

New data-driven simulation model projects national opioid crisis to worsen before it gets better

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A significant challenge in addressing the country's opioid crisis is that policies based on past patterns of behavior may have unintended consequences because those patterns change over time. Collaborating with the U.S. Food and Drug Administration (FDA), Mohammad Jalali and his research colleagues have created a data-driven simulation model that incorporates key behavioral feedbacks such as social influence and risk perceptions. Called SOURCE (Simulation of Opioid Use, Response, Consequences, and Effects), the model has projected three key strategies that could save more than 100,000 lives over the next ten years.

Dr. Jalali is an investigator at Massachusetts General Hospital (MGH), assistant professor at Harvard Medical School, and a senior lecturer at MIT's Sloan School of Management in the System Dynamics Group. SOURCE is the most operationally detailed national-level model of the [opioid](#) crisis to date and provides an integrated

framework for policy decision-making.

According to SOURCE's projections, the opioid crisis will worsen before it gets better and will claim more than a half-million additional lives over the next 10 years. And while the number of people misusing prescription opioids or heroin is already declining, their risk of overdose—particularly for those who use heroin—has increased dramatically since 2013 due to the spread of illicitly manufactured fentanyl.

In response, the researchers used SOURCE to project eleven different strategies and found three with the potential to save more than 100,000 lives during this time period. The three key strategies, which must be implemented together, are: 1) fentanyl harm reduction; 2) naloxone distribution; and 3) recovery support for people in remission from [opioid use disorder](#) (OUD), the group at highest risk of overdose. In the short-term, bolstering buprenorphine providers' capacity to treat more patients with OUD also has a lifesaving effect by helping to overcome the treatment system's current capacity limitations.

Their article analyzing lifesaving strategies was published today in *Science Advances*, while SOURCE is described in a research paper recently published in the *Proceedings of the National Academy of Sciences*.

"This broader perspective is critical to making progress," says Dr. Jalali. "It's like playing whack-a-mole. If you don't look at the whole system and its interconnected parts, then fixing one aspect of the problem can make other aspects worse."

SOURCE replicates the historical trajectory of the opioid crisis, using 22 years of data on prescription opioid use and misuse, heroin use, overdose

deaths, and more. Accounting for these processes allows SOURCE to explain historical shifts in opioid use and overdose trends, as well as how they may evolve in the future. For instance, SOURCE finds that the risks of opioid use are deterring potential new initiates. As a result, the primary source of OUD in the future will be people in remission relapsing. So, recovery support for people in remission to reduce relapse could have a major impact, saving tens of thousands of lives.

SOURCE found that specific strategies to reduce the risk from fentanyl, such as drug-checking services that support people to use drugs more safely, could have a dramatic impact on opioid overdose deaths.

SOURCE also shows that while increased distribution of the overdose reversal drug naloxone has helped mitigate this growing risk, naloxone's positive effects still lag far behind the growing fentanyl threat. Going forward, model analysis shows naloxone should nonetheless remain a key part of the nation's overdose deaths prevention strategy.

Because of the decline in OUD, SOURCE projects that opioid overdose deaths will continue to rise in the near future before eventually falling. "Although we expect deaths to peak in the next few years, we're still talking about over half a million deaths over the next decade. Our projections really underscore the urgency of addressing the substance use and [overdose](#) crisis," says coauthor and MIT Sloan Ph.D. graduate Tse Yang Lim.

Coauthor Erin Stringfellow, a research fellow at MGH and Harvard Medical School agrees: "If we wait for the crisis to peak, it will be too late. We need to use these strategies together, and now, for them to have their maximum impact. These strategies will only become more important if our projections about fentanyl's penetration of the drug supply turn out to be too optimistic."

Jalali adds that "SOURCE is a powerful analytical tool for projecting and exploring policy outcomes and testing strategies. There is a lot of exciting work ahead to be done building on this model."

In addition to Jalali, Lim, and Stringfellow, coauthors hail from Harvard Medical School, MGH, McLean Hospital, the FDA, Stanford University, and Portland State University.

More information: Erin J. Stringfellow et al, Reducing opioid use disorder and overdose deaths in the United States: A dynamic modeling analysis, *Science Advances* (2022). [DOI: 10.1126/sciadv.abm8147](https://doi.org/10.1126/sciadv.abm8147).
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Tse Yang Lim et al, Modeling the evolution of the US opioid crisis for national policy development, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2115714119](https://doi.org/10.1073/pnas.2115714119)

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