Sentiment analysis as a local public health tool: Using community insights to combat COVID-19 vaccine hesitancy
This project was a collaboration between Zencity, Professor Stephen Goldsmith at the Harvard Kennedy School’s Ash Center, and Bennett Midland, and was completed with the generous support of the Robert Wood Johnson Foundation and its work on transforming public health data systems.

Zencity led the sentiment data collection and analysis and provided individualized reports to every city that participated in this study. Zencity is a community insights and analytics platform specializing in supporting local governments through sentiment analysis insights. Zencity is dedicated to ensuring that local governments can easily hear from and understand all of their community members’ real-time needs and priorities, using AI and expert analysts to automatically transform resident feedback into actionable data and tailor-made insights.

Professor Stephen Goldsmith is the Derek Bok Professor of the Practice of Urban Policy and Director of the Innovations in American Government Program at Harvard’s Kennedy School of Government. The Ash Center for Democratic Governance and Innovation advances excellence in governance and public policy through research, education, and public discussion. By training the very best leaders, developing powerful new ideas, and disseminating innovative solutions and institutional reforms, the Center’s goal is to meet the profound challenges facing the world’s citizens.

Bennett Midland is a consulting firm that works exclusively in the civic sector, supporting local government, nonprofit organizations, and philanthropies to tackle pressing problems and design programs and services to maximize their impact for the people they serve. Bennett Midland analyzed city reports and conducted follow up meetings with select cities to better understand the value and use of the results.
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Overview

Sentiment analysis is an AI-driven tool that examines organic discourse on social media platforms to generate insights based on resident interactions such as comments, likes, and shares. Along with online surveys and other sources of data, sentiment analysis gives cities insights into their residents’ needs and helps them understand critical issues that shape residents’ attitudes and behaviors. Sentiment analysis can contribute to local COVID-19 responses by identifying key challenges in the design and evaluation of effective public health communication strategies.

Highlights from the 18-city study

This report draws from an AI-driven sentiment analysis for 18 participating cities and counties between February 1 and March 15, 2021 and from resident surveys collected between March 18 and March 31, 2021. These data show that:

- Interest in the vaccine—measured by the prominence of the vaccine in organic discourse related to COVID-19—varied widely across cities (from 28% to 74% of captured discourse); across the whole cohort, positive sentiment—favorable or supportive resident feedback about the vaccine—exceeded negative sentiment.

- Cities with higher levels of resident interactions with City-run social media accounts had lower levels of negative vaccine sentiment among residents. While interactions with official communications, from local government social media accounts or government-issued statements in local media accounted for only 19% of online discourse, these interactions typically had a positive effect on the overall discourse.

- At the time of the survey, 60% of respondents had not been vaccinated. Of this group, 28% said they would never take the vaccine, 46% were either unsure or wanted to wait, and 26% said they would take it as soon as possible.

- Misinformation—including misleading and inaccurate facts about risk of infection, vaccine safety, etc.—is a key driver of vaccine hesitancy.

- Key drivers of positive sentiment around the vaccine include convenience of the process, the possibility of engaging in normal activities, protecting the health of family members, and direct prompts by friends, relatives, and/or personal doctors.

- Across the cohort, 25% of vaccinated respondents reported difficulty with the process of receiving a vaccine, which drove negative sentiment among this population.
The findings from this study point to three priority areas to consider when designing and evaluating public health communication strategies: visibility, relatability, and equity.

**Visibility**

Strategies to improve vaccination efforts need consistent, clear, and transparent messaging that directly addresses confusion and misinformation. Actions that generate visibility include proactive outreach to residents and online or community-based events where resident questions and concerns can be directly addressed.

**Equity**

Messaging and implementation strategies must recognize and address social determinants of health and promote health equity. Actions that advance equity include community-focused messaging aimed at reducing barriers to access like online appointment systems, partnering with existing community support systems, and monitoring public perceptions of unequal distribution.

**Relatability**

Messengers are most effective when they are recognized members of the community and their messages convey the direct benefits of vaccination for individuals and their families. Actions that prioritize relatability include partnering with trusted community-based nonprofit organizations and highlighting messages that convey the benefits of vaccination, like protecting family members, seeing friends, or going back to in-person public events.

**The value of sentiment analysis**

Sentiment analysis complements existing data systems with real-time insights about organic discourse that capture residents' opinions and attitudes related to local policies and programs. Sentiment analysis can:

- Be used to inform policymaking as cities tackle different social determinants of health and respond to the specific needs of population groups and communities to reduce health inequities.

- Shed light on the online and social media sources that are propagating inaccurate or false information, the specific nature of the inaccurate information, and help local government shape targeted strategies to reduce its negative effects.

- Help cities test initiatives in new ways. Cities can use sentiment data to understand the effects of pilot programs, identify what works and what doesn’t work, and determine how to best allocate resources.
About this study

What is sentiment data and how can it help local government tackle vaccine hesitancy?

Zencity’s sentiment analysis platform is an AI-based tool used to monitor online discourse, aggregating user interactions on platforms like Twitter and Facebook (e.g., comments, likes, shares, posts, etc.) to better understand what drives resident interest in and attitudes towards specific policy issues. Sentiment data may also be drawn from resident surveys, which provide more detailed and disaggregated insights about the perspectives of specific resident groups. Sentiment data has been used by local officials across the country to understand drivers of positive and negative sentiment in their communities, allowing municipalities to directly address misinformation or instances of resident confusion about public services.¹

Vaccine hesitancy is a central challenge for COVID-19 recovery. Despite the growing access to vaccines for residents across the country, vaccination levels have steadily decreased in recent weeks. Vaccine hesitancy is driven by issues of convenience (i.e., how easy or difficult it is to get a vaccine) and of confidence in the effectiveness and safety of vaccines; both factors are often driven by local distribution activities and online discourse, which can be influenced by sources of misinformation. As early as February 2020, the World Health Organization declared the COVID-19 crisis an ‘infodemic’ (Brennen et al., 2020), highlighting the need to improve accurate messaging and build resident trust in public health systems in order to combat the pandemic. Importantly, localized messaging and distribution campaigns have been identified as effective routes towards increasing vaccine uptake (Centers for Disease Control, 2021; LaFraniere and Weiland, 2021). Whether governments are making it simple and exciting to get residents vaccinated at local bars, or partnering with trusted and community-based organizations on roll-out and messaging campaigns, this report outlines a range of opportunities where sentiment data can serve as a valuable input in helping local policymakers assess and improve their roll-out and messaging strategies to drive resident interest and combat misinformation.
What was the focus of this study?

For this study, 18 cities and counties from across the country were asked to participate on a voluntary basis. Cities were drawn from the existing networks of study partners. While some cities had previously worked with sentiment data, others were less familiar with the approach.

Data sources

Insights for this report were collected from three sources:

Data from an AI-driven sentiment analysis of online social media discourse, aggregated from over three million resident-generated data points between February 1 and March 15.

Resident survey data, collected from a non-probability sample of adult residents in each city between March 18 and March 31, totaling 8,722 responses across the cohort.

Discussions with each city, designed to answer questions about the survey results and sentiment analysis insights, draw connections between city-led efforts and local events that may have influenced resident sentiment, and better understand the value of the data in developing policy and communications strategies.
**Key questions explored**

The analysis and discussions with cities explored questions including:

**Residents’ level of interest in the vaccine**
What is the volume of vaccine discourse compared to all COVID-19 discourse? How did this trend evolve over time?

**Resident sentiment and main themes in the organic discourse**
How do residents feel about vaccines? What are the primary drivers of positive and negative sentiment? What other themes are emerging in the online discourse?

**The role of the city in the vaccine discourse**
What role do official City communications play in the online discourse around COVID-19 vaccines (e.g., official city press releases, social media pages, etc.)?

**Residents’ intentions about getting the vaccine**
How eager are residents to get the vaccine? What are the leading contributors to hesitancy? What are the most persuasive factors? Who do residents trust the most?

**Residents’ experience of getting the vaccine**
How are residents describing their experience with getting vaccinated? What pain points or best practices have resonated the most with residents?

**Prominent vaccine-related groups in the community**
What are the notable “cluster” breakdowns of residents? How many are already vaccinated, trying to get vaccinated, or not trying yet?

**Value of sentiment data and use of sentiment analysis**
How can cities use sentiment analysis to advance public health objectives? Does sentiment data have a place within the city's data ecosystem? How might sentiment data be incorporated to inform practice and policymaking? What are the benefits and limitations?
Residents’ level of interest in the vaccine

The level of interest in vaccines, measured by the number of online interactions, varied greatly across the cohort – from 28% of all COVID-19 related discourse in Seattle, to 74% of the same online discourse in Kansas City.

What sparked online interest?

Although interest levels remained relatively consistent over the span of eight weeks, national announcements, like President Joe Biden’s directive in March about expanded vaccine eligibility, and posts from public figures with significant social media followings (e.g., photos of themselves getting vaccinated, information about vaccine access or safety, etc.) generated spikes in interest levels across the cohort.

Resident sentiment and main themes in the discourse

Online discourse across the cohort showed that overall, positive sentiment around vaccines exceeded negative sentiment (representing 22% and 14% of the conversation about COVID-19 vaccines, respectively).

<table>
<thead>
<tr>
<th>Positive drivers of sentiment</th>
<th>Negative drivers of sentiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messaging linked directly to local community members or local issues</td>
<td>Mistrust of the public health system, lack of confidence in vaccine efficacy, and underestimation of risks of COVID-19</td>
</tr>
<tr>
<td>News about eligibility expansion or broad accessibility</td>
<td>Lack of information on how to register for the vaccine or frustration with complicated appointment systems</td>
</tr>
<tr>
<td>Capability to return to regular daily activities after vaccination (e.g., attend events, return to school, etc.)</td>
<td>Unequal distribution of vaccination facilities along racial lines and/or divides between rural and urban locations</td>
</tr>
<tr>
<td>Seeing and hearing about friends and relatives receiving the vaccine</td>
<td></td>
</tr>
</tbody>
</table>
The role of the city in the vaccine discourse

Across the cohort, interactions with official communications—from local government social media accounts or government-issued statements in local media—by the city or county amounted on average to a little under one-fifth of the overall online discourse about COVID-19 (19%). In almost all cities, the remainder of online discourse was driven by local news and through sharing information from other sources on social media.

Why do city-led communications matter?

There was a clear correlation between extensive official communications, like updates about rollout and information about how to access vaccines, and high positive sentiment among residents. By contrast, residents in cities that were below the cohort average in terms of their official communication levels—measured by what percentage of overall online discourse was driven by posts or statements issued by local government—tended to express lower levels of positive sentiment.

Residents’ intentions about getting the vaccine

As noted in other recent national surveys, vaccine hesitancy has persisted in cities across the U.S. (Brenan, 2021). Cohort-wide survey data is outlined below on leading contributors to hesitancy, eagerness to get the vaccine, and the most persuasive factors in getting the vaccine broken out by racial identity.

When the vaccine is available to you, when do you think you would be most likely to take it?

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>As soon as possible</td>
<td>27%</td>
</tr>
<tr>
<td>After a few people I know have taken it</td>
<td>7%</td>
</tr>
<tr>
<td>After many other people I know have taken it</td>
<td>10%</td>
</tr>
<tr>
<td>I am not sure if I will take the vaccine</td>
<td>29%</td>
</tr>
<tr>
<td>I will never take the vaccine</td>
<td>28%</td>
</tr>
</tbody>
</table>
### How big a factor are the following in shaping your opinion about getting the COVID-19 vaccine?

<table>
<thead>
<tr>
<th>Factor</th>
<th>White</th>
<th>Black/African American</th>
<th>Latinx</th>
<th>Asian-American</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal risk posed by COVID-19 is low</td>
<td>39%</td>
<td>61%</td>
<td>61%</td>
<td>49%</td>
<td>47%</td>
</tr>
<tr>
<td>Concerns about effectiveness</td>
<td>36%</td>
<td>65%</td>
<td>64%</td>
<td>53%</td>
<td>46%</td>
</tr>
<tr>
<td>Concerns about side-effects</td>
<td>38%</td>
<td>60%</td>
<td>59%</td>
<td>54%</td>
<td>46%</td>
</tr>
<tr>
<td>Distrust in healthcare system</td>
<td>29%</td>
<td>50%</td>
<td>51%</td>
<td>44%</td>
<td>37%</td>
</tr>
<tr>
<td>Concerns about registration/administration</td>
<td>27%</td>
<td>49%</td>
<td>50%</td>
<td>43%</td>
<td>36%</td>
</tr>
<tr>
<td>Affording the vaccine</td>
<td>9%</td>
<td>26%</td>
<td>29%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Already had COVID-19 and don’t need vaccine</td>
<td>10%</td>
<td>26%</td>
<td>25%</td>
<td>17%</td>
<td>16%</td>
</tr>
</tbody>
</table>

### How important are/were each of the following in your decision on whether to get vaccinated?

<table>
<thead>
<tr>
<th>Factor</th>
<th>White</th>
<th>Black/African American</th>
<th>Latinx</th>
<th>Asian-American</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience getting the vaccine</td>
<td>65%</td>
<td>70%</td>
<td>81%</td>
<td>65%</td>
<td>69%</td>
</tr>
<tr>
<td>Vaccine is required for activities</td>
<td>66%</td>
<td>73%</td>
<td>79%</td>
<td>64%</td>
<td>68%</td>
</tr>
<tr>
<td>Being told by doctor/medical professional</td>
<td>54%</td>
<td>61%</td>
<td>71%</td>
<td>55%</td>
<td>58%</td>
</tr>
<tr>
<td>Seeing a friend or family member get vaccinated</td>
<td>46%</td>
<td>68%</td>
<td>74%</td>
<td>53%</td>
<td>54%</td>
</tr>
</tbody>
</table>
Across the cohort, 75% of survey respondents who had already received the vaccine reported a “very easy” or “somewhat easy” experience securing an appointment, compared to 25% who reported a “not very easy” or “very difficult” experience.

Logistical “pain points” for cities to keep an eye on

At the time of the analysis, sentiment data across the cohort showed that a number of practical challenges had emerged for residents, including:

- Technical difficulties with various registration systems, exacerbated by high demand.
- No confirmation after scheduling an appointment.
- Lack of clarity on how to receive updates or notifications about available vaccine slots.
- Concerns about how accessible and equitable certain vaccination sites are, and trepidation about waiting in line.

Residents’ experience of getting the vaccine

Across the cohort, 75% of survey respondents who had already received the vaccine reported a “very easy” or “somewhat easy” experience securing an appointment, compared to 25% who reported a “not very easy” or “very difficult” experience.

 Authorities/people that residents trust the most

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black/African American</th>
<th>Latinx</th>
<th>Asian-American</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal doctor or medical provider</td>
<td>87%</td>
<td>75%</td>
<td>82%</td>
<td>77%</td>
<td>83%</td>
</tr>
<tr>
<td>A family member</td>
<td>74%</td>
<td>74%</td>
<td>77%</td>
<td>67%</td>
<td>74%</td>
</tr>
<tr>
<td>CDC and other public agencies</td>
<td>72%</td>
<td>70%</td>
<td>73%</td>
<td>61%</td>
<td>71%</td>
</tr>
<tr>
<td>Dr. Anthony Fauci</td>
<td>70%</td>
<td>67%</td>
<td>66%</td>
<td>60%</td>
<td>67%</td>
</tr>
<tr>
<td>President Biden</td>
<td>65%</td>
<td>71%</td>
<td>65%</td>
<td>54%</td>
<td>64%</td>
</tr>
<tr>
<td>Non-profit organization that works in your community</td>
<td>61%</td>
<td>56%</td>
<td>62%</td>
<td>52%</td>
<td>58%</td>
</tr>
<tr>
<td>State and local elected officials</td>
<td>54%</td>
<td>55%</td>
<td>53%</td>
<td>41%</td>
<td>51%</td>
</tr>
<tr>
<td>A religious leader or other community leader</td>
<td>33%</td>
<td>50%</td>
<td>43%</td>
<td>30%</td>
<td>37%</td>
</tr>
<tr>
<td>Public figure or admired athlete</td>
<td>25%</td>
<td>44%</td>
<td>40%</td>
<td>27%</td>
<td>30%</td>
</tr>
</tbody>
</table>
At the time of the survey, the most critical distinction between groups of residents was based on vaccination status (i.e., already vaccinated, trying to get vaccinated, not trying yet). Among those who were “not trying yet” to get vaccinated (around 35% of all respondents), the majority were either waiting until they were eligible or “waiting to see how it goes” before getting their shots; these residents did not hold strongly negative or vaccine-resistant perspectives, but were more concerned about the bureaucratic difficulties of getting vaccinated.

What do we know about the “hardest to reach” residents?
Approximately 12% of all survey respondents were “uninterested” in getting vaccinated. Almost none of them planned to get vaccinated in the near future (59% say they never will and 36% are unsure), and their concerns about vaccine safety and efficacy were far above average. This group was especially distrusting of the healthcare system and reported a low level of trust (6%) in President Biden when it comes to vaccines. The survey did not capture political affiliation or voting patterns, which have been cited as important factors in whether someone plans to get vaccinated (Ivory, Leatherby and Gebeloff, 2021; Miller, 2021; Reston, 2021).
The value of sentiment analysis in shaping public health strategies

Sentiment data strengthens cities' capacity to understand the range of challenges they face in designing effective public health communication strategies. In particular, cities can develop goals and performance metrics based on detailed and real-time data on the most critical issues that shape residents' opinions and behaviors. The central finding from this study is that visibility, relatability, and equity are the most important factors for cities to consider when designing and evaluating public health communication strategies.

Visibility

Strategies to improve vaccination efforts need consistent, clear, and transparent messaging that directly addresses confusion and misinformation. Sentiment data showed that the public is confused and frustrated with the vaccination process, and that these feelings are key drivers of hesitancy. Residents commonly express confusion about vaccine side effects, eligibility, the cost of vaccination, and the process for making appointments. Furthermore, residents receive vital vaccine-related information from multiple sources; legacy media (e.g., local news stations, local print media sites) and social media garner more attention than official government sources (e.g., elected officials, press releases or guidance from official government social media accounts). The analysis also showed that residents are drawn to real-time events (e.g., online discussions, briefings, press conferences). These events can serve as an opportunity for local government to be present for residents and deliver clear, consistent, up-to-date, and interactive messaging.

Sentiment data can help officials make accurate information more visible and accessible to residents and shape strategies that:

- Provide constant and consistent messaging that allows residents to engage directly with sources of information about the vaccine rollout and progress.
- Proactively capture, acknowledge, and engage with residents' frustrations and respond with relevant and targeted messaging.
- Create opportunities for real-time conversations between officials and the public, using Facebook Live or other online event platforms.

Sentiment data for Newark showed that Mayor Ras Baraka's regular Facebook Live events at key moments during the vaccine rollout process generated significant interest and engagement from residents. While the events attracted negative comments from some residents, City staff closely monitored comment sections and responded in real time to dispel misinformation about the vaccine and its efficacy.
In Louisville, the analysis showed that the visibility of the vaccination process—showing public figures and residents getting the vaccine—was a significant driver of online discussion and positive feedback. The Louisville Metro Department of Public Health and Wellness appeared in online discourse data as a prominent source of official information generating positive sentiment. The Department closely tracks resident feedback and runs communications and media campaigns that directly respond to resident concerns. At the time of this analysis, the Department was considering a pivot from campaigns focused on access to vaccination to a focus on the safety and efficacy of the vaccine, which were resident concerns reflected in online discourse.

**Relatability**

Messengers are most effective when they are recognized members of the community and their messages convey the direct benefits of vaccination for individuals and their families. Sentiment analysis can provide useful insights on the factors that make messaging relatable. The analysis showed that the messengers of vaccine information matter just as much as—and sometimes more than—the message itself. Across the cohort, the most trusted messengers of vaccine information are those perceived as being part of the community, as well as those with whom people have direct contact, such as personal doctors, family members and friends, and local celebrities. Sentiment analysis can provide a detailed picture of how population groups react to different messengers and can help cities identify the ideal messenger to reach specific groups. For instance, across the cohort Black survey respondents noted significantly higher levels of trust in public figures or admired athletes (44%) compared to white respondents (25%).

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**Sentiment analysis can help local officials increase the relatability of communications by producing data to design and evaluate strategies that:**

- **Engage local, trusted voices as ambassadors for the vaccine** (e.g., community leaders, personal doctors, nonprofit service providers or organizations, etc.).

- **Create visibility into the vaccination process by encouraging residents or public figures to post on social media about getting the vaccine,** and by giving direct insight into the vaccination process itself (e.g., visuals of the site, people getting the shot, the process for signing up, etc.).

- **Encourage people who receive the vaccine to share direct updates with their friends and relatives,** which serve as both an incentive to be able to see one another and a trust-building activity among hesitant groups.

- **Highlight persuasive messages,** particularly around the ability of vaccinated people to return to their customary activities (“back to normal”), such as attending cultural or sports events, or returning to school or workplaces.
In Newark, a majority-Black city, residents reacted positively to messaging that profiled Queen Latifah receiving the vaccine. Given her role as a significant local figure, highlighting her own experience both reached a wide audience and built upon residents’ interest in seeing someone they know or trust get the vaccine before they signed up themselves.

In San Diego, the city prioritized partnerships with community-based organizations and local nonprofits. Recognizing the important role that nonprofit organizations play in San Diego, particularly in delivering supports and resources to communities of color, the city worked closely with non-profits to elevate their role as primary messengers of vaccine information. The sentiment analysis for San Diego showed that these efforts have been mutually reinforcing, with 76% of Black survey respondents expressing trust in community-based non-profits—the single highest figure of any “trusted” authority or person among all resident groups in the city.

But the messaging that cities employ is also important; sentiment analysis and survey data showed that messaging that is framed around a “return to normalcy” and the possibility of participating in everyday activities and public events can help reduce hesitancy. In ranking factors that are persuasive in getting a vaccine, residents consistently cited its “requirement for activities” as a leading motivator, presenting cities with an opportunity to address hesitancy through more practical measures and messaging strategies—especially among younger populations.

In Miami, where 19% of survey respondents shared that they would consider getting the vaccine “after many other people I know have taken it” (compared to 10% across the cohort), local officials identified a clear opportunity to increase vaccine uptake among younger residents by highlighting the social benefits of being vaccinated and having access to public events. Survey data in Miami showed that younger respondents (ages 18-34) are more likely to be influenced by the vaccine being required for public activities than older populations—a trend that was consistent across the cohort.

In New Orleans, practitioners said that they could use sentiment analysis to assess the strategies targeting young adults, such as their "Shot for Shot" program, in which health providers team up with bars and restaurants to organize vaccination events where participants receive a free drink along with their vaccine.

Building on sentiment data, cities might partner with popular local institutions to incentivize vaccination. For example, governments have partnered with professional sports teams—such as the Los Angeles Dodgers and the New York Yankees—to offer special seating and discounted or free tickets to vaccinated individuals. Sentiment data can also show what kind of reactions these types of strategies generate among the intended target groups and the public in general.
Equity

Messaging and implementation strategies must recognize and address the social determinants of health with direct actions that promote health equity. Since the outset of the pandemic, communities of color have been disproportionately affected by COVID-19. Black and Latinx communities have experienced higher rates of hospitalization and death and are showing lower rates of vaccination. The impact of COVID-19 is driven by social determinants of health such as income, healthcare access, work environments, and housing (Centers for Disease Control, 2021).

Sentiment analysis showed that residents react negatively to uneven and inequitable distribution of vaccines by age group, medical condition, and geographical location, reinforcing issues of distrust in and resentment of public health systems and local elected officials. In designing their vaccine distribution and messaging strategies, cities must acknowledge and address structural inequalities that produce disparate health outcomes—both to achieve health equity and racial justice, and to improve resident trust in the vaccines themselves. Sentiment data showed that vaccine hesitancy among Black and Latinx residents was driven by issues of access more often than for white residents, with significant differences in concerns around affording the vaccine (26% and 29% of Black and Latinx respondents cited affordability as a "significant factor," respectively, versus 9% of white respondents) and in registration/administration processes (49% and 50% of Black and Latinx respondents, respectively, versus 27% of white respondents).

Cities can use sentiment analysis to produce equity-focused strategies that:

- Include targeted messaging, addressing perceptions of health systems among different economic, ethnic, and racial groups.

- Leverage inclusive messaging strategies that reach the public regardless of language proficiency, physical abilities, or access to and proficiency in online resources.

- Enroll community-based organizations as messengers and highlight targeted efforts—such as walk-ins, drive-throughs, and pop-ups—to increase accessibility to vaccines among specific groups.

In New Orleans, sentiment data generated multiple insights that can be used to produce more equitable health outcomes. The data confirmed that low-income communities were not aware of the availability of transportation assistance and pop-up vaccines sites in limited transit access neighborhoods; the data showed that Black communities were particularly driven by their desire to protect family members; and lastly, the data identified social media influencers from communities of color as potential key partners in future messaging efforts.
In Kansas City, sentiment data showed that online discourse was highly polarized—with higher levels of positive and negative sentiment than the rest of the cohort. Furthermore, sentiment data captured that residents reacted strongly to an open letter written by Mayor Quinton Lucas that highlighted racial inequities in Missouri’s vaccine roll-out strategies. Sentiment analysis also revealed that residents echoed Mayor Lucas’s statements and were interested in his commitment to a more equitable distribution process, voicing criticism of the absence of a state-run vaccination site in Kansas City.

Survey responses and sentiment analysis data showed that across the cohort, cities that highlighted strategies aimed at improving access for communities of color also saw positive responses. Specifically, strategies that highlighted personal or community-based relationships (e.g., among faith-based institutions) served to build trust among Black and Latinx residents. Black and Latinx survey respondents cited higher levels of trust in religious or other community leaders than white or Asian-American respondents, and also cited "seeing a friend or family member get vaccinated" as a leading persuasive factor in getting a vaccine (68% and 74% respectively, compared to 46% of white respondents and 53% of Asian-American respondents).

In Philadelphia, where the city redeployed a corps that had previously worked on the census to hold door-to-door and phone-banking conversations with residents, efforts were focused on historically underserved neighborhoods, prioritizing equity not only in its messaging but in its vaccine distribution strategies. Notably, Black respondents in Philadelphia showed higher levels of trust in state and local elected officials (58%) compared to the overall population (52%). The analysis showed that discussion in the city was driven by issues of access and equity, and activities addressing those issues already in place, including the Black Doctors COVID-19 Consortium—a testing and vaccination operation launched by a group of doctors aiming to reduce the disproportionately high rates of infection in Black communities in the city—generated significant online attention.
The public officials who participated in this study—including staff from health departments, data and innovation teams, communications units, and partner organizations supporting local public health efforts—are working tirelessly to combat vaccine hesitancy in their respective cities. Throughout the study we captured and synthesized some of the questions, challenges, and insights that participating public officials raised about the benefits, limitations, and potential value of sentiment analysis for their work, which is summarized as a set of considerations below. As local government officials continue on the path to COVID-19 recovery and tackle existing and new public health challenges, the use of sentiment data can augment what they know about residents and help shape responsive messaging and communication strategies that can accelerate impact.

**Sentiment analysis...**

**Adds a new data layer to the picture**
Sentiment analysis can complement existing data systems with real-time insights about residents' opinions and attitudes related to local policies and programs. Sentiment analysis is particularly useful to understand the general landscape of online discourse and allows policymakers to understand public opinion beyond what can be captured through direct official channels, such as 311 systems. While sentiment analysis expands the capacity of cities to understand how residents react to policies, this tool does not capture the opinion of all residents. As such, and just as with any other research method, sentiment data must be carefully interpreted and contextualized.

**Works best for time-limited, high-priority projects and can help cities test initiatives in new ways**
Citywide initiatives that require high levels of resident trust and a quick physical mobilization of resources, such as census tracking or vaccine distribution efforts, are well-suited for sentiment analysis work given its insights into resident behavior and city strategies. Cities can use sentiment data to understand the effects of pilot programs and identify what works, what doesn’t work, and determine how to best allocate resources.

**Helps cities better understand drivers of resident behavior, including those related to social determinants of health**
Sentiment analysis provides cities with detailed insights into organic resident discourse among different population groups. This data can be used to inform policymaking as cities tackle different social determinants of health (e.g., experiences attaining affordable housing, connecting with health services, accessing city benefits and supports, etc.) and respond to the particular needs of population groups and communities to reduce health inequities.
Allows cities to identify and minimize the negative impact of misinformation and disinformation

Sentiment analysis can shed light on the online and social media sources that are propagating inaccurate or false information, the specific nature of the inaccurate information, and the type of responses these sources are generating in online resident discourse. Real-time access to this information can help local government shape targeted strategies that directly dispel inaccurate information and potentially reduce its negative effect.

Reminds us that investment in data capacity and timely data analysis is vital

Given the fast-changing nature of public sentiment, it is important that cities have “fresh” data on which to base their decisions. Cities need up-to-date information and customizable report functions to better understand how resident sentiment shifts in response to specific events, policy interventions, or any other variables. Cities with robust data, communications, and/or innovation departments that work together on crosscutting initiatives are better equipped to quickly integrate sentiment analysis into their data systems and daily operations.
Endnotes

1 For example, in January, after using Zencity's sentiment analysis platform to identify residents' top questions and concerns about local vaccine distribution, the City of Pasadena developed and published a 21-question FAQ section on their public health website about vaccines. Following the publication of the new FAQ page, the City used sentiment analysis to measure a steep decline in the volume of vaccine inquiries on its official channels – indicating an effective, tailored response to resident concerns.

2 Surveys were administered online in English, Spanish, and Mandarin through targeted digital advertisements and existing survey panels between March 18 and March 31, using a non-probability sample of adult residents in each city. Respondents provided self-reported data to confirm location, age, gender, and race, while quotas were used to ensure baseline representativeness across each of these factors with minimum targets equal to 2/3 of each group's proportion in their city's population. Around 500 responses were collected from each city, totaling 8,722 responses across the entire project. Rake weights were computed for respondents from each city to match Census-reported age, gender, race, income, and education levels among the adult population. While sampling error calculations are not directly applicable to nonprobability samples, the estimated equivalent sampling error for a probability sample would be approximately +/- 4.5% for each city individually and +/- 1.5% for all cities together.

3 With sentiment analysis insights and survey data in-hand, briefing calls were held with mayors, local public health officials, communications officers, data and innovation departments, and others in each participating city to share results and actionable insights. Ahead of each discussion, Zencity developed and shared tailored reports synthesizing trends and insights specific to each city.
References


