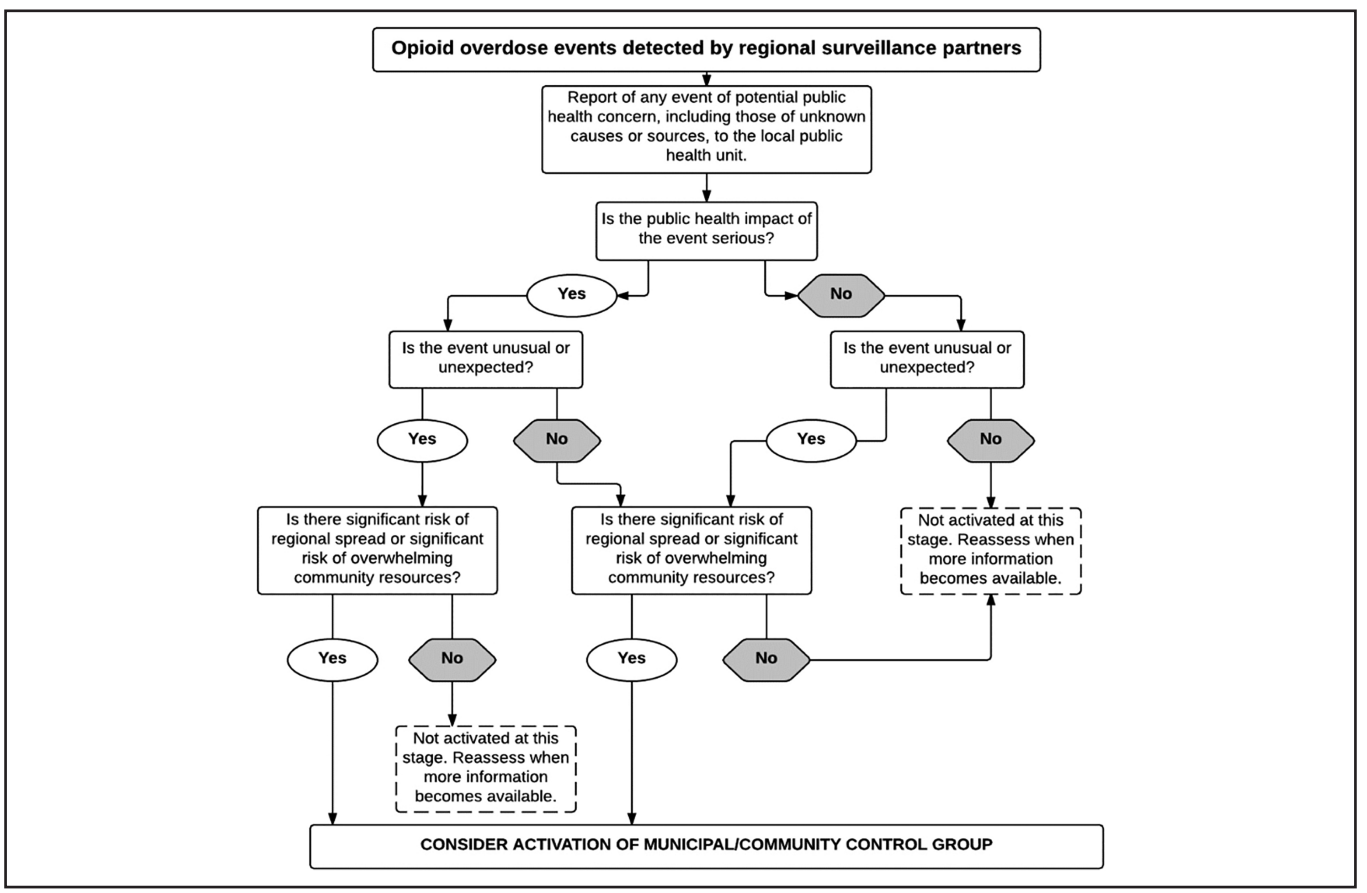

Figure 5. Case definitions for suspected opioid overdose outbreak.

Physician name: _____ Date: _____

Please indicate if there is a (check one of the following):	
New surge in opioid overdose syndrome* with high morbidity or mortality?	☐
Surge in overdoses in an opioid naive population (high suspicion of contamination with illicit opioid)?	☐
Opioid overdose syndrome presentation and (check all that apply): High initial resuscitation narcan required (>3mg)? Prolonged narcan drip required? Limited response from high dose narcan with opioid overdose syndrome or exposure?	☐ ☐ ☐ ☐
Other (please describe):	☐

Opioid overdose syndrome* is defined as:

i. Probable

Unintentional overdose from a suspected opioid

AND

Patient demonstrates clinically compatible signs and symptoms of opioid overodose syndrome:
- Pinpoint pupils
- Decreased respiratory rate
- Decreased level of consciousness
- Cyanosis

AND

Positive response to naloxone (if provided)

ii. Confirmed

All of the above **plus** laboratory confirmation of opiate exposure.

In the above instances, it may help urgent risk communication and harm reduction strategies to know the causative agent:	
IF there is a death, the investigating coroner should inform the regional coroner to discuss expedited testing using the decision tree.	
IF drug has been confiscated by police, expedited testing through Health Canada may be arranged.	Contact # - form
IF harm reduction services have access to the drug, testing can be arranged through Health Canada.	Contact #
IF the specimens are from a patient in a clinical testing, keep the following samples for enhanced clinical testing: • Urine • Blood	x form – clinical information x sent to x lab call #

Figure 6. Decision support tool for enhanced clinical laboratory testing for opioids.

A line listing of cases (Figure 7) can be a helpful organizational tool. Control measures should be implemented based on the hypothesis that is ultimately generated.

8. Implement control measures

In order to minimize the harms associated with opioids, information regarding the dangers of intentional and unintentional opioid-use as well as the supports available to the community should be shared with frontline partners and the public. The local public health agency can ensure the disseminated information is evidence-informed and up-to-date.

A mass risk communication strategy should be created in advance, and the frequency and intensity of the communication should be modified as needed in response to surveillance. The strategy should be multicomponent, incorporating a wide variety of media (eg, social media, TV, print) and all implicated organizations and service providers should play a role in public awareness campaigns (including, but not limited to: pamphlets, new media, social media, presentations and town hall

								Naloxone (Administering provider, route)					
Pt. ID	Age group (10s)	Sex	Arriv. time	ED	Overdose syndrome confirmed?	Toxicol. sent?	Presumed drug used	EMS IN	EMS IV/IO	ED/IV	Disposition	Ref. to addictions/ mental health services?	Take home naloxone provided?
A	30s	F	19:38	HDH	Yes	No	Heroin (?fentanyl)	0 mg	2 mg	2 mg	Dead on arrival in ED	N/A	N/A
B	70s	M	21:32	KGH	Yes	Yes	Fentanyl	2 mg	2 mg	2 mg	Observed, discharged	Yes	Yes
C	70s	M	21:41	KGH	Yes	Yes	Fentanyl	2 mg	2 mg	0.4 mg	Intensive care unit	No	N/A

Figure 7. Line listing of suspected opioid overdose cases. Adapted from the CDC's MMWR "Multiple Fentanyl Overdoses - New Haven, Connecticut, June 23, 2016".[6]

meetings). Sandman's risk communication principles can serve as a helpful guide.[12]

The challenges of communicating risk to stigmatized populations and the role of partners such as Street Health and Community Health Centres in bridging the gap should be considered. Youth, parents, and teachers should also receive special attention in light of reported deaths which suggest exposure to opioids can occur at a young age. The effectiveness of implemented control measures should be monitored by geographic distribution, age, gender, and social determinants of health.

A comprehensive PH response, like any comprehensive emergency response, should not simply be reactive, but should also consider prevention and post overdose care. Access to treatment and counselling for substance use disorders, social supports, and harm reduction efforts in the form of needle exchange, safe disposal, and supervised consumption sites should be ensured. Naloxone kits should be distributed through public health units and community partners, and those at risk of experiencing or witnessing an opioid-related overdose (eg, family members) should be trained to use them. Capacity to rapidly distribute naloxone to exposed communities should be enhanced, and our model proposes that public health could provide this surge response. Further, the number of pharmacy partners distributing naloxone kits should be increased during opioid overdose outbreaks. Adequate support for front-line workers should be prioritized.

9. Communicate findings

Once the outbreak has been declared over, it should be documented and debriefed with analysis as part of a continuous quality improvement process. Government officials at all levels can play an important role in disseminating the lessons learned among their peers and enacting policy changes accordingly.

10. Maintain surveillance

Local public health agencies, as part of their task force responsibilities, should conduct surveillance of hospital admissions, paramedic services, coroner, and naloxone distribution/usage data as well as real-time syndromic surveillance of overdoses in emergency departments to detect surges in baseline opioid-related overdoses. With regards to syndromic surveillance, descriptive diagnostic coding schemes should be standardized across emergency departments to improve the sensitivity and specificity of surveillance systems. The KFL&A regional task force utilizes the "Ontario Opiate Surveillance Monitor" which has been created in response to the gap in available provincial opioid-related data, especially in real-time. The tool collects anonymous real-time data from emergency departments and admissions to hospital relating to opioid-related syndromes.[13] Public Health Ontario also provides an Interactive Opioid Tool with the most recent opioid-related morbidity and mortality data including emergency department visits, hospitalizations, and deaths, organized by public health unit, age, sex, and drug type.[14]

While the above recommendations implicate a variety of stakeholders, the public health professional has three distinct roles and responsibilities in face of the opioid epidemic, as summarized below (Figure 8).

Three Key Roles & Responsibilities of Public Health

1. Surveillance
    a. determine the epidemiological triggers for an alert through analysis of surveillance data from partners
    b. create a community task force with terms of reference for sharing situational awareness and surveillance data on a regular, ongoing basis
2. Communication
    a. communicate dangers of exposure to opioids to community partners, people who use drugs, and the public through a pre-planned multi-component strategy
    b. communicate the confirmed or suspected presence of high-risk opioids to community partners and the public
    c. in addition to monthly reporting and information sharing by the task force, share epidemiological and other relevant information with acute care and community service providers
3. Harm Reduction
    a. assist with the distribution of naloxone in the community and support an urgent response to increase the availability of naloxone to community members at-risk of experiencing or witnessing an opioid-related health emergency
    b. connect with community health, mental health and addictions partners to ensure people who use drugs and those close to them (e.g. family, friends, service providers) have the proper training on harm reduction
    c. provide needle exchange and education programs
    d. prevent drug-related bacteremias, maximize immunization of HBV, increase screening for HBV, HCV, and HIV, and provide early antiretroviral therapy to individuals with HIV.

Figure 8. The roles and responsibilities of public health in an opioid overdose outbreak.

In an effort to achieve continuing quality improvement, metrics and outcome measures will be critical. Data on number of task force meetings, naloxone distribution, usage, overdose rates are being collected through the course of implementation of the KFL&A regional task force. As with any process of improvement, some degree of of reworking the framework may be necessary.

The primary challenges for public health, and indeed any stakeholder with a vested interest in preparing for an opioid overdose outbreak, include: determining the triggers for an urgent community response, communicating and coordinating between the various partners, responding to emergencies in rural communities, resource strain, privacy implications for investigative purposes, and ensuring postevent evaluation for continuous quality improvement.

The urgency of emergency preparedness for opioid overdose outbreaks should not be understated. We have offered a model for a public health approach based on familiar concepts and frameworks. Though details of this framework may be unique to the KFL&A community, the principles could still be adopted and modified by other regions across Canada and the United States. The opioid crisis shows no signs of abating, and it is beholden on all public health professionals to ready themselves for the outbreaks that are sure to come, regardless of the method they choose.

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