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Empowering communities with a smartphone-based response network for opioid overdoses

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Abstract

In a Philadelphia neighbourhood where opioid overdoses are frequent, neighbors used a smartphone app to request and give help for a victim of suspected overdose. A one-year study demonstrated the feasibility of this approach, which empowered the local community to save lives and even respond to overdoses faster than emergency medical services.

The opioid epidemic continues to devastate families, ravage communities, and cause a large number of overdose deaths across the United States. Drug overdoses were the leading cause of injury-related death nationally in 2018, and 70% of those involved an opioid¹ Philadelphia has reported the highest annual rate of overdose deaths among large cities, at 46.8 per 100,000 individuals compared to Chicago's 15.4 and New York City's 11.2². In addition, thousands of non-fatal drug overdoses each year test Philadelphia's available resources such as hospitals and emergency medical services.

One of the efforts to address this complex public health issue is promoting bystander response among community members in order to prevent overdose fatalities. For every

overdose death, several lives are being saved every day by use of the overdose reversal medication naloxone. Naloxone, also known by the brand name Narcan, is administered intranasally to reverse an overdose and prevent death. Laypersons can administer naloxone as a nasal spray with few medical risks, making it a feasible intervention for wide use by the public. In Philadelphia, considerable resources have been channeled into increasing access to naloxone among those who use drugs and members of their social networks.

With increasing naloxone saturation in communities, coordinating response during overdose events could also improve response times and further reduce deaths. Policy efforts are encouraging the development of smartphone applications to connect laypersons carrying naloxone with nearby overdose events, and research is testing such applications. In this column we summarize the research results reported in an article³ on a pilot study of our UnityPhilly app and an article⁴ on formative research that informed the pilot study. We also reflect on some potential implications of pervasive computing on community and public health efforts.

THE UNITYPHILLY APP

UnityPhilly is an app designed as an Emergency Response Community, to support laypersons in signaling and responding to opioid overdose incidents^{3,4}. Volunteers signal an overdose incident with a single button press, initiating an automated alert to other nearby volunteer app users who answer the alert if they can respond to the scene. Design of the app was informed by needs assessment in the form of interviews and focus groups with end users⁴.

Signalling an Overdose

App users signal an alert when they encounter a suspected opioid overdose, administer naloxone if they have any, and speak with 11 through a phone call initiated by the app. Concurrent with sending the alert, a call is initiated from the signaler's smartphone to a dedicated phone number connecting to the Philadelphia Police EMS (Emergency Medical Services) dispatch unit. Smartphone operating system constraints result in slightly different EMS call behavior for Android and Apple-based phones. On Android handsets, calls are placed immediately when the signaling button is pressed. On Apple iOS handsets, a pop-up with the EMS phone number appears requiring the caller to confirm the dial request.

Location data from the volunteer's smartphone are transmitted to UnityPhilly servers which automatically check for other nearby volunteers and send dispatch alerts with the overdose location to the four closest. For our pilot study, 'nearby' was defined as within a 15-minute estimated time of arrival to the overdose site, calculated dynamically based on the participants' declared transport mode (foot, car, etc.).

Responding to an Overdose

Volunteers receiving the alert can use the app to indicate they are responding or declining to respond to the alert; navigate to the overdose site; communicate with the signaler and other responding volunteers; and review salient overdose information including instruction for recognizing overdose, administering naloxone, and rescue breathing.

The system sends alerts to additional volunteers if an alerted volunteer does not acknowledge within two minutes. In this manner, additional volunteers are notified of the incident until either four have confirmed they are en-route, or there are no additional volunteers within the set radius. Volunteer locations are automatically updated every 15 minutes by a message sent from the app to the server. Signalers are automatically informed when nearby volunteers have been found, when volunteers indicate they are responding, and when a volunteer is arriving on scene.

PILOT STUDY IN KENSINGTON

We conducted a pilot study³ of UnityPhilly in the Philadelphia neighborhood of Kensington, from March 2019 through February 2020. Kensington, where fentanyl, heroin, prescription opioids, and other illegal drugs are openly sold, has Philadelphia's highest concentration of overdose deaths². Kensington is also home to Prevention Point Philadelphia, the only city-sanctioned syringe exchange program in Philadelphia, and one of only two in the state of Pennsylvania. We therefore selected Kensington due to its high number of overdoses, its population density, and the opportunity to leverage the sense of community built around Prevention Point's harm reduction services and support.

Prevention Point is a local leader providing naloxone training, working to meet demand by accommodating a high volume of requests for training sessions. Prevention Point distributed about 5,500 doses of naloxone in 2016². The organization's efforts have been recognized as helping to ease the demand on the city's emergency services, and they played a key role on the Mayor's Task Force to Combat the Opioid Epidemic². Our formative research also showed that those who use opioids and are affected by opioid use in Kensington have high levels of trust in Prevention Point⁴.

One hundred twelve community members participated in our pilot study, which they heard about through touchpoints with services provided by Prevention Point. In line with efforts to distribute naloxone to those who are likely to witness an overdose, our model for UnityPhilly is to create a network of people who are actively using opioids, as well as other members of the local community who report they have not had any non-medical opioid use in the past 30 days. The 112 participants were almost equally divided between these groups, 57 and 55, respectively.

While not everyone in the community will have reliable access to a smartphone, our formative research found that we could reach a critical mass for our Emergency Response Community. Participants were therefore required to have their own smartphone with a data plan, and we installed the UnityPhilly app on their phone before providing training and practice with using the app. We notified participants that their location/movements would be tracked by the app. We also provided naloxone training and two doses of naloxone to each participant.

KEY APP USE OUTCOMES

Participants signaled 291 suspected opioid overdose alerts during the one-year study period³.

- Eighty-nine (30.6%) signaled events were determined to be false alarms, i.e., canceled by the signaler within 2 min of the alert being sent or the signaler entering an app chat message to the effect that this was a “false alarm”. Every signaled event initiated a phone call to EMS, irrespective of the alert being true or false, enabling EMS to execute their follow up protocol regardless of layperson responder engagement.
- In 74 (36.6%) of the remaining 202 cases, at least one dose of naloxone was administered by a layperson participating in the study (whether the person signaling or responding through the app). A successful reversal was reported in 71 (95.9%) of these cases.
- In the remaining 128 (63.4%) cases 911 was called but no naloxone administration or follow up by laypersons was reported by incident survey respondents.
- The first dose of naloxone was provided by a nearby volunteer responding to the alert in 22/74 (29.7%) of cases and by the signaling volunteer in 52/74 (70.3%) of cases.
- One on-scene death was reported (1.35%) and two intervention outcomes were unreported (2.7%).

HOW CAN AN APP HELP?

Locations of Overdoses

The Kensington community environment is characterized by an open-air drug market and about 30% of study participants were homeless. Most incidents (58%) were reported as occurring on the street. We also observed a significant number of in-home overdose signaling (23%) indicating the relevance of this approach in providing at-home support for caregivers and family members of opioid users. Allowing entry of layperson responders into homes or businesses in this study was at the discretion of the person who signaled the alert. Other locations reported included in a business, vehicle, and abandoned building. Monitoring location trends of where suspected overdoses have been reported could inform interventions tailored to the needs of the neighborhood.

Participants also suggested real-time geographic monitoring, to help identify when and where especially lethal batches of opioids are infiltrating a community. In addition to varying strengths across different batches, a surge in fatalities has been attributed to batches being mixed with fentanyl, a substance 50–100 more potent than morphine.

Informed Voluntary Response

In interviews before and after our pilot study, we heard consistent suggestions for the app to provide contextual information that can help someone who has been signaled about an overdose to make an informed decision about whether to respond. During the pilot study, the current version of UnityPhilly did not provide additional information outside of an address on a map. Participants described several types of risks that responders to an app signal could

be exposing themselves to, and felt that responders may not even be cognizant of these risks in the moment. An app could either use context-awareness to provide pertinent information, or facilitate question and answer with the person who signaled the overdose. For example, helping a responder determine if the location is in someone's home, or an abandoned building, and whether or not they are comfortable entering such a location. Or, provide an understanding of the victim's condition, such as how long they may have been unconscious, or whether they were breathing.

Each Minute Matters

During the 52-week study, naloxone was administered at 74 overdose events (1.42 times per week on average), and was done more than 5 min in advance of EMS arrival in 59.46% of cases. Without timely reversal, opioid overdose causes respiratory depression that may deteriorate into apnea, leading to anoxic injury. In the minutes immediately following opioid overdose, 'time is brain.'

Interaction with Emergency Services

Participants who initiated calls to EMS using the app, in addition to alerting other volunteers, reported staying with the victim until EMS arrival in 89.19% of cases. One study of behavior during drug overdoses found that no more than half of those who respond to an overdose event sought help from emergency services⁵. During our own formative research in Kensington, participants reported an aversion to communicating with EMS or other authorities, especially if there was a chance of interaction with law enforcement—they did not trust police, and feared that they or others could be arrested⁴. That a majority of app users stayed with the victim could be a bias based on the types of users who self-selected to participate in the study and agreed to respond to a signal of an overdose through the app. Regardless, our study demonstrates the feasibility of a smartphone-based network of layperson responders as part of the ecosystem of emergency services.

Community-Based Peer Help

The name of the app, UnityPhilly, was drawn from insights during our initial qualitative research in the Kensington community. Trust was high in one's peer groups, such as fellow opioid users or members of their neighborhood community, and we found a deep camaraderie and desire to support one another. Smartphone-based networks could therefore have the potential to empower members of a marginalized group and underserved neighborhood to unite and help one another. Community members' distrust of institutions such as emergency services, and the perception that outsiders' prejudice renders them less helpful to overdose victims, enhances their reliance on one another.

Designing apps like UnityPhilly to not only facilitate logistical support, but also promote shared identity and social capital, could have meaningful impact on social support within the community. Moreover, this type of design may help members of a community with coping and mental health in the context of significant death and suffering.

Understanding and Managing Personal Risk

At the same time, participants' concerns about a smartphone application tracking their location stemmed from some distrust of fellow community members. In a community deeply affected by opioid use, theft is commonplace, and bartering with naloxone was even reported. Privacy concerns therefore related to one's own community members misusing a smartphone application, with the risk of theft or assault.

Interestingly, despite a distrust of police coming up in our formative interviews, participants made no mention of their location data possibly being obtained by law enforcement. Techniques for preserving privacy while using location-based services should be explored, and future work could help community members understand various potential risks as well as eliciting their preferences for how their privacy could be protected.

CONCLUSION

The distribution of naloxone to those who are likely to witness an overdose is a key evidence-based strategy for addressing the opioid epidemic. Smartphone applications are a novel medium for facilitating naloxone distribution and administration, and policy efforts are encouraging their development. Our findings support the benefits of equipping community members with naloxone and an emergency response community smartphone app, for alerting EMS and nearby laypersons to provide additional naloxone. Individuals affected by opioid use and overdose reacted positively to the concept and use of our UnityPhilly app, which they perceived as a useful tool that could help combat the high rate of opioid overdose fatalities in their neighborhood. A sense of unity with others who have shared their experiences could be leveraged to connect willing volunteers with victims of overdose, but risk must be mitigated for layperson responders.

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Integration with Dispatch Systems

Philadelphia EMS is one of the busiest systems in the United States. While some U.S. cities have adopted text-based emergency messaging to call centers (text-to-911), this service is not supported in Philadelphia. Therefore, we had to find another way for our app to automate, or at least facilitate, communicating information about a reported suspected overdose to EMS.

An initial version of the UnityPhilly app featured an automatic computer-generated voice call to EMS in which the system “spoke” to a human (MS dispatcher and provided the address+GPS coordinates, and a message that an opioid overdose had occurred – without any direct interaction between (MS dispatch and the human signaler. The text of the original message was “Hi, I am reporting an overdose incident that is happening now. This automated message was generated by the UnityPhilly app and will repeat twice. The overdose is occurring at {Street Address}, {City}. The GPS coordinates are {location GPS x} and {location GPS y}. Please send an ambulance with naloxone.”

During consultations with Philadelphia EMS in preparation for our pilot study, concerns for situational assessment and control were raised leading to an EMS request that this functionality be removed and that a direct person-to-person voice call be established. Therefore, we modified the app to comply with Philadelphia EMS requirements, which enabled a process whereby standard EMS caller interrogation protocols could be followed irrespective of the additional layperson support provided through the UnityPhilly app. These phone calls were initiated immediately and without delay when a participant, having encountered a suspected opioid overdose, pressed the button to signal the overdose event occurring at that location.

Text-based communication with call centers may become more common, and has the potential to ease integration of apps designed as Emergency Response Communities. This may have advantages for empowering communities to provide peer support, but could mean an influx of activity for call centers, which must also be considered.