

A Systematic Evaluation of Mpox Public Health Educational Resources

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INTRODUCTION

Mpox (formerly known as monkeypox), a zoonotic orthopoxvirus related to smallpox, was first identified in humans in the Democratic Republic of the Congo in 1970 and was historically endemic to Central and West Africa, with mainly animal-to-human transmission.¹⁻⁴ However, the 2022 global outbreak marked an epidemiological shift, spreading to non-endemic regions like the United States and disproportionately affecting specific demographics, including men who have sex with men (MSM).^{1,5} By the end of 2022, the US reported over 30,000 cases, with New York City having the largest outbreak.¹ Significant delays in diagnosis and reporting were noted, particularly a median 4-day delay in NYC, which can increase transmission risk in vulnerable populations.² These outbreaks highlight the critical role of timely, accessible public health communication tailored by local health departments, though studies reveal that such communication often remains insufficient.⁶

A significant portion of the general population struggles with health literacy making the clarity and readability of public health materials essential for effective communication, with one study finding that up to 36% of adults in the United States are health illiterate.^{7,8} Prior studies have validated readability metrics, such as the Flesch-Kincaid score, to assess the accessibility of these materials.¹ Lessons from the COVID-19 pandemic emphasize the importance of clear, empathetic messaging in building public trust to ensure compliance.² One study explicated the function of health literacy as a social vaccine, serving a crucial role in mitigating the spread of disease by “understanding and applying information as provided through governments and health authorities.”³ This work, and the increasingly frequent rise of epidemic and pandemic infections, highlights the need for timely and accurate information dissemination to combat misinformation and guide public behavior.

Despite growing awareness of these challenges, there remains a lack of research evaluating the accessibility of public health communications during health crises. Governmental resources

must be tailored to reach a broad audience, especially those with limited health literacy. Resources that exceed the 8th-grade level may leave many without the information needed to appropriately protect against or seek care for emerging communicable diseases.⁹ This study aimed to evaluate the readability of Mpox-related educational materials intended for the public, from various public health agencies, and to identify potential barriers that may hinder public understanding and response.

MATERIALS AND METHODS

Given the significant public health impact of human immunodeficiency virus (HIV) and the recent resurgence of Mpox, as outlined by recent studies on public health communication strategies and disease efforts,¹⁰ evaluating health information dissemination on these infections is critical. Health information targeted to the general population on Mpox and HIV was collected from publicly accessible websites of three types of health departments in each of the 50 US states: state-level departments, the largest metropolitan departments, and one randomly selected non-metropolitan department per state. This sampling approach was designed to capture a diverse cross-section of public health messaging across urban and rural settings.

For each website, standardized search terms, including “Mpox/HIV prevention,” “Mpox/HIV treatment,” “Mpox/HIV diagnosis,” and “Mpox/HIV reporting,” were used to identify relevant educational and informational materials. Data were extracted and categorized by type: prevention, treatment, and diagnosis, and further evaluated for content and accessibility.

To assess inclusivity and cultural relevance, the presence of diverse visual representation was evaluated using the Fitzpatrick Skin Type categorization, which classifies human skin color into six types based on pigmentation and risk of sun damage, and the Monk Scale, an alternate validated scale of skin tone and pigment. This method enabled the objective quantification of the diversity of individuals depicted in health materials, aiming

to ensure representation of various racial and ethnic groups.¹¹ Additional accessibility metrics also included identification of simple language usage, availability of translation options, and readability assessment. The readability of the collected materials was assessed using the Flesch-Kincaid readability score, a widely used and validated metric that evaluates text complexity based on sentence length and word difficulty, providing an approximation of the US school grade level required for comprehension.¹² Chi-square tests were performed to identify significant differences in the availability and readability of prevention, diagnostic, and treatment information across department types (state, metro, non-metro), and visualization techniques, such as heatmaps and bar charts, were generated to illustrate these differences and to identify gaps in resource availability and accessibility.

Furthermore, the association of findings with political leanings was evaluated to investigate the role of policy preferences in public health education efforts. Political leanings were identified via party affiliation as defined by the following considerations: Democrat-leaning or Republican-leaning states were states that had majority electoral votes of the respective party in at least three of the last four presidential elections (2012, 2016, 2020, 2024). Swing states were defined as states that, in the last four presidential elections, the electoral votes were evenly split between the Republican and Democratic Parties. The number of available resources, as determined by the aforementioned measures, and language availability were compared between Democrat-leaning states, Republican-leaning states, and swing states.

RESULTS

State Health Department

The majority (96%) of state departments had information on their websites on Mpox, while 88% (44/50) provided HIV information. Of the states with Mpox data available on their websites, 34% mentioned at-risk populations, and 10% explicitly mentioned racial demographics. Visual resources were available in only 23/50 (46%) of state departments, with 47% of images depicting lighter skin tones (FST I-III) and 53% depicting darker skin tones (FST IV-VI). The FST results suggest statistically significant underrepresentation of lighter skin tones (FST I-III) and overrepresentation of darker skin tones (FST IV-VI) in the Mpox images ($P < 0.01$). The average Flesch-Kincaid reading score for state department materials was 10.5, indicating a high school reading level, above the recommended 8th grade level (Flesch-Kincaid of 8) for public health materials. The average ease score was 40.1, which is below the recommended score of 60-70, indicating that the materials were difficult for the average reader to understand.

Figure 1 and Figure 2 highlight the availability of key Mpox and HIV resources across state health departments based on the

FIGURE 1. Heatmap of resource availability across state health departments.

Number of Monkeypox Resources Available on State Health Department Websites Across the United States

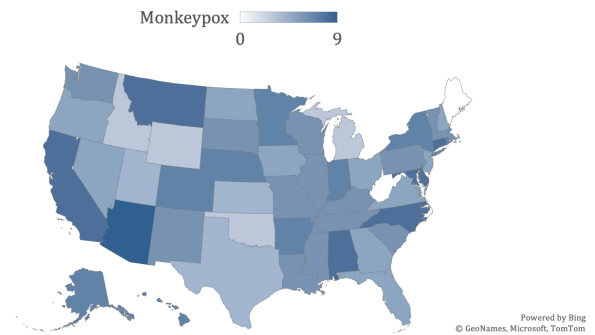
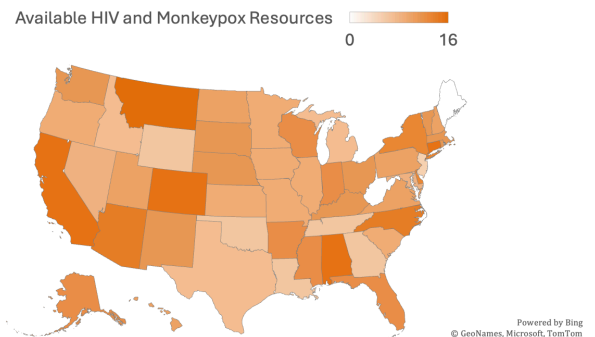


FIGURE 2. Bar chart of resource availability counts for both HIV and Mpox state health departments.

Number of HIV and Monkeypox Resources Available on State Health Department Websites Across the United States



measures outlined prior. Both figures indicate that coastal areas provided more comprehensive Mpox information, including guidance on prevention, diagnosis, treatment, and targeted messaging for high-risk populations.

Among 20 identified Democratic States, 27 Republican States, and 3 Swing states, there were no statistically significant differences in the number of Mpox resources ($P > 0.05$). Additionally, there was no significant influence of political leaning on the availability of non-English language offerings for educational resources ($P = 0.3$) and on mention of at-risk populations in available Mpox resources ($P = 0.2$).

TABLE 1.

Distribution of Fitzpatrick Skin Types (FST) and Monk Skin Tones (MST) Represented in Mpx Resources Across Health Departments				
Department Type	FST I-III	FST IV-VI	MST 1-5	MST 6-10
Local Non-Metro	16	22	16	22
Local Metro	33	34	32	35
State	57	64	43	51
Totals	106	120	91	108
<i>P</i> (Non-Metro vs Metro)	.62*		.72**	
<i>P</i> (State vs Local)	1.00*		1.00**	
<i>P P</i> (Among States)	<i>P</i> <.001 †		<i>P</i> <.001 †	

Chi-square analyses showed no significant differences (all $P>0.05$) comparing FST and MST distributions across all department types when adjusted for FST population distribution¹⁴

*There were no significant differences in the distribution of images across Fitzpatrick Skin Types when comparing local non-metro and local metro health departments or when comparing local and state health departments.

**There were no significant differences in the distribution of images across Monk Skin Tones when comparing local non-metro and local metro health departments or when comparing local and state health departments.

†FST and MST results suggest statistically significant underrepresentation of lighter skin tones (FST I-III) compared to darker skin tones (FST IV-VI) in the Mpx images depicted among state health department websites.

Local Metro vs State Health Departments

However, for major metro areas, information was further limited. 66% of local metro departments had Mpx information. State departments had 1.55 times more resources regarding prevention, treatment, and diagnosis data compared to the local metro departments ($P<0.01$). However, Metro departments also provided more diverse language options, including Spanish, French, and Mandarin.

DISCUSSION

The 2022 Mpx outbreak marked a significant shift in the epidemiology of a virus historically confined to Central and West Africa, with urban centers across the United States becoming hotspots for rapid transmission. Meanwhile, HIV continues to be a major public health concern, particularly among marginalized communities disproportionately affected by both viruses. Clear, accessible, and culturally competent public health messaging remains essential for controlling the spread and improving outcomes for these populations.¹

We assessed the readability of Mpx and HIV health information provided by the US state public health department websites using the Flesch-Kincaid Reading Ease Score. This commonly used tool evaluates text complexity based on sentence strength and syllable count. While statistical comparison between Mpx and HIV resources showed no significant difference in average readability, the mean scores remained in a range suggesting moderate difficulty, often exceeding the recommended 6th-8th grade level for public health communication. This finding aligns with broader concerns about health literacy and accessibility in public materials. Given that complex language can disproportionately affect marginalized populations, these results underscore the need for plain-language revisions to improve public engagement, particularly during outbreaks that require widespread, rapid dissemination of information.

These findings reveal substantial disparities in the availability and quality of Mpx-related public health information across US health departments, regardless of political leaning, suggesting a global need for improved attention to improving public health efforts. We observed inconsistencies in how at-risk groups, such as the LGBTQ+ individuals and racial and ethnic minorities, were addressed in both the visual and written content in public health materials. Although diverse imagery was often present, it was not always accompanied by tailored or contextually relevant messaging. This trend echoes broader issues in public health and clinical education, where communities of color are frequently depicted in the context of infectious diseases, specifically sexually transmitted infections, rather than across a full spectrum of health concerns. Such patterns can reinforce stigma and perpetuate harmful narratives around disease risk.¹³ Standardizing educational materials to accessible language and culturally relevant content is critical for improving health outcomes in future public health crises.

Our analysis found significant disparities in the availability of prevention, diagnostic, and treatment information across local metro health departments. Our study was limited by a potential correlation between outbreak severity and the comprehensiveness of information provided by each state. For example, states like New York, which were more heavily impacted by Mpx, may have generated more extensive data compared to states with fewer cases. However, our findings suggest that the paucity of granular data in metro areas can be of concern, as large cities were targets for the spread and required their own guidelines, as in New York City.

DISCLOSURES

The authors have no potential conflicts of interest or competing interests to disclose.

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