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Permalink

https://escholarship.org/uc/item/61w0q0j6

Journal

Journal of Substance Use, 25(6)

ISSN

1465-9891

Authors

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Publication Date

2020-11-01

DOI

10.1080/14659891.2020.1753833

Peer reviewed

Feasibility of a Citizen-driven Hackathon to Increase Public Engagement and Solutions to Address the Opioid Crisis

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Abstract

Background—Interdisciplinary approaches are needed to address complex societal problems, such as the opioid crisis. We sought to explore the feasibility and potential issues encountered in planning and implementing a 24-hour hackathon competition to bring together teams from law enforcement, public health, and data science to develop solutions to the opioid epidemic.

Methods—We enlisted an advisory board and planning committee, including key stakeholders (e.g., high-level representatives from government agencies) to plan the event. Teams completed an online registration form with questions about team composition. Each team captain completed a survey at the event describing prior experiences with their team, knowledge and interest around the opioid epidemic, and hackathon expectations.

Results—Twenty-nine teams (108 individuals) registered. 76% had a technical/engineering background. Participants were from industry (55%), academia (30%), public health/medicine (9%), and government/public policy (6%). Nineteen teams attended the event. Team captains were primarily 18–29 years of age, had moderate experience and interest in the opioid crisis, and had never attended an opioid-related event.

Conclusions—It is feasible to implement a 24-hour opioid-focused hackathon and recruit teams/ participants from a broad range of disciplines. We discuss the solutions developed, barriers encountered, and insights gained throughout the planning and implementation process.

Keywords

opioids; hackathons; technology; interdisciplinary

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Introduction

Over the past twenty years, the United States (US) has seen a dramatic increase in the use and misuse of opioids (Skolnick, 2018). In the early 2000s, there was a significant increase in the availability and use of prescription opioid medication (Wilkerson et al., 2016). As general medical use of opioids became commonplace, nonmedical use also increased (Wilkerson et al., 2016). Additionally, misuse and abuse of prescription opioids contributed to an increase in heroin and fentanyl overdoses (Gellad et al., 2017). As the number of deaths resulting from opioid overdose continues to rise, the need for new and innovative approaches is more important than ever.

New approaches that engage society are necessary to address the opioid epidemic. These strategies may include education, risk mitigation, addiction treatment (Gellad et al., 2017), vaccines (Skolnick, 2018), pain management (Jones et al., 2015), and community public education efforts (Koh, 2015). However, these often-siloed approaches may have only limited effectiveness and only engage select groups. While these approaches are important in prevention and treatment of opioid use disorder, an approach that engages multiple disciplines, especially helping to engage general citizens, is necessary to effectively address this epidemic. For example, research studies have shown potential in bridging general citizens with researchers in technology, psychology, and clinical fields, such as by using social media/online communities to change health behaviors including HIV and substance use (Ashrafian et al., 2014; Young et al., 2013, 2015, 2019; Young & Heinzerling, 2017). Other studies have bridged these groups by using artificial intelligence modeling methods for detecting outcomes among at-risk populations, including opioid-related populations (Lo-Ciganic et al., 2019; Pandrekar et al., 2018; Young et al., 2018). Similarly, actively engaging citizens in the design, development and implementation of public health and opioid-related solutions may help to improve creativity, engagement, and health outcomes within society.

Relatively newly emerging approaches, such as hackathons, are looking to improve health outcomes using technology in ways that engage societal participation (Angelidis et al., 2016). Hackathons are intense, short-duration competitions in which teams work together to develop a new solution, usually a working software prototype, to a challenge (Angelidis et al., 2016; Komssi et al., 2015). Hackathons encourage collaboration between multiple disciplines as new ideas are generated (Angelidis et al., 2016; Iqbal et al., 2018). With the increasing need for new approaches to combat the opioid crisis, hackathons have the potential to generate novel solutions to this challenge.

This paper seeks to explore the issues encountered in planning and implementing a 24-hour hackathon event to bring together teams from law enforcement, public health, data science, and research to attempt to quickly develop software solutions to assist in solving problems related to the opioid epidemic.

Methods

Phase 1: Planning

The Opioid Hackathon 2018 was an opioid-focused hackathon in Southern California hosted and planned by the University of California Institute for Prediction Technology (UCIPT) in collaboration with the U.S. Department of Health and Human Services (HHS). Interdisciplinary teams of computer and data scientists, public health and policy experts, researchers, and patients/families affected by the opioid crisis participated in this 24-hour event to develop a potential solution to address the opioid crisis in California. Teams competed in four different tracks focused on data sharing, ethics and behavior change-related software, as well as data science and visualization solutions designed for public health. This event is part of a study on whether and how hackathons can be used to scale implementation of opioid-related solutions in public health settings.

The planning occurred over the course of several months. We secured a venue to hold the hackathon, hired a photographer and videographer to document the event, and organized paperwork for participants. Because this hackathon is related to a research study, participants were required to sign informed consent forms as well as complete a baseline survey and sign a photograph/video release and data-sharing/usage agreement. In addition, we planned a webinar one week before the event for hackathon participants. This webinar provided additional information about the study portion of the hackathon, as well as information about the datasets participants could use during the event. One member from each team was required to attend. Participants were encouraged to ask any questions about the study and/or hackathon during this time.

Advisory Board

The UCIPT team put together an advisory board to guide the planning of the event. This advisory board included individuals working in various fields related to the opioid epidemic and included federal and county government officials, law enforcement officers, health care providers, researchers, and community organizers. During the planning stage, the advisory board attended online meetings to provide feedback on the event. The challenges, or tracks, each team competed in were also informed by the advisory board.

Participants

We used various methods to recruit teams to participate in the Opioid Hackathon 2018. Information about the event was disseminated on social media sites, such as Facebook, Twitter, and LinkedIn. The UCIPT team also contacted academic departments within California universities to reach Masters- and Doctoral-level students in Public Health, Computer Science, Engineering, and Medicine. Additionally, details about the hackathon were sent to department-wide email listservs. In addition to these internet-based methods of recruitment, we identified local, technology-based Meetup groups on Meetup.com and other websites (Tech groups in Los Angeles—Meetup, n.d.), and attended these in-person meetings to share information with individuals from the technology industry. Recruitment began six weeks before the event.

Individuals and teams interested in participating were encouraged to register for the event online. Individuals who did not have a team could join the Opioid Hackathon 2018 LinkedIn group, where they could connect with others interested in participating. Teams were directed to the hackathon event website, where they could complete a Google form. This form asked for team information such as names, field of work, and prior experience with hackathons. Teams began registering for the hackathon four weeks before the event, with a few teams registering up until the day of the event. Teams with experience in a prior hackathon and sufficient technical experience were invited to participate in the hackathon via email.

Tracks

The advisory board, in collaboration with the planning committee, co-developed four different tracks that focused on software development and data science. The first track emphasized ethics and data sharing. Teams in this track were asked to create a working prototype of a technology in order to ethically share data and information that may help public health departments deploy interventions and resources. The second track focused on behavior change applications. Track two teams were asked to design personalized behavior change apps with the aim of reducing opioid overdose-related risk behaviors. The third track focused on creating real-time models and visualization tools to track trends on 1) opioid prescribing behaviors among providers, 2) willingness to prescribe or use medication-assisted therapy, and/or 3) harm-reduction actions such as availability of naloxone or related overdose prevention kits. The final track also emphasized real-time models and visualization tools, but teams were required to incorporate non-traditional data sources, such as cannabis data or social media data, into their models.

Datasets

In collaboration with our government (HHS and California Department of Public Health) and industry partners, we identified and acquired more than 120 opioid-related federal, state, and local datasets on topics such as health, opioids, employment, economics, cannabis, as well as proprietary industry data on cannabis sales, shown in Table 1. Access to these datasets was given to participants two days prior to the event.

Phase 2: Event

The Opioid Hackathon 2018 took place on October 14th and 15th in Irvine, California. The 24-hour event began with a speaker symposium, in which twelve individuals working in public health, the justice system, law enforcement, research, and medicine were invited to speak about their work on the opioid crisis and provide information on needs as it relates to addressing the opioid crisis. All participants, as well as community members, were invited to attend. The presentations provided by such a wide variety of speakers and backgrounds were designed to help provide a comprehensive view of the opioid epidemic, approaches, and impact to help inform and inspire the teams.

After the symposium, teams checked in for the hackathon event. Participants were asked to sign a hackathon participation form, data-sharing and usage agreement, and an informed consent form. One participant from each team was also randomly selected to complete a baseline survey, which would provide information on team background, prior experiences

with opioid work and knowledge of opioid epidemic, and hackathon expectations. Teams between two and five were each assigned to a private space in the venue. Teams had 24 hours to develop a solution in one of four tracks. Members of the advisory board and the UCIPT team were present to answer any questions that arose during the event regarding data or the tracks. Teams were also able to interact with other teams.

There were two rounds of judging. Judging criteria followed the National Institute of Health (NIH) guidelines and scoring system, including a nine-point rating system (Scoring System and Procedure3_5_2012, n.d.). Solutions were judged on their significance to the opioid crisis, innovation, feasibility, implementation, and how well the team worked together. The first round of judges included individuals with backgrounds in medicine, government, and public health, as well as technology. From this round, three teams from each track were invited to present their solutions during the final round of judging. The first track consisted of only two teams, so both were able to move forward. Final round judges were federal government officials, researchers, physicians, and community organizers. After discussion among the judges, winning teams of the Opioid Hackathon 2018 were announced for each of the four tracks.

Results

The Opioid Hackathon 2018 took place in the fall of 2018 in Southern California. It was initially intended to be a small, focused event, but received registrations from people from across the country and world. Twenty-nine teams registered for the hackathon. Of these teams, 14% signed up to participate in the first track, 22% signed up for the second track, 47% registered for the third track, and 17% registered for the fourth track (Table 2). Of the 108 participants who registered for the hackathon, 76% had a technical or engineering background. Participants also had backgrounds in industry, such as data science and start-ups (55%), academia (30%), public health or medicine (9%), and government/public policy (6%) (Table 3).

The day of the hackathon, nineteen teams checked in to participate. There were also two individuals who registered the day of the event. They were encouraged to join an existing team still looking for team members.

Teams designed solutions with a high potential for impact in just 24 hours. Winning teams were awarded $5,000, mentorship with design experts, and travel expenses for teams to continue meeting with key stakeholders to further develop and implement their solutions in a public health setting. Winning teams consisted of members with experience in entrepreneurship, engineering, and academia. Solutions focused on behavior change applications and modeling to predict and prevent opioid overdose. The winning team from track one developed an application that regulates opioid dispensing to a patient. This application also offers patients alternatives to taking opioid medications, such as meditation. The track two winning team created an application that uses wearable data, machine learning, and patient data to provide support to people in recovery. The track three winning team used applications of machine learning to create a tool that predicts opioid overdose deaths in California. The winning team from track four developed a tool that uses

open source data analysis and cannabis sales data to predict opioid overdose and to help reduce opioid use.

Results from the surveys completed by the team captains of each team found that the majority of these survey respondents were 18–29 years of age and living in the western US. Most of them had reported never having attended an opioid-related event prior to this one, and had neutral to slightly more than neutral knowledge and interest in helping to address the opioid crisis (Table 4).

Discussion

The aim of this paper is to explore the issues in planning and implementing a 24-hour hackathon to unite the public in co-developing solutions designed to address the opioid epidemic. We found that it is feasible to bring together interdisciplinary teams from law enforcement and justice, public health, data science, and research in a hackathon to create unique and innovative solutions to combat this crisis. Insights and feedback from the advisory board guided the planning and implementation of this hackathon. After several months of planning, the Opioid Hackathon 2018 took place in October 2018 in Southern California. This event began with a speaker symposium in which experts in opioid use presented on their work on the opioid crisis and needs relating to addressing this crisis. Speakers were from public health, the justice system, law enforcement, research, and medicine.

Of the twenty-nine teams who registered for the hackathon, nineteen showed up to participate, suggesting that individuals planning hackathons should plan for attrition through either over-recruitment and/or have methods in place to serve as reminders/check-ins. This may help increase the likelihood that teams will show up to the event after registering. Teams were composed of individuals from both academia (students or professors) and industry. Most participants had a technical or engineering background, as might be expected through an event focused on software development. A large group of participants had a background in public health or medicine (including patients and/or family members affected by the opioid crisis), and government/public policy, showing the event was successful in gaining participation from individuals from diverse backgrounds relevant to public health and technology.

Hackathons might be used to facilitate methods of citizen-driven engagement in public health. Engaging the public in working on ideas and solutions that impact community health might create a new model to address public health challenges. These bottom-up and non-hierarchical approaches may be more likely to create sustainable change. For example, health care delivery has changed such that patients are now engaging in conversations with their health care providers, providing feedback on their medical care (Sacristán, 2013). These methods of joint medical decision-making might be applied to public health in ways where general citizens are able to not only provide feedback on their views about public health but also to jointly develop solutions built for, in collaboration with, and used by public health officials to improve societal health. When citizens become directly involved in finding new approaches to public health problems, such as the opioid epidemic, these

approaches might be more likely to be effectively and efficiently implemented in their communities. Future research can help to explore this idea.

While we found the Opioid Hackathon 2018 to be a feasible method of creating unique, citizen-driven approaches to addressing the opioid epidemic, we experienced some barriers during the planning stages. One such barrier was related to recruitment and registering of participating teams. Though we planned on beginning recruitment two months before the event, marketing and recruitment actually began about six weeks before the event. Teams did not begin to register until four weeks before the event. While a few teams registered four weeks before the hackathon, most registered within two weeks of the hackathon. Because teams were registering so close to the event, we did not have sufficient time to select those teams with the most relevant experience. In the future, we recommend beginning marketing and recruitment for the hackathon earlier in order to ensure enough time before the event to select and invite qualified teams to participate.

Similarly, we found that it is important to either have funding in place before beginning the event, and/or to plan the event with lowest cost options that fit with the budget in order to avoid having to quickly seek funding in the final days of the event. For example, the planning committee advised on reserving the Beckman Center for Science and Engineering in Irvine, which was one of the most expensive venues being considered, because it was an elegant venue compared to most hackathons and might help to lure participants to the event. Further, we had committed on the website to providing a $5,000 prize to each winning team before this funding had been secured, based on previous work from the advisory committee in believing it should be reasonable to raise this funding from industry partners. However, few groups were willing and able to invest the amount of funding that was needed to support this event. Fortunately, our research team submitted an application (which was successfully funded) to the National Institute on Drug Abuse (NIDA) and National Institute of Allergy and Infectious Disease (NIAID) through a grant supplement for funding through the Helping to End Addiction Long-Term (HEAL) Initiative. This grant supplement was focused on exploring the implementation science-related issues in having hackathons to address the opioid crisis and incorporated funding for the hackathon in order to study this event and its impact. This funding was awarded quickly before the actual event, helping to secure the funding needed.

In conclusion, we found that it is feasible to create a hackathon to unite the public in addressing the opioid crisis. Interdisciplinary teams consisting of individuals from public health and medicine, data science, justice and law enforcement, and public policy were successful in creating unique and innovative solutions to the epidemic. Teams were excited to participate in the hackathon and to continue working on their solutions after the conclusion of the event. Based on the insights from this event, we planned another event, The Opioid Hackathon 2019, which was recently held (Opioid Hackathon 2019, n.d.). In the coming months, we will be following up with teams from both events to determine whether and how these events might have had a lasting impact on their passion and work related to helping to solve the opioid crisis. We will monitor the results of the solutions created from the hackathon to report on in the future.

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Table 1.

Data Sources

Data Source	Description
Socrata	Access to an API which includes more than 120 opioid-related datasets
Healthdata.gov	HHS open data resource providing 254 health-related datasets
California Open Data Portal	Provides hundreds of open data datasets on California, including 334 datasets related to health and human services
California Opioid Overdose Surveillance Dashboard	Data tool with enhanced data visualization and integration of statewide and geographically-specific non-fatal opioid-involved overdose and opioid prescription data
OpenJustice	Open source data portal provided by the California Department of Justice
CURES 2.0	Data on California and Safety Code section 11165(d), which requires dispensing pharmacies, clinics, or other dispensers to report prescriptions dispensed for Schedule II, Schedule II, or Schedule IV controlled substances to the Department of Justice
Drug Enforcement Agency Datasets	Data on a variety of drug-related activities, including drug labs in U.S. and drug seizure data
Medi-Cal Drug Utilization Data	Drug utilization data available for fee-for-service outpatient drugs reimbursed on or after july 1, 1996 by Medi-Cal to pharmacies
Inter-university Consortium for Political and Social Research (ICPSR)	Social and behavioral sciences data archive. Hosts 21 specialized collections of data in education, aging, criminal justice, substance abuse, terrorism, and other fields, such as treatment episode data
The State of the USA	Provides data on overall health and economic status at the individual community level
Postmarket Drug Surveillance Programs	Produced by the Food and Drug Administration (FDA) showing adverse drug effects
The Office of Women's Health – Quick Health Data Online	Health indicators with a focus on women (ex., mammogram rates)
Behavioral Risk Factor Surveillance System (Center for Disease Control and Prevention)	Survey of behavioral factors
Cannabis Dispensary/Sales Information from BDS Analytics	Sourced from dispensary Point of Sales reporting
Cannabis/Integrative Health Data from Healer.com	Surveys from medical practices of cannabis and opioid patients

Table 2.

Track registration

	Total N=29	Percentage
Track 1: Ethics and data sharing	4	14%
Track 2: Behavior change applications	6	22%
Track 3: Visualization and modeling tools	14	47%
Track 4: Visualization and modeling tools using non-traditional data sources	5	17%

Table 3.

Participant background (Registered individuals)

	Total N=108	Percentage
Technical/Engineering		
Yes	82	76%
No	26	24%
Industry (Data science or Start-ups)	59	55%
Academia	32	30%
Public Health or Medicine	10	9%
Government or Public Policy	6	6%

Table 4.

Team demographic and background information

	Total N=19	Percentage
Interest in opioid crisis		
Very interested	5	26%
Interested	9	47%
Neutral	3	16%
Uninterested	1	5%
Very uninterested	1	5%
Knowledge about opioid crisis		
Very knowledgeable	1	5%
Knowledgeable	7	37%
Neutral	8	42%
Unknowledgeable	2	11%
Very unknowledgeable	1	5%
Commitment to solving opioid crisis		
Very committed	4	21%
Committed	9	47%
Neutral	6	32%
Uncommitted	0	0
Very uncommitted	0	0
Ever attended opioid-related event		
Yes	11	42%
No	8	58%
Background		
Academia	4	21%
Industry	10	53%
Both academia and industry	5	26%
Location		
Northern U.S.	4	21%
Southern U.S.	0	0
Eastern U.S.	1	5%
Western U.S.	14	74%
Age		
18 – 29 years	12	63%
30 – 39 years	3	16%
40 – 49 years	2	11%
50+ years	1	5%
Unknown	1	5%