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Did COVID-19 Induce A Strenuous Effect on the 311 Non-Emergency Services System?

By

Thao Tran

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Faculty Advisor: **Kanit Kuevibulvanich**

Preceptor: **Kanit Kuevibulvanich**

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Thao Tran
University of Chicago

Abstract

In this paper we examine whether COVID-19 imposed a crowd out effect on the 311 non-emergency services using data from Kansas City, Missouri during the early stage of the pandemic. Using description text data, we identify covid-related requests and use them as a proxy for the strains put on the 311 systems by the health crisis. We find robust evidence through our difference in difference approach that zip code with an additional covid-related request would experience half an hour delay the response time for non-covid related requests. In addition, the strains on the 311 system mainly affected three categories: “Mowing / Weeds”, “Trash / Recycling”, and “Animals & Pets”.

Keywords: crisis response, 311, crowd out effect, COVID-19, text mining

1 Introduction

In this paper, we examine whether COVID-19 imposed a strenuous effect on the 311 non-emergency services using data from Kansas City during the early stage of the pandemic. The 311 system is a non-emergency response system where people can make a request to find information about services, make complaints, or report non-emergency problems, such as potholes and trash collection. Even though it is initially designed to reduce call volume on the overloaded 911 system, 311 request systems have become an integral part of the e-government movement in which technological innovations are deployed to help local governments deliver more efficient and effective services to residents. During times of crisis, 311 systems provide understanding of the flexibility and resilience that city managers and staff had developed in dealing with natural and manmade disasters, which provided a framework that could be modified and adopted to improve resilience and crisis response systems. Thus, our study aims to provide insights for local government and stakeholders on the performance of Kansas City 311 services during the COVID-19 pandemic and whether the services dedicated to response to the health crisis strains the response to non-covid-related services.

2 Literature Review

Our paper contributes to the literature of disaster response where 311 systems have been used to help local governments serve residents in the face of unexpected events or dramatic shocks to the system. In these applications, the use of 311 systems have been modified to provide two-way communications between residents and government. These applications include seasonal issues which while unpredictable in terms of timing, location, or severity, can be “expected” at some point and place (e.g., snowstorms and heavy rains, floods). Some jurisdictions have used 311 systems to communicate with residents, as well as anticipate the need for resource allocations based on initial reports and predictive models (Dawson, 2005). Cities have also monitored calls to flag such events and support the deployment of messaging out to

residents about emergencies and responses (Grabner, 2008). On the “unexpected” front, 311 systems have been used to develop responses to hurricanes, tornadoes, and other natural disasters including warning residents and deploying rapid response systems (Dombrowski, 2005). With respect to unexpected man made events, 311 systems have been used to support citizen needs and monitor activity levels. For example, during the New York City transit strike, the number of calls and response times varied significantly from pre and post-strike levels (Bailor, 2006).

More particularly, our findings add to the literature of the crisis response in the 311 systems during COVID-19. Lieberman-Cribbin et al (2020) documented the increase in covid-related calls in New York City, most of which were placed to get more information on the coronavirus, its symptoms, prevention measures, and testing locations. Pamukcu and Zobel (2021) also provided a descriptive analysis of New York City 311 data during the pandemic, where they found declines in requests for street condition, blocked driveway, and illegal parking and spikes in noise complaints and non-emergency police matters. Dallas 311 data showed reduced noise complaints during the COVID-19 timeframe by about 14% compared to the pre-COVID-19 period, especially in and around the city center (Yildirim and Arefi, 2021).

Different from these papers, we focus on the Kansas City data and document the performance of the 311 system in Kansas City during the pandemic. Using the description text in the Kansas City 311 data, we build an identifier to differentiate covid-related calls from non-covid-related calls to accurately measure the volume of calls flooded in due to the pandemic. Moving beyond descriptive findings, we further identify the resilience of the 311 system by examining whether the spike in covid-related calls delayed the services of non-covid-related calls.

3 Data

The 311 service requests data came from the Kansas City Open Data website (3/1/2019 to 9/1/2020) recording non-emergency calls across Jackson, Clay, Platte, and Cass

counties in the Kansas City, Missouri area (KCMO). The data contains 172,722 requests with attributes including the date the request was made, the date it was completed, location of the request (latitude, longitude, neighborhood, zip code), the category it belonged to, the department in charge, whether it was made via phone or email or other methods, and description of each request. Requests in the “Data Not Available” category are excluded. There are 15 categories including:

- Animals / Pets
- Capital Projects
- City Facilities
- Government
- Lights / Signals
- Mowing / Weeds
- Parks & Recreation
- Property / Buildings / Construction
- Public Health
- Public Safety
- Sidewalks / Curbs / Ditch
- Signs
- Storm Water / Sewer
- Streets / Roadways / Alleys
- Trash / Recycling

Requests related to COVID-19 were identified by searching for keywords in the description of the request. There were 20 keywords related to the pandemic and the policy response to fight the pandemic, including the stay at home orders, mask mandates, and social distancing measures: “covid”, “corona”, “pandemic”, “virus”, “positive”, “mask”, “face cover”, “ppe”, “coverings”, “social”, “distanc”, “6 feet”, “quarantine”, “stay at home”, “gathering”, “essential”, “still open”, “open for business”, “open and operating”, “still operating”. We examined the number of requests containing each keyword over time, before and after COVID-19, to ascertain the identified requests are pandemic-related.

This identification allows us to observe the covid-related 311 request volume in the early stage of the pandemic separated from other significant events that took place in the same time period. The approach helps us avoid confounding effects between non-emergency responses due to the COVID-19 health crisis and other events at the time. For example, we learn that the call volume for “Public Safety” increased by many

folds but we have yet investigated of how much of the increase is driven by covid-related requests, such as calls about lack of social distancing or violations of masks mandate, or by non-covid related requests, such as the civil unrest against systemic racism and the increase in time spent at home.

In addition, differentiating covid-related requests from non-covid related requests provides an opportunity to study how the health crisis shock to the 311 system affects its day-to-day non-emergency services. A measurement for responsiveness is the number of days between the closed date and the created date, which we referred to as response time. Table 1 provides summary statistics of our key responsiveness proxy in the 311 data.

Table 1: Summary Statistics

		Response Time (Days)				
	Obs	Min	Q25	Mean	Q75	Max
All requests	172,722	0	2	32.6	31	532
Covid-related	170,215	0	2	32.8	31	532
Non-covid related	2,507	0	1	19.2	6	180
Year						
2019	96,161	0	2	32.9	36	532
2020	76,561	0	1	32.3	24	238
Category						
Animals / Pets	16,263	0	1	8.7	4	368
Capital Projects	1,818	0	9	52.5	71	210
City Facilities	84	0	1	70.9	180	216
Government	1,193	0	1	14.3	9	320
Lights / Signals	7,590	0	2	8.6	5	243
Mowing / Weeds	8,986	0	9	82.6	180	483
Parks & Recreation	2,156	0	3	30.8	35	211
Property / Buildings / Construction	22,361	0	8	70.2	144	532

Public Health	6,881	0	1	16.0	12	269
Public Safety	1,047	0	5	27.8	29	180
Sidewalks / Curbs / Ditch	3,239	0	1	16.9	14	273
Signs	4,368	0	4	18.5	14	400
Storm Water / Sewer	9,351	0	4	35.3	49	427
Streets / Roadways / Alleys	33,053	0	7	35.6	50	432
Trash / Recycling	54,332	0	1	21.1	8	532

4 Aggregate Trends in 311 Non-Emergency Responses

During the early stage of the pandemic, the 311 non-emergency service system recorded 2,507 covid-related requests. These requests range anything from social distancing to non-essential business opening to mask mandates. The volume of covid-related requests only accounted for 4.5 percent of all 311 calls, which is comparable to the share of covid-related calls in New York City in the same time period at 4.1 percent as reported in Lieberman-Cribbin, Wil, et al (2020).

While the share of covid-related requests is less than five percent, it clusters in two main categories, Public Health and Public Safety, where more than 90 percent of covid-related requests belong to these two categories. This dense concentration leads to the volume of Public Health and Public Safety increasing by 3 times and 3.5 times respectively during the early stage of the pandemic.

Figure 1 portrays the shock of covid-related requests on Public Health and Public Safety month by month. As the pandemic hits in March-August 2020, there is a significant influx of “Public Safety” requests, both non-covid related and covid-related requests. In particular, its volume spiked in April 2020 with covid-related requests accounting for more than half of the increase. In the “Public Health” category, covid-related requests

accounted for 77 percent of the tripled volume. While its volume peaked in April and July, the trend was mainly driven by covid-related requests.

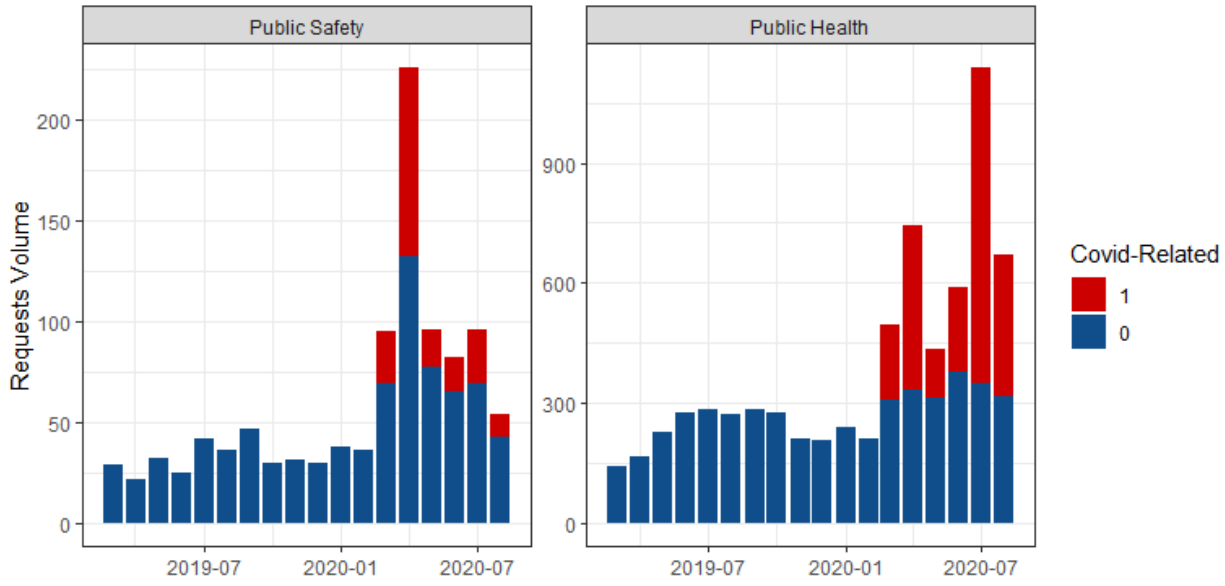

Figure 1: Monthly 311 requests volume in “Public Safety” and “Public Safety” categories. Covid-related requests volume are colored in red.

With such a substantial increase in volume, we would expect the city would take longer to complete these “Public Health” and “Public Safety” requests holding all else constant. Figure 2 shows that opposite where the average number of days it takes to complete a request in these two categories for both non-covid related requests and covid-related requests are similar if not shorter than pre-pandemic requests. Specifically, before the pandemic, the response time for “Public Safety” was around 30 days but during the pandemic the response time averaged at 22 days to complete a request. Likewise, “Public Health” requests pre-pandemic took roughly 18 days to close out, which decreased to 15 days for a request during the early stage of the pandemic for both non-covid related and covid-related requests.

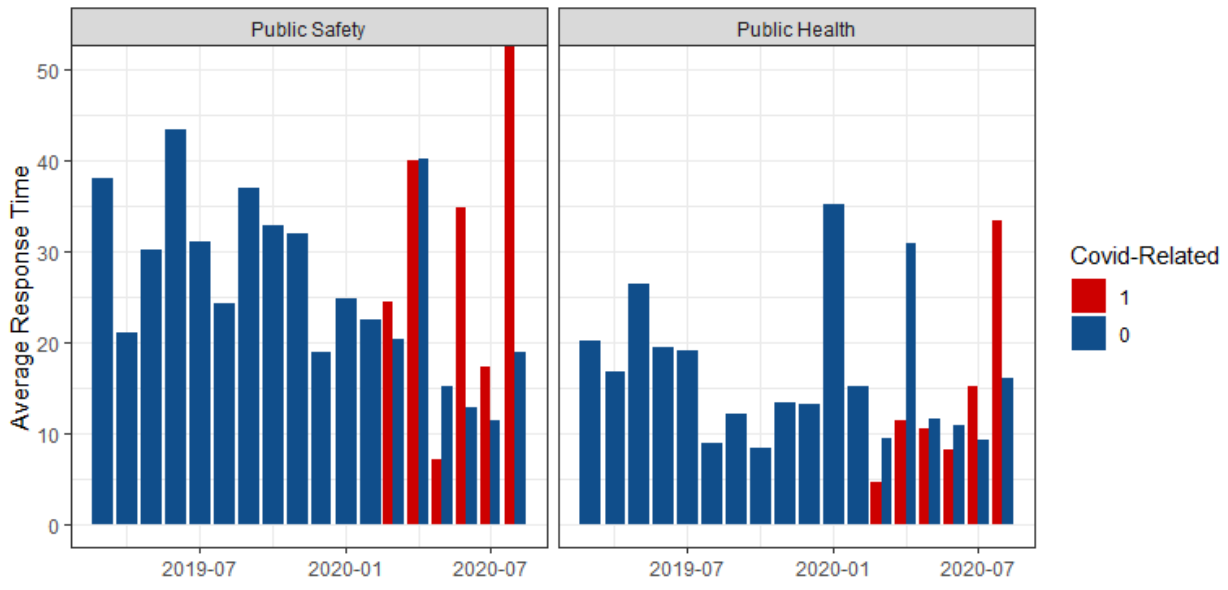

Figure 2: Monthly 311 average response time (days) in “Public Safety” and “Public Safety” categories. Covid-related requests volume are colored in red.

While 311 request volume for “Public Health” and “Public Safety” more than tripled during the early stage of the pandemic, their response time shortened. The unexpected findings suggest possible resource reallocation to prioritize and address the health crisis at hand and inquire further investigation.

In addition to “Public Health” and “Public Safety”, We compare the difference in cumulative request volume of the March-August period between 2019 and 2020 for each type of service requested. Figure 2 displays all 15 categories of services ranked from the largest (most positive) percentage change to the smallest (most negative) percentage change.

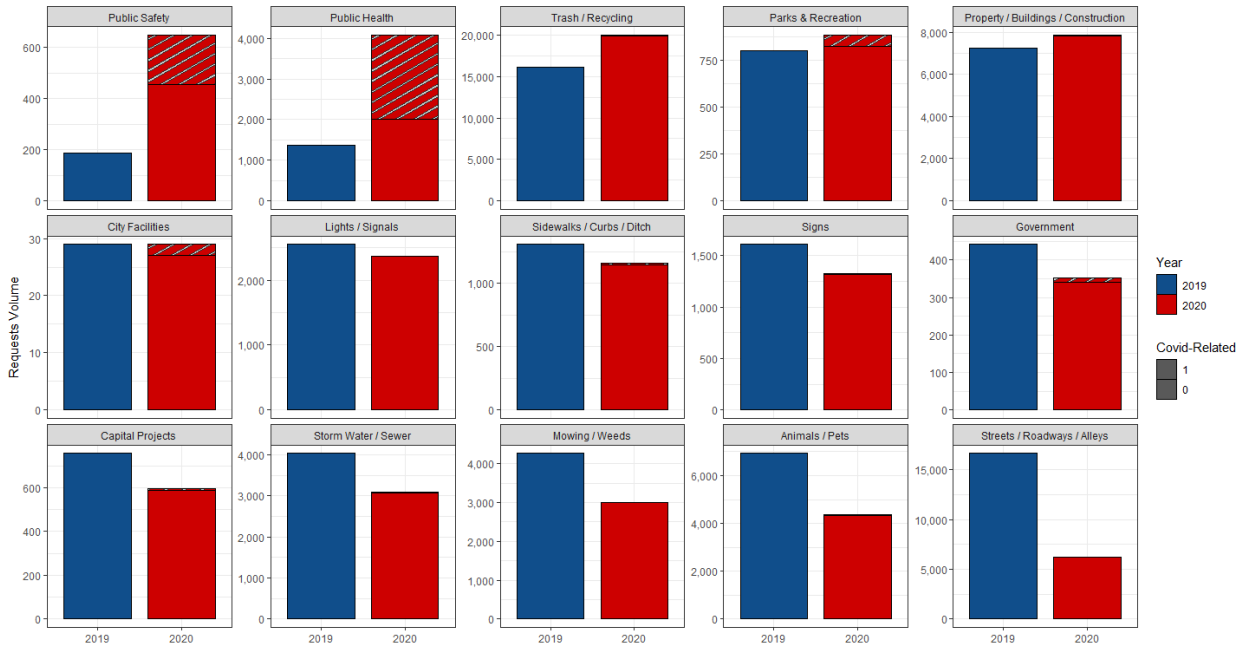

Figure 3: Aggregate 311 requests volume in March-August 2019 versus 2020 by categories. Covid-related requests volume are covered in stripes.

The top row, which includes “Public Safety”, “Public Health”, “Trash/Recycling”, “Parks & Recreation”, and “Property / Buildings / Construction”, represents the five categories that experienced an increase in call volume during the pandemic while the rest of the categories saw the opposite. Other than “Public Safety” and “Public Health”, the increased volume in “Parks & Recreation” is also mainly attributed to covid-related calls despite being much smaller than the other two categories with an increase in request volume of 10.3 percent. While “Trash/Recycling” and “Property / Buildings / Construction” observe a similar sizable increase, their increases are not directly related to the pandemic.

On the other hand, two-thirds of the 15 categories in 311 non-emergency service faced a significant decline in call volume during the pandemic. “Streets/Roadways/Alleys” had the largest decrease in number of requests where its volume in March-August 2020 is only a third of its volume in March-August 2019. Volumes of “Animals/Pets” and

“Mowing/Weeds” requests also experienced a sizable decline of roughly two thousands calls and one thousand calls respectively during the pandemic.

Thus, we examine whether the non-covid related requests in these categories experienced changes in response time similar to “Public Safety” and “Public Health” requests. The response time in the 311 data is measured by the number of days between when a request is created and when it is closed and resolved. We specifically compare the average response time for non-covid related requests before and during the pandemic (Figure 4).

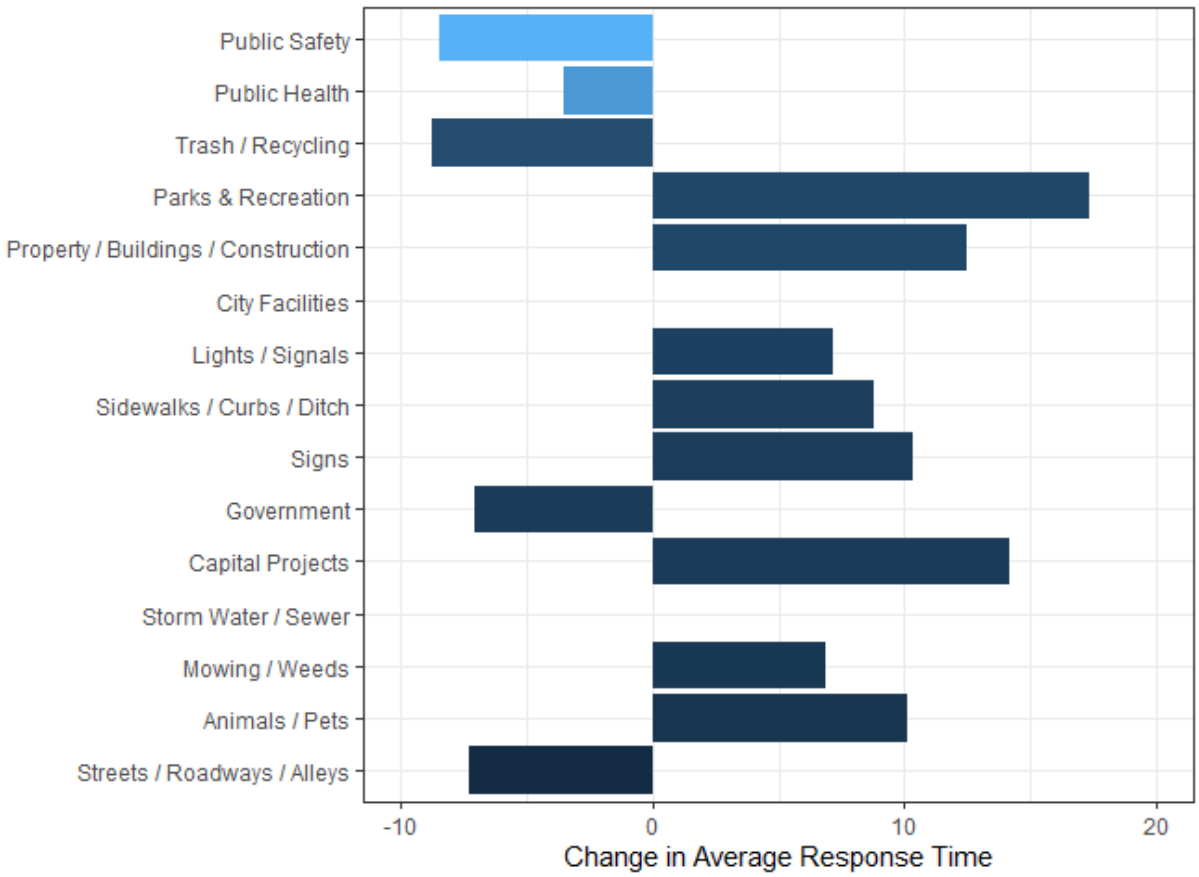

Figure 4: Change in average response time (days) for non-covid related requests in March-August 2019 versus 2020 by categories. Categories are ordered from the largest (most positive) percentage change to the smallest (most negative) percentage change in request volume.

Interestingly, eight out of ten categories that experienced a decline in 311 volume faced longer response time during the pandemic. Categories with a major drop in number of requests such as “Animals/Pets” and “Mowing / Weeds” took seven to ten days longer to complete during March-August 2020.

This preliminary and aggregate evidence might signal a crowd out effect where efforts to address the influx of pandemic-related requests lead to delays in other non-emergency services. More specifically, it is possible that resources to respond to non-emergency service were reallocated to prioritize categories strongly affected by covid-related requests and thus reducing response time for “Public Safety” and “Public Health” while increasing response time for other categories. In order to further explore these dynamics, we employ variations in call volumes and response time across zip codes.

5 Methods

5.1 Geographical Variation

The 311 data allows observations across geographical areas, such as zip codes and neighborhoods. In particular, 311 non-emergency service requests spread across 50 unique zip codes in the Kansas City Missouri area, which provides great variations in service volume as well as exposure to the impact of the pandemic across zip codes.

Figure 5 displays the volume of covid-related requests in the 311 non-emergency service system by zip code during the early stage of the pandemic. This measure is zip code specific and remains the same throughout the entire period of analysis. The choropleth shows that the impact of COVID-19 on the 311 system varied largely from one zip code to another as many zip codes experienced over two hundreds covid-related requests while many have no covid-related requests.

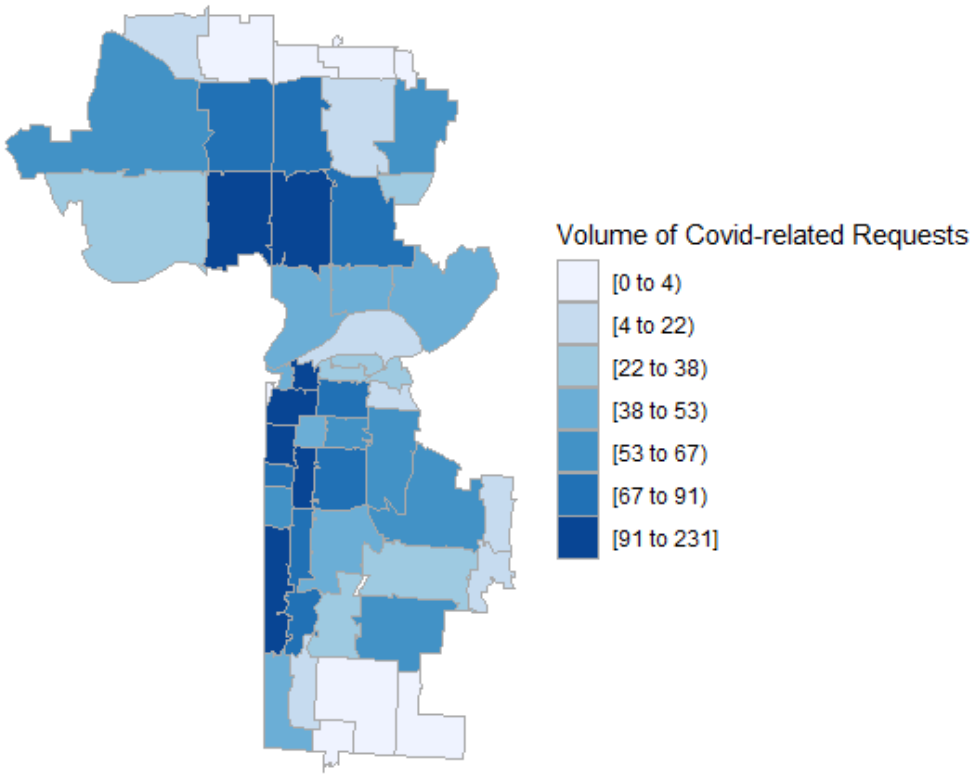

Figure 5: Volume of covid-related requests by zip codes in Kansas City, MO

We proceed to use the volume of covid-related requests to proxy for the pandemic shock on the non-emergency services in a particular zip code as it reflects the strain the pandemic placed on the 311 system. In addition to variation across zip codes, the fact that a covid-related request takes place independently and exogenously from non-covid related requests allows the volume of covid-related requests to be an appropriate treatment variable in our analysis.

If the crowd out effect as we discussed exists, we would expect to see non-covid related requests in zip code that faced large influx of covid-related requests to experience delays in response time compared to pre-pandemic period. We can visualize this hypothesis via a scatter plot of changes in response time for non-covid related requests versus volume of covid-related requests by zip codes (Figure 6).

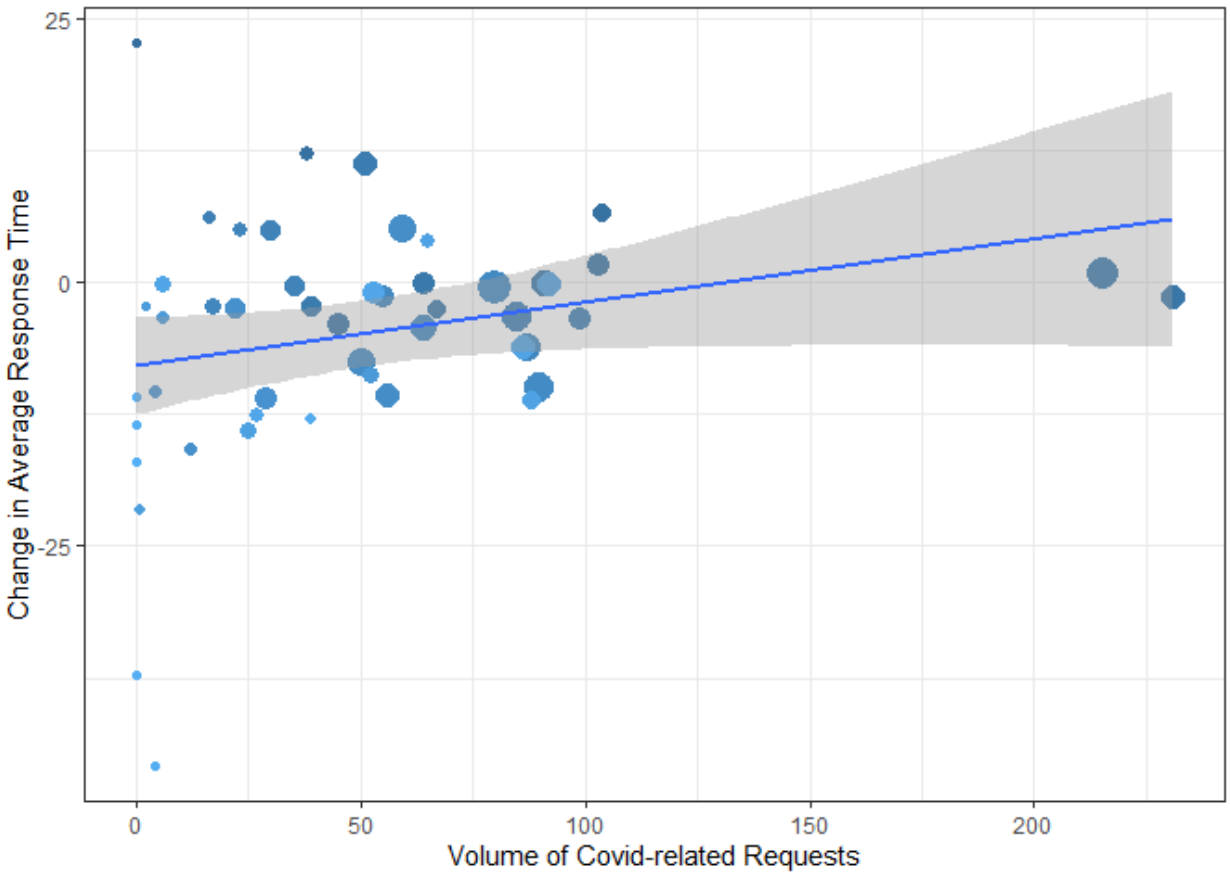

Figure 6: Changes in average response time (days) between March-August 2019 and 2020 for non-covid related requests versus volume of covid-related requests. Each point represents a zip code and its size corresponds to the volume of all 311 requests in that zip code pre-pandemic.

The scatter plot displays a slight upward trend between the volume of covid-related requests and changes in response time of non-covid-related calls. The trend has a positive and significant slope of 0.0605 with standard error of 0.0323, which suggests non-covid related calls in zip code with an additional covid-related request would experience additional delays of approximately 1.5 hours (0.0605 days x 24 hours/day) in response time.

It is important to note that the zip code reported in the 311 data is not consistently attached to the citizen's neighborhood or the area specific to the request for

covid-related requests versus non-covid related requests. For a non-covid related request example, a person runs into a broken traffic light on her way home from work and makes a 311 request for it. The request would record the zipcode where the broken traffic light is located rather than her place of residence. On the other hand, in a covid-related example, when a citizen reports her neighbors violating social distancing orders, the zip code would reflect her neighborhood. The inconsistency of zip code assignment and definition poses a weakness to our estimation.

In addition, by utilizing zip code as geographical variation, we make the assumption that the city resources to respond to 311 non-emergency service is exclusive to a particular zip code and independent from other zip codes. This is a strong assumption as even though requests might be assigned to different departments based on geographic location and categories, it is unlikely to be zip code specific.

5.2 Difference in Difference

Given the zip code variation, we employ the following difference-in-difference framework to estimate the crowd out effect of covid-related requests on the 311 non-emergency service system:

$$ResponseTime_{izt} = \beta_0 + \beta_1 Treatment_z \times After_t + X_{izt} + \delta_z + \varphi_t + \varepsilon_{izt}$$

where the response variable, $ResponseTime_{izt}$, represents the number of days it takes to complete the non-covid related request i in zip code z and month t. The treatment effect is represented by the volume of covid-related requests in zip code z, $Treatment_z$. The timing of the treatment started in March 2020 represented by the indicator $After_t$, which equals 0 if month t is before March 2020 and 1 if month t is March 2020 or after. We also have the controls X_{izt}, zip code fixed effect δ_z, and time fixed effects φ_t. Error terms are represented by ε_{izt}.

Two important controls to consider while investigating the crowd out effect in 311 system during COVID-19 are possible substitution effect in the 911 emergency services and the fluctuation in the service providers.

As the 311 non-emergency service system was designed to relieve the overloads on the 911 emergency service system, there is a possible substitution effect between the two systems. A substantial influx of covid-related in the 311 systems might invoke the 911 systems to partake and resolve a portion of this health crisis shock to the city services. In this scenario, the strain is transferred to the 911 systems instead of the non-covid related requests in the 311 system. In order to control for this substitution effect, we use the monthly 911 volume from the KCMO fire department and the police department reported in the Regional Call Volume Report by the Kansas City Regional 911 system.

The response time can also be heavily affected by the number of city service providers. In particular, in order to respond to the substantial influx of covid-related in the 311 systems the city might increase their task force or increase working hours. On the other hand, the city might experience a decline in their service providers due to workers getting sick from COVID-19 itself or low funding leading to temporary layoff, which would exaggerate the stress on the system. We proxy for this aspect with the monthly number of local government employees in Kansas City, MO-KS (MSA) reported in the State and Metro Area Employment, Hours, and Earnings released by the U.S. Bureau of Labor Statistics.

Our coefficient of interest is β_1 for the interaction between the treatment and the treatment period indicator. If there is some evidence that the COVID-19 shock would lead to delays in response time for non-covid related requests, we would expect β_1 to be significant and positive as non-covid related requests in zip code with higher influx of covid-related requests would be expected to take longer to complete during the pandemic.

6 Results

Our difference-in-differences estimates on the request level are shown in Table 2. Column (1) shows the impact of covid-related requests on the response time for non-covid related requests without the control variables. We find that the strain of an additional covid-related request is associated with a delay in completion time of non-covid related calls during the pandemic by about 26.6 minutes (0.0185 day x 24 hours/day x 60 minutes/hour) compared to the average response time for non-covid related requests of 33 days.

Table 2: Request-level regression results for requests

	(1)	(2)	(3)	(4)
DiD effect	0.0185 **	0.0198 ***	0.0192 ***	0.0199 ***
	(0.0058)	(0.0058)	(0.0058)	(0.0058)
911 Vol Fire Department		0.0039 ***		0.0030 ***
		(0.0002)		(0.0002)
911 Vol Police Department		-0.0006 ***		-0.0003 ***
		(0.0000)		(0.0000)
Local Government Employees			1.3750 ***	0.9850 ***
			(0.0816)	(0.0948)
Num. obs.	170260	170260	170260	170260
Num. groups: n_allcovid	41	41	41	41
Num. groups: after	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

Our estimate remains significant after controlling only for the volumes of 911 emergency calls from the Fire Department and the Police Department as shown in column (2). The difference-in-difference effect suggests a delay of 28.5 minutes (0.0198 day x 24 hours/day x 60 minutes/hour) in response time given an additional covid-related requests. On the other hand, column (3) only controls for the trends in local government employees in Kansas City, MO. We find a positive and significant effect of 27.6 minutes (0.0192 day x 24 hours/day x 60 minutes/hour) of delays in response time given an additional covid-related requests. Both estimates are slightly larger but not statistically different from findings in column (1).

The last column shows significant impact of covid-related requests on the response time for non-covid related requests even after including both sets of controls. We find that the strain of an additional covid-related request is associated with a delay in completion time of non-covid related calls during the pandemic by about 28.7 minutes (0.0199 day x 24 hours/day x 60 minutes/hour). Overall, our main regression results show positive and significant crowd out effect despite our controls, where zip code with an additional covid-related requests would experience delays of roughly half an hour in the time it takes to complete a non-covid related non-emergency service request.

6.1 Which categories were most affected?

We further examine which 311 non-emergency categories experience the most delays due to the influx of covid-related requests. Table 3 displays the regression results from employing the difference-in-difference model on the 311 data subset to each of the 15 categories. The strain of COVID-19 on the 311 non-emergency service system centralizes in three main categories, “Animals & Pets”, “Mowing / Weeds”, “Trash / Recycling” as shown below.

Table 3: Request-level regression results for requests by categories

Panel A

	Animals / Pets	Capital Projects	City Facilities	Government	Lights / Signals
DiD effect	0.0371 **	0.0337	0.1076	0.0589	-0.0188
	(0.0117)	(0.0383)	(0.6713)	(0.0553)	(0.0116)
911 Vol Fire Department	1.0010 ***	1.9314 **	-4.3699	0.8018	0.1685
	(0.1567)	(0.7472)	(5.7445)	(0.6738)	(0.2106)
911 Vol Police Department	0.0015 ***	0.0182 ***	0.0171	0.0011	0.0016 ***
	(0.0003)	(0.0016)	(0.0128)	(0.0015)	(0.0004)
Local Government Employees	-0.0005 ***	-0.0027 ***	-0.0030	-0.0006	-0.0005 ***
	(0.0001)	(0.0004)	(0.0029)	(0.0003)	(0.0001)
Num. obs.	16252	1812	82	1182	7586
Num. groups: n_allcovid	41	41	18	41	41
Num. groups: after	2	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

Panel B

	Mowing / Weeds	Parks & Recreation	Property / Buildings / Construction	Public Health	Public Safety
DiD effect	0.1056 *	-0.0365	0.0125	0.0009	-0.0324
	(0.0423)	(0.0427)	(0.0250)	(0.0174)	(0.0537)
911 Vol Fire Department	4.5563 ***	1.1339	2.5308 ***	-0.8397 **	1.1520
	(0.7009)	(0.6402)	(0.3367)	(0.3056)	(0.8129)
911 Vol Police Department	0.0044 **	0.0087 ***	0.0088 ***	0.0021 **	-0.0053 **
	(0.0014)	(0.0014)	(0.0008)	(0.0007)	(0.0019)
Local Government Employees	-0.0009 **	-0.0017 ***	-0.0019 ***	-0.0010 ***	0.0006
	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0005)
Num. obs.	8969	2097	22334	4804	853
Num. groups: n_allcovid	41	36	41	41	39
Num. groups: after	2	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

Panel C

	Sidewalks / Curbs / Ditch	Signs	Storm Water / Sewer	Streets / Roadways / Alleys	Trash / Recycling
DiD effect	0.0072	-0.0071	-0.0012	-0.0232 *	0.0622 ***
	(0.0263)	(0.0203)	(0.0185)	(0.0097)	(0.0090)
911 Vol Fire Department	1.1116 **	1.6073 ***	-0.8295 *	0.6857 ***	0.2235
	(0.4111)	(0.3772)	(0.3249)	(0.1772)	(0.1473)
911 Vol Police Department	0.0041 ***	0.0029 ***	0.0015 *	0.0040 ***	0.0013 ***
	(0.0009)	(0.0008)	(0.0007)	(0.0003)	(0.0003)
Local Government Employees	-0.0008 ***	-0.0004 *	0.0002	-0.0004 ***	-0.0005 ***
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Num. obs.	3231	4362	9337	33034	54279
Num. groups: n_allcovid	40	41	41	41	41
Num. groups: after	2	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

The largest crowd out effect from our analysis by categories is experienced by non-covid related requests in the “Mowing / Weeds” category. In particular, we find a strong positive and significant estimate of 0.1056 and standard error of 0.0423 (Table 3 Panel B). This suggests that zip code with an additional covid-related requests during the early stage of the pandemic experienced a delay of 2.5 hours (0.1056 day x 24 hours/day) in response time of non-covid related requests related to mowing services and outgrown weeds, where the average response time for non-covid related requests in the “Mowing / Weeds” category is over 80 days.

The “Mowing / Weeds” category is followed by the “Trash / Recycling” category, where the effect of covid-related requests on the completion time of non-covid related requests is significant and estimated to be 0.0622 (Table 3 Panel C). Another covid-related requests can lengthen the number of days it takes to complete a non-covid related requests in “Trash / Recycling” by 1.5 hours (0.0622 day x 24 hours/day) given that the average response time for a non-covid related request in this category is 21 days.

Lastly, the crowd out effect is positive and significant for non-covid related requests in the “Animals & Pets” category. During the early stage of the pandemic, the influx of covid-related requests delayed the response time for non-covid related requests in the “Animals & Pets” category by 0.9 hours (0.0371 day x 24 hours/day) compared to the average response time for requests in this category is approximately 9 days.

While these estimates seem economically insignificant compared to the corresponding response time among non-covid related requests in the 311 system during the early stage of pandemic, it is important to note the estimates represent the crowd out effect of an additional covid-related requests in a zip code. In fact, the interquartile range of the volume of covid-related requests is 63.8 requests. Thus, in order to appropriately address the economic significance of the crowd out effect, we multiply the estimate for one additional covid-related requests with the interquartile range.

After accounting for the observed interquartile range among zip codes in the crowd out effect estimates, we find the delays in response time for non-covid related requests due to COVID-19 strain on the 311 system to be economically significant. Overall, the influx of covid-related calls in a zip code would delay the completion time of a non-covid related request by 1.3 days, which corresponds to a four percent increase in response time. The delay is even larger when we zoom into specific categories. In particular, non-covid related requests in the “Mowing / Weeds” category would experience a delay of 6.6 days in response time (8.3 percent increase) due to straining of covid-related calls, followed by delays of 4 days in the “Trash / Recycling” category (19 percent increase) and 2.4 days in the “Animals & Pets” category (26.6 percent increase).

7 Robustness

We further examine the robustness of our methods and results using placebo tests as implemented in Slusky (2017). The use of placebo tests acts as a sensitivity check for our difference in difference design.

We first conduct placebo tests for treatment time by applying treatment time of after January 2020 instead of the actual start of the pandemic March 2020. Given the placebo treatment time, we expect no significant evidence since we expect no treatment took place at that time. Table 5 displays the regression results with the placebo treatment time under different controls.

Table 5: Placebo tests for treatment time

	(1)	(2)	(3)	(4)
DiD effect	0.0051	0.0065	0.0049	0.0065
	(0.0054)	(0.0054)	(0.0054)	(0.0054)
911 Vol Fire Department		0.0038 ***		0.0036 ***
		(0.0002)		(0.0002)
911 Vol Police Department		-0.0005 ***		-0.0005 ***
		(0.0000)		(0.0000)
Local Government Employees			0.4958 ***	0.1771 *
			(0.0665)	(0.0799)
Num. obs.	170214	170214	170214	170214
Num. groups: n_allcovid	41	41	41	41
Num. groups: placebo_after	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

The results from the treatment time placebo unanimously shows positive and insignificant estimates. This is consistent with our expectation as there was no treatment taking place at the time and further strengthens the robustness of our estimation.

Secondly, we conduct placebo tests for treatment assignment where we keep the correct treatment time and randomly reassign treatment effects. We again expect non-significant results as the shock is randomly distributed. Table 6 presents the results for the treatment assignment placebo tests.

Table 6: Placebo tests for treatment assignment

	(1)	(2)	(3)	(4)
DiD effect	-0.0021	-0.0023	-0.0024	-0.0023
	(0.0048)	(0.0048)	(0.0048)	(0.0048)
911 Vol Fire Department		0.0039 ***		0.0030 ***
		(0.0002)		(0.0002)
911 Vol Police Department		-0.0006 ***		-0.0003 ***
		(0.0000)		(0.0000)
Local Government Employees			1.3753 ***	0.9844 ***
			(0.0817)	(0.0948)
Num. obs.	170213	170213	170213	170213
Num. groups: n_allcovid	41	41	41	41
Num. groups: after	2	2	2	2

*** p < 0.001; ** p < 0.01; * p < 0.05

We find no significant evidence for the placebo treatment assignment, showcasing that our difference in difference design is robust toward different placebo tests.

8 Conclusion

Our analysis examines whether COVID-19 imposed a crowd out effect on the 311 non-emergency services using data from Kansas City, Missouri during the early stage of the pandemic. In this case, the crowd out effect takes place when the requests unrelated to COVID-19 experienced delays due to influx of covid-related requests.

By using description text data, we were able to identify covid-related requests and use the volume of covid-related calls across different zip codes as a proxy for the strains put on the 311 systems by COVID-19 during the early stage of the pandemic. The difference in difference approach then allows us to estimate how much an additional covid-related request can postpone the completion time of a non-covid related request during times of crisis.

The main regression results suggest that zip code with an additional covid-related request would experience half an hour delay the response time for non-covid related requests. Given the interquartile range in volume of covid related-requests among zip codes, we find that the influx of covid-related calls in a zip code would delay the

completion time of a non-covid related request by 1.3 days, which corresponds to a four percent increase in response time. In addition, the strains on the 311 system centralizes among three categories: “Mowing / Weeds” with a delay of 6.6 days, “Trash / Recycling” with a delay of 4 days, and “Animals & Pets” with a delay of 2.4 days. Our difference in difference estimates are robust against the placebo tests for treatment time and treatment assignment.

Our approach and estimation is without limitations. First, our approach is vulnerable to the accuracy of identifying covid-related requests via text description. There exists requests that should have been identified to be covid-related and vice versa. Second, the zip code reported in the 311 data is not consistently attached to the citizen's neighborhood or the area specific to the request, which poses a weakness to our estimation. Third, by utilizing zip code as geographical variation, we make a strong assumption that the city resources to respond to 311 non-emergency service is exclusive from zip code to zip code even though requests might be assigned to different departments based on counties and categories.

Lastly, we hope our analysis will provide a foundational framework that can be applied across municipalities, such as Chicago, New Orleans, New York, to understand whether COVID-19 induced a strenuous effect on the 311 non-emergency services system. In addition, a nation-wide study of how the 311 systems were utilized during times of crisis such as the COVID-19 pandemic can provide valuable information to both local governments and residents alike. While local governments can learn about the importance of 311 systems as a communication bridge between citizens and municipalities and optimize the allocation of local resources accordingly, residents can learn how to best navigate and utilize the 311 non-emergency services even during times of crisis.

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