



**Understanding Opioid Overdose and Mental Health Through a Public Health Dashboard:
A Qualitative Evaluation of mHOPE**

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Research Report

Background

The opioid overdose epidemic remains a major public health and clinical challenge in the United States. Although opioid overdose deaths declined by approximately 4% from 2022 to 2023, from 25 to 24 deaths per 100,000 people, substantial disparities remain across race, geography, age, socioeconomic status, education, treatment availability, and housing stability [1, 2]. The opioid crisis also intersects with the broader mental illness epidemic, as communities experiencing opioid-related harms may also experience high levels of mental health conditions and other related social and health challenges. Understanding these overlapping patterns is important for identifying where risk is greatest and where public health interventions may be most needed [3]. However, examining these relationships can be difficult when relevant data are separated across different sources, geographic levels, or health outcomes.

Public health dashboards are valuable tools that use web-based interactive data visualizations to communicate community-specific health metrics. They can help communicate the scale of public health problems, contextualize trends at both national and local levels, guide interventions, and support research and policy decisions fostering connections between government officials, researchers, and the general public [4]. Dashboards have been used to monitor a variety of public health issues, including opioid overdoses, vaccination benefit-risk assessments, and quality improvement. Their use became particularly prominent during the COVID-19 pandemic, when national dashboards helped demonstrate the real-time burden and geographic distribution of the pandemic [5, 6].

However, the usefulness of a public health dashboard depends not only on the data it contains, but also on how easily users can access, navigate, and interpret the information presented. Usability testing is a research method in which users are observed performing tasks on a product to identify potential flaws or evaluate how well a product meets user needs. Usability testing is particularly important for dashboards because it can help identify issues related to accessibility, appropriateness, and acceptability. Evaluating a tool during the development process allows users to provide feedback that can be considered before the tool is published. Previous studies have used qualitative methods to evaluate public health dashboards. For example, a mixed-methods evaluation of a PrEP data dashboard found that the dashboard was useful and acceptable while also providing participants with an opportunity to give constructive feedback [7]. Qualitative methods can provide more user-centered information and allow structured feedback to be communicated back to the development team. Similarly, this study used a qualitative method to identify areas of success and improvement within the mHOPE (Mental Health and Overdose Prevention Explorer) dashboard.

Existing national opioid-related dashboards are often limited because they primarily focus on statewide data, emphasize overdose outcomes without additional context, or rely on a single data

source. This creates a need for a more comprehensive and user-friendly platform that integrates multiple datasets and provides deeper insight into overdose disparities and treatment access.

While existing literature provides guidance on the types of data that can be included in public health dashboards, less guidance is available on how these tools should be designed to effectively facilitate interaction with the data [8]. Dashboards can be powerful tools when properly developed and designed, ideally facilitating the way that the public interacts with the data presented [4]. Therefore, evaluating how users interact with a dashboard during their development can help identify areas where the presentation of information may be improved.

With the goal of expanding knowledge of the opioid crisis, the mental illness epidemic, and their intersection, mHOPE integrates multiple datasets that allow users to examine overdose, mental health, treatment access, and related social and geographic factors. The dashboard is currently presented as a WordPress-based website featuring interactive statistics, trend analyses, geographic information systems mapping, and spatial data visualization tools. Although it was not public facing at the time of the study, the development team was in the final stages of development for publication. Previous qualitative studies examining the improvement of opioid data dashboards have identified target areas such as storytelling, actionable insights, minimizing gatekeeping, access, and engagement when considering ways to improve these tools [9]. Likewise, this study aimed to identify areas of success and improvement that the mHOPE dashboard project should target in the existing model prior to publication.

Objectives

The main objective of this study was to qualitatively evaluate the usability, clarity, accessibility, and effectiveness of data presentation within the mHOPE dashboard. Because mHOPE was developed to expand knowledge of the opioid crisis, the mental illness epidemic, and their intersection, this evaluation focused on whether users could effectively navigate, interpret, and apply the information presented across the dashboard. The principal research question was: How can user-centered qualitative feedback improve the presentation, accessibility, and usefulness of data visualizations and spatial analytics in opioid overdose surveillance tools? Findings were used to establish current perceptions of the dashboard and identify gaps in knowledge, design, and use that could be considered for further improvement of the dashboard.

Methods

Ethical Considerations

The Tufts Health Sciences Institutional Review Board (IRB) reviewed and approved the mHOPE study protocol.

Between July 31 and August 12, 2026, a quality assurance and quality improvement assessment of the mHOPE dashboard was conducted. During this period, there were no fundamental revisions made to the dashboard.

Project Design and Setting

A qualitative assurance and quality improvement strategy was chosen for this project to test whether the current version of the dashboard met its goals and to determine how it could be improved in future versions. Qualitative evaluation would allow verbal feedback to be given to the research team to take into consideration the development of the dashboard. Semi-structured qualitative interviews were conducted with participants, which allowed the investigators' flexibility to explore different target areas to be evaluated throughout the interview.

Dashboard

The tested version of the mHOPE dashboard is hosted on the GitHub platform as a Word-Press website. The web page contains seven different tabs for users to explore: Splash, Maps, Trends, Data, Blog, About, and Definitions.

The Splash tab contains the title of the project followed by links to the interactive maps and trend visualization that the site has to offer. It also contains an 'Information & How to Use' section where context, goals, how-to, and uniqueness of the website are outlined. The Splash page ends with a summary of information on each dataset used in the dashboard.

The Map page hosts the dashboard portion of the website. Here is where opioid overdose, mental health, travel to treatment, social vulnerability, and health related census data can all be visualized across states and counties.

The Trends page contains visualizations on overdose, treatment access, and demographic characteristics; including bar, line, and whiskers and plots graphs.

The Data page hosts the data query where specific data from the available datasets can be exported. Additional information on the datasets and mapping information, such as the usage of quintiles, is also found on this tab.

The Blog page hopes to hold blog posts related to the topics of opioid use disorder and mental health. At the time of the interviews, no blog posts were available for review, but the tab was available for preview.

The About page lists the methodology used when creating the dashboard as well as recognition for the team of people that worked on the project.

Participant Recruitment

The first two participants for this study were recruited using purposive sampling to identify public health researchers who could potentially utilize this tool in the future. Additionally, snowball sampling was used by asking participants to refer to other individuals who might meet the study's inclusion criteria. Potential participants were invited via email to schedule a semi-structured interview. Six participants were interviewed by the end of the research period.

Interview Procedure

Interviews were conducted using an interview guide developed at the beginning of the research period. The first two interviews were conducted in person, and the remaining four were held virtually over Zoom. The length of the interviews varied from 35 to 55 minutes. At the beginning of each interview, the project objectives were explained, and verbal consent was received from all participants. One participant declined to be audio recorded; therefore, extensive notes were taken during that interview.

The interview guide aimed to evaluate five different target areas: navigation and usability, data visualizations, information and content, usefulness, and improvements. To receive this feedback, interviews were structured into two parts: dashboard activities and semi-structured questions. The dashboard activities were designed to familiarize participants with the tools and features of the dashboard website while also allowing interviewers to observe how participants navigated and interacted with the dashboard.

Participants were asked to complete the following activities:

1. For the first five minutes, participants were asked to browse the different tabs on the site to gain familiarity with its features.
2. Participants were asked to find the “Provisional Overdose” rate from 2024 in a county familiar to them.
3. Participants were asked to determine which county had the higher commute length to an opioid treatment center in 2026, Tulare County or Piscataquis County.
4. Participants were asked to imagine they were interested in comparing overdose death data and depression prevalence data. They were asked to find two datasets from any year, compare them, observe the bivariate map, and generate a scatterplot.
5. Participants were asked to export data using any values, dataset, specific years, and state.

Following these activities, the interviewer asked a series of semi-structured questions about the participant's experience using and interacting with the dashboard. Six questions served as the baseline for the interview. Questions were sometimes skipped or changed depending on the participant's experience and expertise.

Rapid Qualitative Analysis

Interview audio recordings were transcribed by hand, and interview notes were reviewed. A rapid qualitative analysis (RQA) method was chosen to gather, condense, and analyze the data within the six-week timeline of the project. Findings from each interview were initially summarized into the predefined domains of the interview guide. A cross-participant matrix was then developed to identify recurring patterns across interviews. Emerging themes were refined, and the findings were translated into written recommendations for improving the dashboard.

Results

From the cross-participant matrix, five emerging themes were identified and refined.

Theme 1: Strong value and potential of the dashboard

Participants generally viewed the dashboard as a valuable resource for exploring and understanding opioid-related public health data. Across interviews, participants highlighted the benefit of having multiple types of information within a single interactive platform, particularly data related to overdose, mental health, treatment access, and geographic variation. The dashboard's ability to provide information at the county level was viewed as especially useful for identifying differences between communities and exploring patterns that may be less apparent when examining data at the state or national level. Participants also identified the dashboard's interactive maps and data-export capabilities as strengths; noting that these features could support further exploration and analysis beyond the dashboard itself. Several participants described potential applications in research and public health practice, including generating research questions and hypotheses, examining geographic disparities, and informing discussions about treatment access. Overall, participants' feedback suggested that the dashboard has strong potential as a centralized resource for exploring opioid-related data, while also identifying areas where its presentation and functionality could be refined to make this information more accessible to a broader range of users.

"I think just making sure that as you build it, just reevaluating the system and making sure that the updates are understandable allowing people to provide feedback, whether its email a form or something, and yeah publishing it in an academic journal to make it

reproducible for not even opioids but for anything really cause this is honestly one of the best examples I've seen of a spatial dashboard, so” (P04)

“Yes, 100%, especially because it provides data at the county level. And I think I could see it being really valuable for hypothesis generation. I could see it being really valuable for presentations. If you can just export those graphs or export even those images showing over time. And then, of course, the data. One of my tasks as a postdoc was creating this state county data set of a bunch of state, county level data...across many years. And honestly, half the battle of that was pulling publicly available data sources, which I think is such a challenge with doing county level work is just finding those data. So, I 100%, the more data included on here, the better. I think so many researchers would find that very valuable.” (P05)

Theme 2: Usability and information architecture

Participants identified several aspects of the dashboard’s organization and navigation that could be improved, particularly for users encountering the dashboard for the first time. Although participants generally found the dashboard’s search functions and interactive features useful, several noted that the landing page presented a large amount of information at once, making it difficult to understand the dashboard’s purpose and available tools at first glance. Participants suggested moving or reorganizing information such as the goals, “how-to” instructions, and dataset descriptions so that users could more easily understand how to navigate the dashboard before beginning to explore the data. Navigation challenges were also identified within individual sections of the dashboard. For example, one participant had difficulty locating the “travel to treatment” information because the data became visible only after selecting the 2026 year, while another suggested adding more descriptive sub-headers to the Trends section to make the available information easier to identify. Participants also recommended adding interactive features, such as navigation between graphs, county selection, and plot points to the graphs in this same section. Overall, the findings suggest that the dashboard contains useful interactive tools, but its information architecture could be refined to provide clearer orientation and reduce the effort required for users to locate specific information.

“But maybe like information on how to use and goals. Maybe something where that’s at the beginning so it’s like very clear... or something. But maybe, because I know that there’s interactive maps and trends because I have viewed and explored the data, the entire website. So, now I have a better sense of what everything has to offer but it is like busy and not as clear when I look at the first landing page.” (P03)

“Oh, I like the pop ups, I will say it is pretty wordy, like the text is rather small. And I’m just looking at this section of information and how to use, and I think the bolding could be more effective, like on particularly on the how-to page across the top bar is bolded

alone but can't really stand alone, you know what I mean? I feel like if you're gonna bold stuff, this is like my philosophy, it should be able to like; I should just be able to read the bolded parts and get it, you know?" (P02)

Theme 3: Accessibility and plain-language communication

Participants emphasized the importance of presenting the dashboard information in language that can be understood by users with different levels of familiarity with epidemiology and public health terminology. Several participants encountered terms that were unfamiliar or insufficiently explained, including “syndemic,” “model-based,” “OTP,” and “bivariate map.” Although these terms may be familiar to researchers working in related fields, participants noted that they could create barriers for less experienced users or members of the public. Participants also commented on the amount and presentation of text on the landing page, noting that some instructions were wordy or difficult to interpret quickly. Suggestions for improving accessibility included making definitions more visible, providing simple explanations of technical terminology, and incorporating additional guidance directly into interactive visualizations. For example, participants suggested clarifying how bivariate maps should be interpreted and providing more information about terms and data points when users encounter them. These findings indicate that improving accessibility does not necessarily require reducing the amount of information available but rather presenting technical concepts in ways that allow users with different backgrounds to understand and appropriately interpret the dashboard.

“‘Syndemic,’ I’d never heard that word before. Okay, ‘Splash,’ I had also never seen that before. That just means, sort of the main page, I guess?” (P01)

“I think if there's a way to incorporate these definitions into the tools a little more, that'd be great. But now that I know how to use this, like this is understandable because it's hard to fit that many words in such a small space.” (P05)

Theme 4: Data transparency and interpretation

Participants valued the transparency and availability of the dashboard’s underlying data but identified several areas where additional context was needed to support accurate interpretation. The ability to download data was consistently viewed as a major strength, particularly because it could allow researchers and other users to access information without independently collecting or calculating data from multiple public sources. At the same time, participants reported uncertainty about how individual data points were defined, which sources contributed to specific measures, and why some variables were available for different years than others. One participant

noted that exported data did not always make it clear which source corresponded to a particular value, while another questioned whether blank values represented zeroes, suppressed data, or missing information. Participants also raised concerns about interpreting geographic measures, particularly when county-level data may conceal variation within counties or when quintile-based categories may obscure extreme values. Additional context was suggested for measures such as travel time to treatment and for changes or spikes in trends that may be related to broader events such as the COVID-19 pandemic. Overall, participants viewed transparent and downloadable data as an important strength, while emphasizing that clearer definitions, source information, and contextual explanations would improve users' ability to interpret and appropriately use the data.

"I wonder if that is missing data or true zeroes so I think, I assume, it's missing data or suppressed, so maybe that's somewhere in the information, Yea you can't tell for sure in this if it's true zero or suppressed or missing data at all." (P04)

"[O]kay so I'm a little unclear what the VSSR data is. I think that's maybe the National Vital Statistic System, I'm not clear...opioid overdose [data] it is not clear to me if it is the opioid overdose rate or the counts or if it's the modeled rate, or the provisional estimate. So not exactly clear about the final estimate of the opioid overdose and the data source [where] it is coming from, it is not clear to me. But it is clear that it is [from] 2024 and it encompasses all the counties in Maryland" (P03)

Theme 5: Need for more interactive and refined visualizations

Participants generally responded positively to the dashboard's maps and interactive visualizations, but several identified opportunities to make the visual presentation more interactive, intuitive, and informative. Maps were repeatedly described as a strength, with participants noting that they could make geographic differences easier to recognize and encourage users to explore patterns in the data. The bivariate map was particularly compelling to several participants because it allowed users to examine the spatial relationship between two variables, although participants also noted that this visualization could be difficult for unfamiliar users to interpret. In contrast, the Trends section was viewed by several participants as less developed and less interactive than the maps. Suggestions included adding toggles to compare trends over time, allowing users to stratify a single graph by different variables, and providing clearer labels for individual data points. Participants also suggested improving the color scheme of the bivariate map, including consideration of accessibility for colorblind users, and reconsidering how quintiles represent outliers and differences in burden. Additional concerns

included cut-off labels in generated scatterplots and the relatively simple presentation of a average travel time to treatment figure. Taken together, participants' feedback suggests that the dashboard's visualizations provide a strong foundation, particularly through its maps, but that greater interactivity, clearer labeling, and more refined visual design could make the visualizations more effective for both research and broader public use.

"I guess what I would rather see is like something where I can toggle between the years. Like a slider, I guess. I think would be helpful that toggles between the different histograms so I can see how it is changing over time in a more interactive way. That's kind of what I was expecting cause like I clicked on the 2017 one, I read this interpretation about the distribution compared to the other years, but then I was like how do I get to the other years? I assumed that they weren't there but then I just had to like close it out, and like look, and click on the other ones and then see that." (P02)

"I would recommend to combine [the graphs] side by side, make it more interactive and be able to hover over the points and show the points on the graph. Some of them are very simple graphs, they could be more exciting and interactive and have more colors. You also should be able to compare different results in one graph on just one screen instead of switching between them." (P06)

Discussion

The main objective of this study was to evaluate the usability, clarity, accessibility, and effectiveness of data presentation within the mHOPE dashboard. Across six interviews, participants generally viewed the dashboard as a valuable resource with potential applications in research, public health practice, and communication of opioid-related data. At the same time, participants identified areas where the dashboard could be improved, particularly in its organization, use of technical terminology, presentation of data, and interactive visualizations. Taken together, these findings suggest that the presented version of the dashboard has a strong foundation, but improvements in how information is organized and communicated may be necessary for the dashboard to effectively serve users with different levels of technical and public health expertise.

Value and Potential of the Dashboard

One of the most consistent findings was participants' recognition of the potential value of the dashboard. Participants' recognition of the dashboard's value was particularly relevant to mHOPE's broader goal of connecting information about opioid overdose, mental health, treatment access, and social conditions. Rather than presenting overdose outcomes in isolation, the dashboard allows users to examine multiple factors that may provide additional context for understanding patterns across communities. Several participants described potential applications

for research and public health activities, including hypothesis generation, presentations, and exploration of geographic disparities. This suggests that the dashboard may provide value not only as a source of information but also as a tool for encouraging users to ask new questions about opioid overdoses and mental health metrics, as well as related social and health factors.

The combination of multiple datasets within one platform was an important aspect of this potential. Rather than requiring users to independently locate and combine information from multiple public sources, the dashboard provides an integrated environment for exploring these measures. Participants particularly valued the ability to download data, which could reduce the amount of time required to locate and prepare publicly available information for further analysis. These findings support continued development of the dashboard as a centralized resource while also emphasizing the importance of ensuring that the integration of multiple datasets does not make the tool more difficult to understand.

Usability and Information Architecture

Although participants recognized the dashboard's functionality, their feedback showed that the large amount of available information can also create challenges for first-time users. Participants frequently commented on the landing page and the difficulty of immediately understanding the dashboard's purpose, organization, and available tools. This suggests that the dashboard's usability is influenced not only by whether individual features function correctly, but also by how easily users can understand where to begin and how sections may relate to one another.

The finding that some participants had difficulty locating particular information, is especially relevant because a dashboard can contain accurate and useful data, while still being ineffective if users cannot easily find or interpret it. Suggestions to reorganize the landing page, provide clearer section headings, and improve navigation between visualizations may therefore help reduce the cognitive effort required to use the dashboard. Participants' feedback also suggests that the dashboard should provide greater orientation before asking users to interact with more complex features. Improving the initial user experience may be particularly important if the dashboard is intended to reach audiences beyond researchers who are already familiar with public health data systems.

Accessibility and Plain-Language Communication

Another important finding was the need to make technical information more accessible to users with different levels of expertise. Participants identified several terms and concepts that were unfamiliar to them, including "syndemic," "model-based," "OTP," and "bivariate map." While these terms may be appropriate within epidemiological and public health contexts, their use without sufficient explanation may limit the dashboard's accessibility to individuals outside these fields.

This finding is particularly important given the dashboard's potential use by both technical and nontechnical audiences. Participants described the maps and other visualizations as potentially useful for the general public, while also identifying potential applications for researchers and public health professionals. These different audiences may require different levels of explanation. Providing plain-language definitions, making the Definitions tab more visible, and incorporating explanations directly into visualizations could help bridge this gap without removing technical information from the dashboard. Rather than simplifying the underlying data, the goal should be to make the meaning of the data easier to understand.

Data Transparency and Interpretation

Participants also identified a tension between the dashboard's strength as a data-rich resource and the challenges associated with interpreting multiple datasets. While participants valued the transparency and ability to download data, they raised questions about data sources, variable definitions, differences in available years, and the meaning of missing or suppressed values. These concerns indicate that providing access to data alone may not be sufficient to support appropriate use of the dashboard. Users also need enough contextual information to understand what the data represents and how different measures were generated.

This issue was particularly evident in participants' feedback regarding exported data. Participants appreciated the ability to download information but sometimes found it difficult to determine which source corresponded to specific values or what particular columns represented. Improving metadata and providing operational definitions for variables could therefore strengthen the usefulness of the export function. Clearer documentation of data sources and limitations may also help users recognize differences between datasets rather than interpreting discrepancies as errors.

Participants' concerns about geographic interpretation further highlight the importance of context. County-level measures can be useful for identifying broad geographic patterns, but they may not capture variation within individual counties. Participants also raised concerns about how outliers in the quintiles were represented visually. These observations suggest that users should be provided with enough information to understand the appropriate level of interpretation of the data and avoid drawing conclusions that extend beyond what the dashboard can support.

Interactive and Refined Visualizations

The findings also indicate that the dashboard's visualizations represent both a major strength and an important opportunity for improvement. Participants consistently responded positively to the maps, particularly their ability to display geographic variation and encourage exploration. The bivariate map was viewed as especially interesting because it allowed participants to consider two variables simultaneously. However, participants also indicated that some visualizations

required additional explanation and that certain sections, particularly the Trends section, could benefit from greater interactivity.

These findings suggest that interactivity should be used not simply to make the dashboard more visually engaging, but to help users explore and understand the underlying data. Features such as toggles between variables or years, clearer labels, and more flexible filtering could make trends easier to explore. At the same time, participants' concerns about bivariate maps demonstrate that increased complexity can also create an accessibility barrier if users are not given adequate guidance. Thus, future development should balance the desire for more sophisticated visualizations with the need for intuitive interpretation.

Implications for Dashboard Development

Taken together, the findings point toward several priorities for continued dashboard development. First, the dashboard would benefit from a clearer introductory experience that explains its purpose, organization, and available tools. Second, technical terminology and complex visualizations should be accompanied by accessible explanations for less experienced users. Third, data exports should include sufficient labeling and documentation to allow users to understand the origin and meaning of the information they download. Finally, interactive visualizations should be refined to improve exploration while maintaining ease of interpretation.

Importantly, these recommendations emerged from participants with different concentrations in the public health profession and levels of familiarity with dashboards. This variation was useful because it revealed that a feature that may be intuitive to an experienced epidemiologist may not be equally intuitive to a less specialized user. Incorporating feedback from multiple types of users may therefore help the dashboard become more accessible without reducing its usefulness to researchers and public health professionals.

Limitations

This project has several limitations. First, the sample consisted of six participants heavily involved in the public health field, limiting the range of perspectives captured and preventing the findings from being considered representative of all potential dashboard users. Participants varied in their familiarity with public health dashboards, meaning that their experiences may not reflect those of other audiences. Additionally, with only six participants, it was challenging to reach thematic saturation. Meaning that it was difficult to reach a point when no new ideas or feedback were provided. To counter this limitation, presented findings focused on feedback heard from at least 2-3 participants to avoid presentation of spurious findings. Second, participants interacted with the dashboard during a single interview rather than using it repeatedly in their usual professional or community settings. As a result, some usability issues that emerge during longer-term use may not have been identified. Finally, because the dashboard

was still under development, some of the issues identified by participants may be addressed through future development. These limitations should be considered when interpreting the findings and determining how they can inform subsequent iterations of the dashboard.

Future Directions

Further testing could examine whether changes to the landing page, definitions, navigation, data exports, and visualizations improve users' ability to locate and interpret information. Including participants from a wider range of backgrounds, particularly community members, on a community advisory board, and other nontechnical users, could also provide additional insight into the dashboard's accessibility. Continued iterative evaluation would allow the development team to identify remaining usability barriers and assess whether changes made in response to this project will improve the overall user experience.

Conclusion

This quality improvement project evaluated stakeholder and potential end-user perspectives on an opioid overdose and mental health dashboard designed to communicate information about overdose trends, treatment access, and related health and social factors. Participants generally viewed the dashboard as a valuable and promising resource, particularly because of its county-level data, interactive maps, integration of multiple datasets, and data-export capabilities. At the same time, participants identified opportunities to improve navigation, accessibility, data transparency, and the interactivity and clarity of visualizations.

The findings demonstrate the importance of evaluating not only the information provided by a public health dashboard, but also how effectively users can locate, understand, and apply that information. Continued incorporation of user feedback can help refine the dashboard and make it more accessible to audiences with different levels of technical expertise. Although the findings are limited to the perspectives of a small group of participants, they provide practical recommendations for the continued development of the dashboard and illustrate how qualitative user feedback can contribute to the iterative improvement of public health data tools.

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