

Mapping the shifting opioid epidemic to aid public health efforts

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Combining emergency medical services and vital statistics data, a new study led by researchers from Tufts University School of Medicine provides a unique view of the opioid overdose epidemic in an urban

area. The study identifies neighborhoods with the highest risk of overdose and other drug-related disorders, as well as supports efforts for targeted public health interventions.

The collaborative research team included emergency medical services (EMS) staff, public health officials, and academic researchers who pooled and analyzed data for reports of publicly discarded syringes, opioid-related incidents (ORIs), and fatal opioid overdoses (both the death and injury locations) in order to assess the risk environment in Lowell, Massachusetts. The study was published online on Oct. 6 in *Preventive Medicine Reports*.

"Lowell has devoted resources to fighting [opioid use](#), but the city continues to experience elevated risks in overdose deaths, ORIs, and other injection-mediated risks, including new hepatitis C and HIV infections. These risks have largely been attributed to the introduction of fentanyl into the drug supply. But how do we use everything we know about what is happening across the city to better understand and address the burden of this epidemic?" said Thomas J. Stopka, an epidemiologist at Tufts University School of Medicine and first and corresponding author on the study. "This study leverages data and expertise from different constituents in order to identify the hotspots."

The work stems from a collaborative harm reduction program and ORI monitoring and tracking system implemented by local EMS, public health officials, and [academic researchers](#) to monitor and respond to ORIs in an effort to curb the area's opioid overdose and opioid-related health outcomes. Stopka brought to these projects an expertise in spatial and trend analyses in infectious diseases and opioid use disorder.

For this study, the team used [geographic information systems](#) (GIS) to develop descriptive maps, heat maps, and cluster analyses to highlight areas with the highest concentrations of discarded syringes and fatal

overdoses, assess change over time, and identify significant hotspot clusters. An ORI is defined as an incident in which EMS responded to a 911 call where opioid use was observed, reported or suspected. Data for ORIs were not mapped in order to protect the privacy of people who survived the incidents. Syringe discard reports for 2011-2018 and opioid-related illness reports for 2008-2018 were documented in calls to 911 and provided by Trinity Emergency Medical Services. One 911 call does not equate to one syringe discarded; there may have been multiple calls to 911 for the same discards or multiple syringes recovered.

The researchers obtained overdose injury and death locations for 2015-2017 from the Massachusetts Registry of Vital Records and Statistics. The injury location documents where an individual experienced an overdose, in a location such as their place of residence or a local sidewalk or alleyway, prior to being recorded fatal elsewhere, often at a local hospital to which they are transported.

Overall, discard report and ORI rates per 10,000 people were highest for Lowell's downtown neighborhood, where the discard rate was almost two times greater than the neighborhood with the second highest rate and the ORI rate was 2.5 times higher than the second highest. In the ten years studied, both discard reports and ORI rates increased year over year.

Syringe discard reports

The highest concentration of discarded syringes reported for 2011-2018 was within the downtown and four adjacent neighborhoods. The area with the highest density of reports grew from 50-250 per quarter mile to a high of 1,864 per quarter mile and expanded to cover all of the downtown and much of five adjacent neighborhoods in central Lowell. For this period, the team identified a hotspot, or a cluster with a higher concentration of activity, for syringe discard calls in the downtown and two adjoining neighborhoods in central Lowell.

Fatal overdoses

Lowell, a city of 111,000 residents, recorded 63 opioid-related deaths in 2015, 68 in 2016, and 53 in 2017. Overdoses occurred in the greatest concentrations in the downtown, central, north, and northeast of the city. For 2015-2017, the team identified hotspots in the downtown and seven adjacent neighborhoods in central Lowell for aggregated fatal opioid overdoses that were not recorded at hospitals. They also identified hotspots in the downtown and two adjacent neighborhoods for aggregated injury locations of fatal overdoses.

In addition, the researchers noticed increases in syringe discard reports, ORIs and overdoses in summer months.

"Opioid-related deaths have decreased for many reasons, key among them: enhanced education for patients and their families, the availability of Narcan, and more treatment options. The availability of real-time EMS data plays a significant role in supporting each of these prevention and intervention efforts. Knowing who and where people are using helps target those areas specifically," said study author Jon Kelley of Trinity Emergency Medical Services.

"Public health research has the potential to have a great impact when we examine an epidemic through many lenses," said study author Wilson R. Palacios, a criminologist at the University of Massachusetts, Lowell.

"Understanding the risk environment of opioid incidents in Lowell provides a new framework for looking at both the shifting epidemic and how public health officials can respond."

"These analyses help us see where and when communities have been hardest hit," said study author Lainnie Emond of the City of Lowell Health Department. "With this information we can work with our partners to emphasize education, treatment, prevention and screening for

our residents who need enhanced access to this support."

Study limitations include EMS data reflecting ORIs reported through 911 calls, not all non-fatal overdoses and ORIs in Lowell. Still, EMS data represent the strongest available real-time data for these incidents. The documented location of an overdose death may be different from where the [overdose](#) actually occurred, particularly when a hospital is the location of death on record. The researchers sought to address this limitation by reviewing injury locations as well.

The other study authors are Erin Jacque, formerly of Tufts University School of Medicine, and Kerran Vigroux, formerly of the City of Lowell Health Department.

More information: Thomas J. Stopka et al, Examining the spatial risk environment tied to the opioid crisis through a unique public health, EMS, and academic research collaborative: Lowell, Massachusetts, 2008–2018, *Preventive Medicine Reports* (2021). [DOI: 10.1016/j.pmedr.2021.101591](#)

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