Using Civic Service Design Methods to Redevelop a Data Communication Website With a Health Literacy Lens

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ABSTRACT

Context: Public health agencies routinely publish data in hopes that data influence public health policy and practice. However, data websites can often be difficult to use, posing barriers to people trying to access, understand, and use data. Working to make data websites easier to use can add value to public health data communication work.

Program: The New York City Department of Health and Mental Hygiene (DOHMH) redesigned its Environment and Health Data Portal, a website used to communicate environmental health data, with the goal of making data more accessible and understandable to a broader audience. The DOHMH used Civic Service Design methods to establish priorities and strategies for the redesign work, to build a data communication website that emphasizes a high level of usability, and content that explains data.

Implementation: By following a Civic Service Design process, the DOHMH synthesized findings from health communications, data visualization and communication, and web usability to create an easy-to-use website with explanations of data and findings alongside datasets. On the new site, automated dataset visualizations are supplemented with narrative content, explanatory content, and custom interactive applications designed to explain data and findings.

Evaluation: Web analytics showed that, in its first year of operation, the site's web traffic grew substantially, with the last 12 weeks recording weekly page views 150% higher than the first 12 weeks of operation (7185 average weekly page views compared with 2866 average weekly page views). Two-thirds (66.3%) of page views include recorded user engagement. Additional evaluations to measure specific aspects of usability compared with the previous version of the site are planned.

Discussion: By following a Civic Service Design process, the DOHMH redesigned a vital data communication platform to increase its usability and saw significant increase in engagement in its first year of operations. By designing data material with usability in mind, public health departments have the potential to improve public health data communication work.

KEY WORDS: data communication, data visualization, design, health communication, health literacy, web usability

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In 2022, the New York City Department of Health and Mental Hygiene (DOHMH) redesigned the Environment and Health Data Portal (EH Data Portal). The EH Data Portal is a website where the DOHMH publishes environment-and health-related datasets (https://a816-dohbesp.nyc.gov/IndicatorPublic).

In 2021, the DOHMH initiated a redesign process to make the EH Data Portal appeal to a broad audience. This process used the Civic Service Design, a design methodology that centers user needs in the redesign process.[1] As a result of this process, the DOHMH established priorities for ease of use, effective data visualizations, and development of explanatory content to help users find and understand

content. The new website, redesigned according to these priorities, was launched in October 2022.

In this article, we explain how we used the Civic Service Design process to establish priorities for the redesigned site, describe features and strategies, and show that Civic Service Design can guide development of clear, effective data communication products.

Establishing a Health Literacy Lens

Health literacy principles can guide work to communicate data to broader audiences. "Health literacy" is individuals' ability to obtain and understand information so they can make health-related decisions.[2] In 2020, the Centers for Disease Control and Prevention (CDC) updated its definition with "organizational health literacy," the degree to which organizations enable individuals to find, understand, and use information to inform health-related actions for themselves and others.[3] Communicating with a health literacy lens means delivering information that meets the health literacy levels of audiences.[4] This requires the assumption that they have needs that differ from those of experts; conducting research to understand what they know; using easier-to-understand writing, design, and content organization techniques to communicate; and evaluating effectiveness. The DOHMH applied this approach to communicating data.

Understanding Effective Data Communication

One of the CDC's fundamentals of public health is to "communicate effectively to inform and educate people about health, factors that influence it, and how to improve it."[5] However, Rudd and Bauer[6] argue that communicating data is not given adequate strategic consideration in public health. Hsee and Zhang[7] point out that those with data expertise are prone to overestimate others' ability to comprehend data, and data are often communicated in ways that make them difficult to understand. This indicates a gap between data producers and its potential users.

It is widely understood that data visualization can bridge this gap to make data easier to understand.[8] When visualizations are combined into web systems or dashboards, usability—the extent to which people can find and understand the material they are interacting with—is central to their effectiveness.[9] On the web, factors like design, system consistency, navigation paths through content, the language used to describe content, and even the length of option menus can affect a system's usability and thus its effectiveness.[10]

Regardless of usability, visualizations alone may not suffice in a health communications context.[11] Certain techniques can help increase visualization effectiveness. Simplifying visualizations and focusing on findings can improve users' ability to understand visualizations.[12,13] Nelson et al[14] provide a roadmap for applying communication principles to data content, like filling gaps in audiences' understanding with explanations about what the data mean. Similarly, Zikmund-Fisher[15] argues that use-relevant contextual information is the "single best thing . . . to improve data communication effectiveness"—whether the audience is patients, the public, or policymakers. Narratives like these "increase the persuasiveness of interactive data visualizations."[16] There is evidence that storytelling can help people retain information longer[17] and provide opportunities to increase engagement through tailoring.[18,19] This shows that data visualization is not just an output of analysis, but a comprehensive communication step that must be properly planned and designed for effectiveness.

The Preexisting Website

The preexisting website was designed for an audience of public health professionals and data users.[20] Launched in 2009 as part of the Center for Disease Control and Prevention's Environmental Public Health Tracking Program, the EH Data Portal provides data on topics like air quality, asthma, climate, and housing. It allowed users to view neighborhood-level data as tables, maps, trends, or scatterplots for different environmental health indicators.

As the DOHMH began to broaden the scope of its data communication work, it added different types of content, like data stories, to the site. However, the site struggled to support this growth. Preexisting designs did not include navigation between legacy components and new components, and the technology underpinning the site required working with contractors to maintain or update it. Since the site's design and technology were outdated, it could not adequately support new priorities. To ensure usability and reach broader audiences, the DOHMH decided to redesign the website.

The Civic Service Design Process

Following previous work making digital data communication projects usable and impactful,[21] the DOHMH used a Civic Service Design process to guide the redevelopment of the EH Data Portal. This approach applies contemporary design approaches popularized in the private sector to the unique needs of government work. Civic Service Design emphasizes user-centered design, iterative work, and sustainable technology to improve how government agencies

deliver services and information to constituents.[22] Design methodologies like these emphasize that design is how something works, not how it looks. They are shown to add value in public health settings.[23]

To apply a health literacy lens to the unique challenges of communicating data to broad audiences, the DOHMH chose Civic Service Design methods to develop priorities rooted in user needs.

Approach

Following a Civic Service Design entails the following steps, which are detailed in *Civic Service Design Tools + Tactics*, by the NYC Mayor's Office for Economic Opportunity[1]:

- Setting the stage: reviewing evidence and scanning the landscape.
- Talking to people: learning from user research.
- Connecting the dots: synthesizing findings from different activities.
- Trying things out: brainstorming and prototyping.
- Focusing on impact: developing and evaluating solutions.

Setting the stage: We audited the preexisting site's usability using heuristic evaluations,[24] in which usability experts reviewed the website using established usability guidelines.[25] This step is a vital way to understand barriers to usability and establish paths to improve. Our heuristic evaluation identified barriers that include inconsistent designs across content types; a lack of a consistent navigation function; a site search tool that only searched part of the site's content; difficult-to-find site functions; and a lack of connections between related material. We also conducted a content audit, reviewing the site's content and content organization to identify ways to organize content more intuitively.

Talking to people: To understand needs and inform how a product or service can meet them, we spoke with internal partners (data stewards and subject matter experts) to understand what they needed out of a data communication platform. We also reviewed a history of user feedback to understand users' barriers, needs, and preferences when looking for data. We identified themes in the feedback that informed user experience priorities for the site redesign (provided in the "Priorities" section). Additionally, we commissioned a technology contractor to examine the site, interview partners, review technology, and make broad recommendations to our program to help guide decision-making around technology that would support our goals.[26]

Connecting the dots: Through a series of collaborative team meetings, we reviewed work regularly to synthesize findings. By discussing the findings from usability analyses, user research, and technology reviews together, we identified common themes, which developed into user experience priorities, content priorities, and technology priorities that would guide the redesign (detailed later). Synthesizing findings from different areas allows strategies from one area to reinforce priorities from another area.

Trying things out: To test strategies to meet these priorities, we brainstormed and refined ideas through an ongoing process of testing and revision. Initial designs were done as drawings, collaboratively edited, and developed into wireframes. This allowed for extensive revision prior to development work. Once development started, initial versions of site components (like landing pages and navigation functions) were routinely evaluated by testing them with coworkers. They were subject to an ongoing iterative design process. Through this process, we settled on specific strategies that would meet our priorities (detailed later).

Focusing on impact: With much of the groundwork laid, the final step is to focus on impact by developing solutions to problems, setting measures of success, and evaluating effectiveness. We established content strategies and priorities that would be most likely to be understood by our audience; developed ability to monitor site performance using Google Analytics; and establishing plans to conduct comparative usability testing to measure the performance of the new site versus the old site.

Priorities

Following the steps of the Civic Service Design resulted in a list of priorities for the redesign. These priorities were grouped into 3 areas: user experience, content strategy, and technology.

User experience priorities

In reviewing a history of user feedback, we noticed that our users—including those with strong self-reported technical abilities or data experience—overwhelmingly said that they prefer a system that is easy to use. This reinforced our decision to focus on usability. Additionally, many users—whether they are new to data or power users—said that they prefer explanations, rather than having to analyze data and draw their own conclusions. Accordingly, we centered content priorities around integrating explanations and communicating meaning in the data:

1. Make the site easy to use, with good usability and contemporary web design.
2. Make the site easy to explore, so users can find what they are looking for or information related to their interests.
3. Connect content in a variety of ways, so that users are exposed to related material when browsing.

Content priorities

We established priorities to guide the development and publication of content on the website to appeal to broader audiences.

1. Develop additional explanatory content types to explain data in accessible, easy-to-understand ways that highlight findings and communicate key messages.
2. Enhance visualizations to provide the most meaning.
3. Write using accessible language.

Technology priorities

Technology should allow us to continue to develop new data communication products and refine designs in response to user research without high-cost maintenance.

1. Establish a flexible site infrastructure that lets us create and integrate new content, maintain old content, and revise design in response to user input.
2. Minimize technical debt, with conventional, interoperable technology.

Design strategies

With priorities established, we developed strategies to meet these priorities.

User experience

To make the site easier to use, we designed the site into a single cohesive system with responsive, mobile-compatible web design to meet expectations for contemporary websites. It was designed to feature an omnipresent navigation menu to communicate system location and content organization. We designed the Home Page to emphasize top tasks, reinforce how content is organized, and promote new material (Figure 1). Throughout the site, content would incorporate visuals, previews, explanations, and microcopy to help users understand options as they explore.

To make the site easy to explore, we designed the site to have a "flat" system that requires fewer steps to reach important content. To encourage exploration, we designed content to incorporate visuals, previews, explanations, and prompts to help users understand options as they explore. To further encourage exploration, we designed lateral selection options on content pages to allow users to navigate without returning to a landing page. For example, the site's Data Explorer was designed to allow users to toggle between indicators or see other available topics without leaving the page, and Neighborhood Reports were designed for users to easily load different topics for their chosen neighborhoods or change neighborhoods. Additionally, we used static site technology, where the system does not make database calls to display data, making page loading and interaction faster, lowering the cost of interaction and exploration.

To connect related content, we designed ways to support connections between both content topic areas (like air quality or housing) and types (like dashboards or data stories) in several ways, including:

- Creating Key Topic umbrella pages connecting hosting topic-specific data features, and connecting related content across meaningful, cross-cutting topics.
- Building keyword and tag libraries that offer a flexible, powerful way to create associations among content types. We designed ways to display related content and provide ways for users to explore more content.
- Building a sitewide search to help users find content. The search function allows us to modify the algorithm and customize results to return most relevant content.

Content strategy

To emphasize explanations of data, we designed the site to support a variety of flexible, customizable ways to explain data. Its site was designed to prioritize the following types of content:

- Data Stories: easy-to-read narratives with message-based data visualizations that explain findings and perspectives on important topics. Data Stories prioritize clear communication, creative, communication-oriented custom data visualizations, and topics with high public health importance.
- Neighborhood Reports: neighborhood-specific data for 5 environmental health topics: asthma, climate, housing, outdoor air, and active design. They provide location-tailored data with indicators curated to provide insight into a topic.

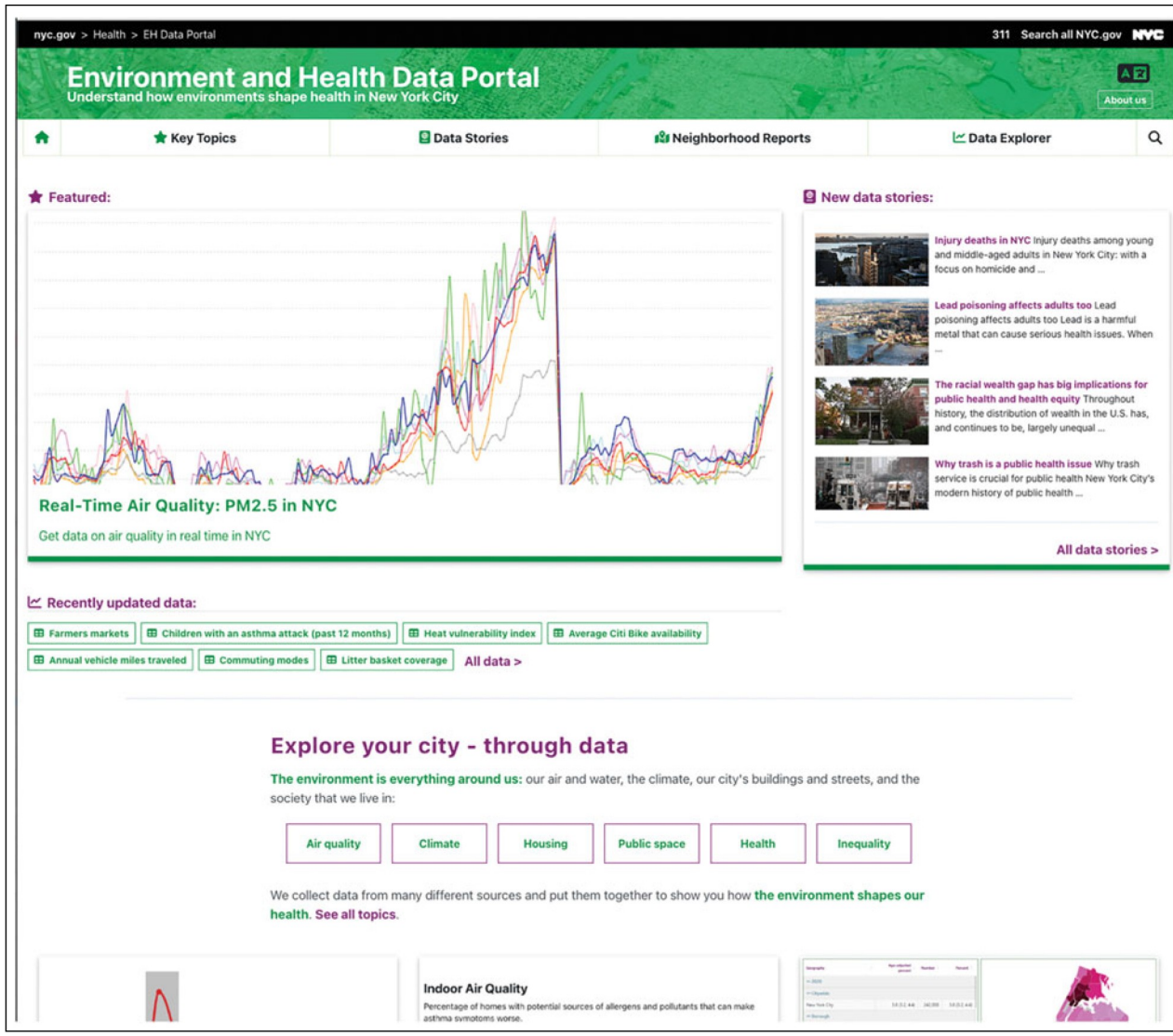

FIGURE 1 The Redesigned EH Data Portal Home Page
This figure is available in color online (www.JPHMP.com).

Neighborhood Reports offer a quick data overview for a chosen neighborhood, and allow users to explore data in further detail.

- Data Features: custom interactive infographics that combine interaction, visualizations, and explanations to explain topics like real-time air quality and the heat vulnerability index. They prioritize creatively explaining complex topics and combining interaction and explanation (Figure 2).

We also focused work on enhancing visualizations to ensure usability and provide meaning. On the site's Data Explorer, we designed tables, maps, trend charts, and scatterplots to provide topic-specific insight. The Data Explorer lets users filter data to view different measures, geographies, or years for each indicator (Figure 3). It includes new visualizations to provide additional information, and retains text on the same page as data displays for explanation. For other content, we refined visualization standards to incorporate explanatory techniques to highlight findings and main messages and focus attention on tailored data. These strategies help produce visualizations that show insights, not just data.

Lastly, to help make content accessible to audiences with varying health and data literacy levels, we established the standard to write text at or below an eighth-grade reading level. We focused our content strategy around using an informal tone, addressing our audience as "you" and referring to the DOHMH as "we," incorporating plain language, and clearly explaining jargon.

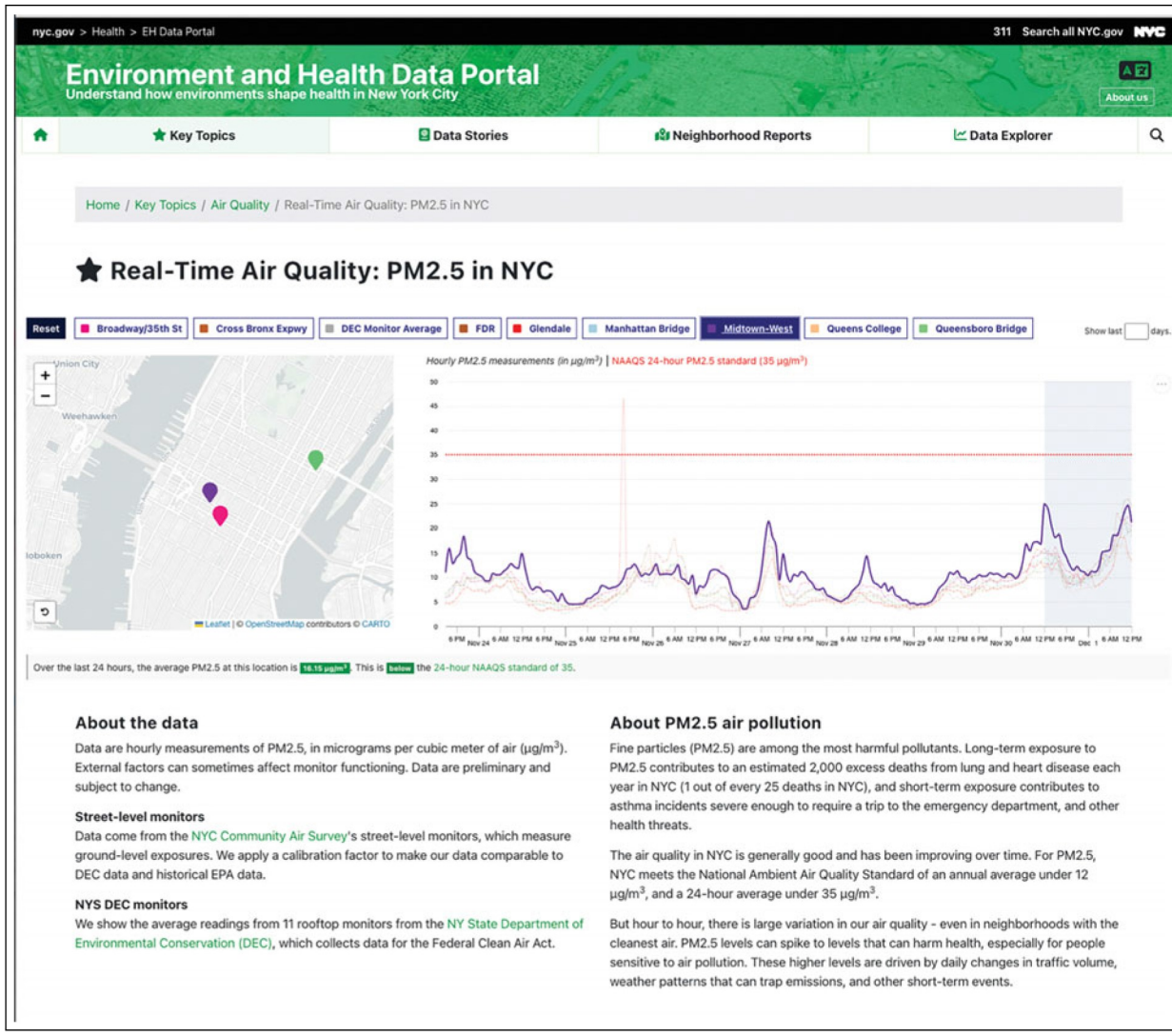

FIGURE 2 The EH Data Portal's "Real-Time Air Quality" Data Feature
This figure is available in color online (www.JPHMP.com).

Technology strategy

For the redesign of the site, we prioritized lightweight technology that would allow us to develop and maintain the website, without the burden of difficult maintenance costs. To build the site, we chose a free, open-source static site builder called Hugo. This software programmatically assembles HTML pages and other resources from source code. Static sites avoid server-side processing or database calls, simplifying development and resulting in a fast, simple, secure site. It is simple to add content or revise designs. This facilitates ongoing site development, iterative design, and development of new material.

Individual site components are also build using free, preexisting, open-source software. The site is built using common, conventional technology (HTML, CSS, and JavaScript, the core languages of the web). For front-end design, we used the NYC Core Framework (a front-end framework based on Bootstrap), which provides mobile-friendly, translation-compatible, and accessible web templates. Visualizations are built with open-source, interoperable JavaScript libraries Vega-Lite, DataTables.net, Arquero, and Leaflet. This approach leverages preexisting software that is interoperable and highly customizable, relying on common standards to ensure a high degree of in-house maintenance and development or low-cost modular contracting.

Implementation

With design and technologies strategies established, we took a modular, iterative approach to site development. First, we engaged a contractor re-built the site's

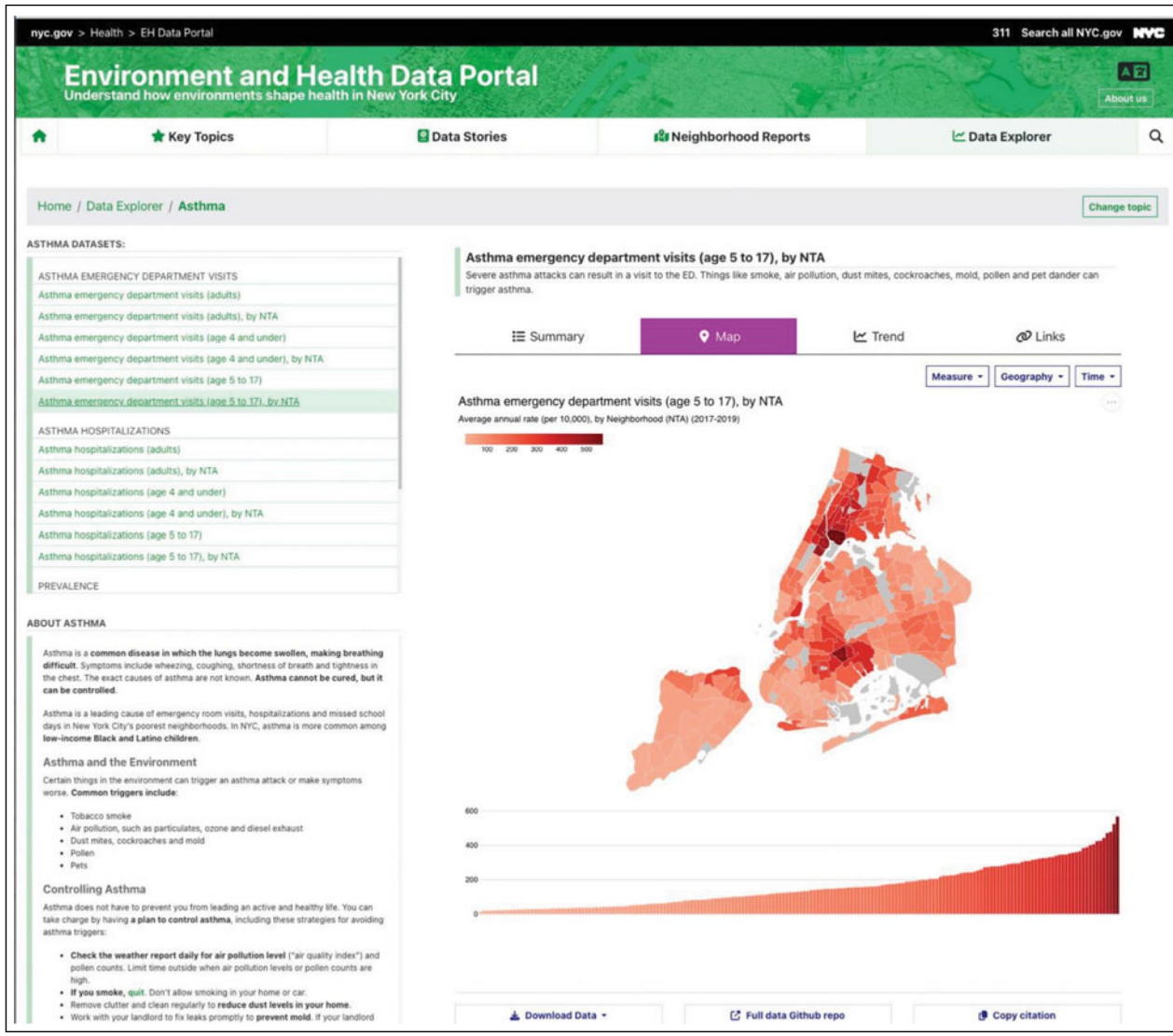

FIGURE 3 The EH Data Portal's Data Explorer Dashboard Module
This figure is available in color online (www.JPHMP.com).

Neighborhood Reports using Hugo as a proof-of-concept to implement the new technology. This allowed us to gain experience with new technology for minimal cost and establish the architecture around which to build the full website. Then, we began building the full site—adding other content and sections, designing site templates and components, and finally building the site's most complex component, the Data Explorer dashboard module.

This modular approach allowed us to test and refine designs during development without being locked into any single direction. Designs evolved constantly throughout this process as we evaluated designs against our priorities and strategies, and iteratively improved them. For example, we progressed through several versions of landing pages like the Home Page and the Data Explorer, varying ways to balance page elements, guide users, and explain choices. This iterative process meant that the site evolved and improved throughout the building process. In October 2022, we deployed the redesigned EH Data Portal to our servers, launching this new version of the site.

Evaluation

Web analytics

We integrated Google Analytics to evaluate site traffic since it is free, easy to implement, and is a widely used tool for web evaluation. Initial evaluation of web analytics shows traffic increasing from launch (October 2022) into Spring 2023, with

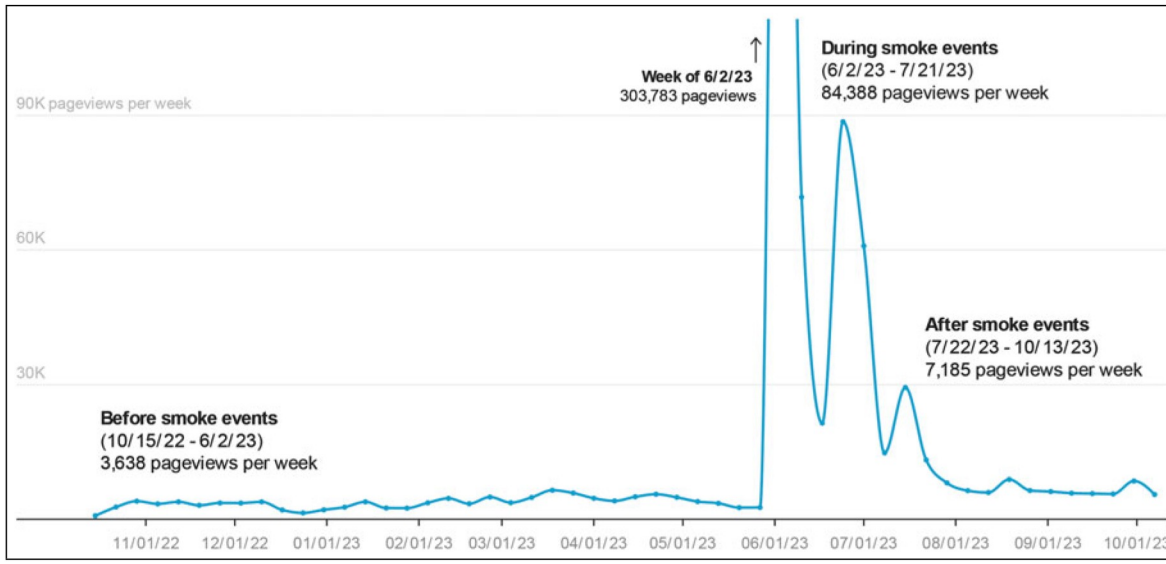

FIGURE 4 Weekly Page Views on the EH Data Portal (October 15, 2022, through October 14, 2023)
This figure is available in color online (www.JPHMP.com).

October 2022 through January 2023 averaging 2865 page views per week, and February 2023 through May 2023 averaging 4365 page views per week. This traffic growth suggests strong user uptake (Figure 4).

In June 2023, wildfire smoke blanketed New York City and drove a massive increase in traffic from people accessing real-time air quality data on the website. Afterward, regular web traffic remained higher than it was prior to the air quality events, with the final 12 weeks of the redesigned site's first year averaging 7185 page views per week—150% higher than the first 12 weeks (2866 page views per week).

Cumulative web analytics indicate a high level of user interaction (Figure 5). Two-thirds of page views come from engaged users, and nearly 30% include users scrolling to the page's bottom. Web users' attention can easily be interrupted, and web traffic can be prone to high bounce rates, so these high rates of engagement are encouraging signs that users are interacting with the site in meaningful ways.

Limitations

Using web traffic to evaluate a website offers only a rough evaluation of site performance. While it provides information on engagement and web traffic, these are not adequate proxies for usability. Web analytics

Site engagement analytics (10/15/2022 through 10/14/2023)

Event name	Description	Count	Percent of page views:
session_start	Opening the page in the foreground or viewing a page or screen.	601,392	75.4%
user_engagement	Having the web page in focus or app screen in the foreground.	529,087	66.3%
first_visit	Opening the page for the first time.	342,392	42.9%
scroll	Scrolling to the bottom of the page.	234,609	29.4%
click	Clicking an external link.	19,069	2.4%
file_download	Downloading a data file from the website.	11,691	1.5%

FIGURE 5 EH Data Portal Web Engagement Analytics (October 15, 2022, through October 14, 2023)
This figure is available in color online (www.JPHMP.com).

do not offer the ability to compare the redesigned site against the old site, which used a deprecated version of Google Analytics that reported different metrics. Furthermore, since the redesign changed many things at once, causes of changes in web traffic cannot be isolated and there is no control against which to measure the redesigned site's performance. To fully evaluate the site's usability in comparison to the old site, detailed usability research is planned.

Discussion

Data communication comes with unique challenges, like the difficulty explaining complex content to broad audiences and the technological complications of publishing varied data content. In redesigning the Environment and Health Data Portal, we sought to build a website for the DOHMH to effectively communicate data to a wide variety of potential data users. We applied a health literacy lens to this work, working to develop a system that is easy-to-use, removes barriers, and facilitates exploration and understanding.

Civic Service Design provided a valuable methodology for this redesign work. It guided our development of priorities and strategies that centered user needs throughout the redesign, supported our ability to make technology choices that support user experience priorities, and encouraged exploration and iterative work that refined and improved the website.

In its first year of operation, the new Environment and Health Data Portal was viewed 797 004 times—by public health professionals, policymakers, workers at community-based organizations or advocacy organizations, journalists, educators, students, and others who are exploring public health data. They may use data to inform their health decisions, to advocate for change, or to develop policies that affect other New Yorkers. By redesigning the Environment and Health Data Portal with an emphasis on usability and explanation, the DOHMH serves these people with information that is more comprehensible, findable, and useful to more people.

Implications for Policy & Practice

- Clear data communication should be a priority for public health departments. Communicating data effectively requires that agencies learn from the end users of their information, act on what they learn, and incorporate knowledge form health communications, data visualization, web usability, and technology into their data communication products and platforms.
- Civic Service Design is a method that can be used to develop strong priorities and strategies to communicate data, focusing data communication products on the needs of users. It has the potential to make successful data communication products that engage users and effectively deliver information.
- Sharing DOHMH's experience, priorities, and strategies can benefit other departments of public health seeking to improve their data communication work and deploy effective data visualization and communication projects.

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