Preliminary 311 Response Times

Nick Solomon

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1 Summary

This report contains preliminary findings concerning duplicate 311 calls and response times during the 2017 calendar year. The purpose of this report is to present preliminary descriptive statistics and plots about the available data to inform the discussion around the issue of 311 response times and agency effectiveness in responding to calls that are duplicate reports of incidents already known to the agency.

We find that the vast majority (88%) of 311 calls are not duplicates. Furthermore, non-duplicated reports are resolved more quickly, in general, with a median response time of 17 hours. Compare this to the median reponse time for duplicated complaints of 75 hours. However, this trend is reversed among the most common complaint types. Of the top 10 most common complaint types reported to 311, in all cases duplicated complaints are resolved faster.

Also of interest is the fact that certain complaint types exhibit a much larger difference in response time between duplicated and non-duplicated reports. For example, graffiti complaints are resolved more than two weeks faster when they are duplicated. Even more drastically, overgrown tree complaints are resolved more than a month faster when duplicated.

Notice that in all of these examples, the specific cases are opposite the general trend:

2 Data

The data analyzed within this report consist of information about 311 calls made during 2017. This dataset contains a record corresponding to each 311 call. This record holds things like the date the complaint was made, the type of complaint, and the location of the incident. This data also contains a field that holds the date the complaint was closed. This allows us to analyze the response times of different complaints.

3 Assumptions and Definitions

The data presented here has been aggregated to the "incident" level. By this we mean that each 311 call reported in the dataset corresponds to an incident requiring attention from a government agency. Multiple calls may report the same incident. For example, if two neighbors both make a noise complaint about a party across the street. Calls referring to the same incident are identified as duplicates, and aggregated together. We identify calls as duplicates by finding calls reporting the same incident type at the same location within a fixed window. The size of the window is chosen based on the time needed to resolve complaints of each type and a heuristic intended to capture the majority of duplicates while not over-zealously grouping calls. Once identified, each duplicate is then tied to the original report using the original call's unique ID. These "duplicate IDs" are used to aggregate the data.

When calculating response times, we make use of the the "Created Date" and "Closed Date" fields for each call. The response time is the difference between these two times. In the case of duplicate calls, when we aggregate to the

Table 1: Median response time in hours

Is Duplicated	Response Time	Number of Incidents	Percent of Incidents
FALSE	17.13333	1,528,473	87.56789
TRUE	75.24000	216,999	12.43211

incident level, the response time is the difference between the earliest Created Date value and the earliest Closed Date value. That is to say, we assume an incident begins as soon as it is reported and is resolved as soon as the first call is resolved.

We have also made the choice to exclude a portion of the data from analysis (approximately 13.2135067% of 311 calls). This includes calls that were marked as cancelled at the caller's request, calls without a current resolved time, calls in which any of the information required for identifying duplicates was not reported, and calls in which the response time is invalid. This was done because without this information, we are not able to calculate response times, so we can not make meaningful statements about these data points.

4 Analysis and Results

In Table 1 the median response time for incidents with and without duplicate calls is reported, along with the number of each type of incident. Non-duplicate calls are much more common, with duplicates representing only 12.4321101% of reported incidents. The median response time of incidents with duplicate calls is more than four times that of incidents without duplicates. This indicates that it takes much longer to respond to duplicated incidents overall Investigating further, we examine the difference in median response times across the 10 most common complaint types. These complaints account for 50.0967128% of all incidents reported to 311. Figure 1 shows the median response times by complaint type for complaints that were and were not duplicated. In Figure 2 we see that the difference between duplicated and non-duplicated complaints can be extremely large in some cases. For example, building use complaints take around 40 days longer when they are not duplicated. Next, in Figure 3 we plot the difference in median response times by agency. Here, a positive value indicates that duplicate complaints are resolved faster. Most agencies resolve duplicate complaints faster. Furthermore, in 4 shows the average number of calls made per incident by agency. Incidents at most agencies are reported, on average just over one time. However, two noticeable exceptions appear. HPD incidents are reported almost twice on average and DOB incidents around 1.35 times.

```
# A tibble: 2 x 2
  dup   med
  <lgl> <time>
1 FALSE 273733.5 secs
2 TRUE  178170.0 secs
```

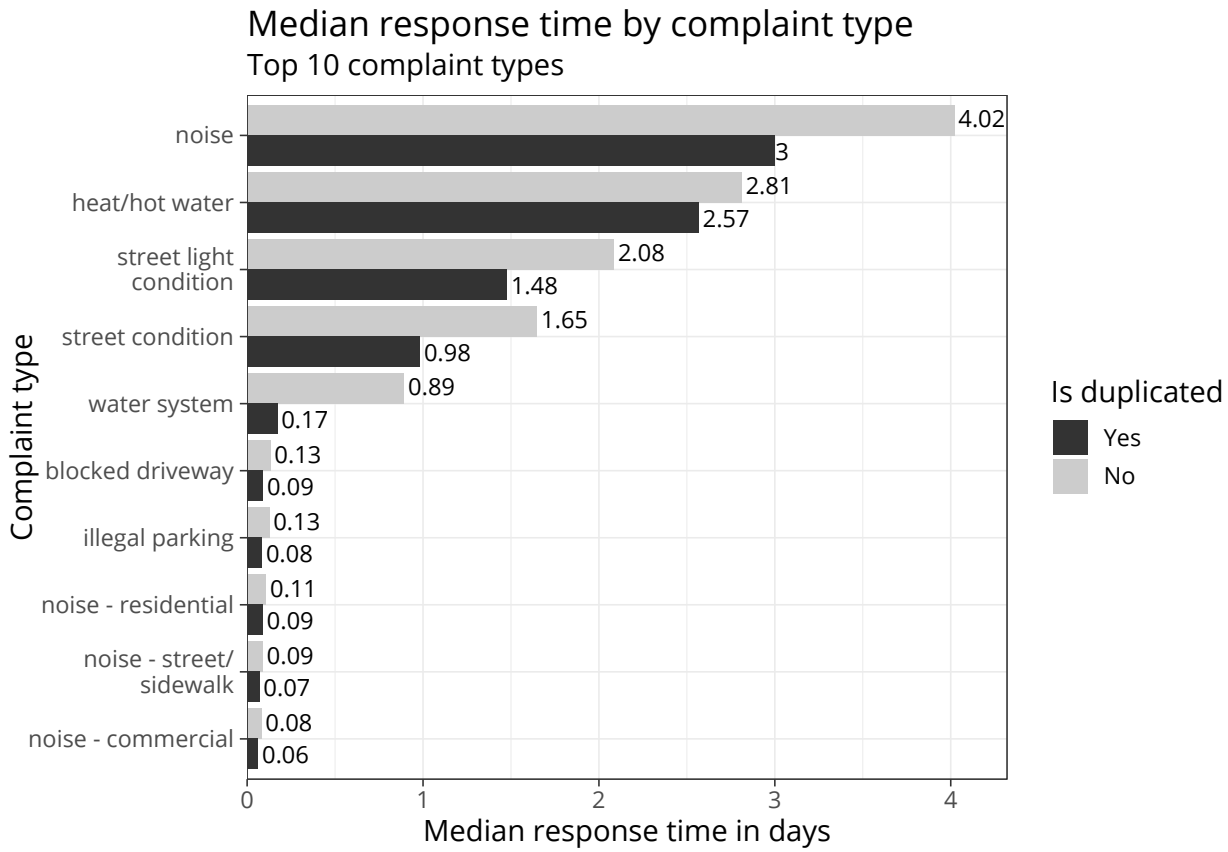


Figure 1: The median response time by complaint type for the 10 most common complaints.

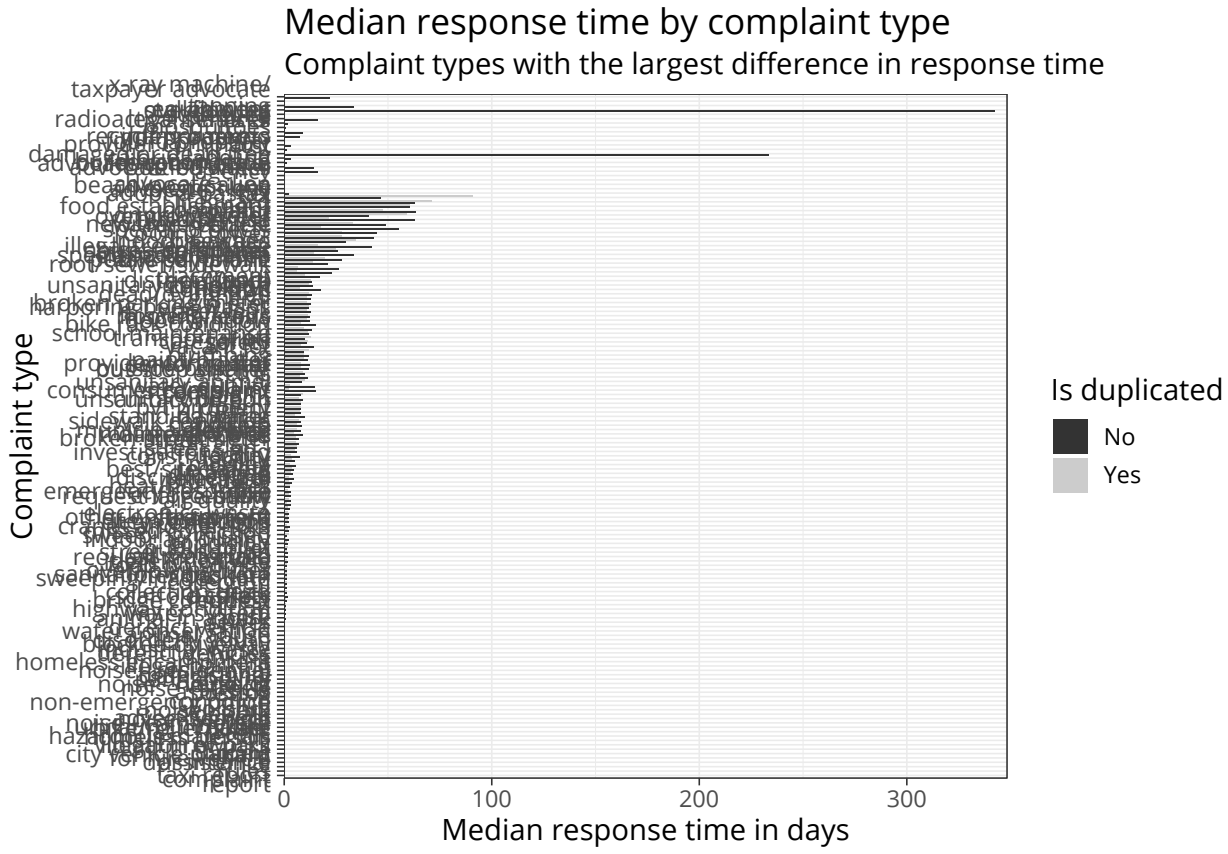


Figure 2: The median response time by complaint type for the 10 complaint types with the largest difference in reponse times.

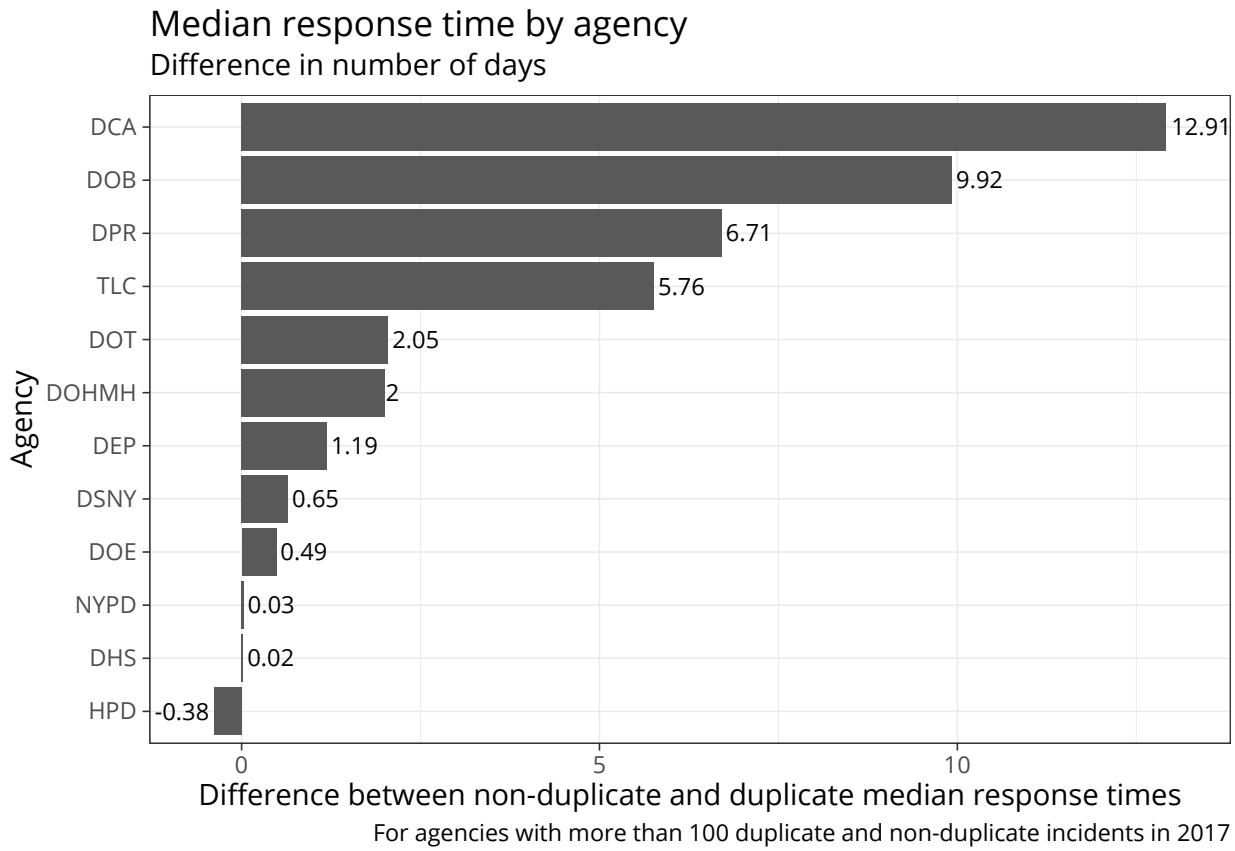


Figure 3: The difference in median response time by agency.

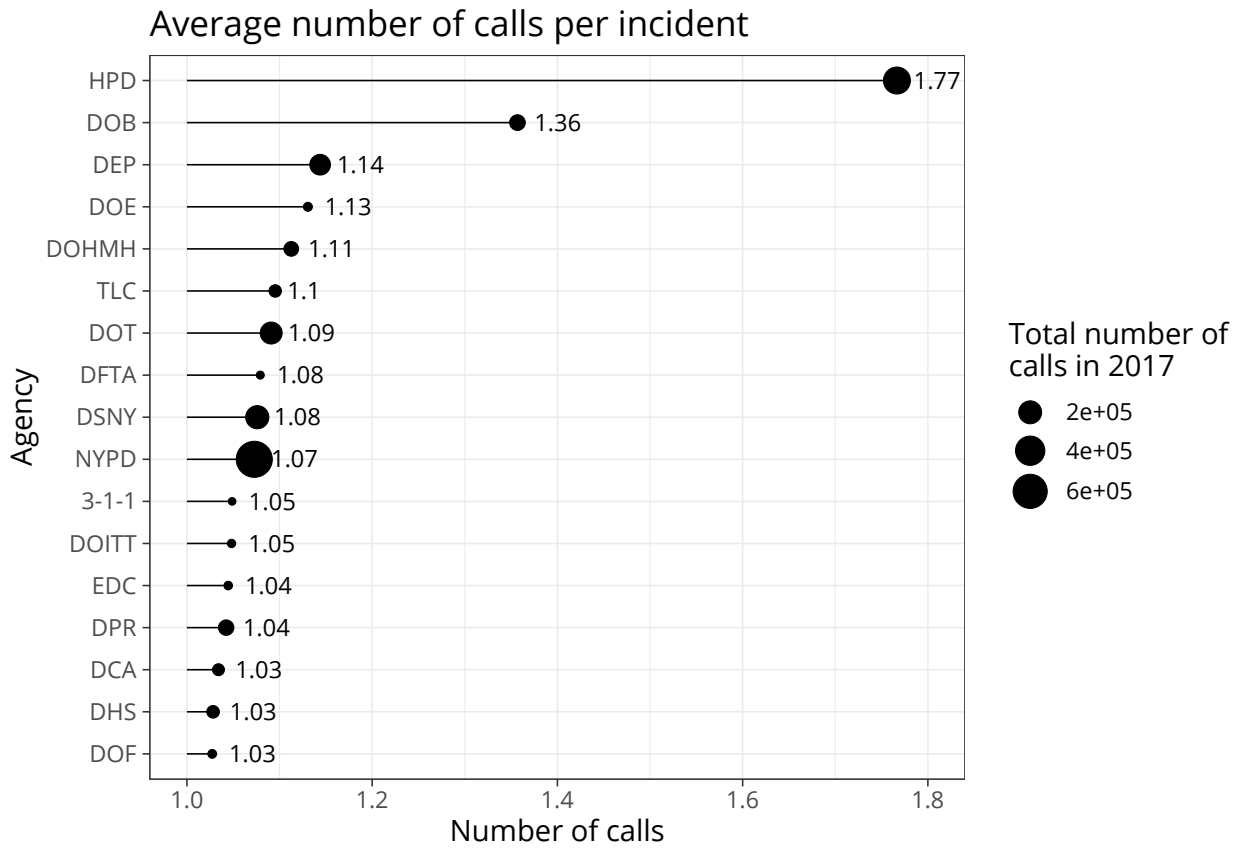
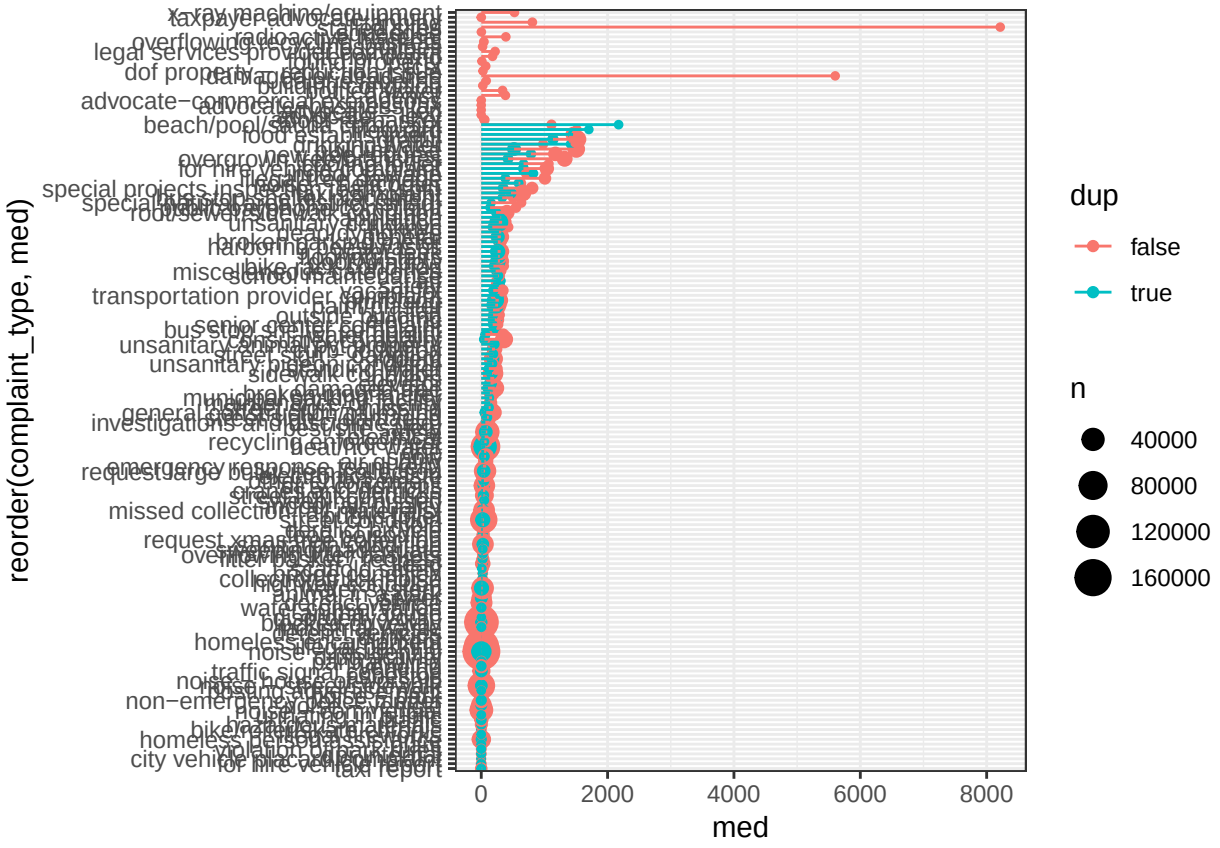


Figure 4: The average number of calls per incident by agency.



5 Questions

In the wake of the findings presented here, several questions of interest arise:

1. How do agencies handle duplicate incident reports? How are these duplicates identified and what is done with this information to improve service?
2. Do certain kinds of complaints take longer to resolve? Are these complaints more likely to create duplicate reports because they are outstanding for a longer period of time?
3. Can the differences in response times and average number of calls per incident between agencies be completely explained by the differences in the amount of time needed to resolve the types of complaints received by that agency?
4. What are the most important factors that influence the response time of a complaint, in the agencies' opinions?

6 Appendix

The following is a technical description of the data processing and analysis performed.

6.1 Data Acquisition and Processing

The data were first downloaded from the New York City Open Data Portal API. This full data set includes all 311 calls made since 2010. This data was then filtered to include only calls with a "Created Date" in 2017. This allows for response times that to incidents that continued into 2018 to be calculated. Following that calls whose resolution description contained the word "cancelled" were removed. These represented a small but significant number of calls where the request had been cancelled at the behest of the caller. These all came from DEP.

Next, further processing was done with the goal of identifying and aggregating duplicate calls. We decided that calls would be considered duplicates if they were the same type of complaint, referred to nearby locations, and were placed near each other in time. First calls missing any of the complaint type, the call time, or the location were removed. We excluded these on the basis that we were unable to make any conclusions about them. Next, for each complaint type, a window was defined in which to look for duplicate calls. This window was intended to be an estimate of the average number of calls of the same type made to 311 during the time it took to resolve 75% of complaints of that type. This window was chosen for several reasons. First, the decision was made to define the window in terms of a number of calls, not a duration of time. This conferred several advantages in processing the data and allowed us to create a reasonably efficient algorithm. Secondly, the choice was made to use 75th percentile of response times for each complaint type to balance the desire to capture duplicate calls that came in due to long running incidents with the need to not over zealously group together calls. The 75th percentile captured the majority of calls classified as duplicates by agencies and indicates as such in the resolution description. This threshold also captured a large number of duplicates *not* identified by agencies. This was expected, but a lower threshold was chosen (compared to 90th and 95th percentiles) in order to conservatively estimate the clustering of calls.

The next decision made in grouping calls was the geographic granularity. Calls with locations reported are geocoded to a precise latitude and longitude, which is included in the data set we used. We rounded these coordinates to 4 decimal places, for a precision of approximately 11 meters, or about 36 feet. This was done to account for small variations in incident geocoding due to slightly different reported addresses.

Next, an algorithm was written that took all 311 calls of each complaint type, sorted by date. This algorithm looked at each call and, if it was not a duplicate, looked forward within the specified window for calls from a nearby location. When found, these calls were tagged as duplicates. The algorithm then moved on to the next non-duplicate call.

Lastly, incidents with nonsensical response times were removed before all plotting and analysis. This includes incidents whose response times were missing or less than or equal to zero.

6.2 Analysis

The majority of the statements made in this report are purely descriptive. They require little justification. The exception is the conclusion that incidents reported to HPD and DOB receive an average number of calls greater than that of other agencies. While it is very clear from Figure 4 that this true, further analysis was carried out to justify this conclusion. Namely, confidence intervals for these means were calculated by modeling the number of calls as a zero-truncated Poisson (ZTP) process. This model returned an estimate of the ZTP parameter for each agency, found via maximum likelihood estimation. Standard errors were also returned, found in the usual way. This parameter can be used to calculate the group-wise means (equal to the observed means in this case) via a simple formula. The delta method for this formula was then used to find standard errors for the means. Upon examination of the 95% confidence intervals for these means it became clear that there was no question about the significance of the difference between the HPD and DOB values and those for other agencies. For that reason, and in the name of simplicity, the confidence intervals were not included in the final report.