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# Fighting the opioid crisis by design. Technology solutions as innovative systems for advancing communities of care against overdose deaths

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## Abstract

The epidemic of opiate overdose deaths has continued to advance in the United States, even more so during the COVID-19 pandemic. The state of Ohio is at the centre of the nation's opioid crisis, with one of the highest rates of overdose deaths. Ohio's approach to fighting the opioid crisis involves several items as part of the RecoveryOhio plan, including increasing accessibility of naloxone in communities and promoting harm reduction through education. Various state programmes exist for distributing naloxone, but these are not sufficient for the magnitude of the crisis. Moreover, Emergency Medical Services (EMS) are oversaturated with calls concerning overdoses. The opioid epidemic has scaled to proportions where the country is in dire need of innovative solutions. This paper describes innovative community-based solutions for fighting the epidemic. Two pilots are described in detail: NaloxBox and AntiOD. These pilots involved collaborations between experts in emergency medicine and industrial design, trainers in overdose recognition and rescue, and community agencies and municipalities to design and launch systems for providing community access to naloxone so that lay people can rescue overdose victims in advance of the arrival of EMS. These pilots are design-led projects, implemented in communities, which aim not only to educate individuals about naloxone administration but also to empower communities to act and save lives. This model leverages technologies to bridge the access gaps and comply with the requirements of different stakeholders and state regulations while sharing the responsibility of saving lives from opiate overdose.

**Keywords**: Opioid crisis, Overdoses, Harm reduction, Community-led

## Introduction

In the United States (US), drug overdose is the leading cause of injury-related deaths, with more than 932,000 cases since 1999 (Centers for Disease Control and Prevention [CDC], 2022a). The number of deaths from overdose involving either prescription opioids or illegal opioids, such as heroin, was six times higher in 2017 than in 1999 (Hedegaard et al., 2020). In 2020, the states with the highest rates of death due to drug overdose were West Virginia (81.4 per 100,000), Kentucky (49.2 per 100,000), Delaware (47.3 per 100,000), Ohio (47.2 per 100,000) and Tennessee (45.6 per 100,000), while Ohio registered 5,204 opioid-related deaths (CDC, 2022b). In Cincinnati, a city located in Southwest Ohio, the emergency medical services (EMS) reported 2582 responses to overdoses in 2017 (City of Cincinnati, 2022). Narcan® (naloxone) is a powerful medication that reverses the effect of opioids and can save a person in an overdose situation (Emergent Devices Inc., 2022). Naloxone is currently used by quick response teams (QRTs) to answer opioid-related emergencies. It must be delivered as promptly as possible to avert death or permanent injury from hypoxia, and the need for prompt administration of naloxone has become a central point. Naloxone is available in different delivery methods, and while all methods are effective for use and administration, the intranasal formulation is more suitable for layperson use. Significant figures, such as the Surgeon General of the United States, have emphasized the importance of naloxone and encouraged the public to have naloxone in reach (US Department of Health & Human Services, 2018). Although there are significant efforts to increase its availability, access to naloxone is still limited and, in many cases, problematic (US Food & Drug

Administration, 2019). Even if someone has naloxone for personal use, they cannot self-administer it if rendered unconscious by an overdose. In addition, communities rely heavily on EMS, whose systems are saturated with requests.

The opioid epidemic has scaled to proportions where the country is in dire need of innovative solutions to fight the crisis. Community involvement to rescue lives from overdose affords an opportunity for innovation and helping with the crisis. Most states in the US have Good Samaritan laws protecting lay rescuers (Good Samaritan Assessment Act, 2016), meaning that liability is limited and protection from claims of negligence is provided for those who voluntarily perform care and rescue in emergencies. Within this rationale, involving the community as first responders may become a vehicle for innovation.

## Community engagement and social innovation

The Centers for Disease Control and Prevention (CDC) defines community engagement as a process of collaborative work, focusing on building trust, involving added resources and allies, and improving communication, which can have a positive effect on health and well-being (McCloskey et al., 2011). As the CDC states, community engagement "frequently involves — and often evolves into — long-term partnerships that move from the traditional focus on a single health issue to address a range of social, economic, political, and environmental factors that affect health" (McCloskey et al., 2011, p.7). Community engagement initiatives link people who may have a passive attitude to a problem and initiate a collaborative process that will lead the community to an active leadership role, guaranteeing the sustained effort of the initiative. This linkage opens the possibilities for social innovation to be sustainable and effective.

Phills et al. (2008) note that many innovations can tackle social problems or meet social needs, but only for social innovations is the distribution of social value. For Phills and colleagues, if a solution to a social problem renders a bigger benefit to a stakeholder different than society, it is not social innovation. Manzini (2015) moves from the grassroots description towards collaborative organizations, companies evolving in highly connected environments characterized by freedom of choice of their members and an open attitude.

From the social innovation perspective, there is a good opportunity to bridge the gap between communities and patients in addiction treatment and to provide platforms in which we share the care of members of our society who are vulnerable due to addiction and increase their chances to stay in treatment.

The opioid epidemic is an issue that requires a multi-modal approach, not only a top-down view where legislation and policies slowly move forward and communities are passive protagonists, but a combination that includes bottom-up views where the community takes a leading role and drives change. Social innovation perspectives propose a change in the ownership of the solutions, giving communities the possibility to take responsibility and actions. Bottom-up approaches also open up the potential for more compassionate and empathetic solutions because they represent the community responding from within.

There is evidence that communities are self-organizing and attempting to prevent and reduce the rise in opioid overdoses at various levels (Leece et al., 2019). These groups of citizens use strategies that can be focused on different areas such as social change, represented in activities of training, education, stigma reduction and advocacy, and intersectoral collaboration or harm reduction programmes that include naloxone distribution (Ramirez-Loaiza & Rebola, 2022). There are different barriers to the distribution of this life-saving medicine, including stigma, lack of outreach and the overall need for easier access.

The purpose of this paper is to describe two design-led projects, Naloxbox and AntiOD, that use technology to bridge the gap between communities and life-saving resources.

## Community resources

The state of Ohio is addressing the opioid use disorder with approaches on different fronts, including stronger regulation of pharmaceutical wholesalers, increased penalties for trafficking in and possession of fentanyl-related compounds, expanding local prescription drug overdose prevention initiatives, and investing in strategies for granting better access to naloxone (RecoveryOhio, 2018).

Project DAWN is a community-based overdose education and naloxone distribution programme in which members of the community receive training on recognizing the signs and symptoms of overdose, distinguishing between diverse types of overdoses, performing rescue breathing, calling EMS, and administering intranasal naloxone (Ohio Department of Health, 2019). Hamilton County Public Health works through the Naloxone Distribution Collaborative to give naloxone free of charge (Hamilton County Public Health, 2019). The critical element that hinders access to naloxone is the required training before obtaining naloxone.

Other stakeholders involved in access and distribution of naloxone include AltrixMedical, which developed NaloxoFind, a mobile app that allows people to locate naloxone in a two-mile radius from registered carriers (and registered locations), making it a crowd-sourced supply of naloxone (AltrixMedical, n.d.). There is also a community of first responders that seeks to build a community of trained and empowered citizens to act in an overdose emergency and save lives where QRTs have longer response times (Community of First Responders, n.d.). While these are effective mechanisms for naloxone distribution to save lives, there is no system for providing or integrating community-access naloxone, meaning preventable deaths due to the absence of a system that furnishes life-saving naloxone for Good Samaritan, community use.

## NaloxBox

NaloxBox was an innovative programme to provide tools, training and awareness to empower laypeople to rescue victims of opioid overdose (RIDMAT Inc, 2022). NaloxBox is to opioid overdose what an automated external defibrillator is to sudden cardiac arrest. It provides requisite tools in public places to enable laypeople to save a life in advance of the arrival of EMS. NaloxBoxes contain multiple doses of naloxone, the antidote for opioid overdose, along with a barrier mask to administer rescue breaths. The NaloxBox programme design included technologies to support collaborators and end users, and installations were coordinated with overdose training.

The NaloxBox design involved collaboration between an emergency medicine physician and an expert in industrial design. The design purpose was to create an attractive, approachable, accessible unit that communicates emergency (Image 1), with graphics and instructions to facilitate rescue, and information about what NaloxBox is, how to secure personal naloxone and how to access addiction services.


*Image 1: NaloxBox pilot product design*.

The NaloxBox pilot project was supported by the Rhode Island Department of Health's mini grant programme in overdose prevention, which, in turn, is supported by the CDC. The pilot was launched in cities and towns across Rhode Island, a state severely affected by the opioid overdose epidemic. Two mini-grants supported this work, which commenced in mid- 2017. Initially, NaloxBoxes were implemented in homeless communities where training was provided. The pilot partnered with initiatives such as Preventing Overdose and Naloxone Intervention (PONI), which was part of the task force where the cabinet was first deployed (Prevent Overdose RI, 2022).

NaloxBox's novel design and collaborative engagement of overdose education and naloxone distribution experts, agencies serving high-risk populations, and public health and municipal officials provide a replicable, scalable model for community countermeasures for the epidemic of opioid overdose deaths. The overall purpose of the project and its implementation was to empower communities to save lives by providing naloxone and the information to administer it. This programme created accessible units with a tech component that sent a text message to the owner when the box was opened (Capraro & Rebola, 2018). A significant aspect of deploying NaloxBox as a pilot was to evaluate the response from the community taking a role as first responders in the crisis. While the project hoped for a successful impact involving community members, the results exceeded expectations in validating the need for refining and scaling programmes, products and services such as NaloxBox (Jochem, 2019; Kantor, 2019; Orestein, 2017).

### From Naloxbox to AntiOD

Learning from NaloxBox, the AntiOD project started the goal of replicating the programme in Cincinnati with an increase in the wide distribution of naloxone by involving the community as first responders for the crisis and supporting EMS response. The design was improved by providing single-use kits of Narcan, containing disposable gloves and a cardiopulmonary resuscitation (CPR) shield. The package itself was

a bilingual training tool (Image 2), providing education about signs of overdose, steps to administer Narcan, and how to roll a victim into the recovery position.

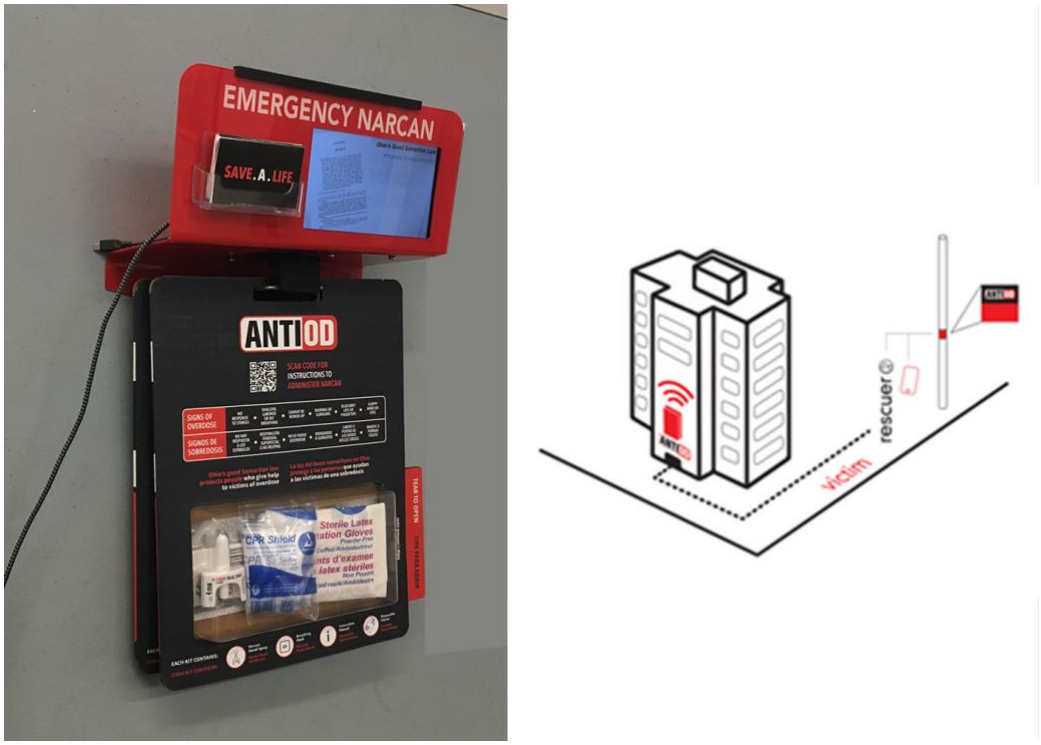


*Image 2: AntiOD product design*.

It was designed to be opened in an emergency by pulling from a tab and tearing a pre-cut strip, leaving the blister and the content ready for use. Instead of a box enclosing the packages, AntiOD proposed a smart dispenser for each location that could hold two kits (Image 3). The packs are unlocked by providing information to the smart dispenser (e.g. name and phone number).


*Image 3: AntiOD single-use pack*.

The smart dispenser used a lock safety mechanism for naloxone access to address regulatory mandates. A spectrum of access types was designed within the unit described as private, semi-private and semi-public configurations. The private configuration would be available for unit holders who would keep units in monitored spaces (e.g. offices) without the need to input information for unlocking the unit. The semi-private configuration would allow the unit holder to generate a unique access code to be shared with a group (e.g. front desk spaces). Lastly, the semi-public configuration would require users to input their names and phone numbers for data collection-tracking of naloxone distribution. With any configuration, removal of the single-use pack (Narcan) is enabled. When someone requires Narcan, they touch the 7-inch (17.78 cm) screen, and a 4-digit passcode is requested. When the passcode is given, the product is unlocked and a video of the four steps to administer naloxone is displayed. A switch in the latch is used to confirm that the product was retrieved. This action sends a notification to the location staff and the AntiOD team.

Besides being part of the safety mechanism, the platform had three objectives: 1) to give information to bystanders (i.e. how to recognize an overdose, where to get Narcan); 2) to provide instructions on the administration of Narcan, giving rescue breathing and rolling the victim to the recovery position—a necessary component to meet state regulations for naloxone distribution; and 3) to alert EMS with the location for completing the rescue of a victim from overdose (Rebola & Ramirez-Loaiza, 2020). Several graphic materials were developed to help the AntiOD deployment meet the requirements (Image 4). Several iterations were developed to provide fast and accurate and accessible information for naloxone administration: bilingual, graphical, and video.


*Image 4: AntiOD collateral materials for locations.*

The system relied on WiFi connectivity via the touch-enabled tablet screen, and information is input directly into the unit. By connecting the dispenser to a wireless network, the team can keep track of each location, plan restocking, keep a record of the activity and, more importantly, oversee the expiration date of every naloxone dose in the programme. Moreover, having the smart dispenser be unlocked with a passcode as an access feature ensures accountable staff in each location and the mandatory data (name and zip code) for naloxone distribution.

The programme was well received within the Cincinnati community, validating the need for such programmes (DiTirro, 2019; Kirklen, 2019). AntiOD received an honourable mention in the Fast Company's World Changing Ideas in the Health and Wellness category (Fast Company, 2019).

**From AntiOD to the public**

AntiOD partnered with several initiatives and organizations for its implementation. For example, the Community of First Responders was involved to provide information access to the smart dispensers for the people enrolled and trained in their programme, registered as naloxone carriers in the NaloxoFind app. In addition, the AntiOD project worked with organizations such as the former Downtown Cincinnati Inc., now part of the 3CDC group, for stakeholder engagement, and Cincinnati Bell for supporting the communication and technology aspects of the project. While these collaborations were instrumental, the larger public community was a necessary component to close the circle of innovation. It became apparent that there was a necessity to engage and educate the public about the reality of the crisis. The "AntiOD: Reclaiming our City" exhibition, hosted at the Cincinnati Central Public Library of Hamilton County (Image 5), was deployed to empower the public to take action (Royzman, 2019).


*Image 5: AntiOD Exhibition at Cincinnati Central Public Library.*

Instead of delegating the problem to institutions, the idea was to design mechanisms to share the responsibility of combatting the crisis.

The exhibition was designed to be an interactive platform for collecting and distributing information on overdose signs, treatment, support and resources for victims, relatives and the public. The exhibition was divided into four main sections: Act: what and how can someone save a life from an overdose? Share: what are the real stories related to addiction and/or overdose? Learn: what are the facts and resources available for overdoses? And Know: how is life after an overdose and can we learn from individuals touched by the crisis? With these four areas, the public was provided with information on naloxone administration, signs of overdose, local resources like Project DAWN and destigmatized language guidance, to mention a few. The exhibit also engaged the public by displaying *The Enquirer*'s Pulitzer Prize-winning "Seven Days of Heroin" video documentary (Enquirer and Media Network of Central Ohio staff, 2017). Overall, the exhibition was an invaluable venue for creating a network of shared responsibility and community involvement.

## Scalability and opportunities

Any design project presents obstacles throughout the process. NaloxBox and AntiOD encountered different obstacles that served as motivation to design technology for community engagement. This article presented iterations in creative development that explain how products and systems evolve to meet requirements across states. The success lies in transforming those obstacles into opportunities, thus making the later design stronger, as presented in the public exhibition. Additionally, it is noteworthy how the design had to meet regulations and comply with legislation, in our case, set by local and state health entities, while at the same time keeping in consideration its ease of use, for example, the collection of names and zip codes before unlocking the pack and the display of interactive information on how to use naloxone. Design can be an agent of change, generating community engagement and a social push to change legislation and promote better situations in our cities and communities, such as wider access to Narcan. Overall, this article claims that collaboration among experts, stakeholders and the public can result in a supplemental method to rescue overdose victims

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