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# How Smart Cities Could Improve Open Data Portals to Empower Local Residents and Businesses

## A Case Study of the City of Los Angeles and COVID-19

**T**he global trend toward urbanization, combined with innovations in information and communications technologies (ICTs), has resulted in movements toward revolutionizing local governments through digital transformations of communities to become “smart cities” (Silva et al., 2018).

These smart cities typically seek to connect the physical infrastructure of the city to a broader virtual infrastructure that enables the collection, integration, analysis, and utility of detailed operational data to improve local decisionmaking (Harrison et al., 2010). Smart city initiatives have involved a wide array of projects, including those focused on mobility, water management, and electricity delivery (Appio, Lima, and Paroutis, 2019).

As these developments progress, both urban planners and city leaders have sought to facilitate the inclusion of local community members (Albino, Berardi, and Dangelico, 2015). By providing local citizens with access to public information,

the breadth of which is rapidly expanding because of increased deployment of ICTs, city leaders can promote democracy and increase the participation, interaction, self-empowerment, and social inclusion of residents (Zuiderwijk and Janssen, 2014). Indeed, citizens and stakeholders can contribute to a city's development in several ways, including by working with local leaders to identify problems; community-specific attributes; the spatial context; planning goals, objectives, and targets; planning outcomes; and policy options (Stratigea, Papadopoulou, and Panagiotopoulou, 2015).

In the context of smart cities, the objective of inclusion has been operationalized through open data portals, which serve as publicly accessible repositories for smart city data that aggregate data streams that were historically isolated

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in individual siloes of information (Zuiderwijk, Janssen, and Davis, 2014). Numerous cities, including at least 85 cities within the United States (Brown, 2017), have deployed open data portals to enable citizen-based innovation and improve transparency in the decisionmaking and implementation processes (Kumar et al., 2020). Despite the initial promise of open data portals for facilitating citizen access to information, reports have found that use cases are limited. Reports also have identified numerous contextual, technological, and organizational challenges that limit the utility of these open data portals (Falco and Kleinhans, 2018).

In this Perspective, we use the city of Los Angeles's (LA's) open data portal to access and analyze data to develop generalizable strategies that city leaders—particularly those responsible for managing the local open data portal (e.g., the chief digital officer, chief information officer, or director of the office of performance management)—could adopt to improve the utility of their local open data portals. Specifically, we sought to develop an understanding of how city services and residents were affected by the coronavirus disease 2019 (COVID-19) pandemic. Although this unprecedented public health emergency might represent an edge case, emerging research has demonstrated that the disclosure of timely and accurate information can promote bottom-up, collaborative problem-solving (Chen et al., 2020) and adherence to national and local COVID-19 crisis management policies (Shaw, Kim, and Hua, 2020; Van Bavel et al., 2020). Indeed, strong and effective responses to the COVID-19 pandemic, such as physical distancing (also known as *social distancing*), quarantine measures, hand-washing, and mask-wearing, all require wide-spread (and often voluntary) community participation

(Anderson et al., 2020; Cheng et al., 2020). Although LA government sources regularly release data for public consumption via press releases and news conferences,<sup>1</sup> the LA open data portal could, in theory, provide a higher level of access through routine updates of data sets.

In principle, smart city data should be useful for understanding local emergencies, particularly compared with traditional means of data collection (Alazawi et al., 2014; Sakhardande, Hanagal, and Kulkarni, 2016). First, smart city data are collected frequently and consistently, meaning that they can address some of the expenses and quality issues that are commonly associated with collecting near-real time data. Second, the data sets are broad in scope, so they can be used to understand the impacts of health outbreaks from a variety of perspectives and groups. Enabling citizen access to these data and understanding of their implications promotes transparency about the effects of local decisionmaking and could enable the development of bottom-up solutions to rapidly emerging challenges associated with the COVID-19 pandemic (Chari et al., 2017). This aligns with the extensive body of research showing the efficacy of community-based approaches to disaster management and response that are increasingly articulated in policy doctrine, such as the Federal Emergency Management Agency's (FEMA's) "whole-of-community approach" to emergency management (FEMA, 2011; Maskrey, 2011; Wisner et al., 2004).

LA is an ideal case study for an assessment of an open data portal, particularly during the ongoing COVID-19 pandemic. LA's portal has been highly ranked by the U.S. City Open Data Census and the World Council on City Data (Office of the Mayor of Los Angeles, 2015), and it contains more than 1,500 data sets. In addition, the

city's residents and workers have been heavily affected by COVID-19, with 40,000 cases and 2,000 deaths reported as of May 19, 2020 (County of Los Angeles Department of Public Health, undated). Furthermore, state and local governments have issued numerous orders affecting daily life, in addition to the orders and guidance issued at the federal and international levels (see Figure 1).

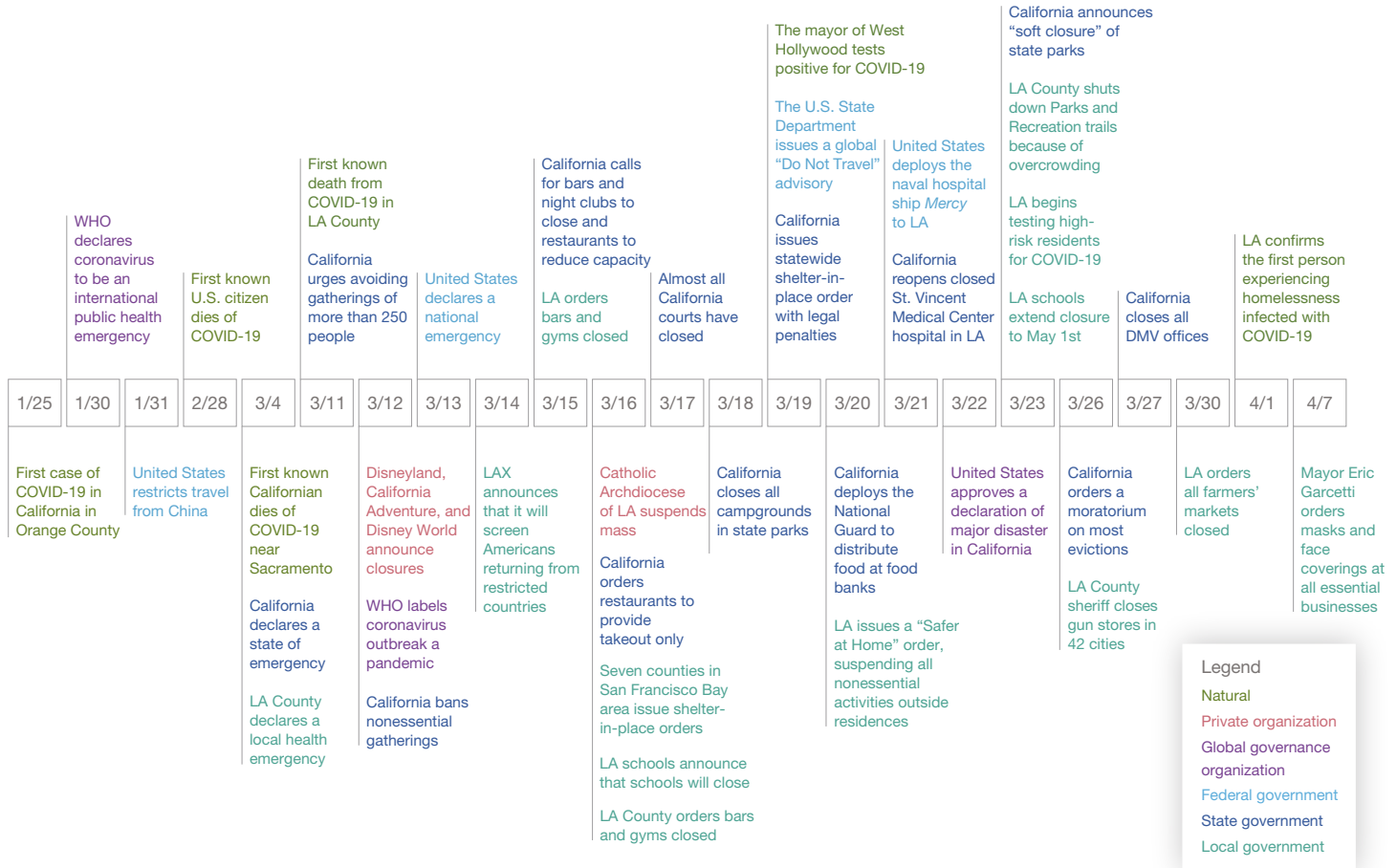
## Results

The LA open data portal is an online, searchable database used by the city to share data from its agencies with the public, researchers, and other interested parties (Office of the Mayor of Los Angeles, undated a). Visitors to the webpage can search for specific data sets to view from the more than 1,500 available, browse data by topic, explore examples of how select data sets could be used, and even create data visualizations. The homepage also provides a series of videos intended to help users access the data sets along with links to its application programming interface (API). Each data set includes a summary that briefly describes the data set, the source agency, date of last update, update frequency, and relevant attachments. Data sets can be downloaded for offline use in CSV, RDF, RSS, TSV, and XML formats.

Data sets were selected for download and analysis in April 2020, near the beginning of the COVID-19 pandemic in the United States. We first filtered the data sets by date of last update, removing data sets that had not been updated since mid-March, when the United States declared a national emergency and a flurry of local government actions were taken. Data sets that were selected using this standard but that contained metadata indicating otherwise

FIGURE 1

Timeline of Major Events and Actions Related to the COVID-19 Outbreak in Los Angeles, January to April 2020



SOURCE: Data were compiled from news articles and government press releases.

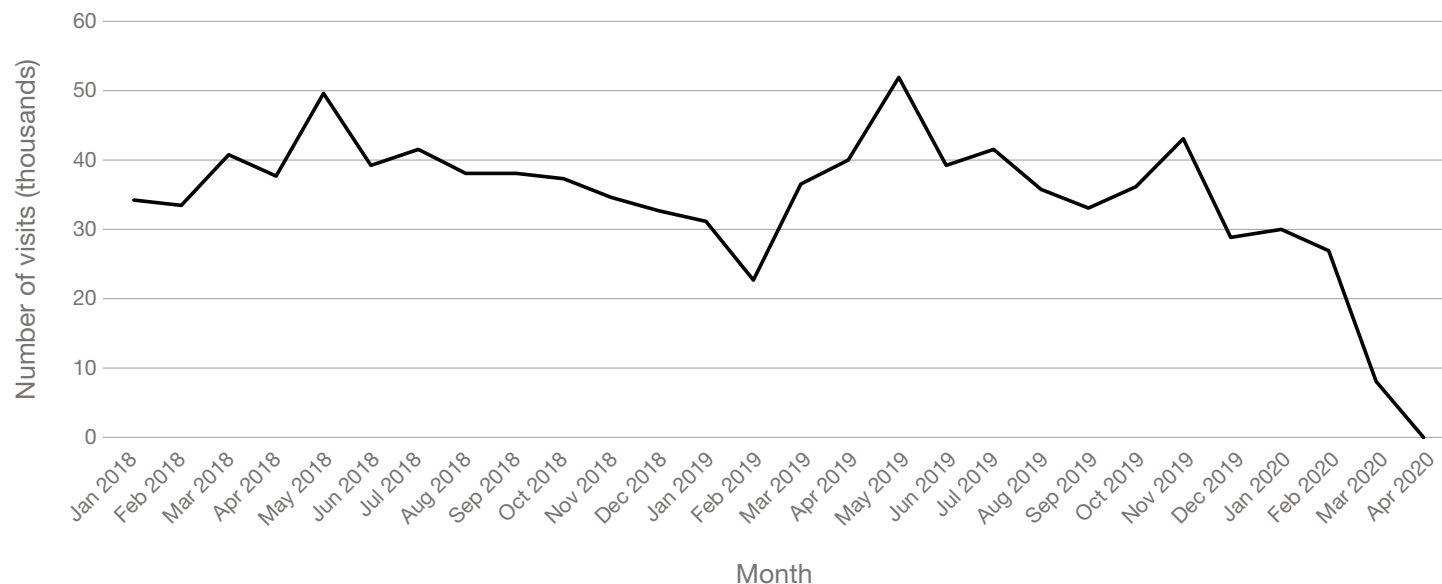
NOTE: DMV = Department of Motor Vehicles; LAX = Los Angeles International Airport; WHO = World Health Organization.

(i.e., titles stating that the data set was scoped to data collected in previous years) were removed. We also removed static data sets that contained data that were not expected to change in response to local conditions (e.g., post office locations or geographic boundaries) and data sets without archived longitudinal data, which left fewer than 50 data sets (or less than about 3 percent of the data sets made available in the open data portal) for analysis. We also removed redundant data sets; we analyze the remaining data sets in this Perspective.

## Data Sets Highlight the Impact of the COVID-19 Pandemic on Los Angeles

We found that LA's open data portal provides users with access to data streams that are highly localized and that convey details about how the behaviors of local residents are changing during the ongoing public health emergency. For example, Figure 2 suggests that local tourism fell significantly, as indicated by the sharp decline in the number of visits to museums in the El Pueblo de Los Angeles Historical Monument. Additionally, the number of daily traffic collisions declined by more than 60 percent, with a steep decline initiating in mid-March, as shown in Figure 3.

FIGURE 2  
Total Visits to LA Museums in the El Pueblo Monument, by Month



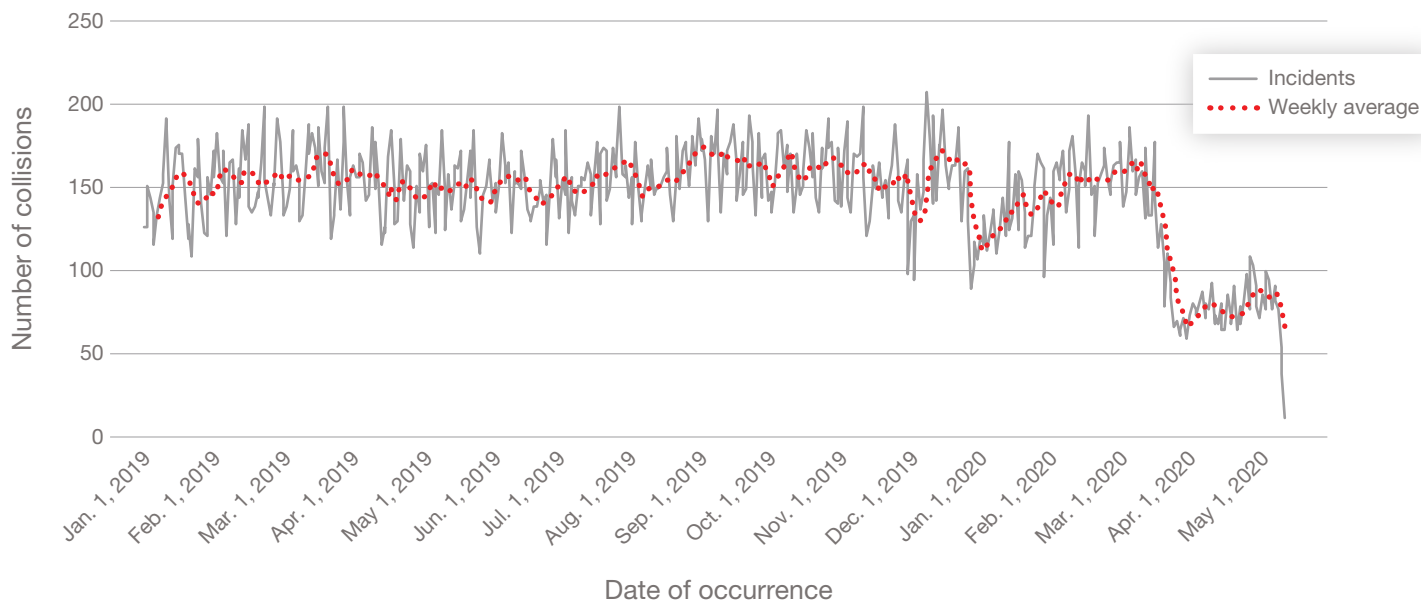
SOURCE: Data are from Office of the Mayor of Los Angeles, 2020b.

Several data sets in the open data portal facilitate analyses of how the COVID-19 pandemic affected local demand for and the city’s provision of important services. For example, Figure 4 shows the number of construction permits issued from January 2019 to May 2020. The graph reveals a sharp drop in permits in mid-March, followed by a gradual increase through April, although there are still fewer than the previous year’s average. Figure 5 shows the number of special event permits by event start date. Although the numbers are not as consistent as those for construction permits, the graph similarly indicates a sharp drop in special event permits. Meanwhile, the numbers of

311 requests (Figure 6) and 911 dispatch calls (Figure 7) have remained relatively stable throughout the public health emergency, and the frequency of 311 request types has been consistent with historical patterns. These two data sets suggest that, while COVID-19 is reshaping many economic activities and the use of city services, other aspects of city life remain unaffected.

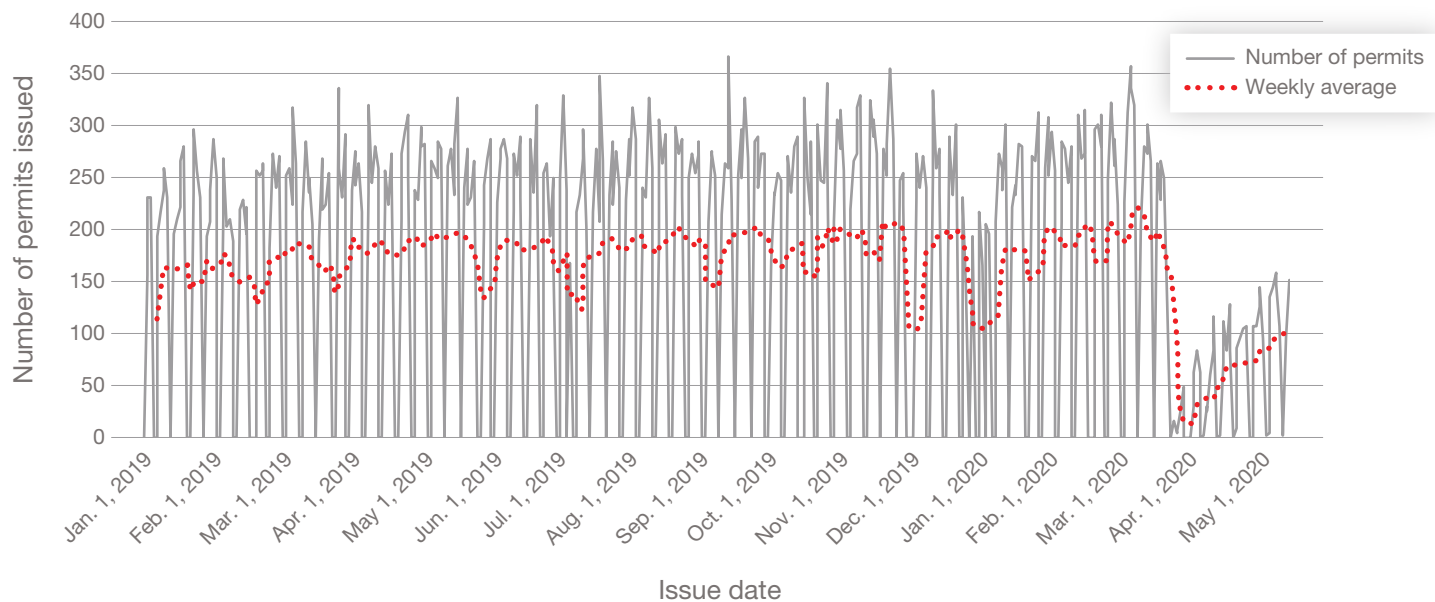
The data shown in Figures 2–7 provide users with evidence of the impact of the COVID-19 pandemic in the LA community, particularly the impact of the California and LA stay-at-home orders (which were issued on March 19 and March 20, respectively) and the March 16 closure of

FIGURE 3  
Traffic Collisions, by Date of Occurrence



SOURCE: Data are from Office of the Mayor of Los Angeles, 2020d.

FIGURE 4  
 Issued Construction Permits, by Date of Issuance



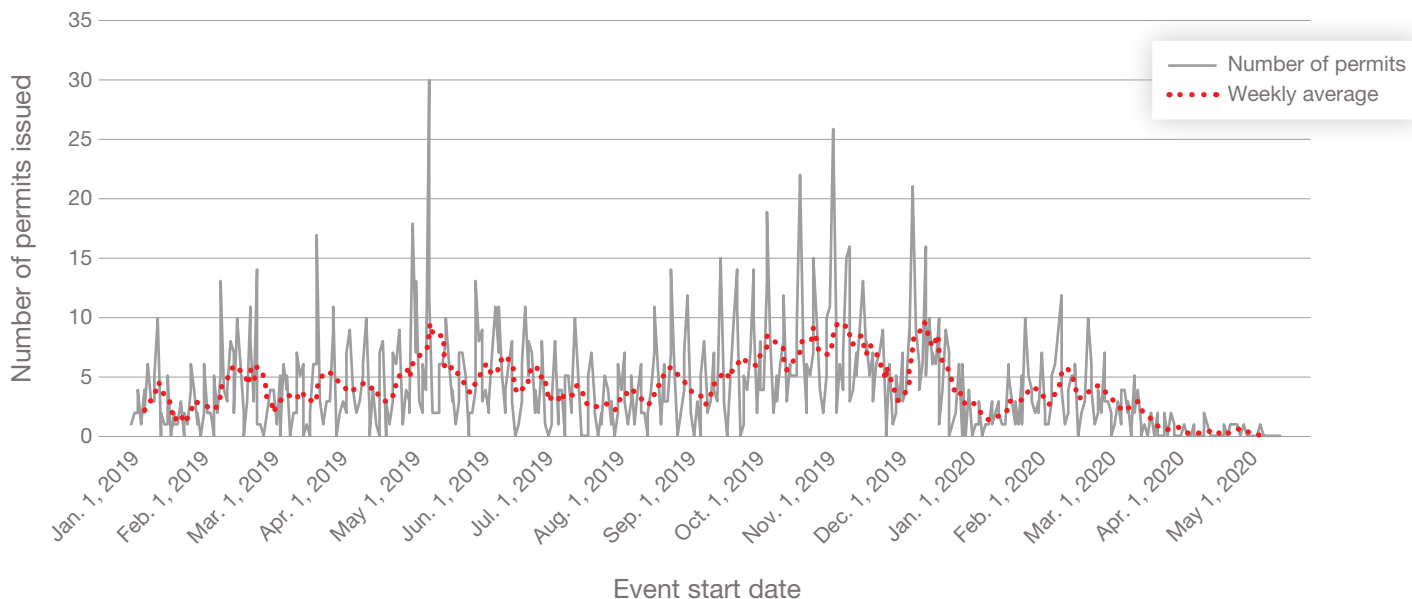
SOURCE: Data are from Office of the Mayor of Los Angeles, 2020f.

the El Pueblo facilities (County of Los Angeles, undated). These data can serve as indicators of local economic activity, and their public availability could facilitate the development of community-based solutions to COVID-19-related impacts, such as donations to organizations supporting museums and/or sector-specific workers. Additionally, these data could provide advocates of community reopening with indicators of the sharp economic pain correlated to the implementation of local and state stay-at-home orders.

Furthermore, several of these data sets contain more-granular information that could help community

groups identify populations that might be more vulnerable to COVID-19 impacts. For example, the data set containing 911 dispatch call data shows that calls concerning incidents of domestic violence have occurred at a frequency consistent with historical norms. Reported increases in the frequency of domestic violence calls could activate a system of community-based social and psychological support, as has been done in other communities (Kumar and Nayar, 2020). Furthermore, the traffic collision data set provides data indicating the gender and ethnicity of the drivers involved in the incident, along with the neighborhood in which the incident occurred. Using traffic collisions as a proxy

FIGURE 5  
Special Event Permits, by Event Start Date



SOURCE: Data are from Office of the Mayor of Los Angeles, 2020e.

measurement for mobility could highlight populations that are unable to telework and are therefore more exposed to the virus (Klein et al., 2020; Oliver et al., 2020).

We found several characteristics of LA’s open data portal that represent opportunities to improve its usability. For example, most of these data sets do not include supporting information that define variables or values, requiring users to make judgments based on contextual clues within the data set. This might result in interpretation errors. Furthermore, the methods used to collect the data are not specified, so it is unclear which data are updated or are

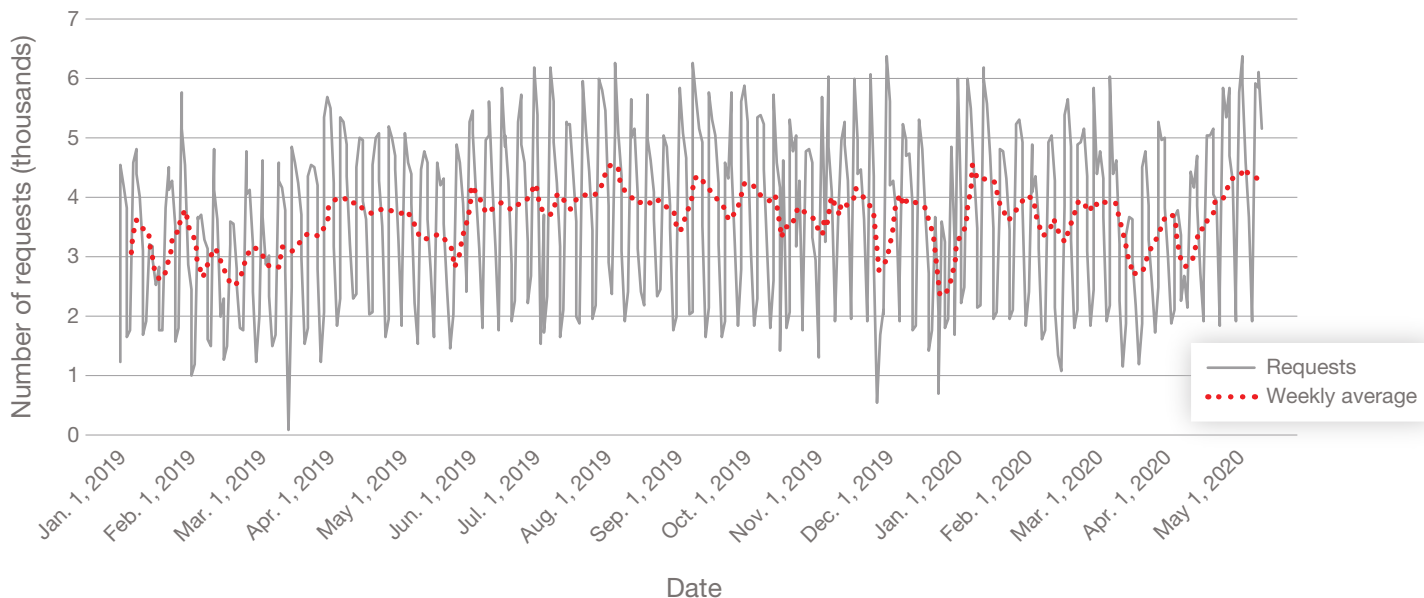
lagging. We describe these and other challenges further in the next section.

### Current Shortcomings Limit the Utility of LA’s Open Data Portal for Enhancing Transparency and Empowering Residents

Open data portals are mechanisms through which city leaders are aiming to facilitate the inclusion of community members in local decisionmaking (Albino, Berardi, and Dangelico, 2015). According to Mayor Garcetti, city data are shared with the public through the open data portal “to



FIGURE 6  
MyLA311 Requests, by Date Requested

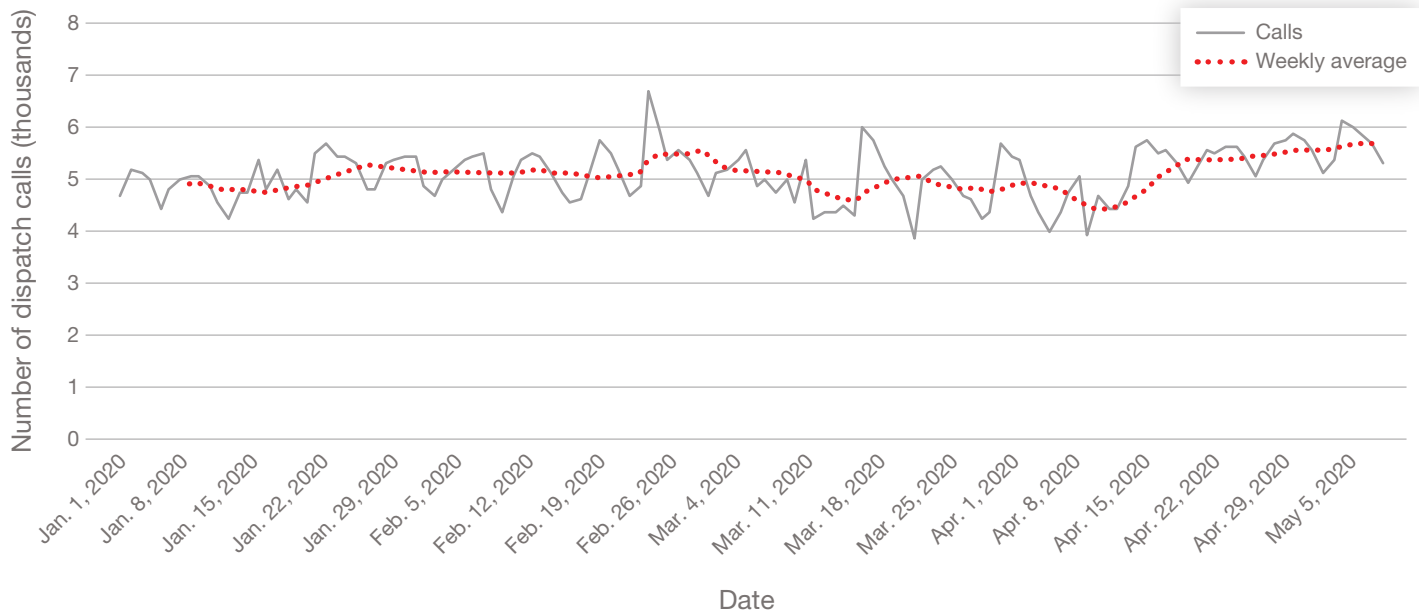


SOURCE: Data are from Office of the Mayor of Los Angeles, 2020g; Office of the Mayor of Los Angeles, 2020h.

increase transparency, accountability and customer service and to empower companies, individuals and non-profit organizations with the ability to harness a vast array of useful information to improve life in our city” (Office of the Mayor of Los Angeles, undated a). However, we found that certain characteristics of the open data portal prevent it from achieving this objective for assessing the community-level impacts of COVID-19. Although the COVID-19 pandemic might represent an edge case, addressing these limitations could make the portal more useful for other use cases that might be closer to what policymakers had originally envisioned.

Insufficiently frequent updates to many data sets is a significant shortcoming of LA’s open data portal, which sharply limits the data that are available for users to analyze the short-term impacts of the COVID-19 pandemic on LA residents and city services. These types of data include several top-line social and economic indicators, such as city revenue, city procurements, and crime. LA’s revenue data are compiled at the end of the fiscal year, preventing near-real-time analyses of the city’s budget health or the impacts of the pandemic on certain economic sectors. A particularly relevant data set detailing the city’s purchases of hand sanitizer has not been updated since 2015.

FIGURE 7  
911 Dispatch Calls, by Date Requested



SOURCE: Data are from Office of the Mayor of Los Angeles, 2020a; Office of the Mayor of Los Angeles, 2020c.

A potentially costly situation arises when an open data portal incorrectly indicates that a data set has been recently updated and when users rely on data that are actually out of date. For example, the time series shown in Figure 8 on traffic collisions—data that LA’s portal indicates are updated daily—illustrates how data updates can alter the analysis for a rapidly developing event. Data downloaded on April 14, 2020, indicated that traffic collisions began a second major decline around April 7. However, data downloaded on May 7, 2020, revealed that collisions had instead plateaued since March 30 (after a slight uptick from

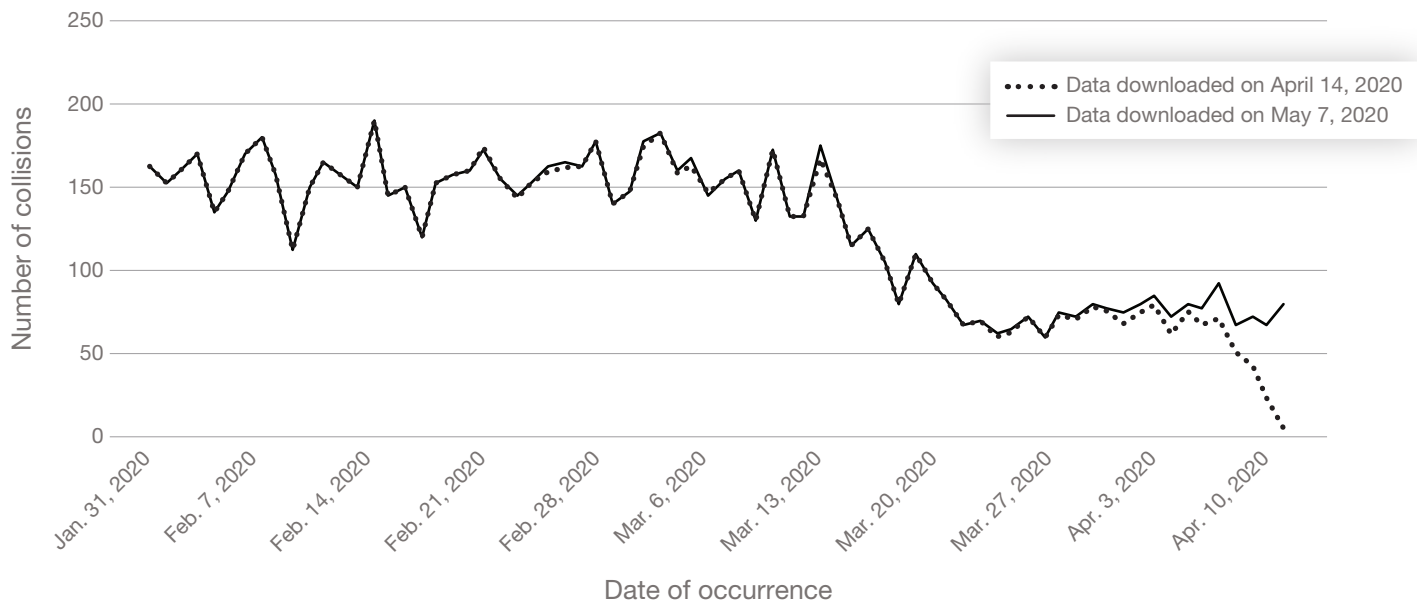
the low point on March 27). Subsequent data downloads in mid-May showed no further change in the data. Although this data distortion was fairly dramatic and visible to the trained eye, less-obvious distortions could result in the mistargeting of local resources to address problems that are not real.

Another shortcoming is the lack of a historical log of data. High-frequency updates are most useful when the updated data are archived because they can be used to help see the impacts of health disasters (Wond and Macaulay, 2011). However, several data sets in LA’s open data portal

are updated in real time but are not archived. For example, the LA Department of Transportation parking meter occupancy data set and the LAX parking lots data set fall into this category. Records of parking occupancy over time could show shifting patterns of commercial activity across different parts of the city over the course of the pandemic or changing patterns of air travel in and out of the city. Unfortunately, these types of longitudinal analyses were not possible because the data were not available in accessible archives.

Comparing LA's open data portal updates with those of Chicago, Illinois; Columbus, Ohio; New Orleans, Louisiana; and New York City shows that other major cities have similar issues with both the frequency of updates and users' ability to identify the most-recently updated data sets. Figure 9 shows the data sets by the date they were last updated. The majority of data sets made available for analysis in open data portals have not been updated on a timescale that is relevant for COVID-19 impact analyses. Indeed, for every city except Los Angeles, the majority of data sets were last updated before 2020, significantly

FIGURE 8  
Daily Traffic Collisions, January to April 2020



SOURCE: Data are from Office of the Mayor of Los Angeles, 2020d.

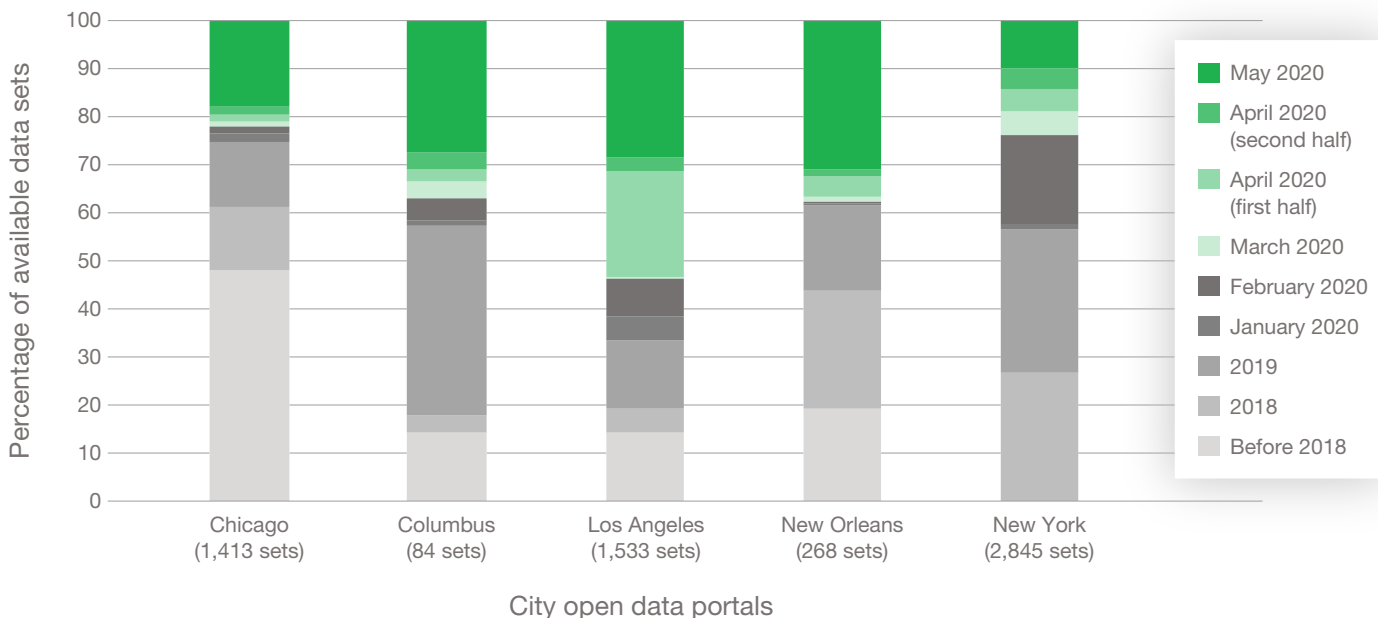
NOTES: These data are shown over a longer period in Figure 2. Data were downloaded from the portal on April 14, 2020, and May 7, 2020.

limiting their utility for short-term impact analyses. These older data sets are indicated in shades of gray in Figure 9. In terms of identifying the most recently updated data sets, Columbus’s data portal was the only one we examined that allows users to filter the data sets to a specific date range for the last update. In contrast, Pittsburgh, Pennsylvania’s open data portal (not shown) had no mechanism for filtering the data sets by date of last update. Sorting the data sets in order of “last modified” places them into an order that

did not correspond to the “modified timestamp” dates in the individual data sets.

Furthermore, even data sets that are labeled as having been updated in spring 2020 (i.e., within the COVID-19 pandemic time frame) might not actually contain new data that are relevant to this period. The open data portals tagged many data sets as being recently updated despite indications that the data sets contained historical information from years or even a decade earlier, such as

FIGURE 9  
Proportions of the Data Sets in the Open Data Portals of Various U.S. Cities, by Last Listed Update



SOURCE: Data are from City of Chicago, undated; City of Columbus, undated; Office of the Mayor of Los Angeles, undated a; City of New Orleans, undated; City of New York, undated.

NOTE: These data are as of May 5, 2020.

the Chicago data set “Beach Water Quality - Automated Sensors - 2015 - Wave Height” and New York City’s data set for “311 Service Requests for 2005” (City of Chicago, 2020; City of New York, 2020). This observation suggests that significantly fewer data sets are relevant for real-time impact analyses than indicated in Figure 9.

Finally, more-up-to-date information often can be obtained from sources other than city open data portals. For example, one of Columbus’s oldest data sets contains a list of locations for CoGo bike-share stations that was last updated in 2017, but the homepage of CoGo’s website displays an up-to-date map (CoGo Bike Share, undated).

## Conclusions and Recommendations

LA’s open data portal is a promising source of information that is freely available for users to access and analyze. For the most part, data sets in LA’s open data portal are clearly labeled, well formatted, and easy to access. However, significant obstacles exist that limit the open data portal’s utility toward achieving Mayor Garcetti’s objective of increasing transparency and empowering local users. Many of LA’s data sets—and particularly, ones that would be relevant to COVID-19 impact assessments—are not updated at sufficient frequencies, while others are difficult to analyze because of missing details regarding data collection and update frequency. Although we acknowledge that the open data portals were not necessarily designed to facilitate community-based analyses during such fast-moving public health emergencies as the COVID-19 pandemic, public access to data sources, such as the open data portal, could be useful for promoting bottom-up, collaborative problemsolving that addresses emerging challenges (Chen et al., 2020).

We offer three recommendations for how LA and other governments could improve their local open data portals to enhance the portals’ utility. Local governments should weigh the opportunity costs associated with implementing these recommendations because they might drive cost increases that could divert resources from other priorities.

**Recommendation 1: Upload and update data more frequently.** We found that fewer than 3 percent of the data sets in LA’s open data portal were updated recently enough to be relevant for COVID-19 impact assessments. Furthermore, a significant number of these data sets were updated monthly, preventing quick-turn analyses that could facilitate the rapid deployment of community-based resources. Having access to data at higher frequencies could facilitate the timely bottom-up development of community-oriented solutions that can address the most-pressing local challenges (Zuiderwijk and Janssen, 2014). Data sets also should contain change logs that indicate the substance of recent updates. Data sets’ listed dates of last update should include only true changes to content (or, if applicable, a specific entry that zero incidents occurred during the last reporting period). Frequently updated data sets should have metadata indicating whether they are still being updated, how frequently the updates occur, and the most recent date for which the data should be considered reasonably finalized and unlikely to change. Old data sets that are considered finalized should not need to be updated often, but when they are, they should include metadata giving the reason for the late update. Open data portals should permit users to filter data sets by time of last update.

**Recommendation 2: Records of real-time data should be saved and made available.** Longitudinal data are important for providing situational context and

information on change causality, both of which are highly relevant to public management (Wond and Macaulay, 2011). However, our analysis of LA's open data portal found that longitudinal data were not available for potentially highly informative data sets that were being updated in real time (e.g., the LA Department of Transportation parking meter occupancy data set). If maintaining the complete record is impractical, the portal should record relevant summary statistics that will enable reasonably fine-grained longitudinal analysis.

**Recommendation 3: Data sets should contain meta-data that offer relevant context.** We found that data sets in LA's open data portal lacked sufficiently descriptive information about the data included in the data sets, which slowed our analyses and could turn away less-experienced users. By providing descriptive metadata, cities could facilitate the searching, evaluating, and viewing of data sets in open data portals (Zuiderwijk, Janssen, and Davis, 2014). In addition to clarifying how up-to-date a data set is (Recommendation 1), metadata should detail exactly which data are provided, sources of the data, limitations, explanations of missing data, and any changes in data-collection practices that might introduce spurious trends, such as changes in reporting requirements for the data sources or the addition of new sensors. The metadata should take structured and searchable forms to the maximum extent possible, supplemented by unstructured descriptions as necessary. The metadata should list any related data sets that are publicly accessible (in the open data portal or elsewhere), such as corresponding data sets that provide similar information for other time frames. To help users quickly identify relevant data sets of the thousands that are sometimes available, the portals should allow advanced

searching and filtering of the data sets that can combine requirements across different categories of metadata.

## Notes

<sup>1</sup> See Office of the Mayor of Los Angeles, undated b, for recent press releases issued by Mayor Eric Garcetti and KTLA news coverage for an example of how these press releases have been disseminated to the public (Martin, 2020).

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## About This Perspective

The global trend toward urbanization, combined with innovations in information and communications technologies (ICTs), has resulted in movements toward revolutionizing local governments through digital transformations of communities to become “smart.” As these communities update and improve local processes and infrastructure, urban planners and city leaders have sought to facilitate the inclusion of community members in local planning processes through access to public information. This objective often has been operationalized through open data portals, which serve as publicly accessible repositories for smart city data. Despite the initial promise of such data portals, reports have found that use cases are limited and have identified numerous challenges limiting their utility. Here, we attempt to use the City of Los Angeles’s open data portal to access and analyze data to develop generalizable strategies that city leaders could adopt to improve the usability of their local open data portals. As a case study, we sought to develop an understanding of how city services and residents were affected by the coronavirus disease 2019 pandemic. We found that significant obstacles exist that could limit the open data portal’s utility toward achieving Mayor Eric Garcetti’s objective of increasing transparency and empowering local users. Furthermore, many of these obstacles are common characteristics of open data portals managed by cities across the United States. We conclude by offering several recommendations for how Los Angeles and other city governments can improve their local open data portals.

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