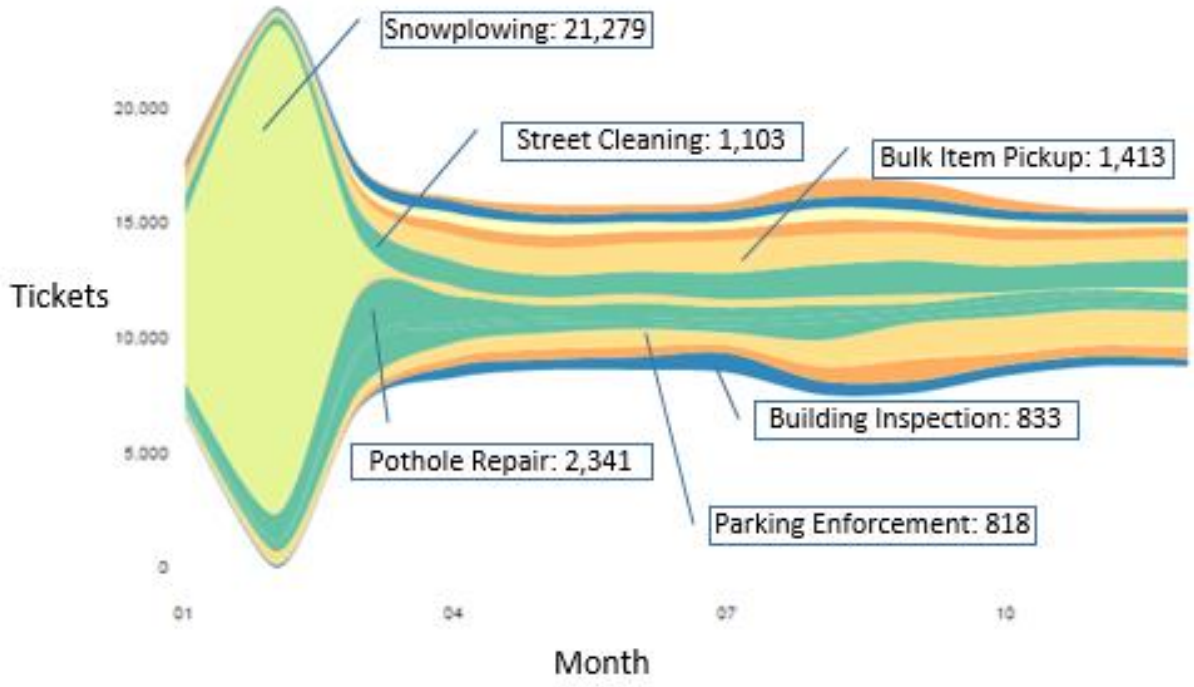
BOSTON AND 311 TICKET ORIGINATION

POLICY ANALYSIS EXERCISE 2016, BY BRYANT RENAUD & NICK RYAN



EXECUTIVE SUMMARY

Using Boston 311 (non-emergency call center) data from 2015, we uncovered mild evidence that historically underprivileged groups were initiating contact with government services through the system proportionately less than more well-off communities. Disparities between geographies with low income vs. high income areas, as well as different ticket-origination rates between areas with high and low proportions of Hispanic/Latino populations were the most worthy of notice. Going into the future, Boston can build on the successes of its 311 system by proactively reaching out to these communities. We conclude by proposing several alternative strategies moving forward for the 311 Office to address equity concerns and continue bettering Boston constituents' lives through efficient, high-quality provision of public services.

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INTRODUCTION

When Boston Mayor Martin J. Walsh officially announced the city's migration from the mayor's hotline to a 311 system in August of 2015, he framed it as a way to "increase civic engagement" and accomplish the city's job; "customer service" (Herndon 2015). This moment is just a hint at the complex motivations cities are increasingly moving to 311-type Citizen Relationship Management (CRM) systems. Public officials are also turning to the system as a way to ease budget crises and using it as a performance management system for agencies.

The city is aware that different neighborhoods have differing levels of take-up for the 311 program. Even at the launch, Walsh reportedly "said he hoped the new technology can improve nonemergency reporting across the city, but specifically in the Roxbury, Dorchester, and Mattapan neighborhoods. When we first sat down with officials in Boston's 311 Office, our client, we agreed to look patterns of take-up and what factors might correlate with these rates of 311 penetration.

The deeper we have dug into the project, however, the more we have learned how critical this analysis is to wider issues at the intersection of technology and policy. When doing our literature review, we learned that this topic spans an incredibly diverse range of academic and public administration interests, including service delivery, civic engagement, e-government, community-oriented government, digital exclusion, and more.

While we ultimately conclude that there are only weak correlations between historically privileged group status and higher use of Boston's 311 system, it will be important for this office and other 311 administrators across the country to continue taking active steps to ensure that the distribution of government services, at minimum, does not reflect the patterns of disadvantage and bias that may color a city's past. These agencies may even wish to take the further step of actively using their CRM and task allocation systems to proactively address issues of equity in their municipal boundaries.

Our Mission:

1. *Determine whether equity is a problem in 311's penetration patterns.*
2. *Prescribe next steps for building upon the 311 Office's impressive record of improving efficiency and quality of Boston's service delivery, to the betterment of its citizens.*

THE ORIGINS OF 311

A June 1996 U.S. News and World Report claimed that some 50 – 90 percent of 911 calls turned out to not be emergencies (U.S. Department of Justice). The implication; this clogging of 911 systems was leading to unnecessary harm and fatalities for those stuck on hold. Within a year, the Federal Communications Commission set aside 311 as a toll-free, non-emergency phone number across the nation.

Initial results from pilot cities utilizing the number were very positive. Baltimore, the first such city, experienced a 50% decrease in answer time for 911 calls, a 50% reduction in abandoned 911 calls, and a host of other improvements in indicators of 911 system congestion and inefficiency (COPS). Over the next three years, Baltimore saw cost savings totaling $100 million (Borins et al. 2007).

Although initially enacted as simply a way of siphoning non-emergency calls away from 911 lines, cities began considering 311's potential as a way to consolidate citizen contacts with government to streamline these touch-points and lower barriers to this type of communication. One such example is Dallas which, in 1997, "consolidated 28 customer service numbers and seven call centers into a single 311 non-emergency call center" (Schwester et al. 2009). All of a sudden, the intent behind adopting a 311 system had expanded beyond 911-congestion elimination to one "designed to provide citizens with accurate information about city services, eliminate bureaucratic red-tape, and provide citizens with the services they needed in a timely and efficient manner" (Schwester et al. 2009). Many cities have since followed suit, sparing citizens the necessity of thumbing through dense directories of city government services.

This second conception of 311, which moved it from a consolidator of non-emergency services towards a method of improving the provision of information and services, was followed by a third movement which recognized the value of 311 data as a performance management system. New York City implemented 311 in 2003 aiming to achieve all the benefits discussed above, but it also emphasized citizens' ability to track the progress of their requests. This represented a step towards 311 as a tool of government accountability.

> "311 callers are helping to build more intelligent, more responsive cities."
> ~ Kiviat 2005, p. 1

In this paper we investigate both a) whether Boston's 311 system can be said to be achieving these improvements in an equitable way and b) how 311 systems might evolve into yet another era, beyond service improvement and accountability, towards a tool used proactively to counter historical inequality among geographic areas.

THE PROMISE OF 311

Techno-optimists tend to think of 311 in several different ways, in turn emphasizing different sets of potential benefits a 311 line may bring about. Those who talk about 311 as moving more towards "community-oriented government" emphasize its value as strengthening the link between citizens' needs and the activities of the government (COPS). These discussions focus on people's ability to track requests and city hall's efforts to address them.

311 is also brought up in the context of "coproduction of government services" literature, referring to how government is enlisting citizens as partners in service delivery (Clark et al. 2013). While coproduction was researched extensively in the 70s and 80s, "it fell out of favor as governments and scholars alike focused on efforts geared toward improving services and saving money through privatization and marketization" (Clark et al. 2013, p. 687). More recently, coproduction has been emphasized as another way for local governments "to reduce their budgets yet still deliver the level and

quality of services to which residents have become accustomed" (Clark et al. 2013). 311 applications and internet portals can range up to 90% cheaper per constituent report than operator-based systems (Clark et al. 2013, p. 690).

Reacting against the budget justification of coproduction, authors from a service delivery focus protest that coproduction is "more than a financial panacea for fiscally strapped governments" (Levine 2008, p. 83). They stress coproduction as "an important means of enhancing both the quality and quantity of public services" (Pestoff 2006, p.507 as quoted in Clark et al. 2013, p. 689).

Studies have also focused on the ability of 311-type systems to increase support for government. Buell and Norton (2013) find that study participants who observed "operational transparency" in government services through observing the visualization of work being done in a manner akin to 311 portals "expressed more positive attitudes toward government and greater support for maintaining or expanding the scale of government programs" (p.2).

"Potholes are the gateway drug for civic engagement."
~ Ben Berkowitz[1]

THE "DARK SIDE OF CROWDSOURCING" AND OTHER 311 CONCERNS

311 systems, of course, are not without their weaknesses. As the system increasingly takes on a role as performance management system, managers are beginning to ask whether metrics created by public requests is a rational indicator to be measured by. In one interview with a public official from a southern city, we heard that city workers had become entirely focused on the metrics routinely calculated by the 311 system. This meant that they were no longer going around the city to look for issues proactively. Rather, they would focus on minimizing the time between receiving a request for service from the 311 routing system and the time it took them to go to the originating site to address the issue. In the positive narrative, this is exactly the mechanism that drives 'responsiveness' and 'accountability.' A problem arises, however, when city hall's reliance on 311 as a routing system becomes so heavy that the distribution of city resources starts to resemble unfair distributions of complaints.

In one story, we heard about a team of city officials who responded to a 311 complaint that kept reoccurring; neighbors routinely requested that the city punish someone for not properly placing trash cans on the curb. The perpetrator turned out to be an elderly blind woman, but this did not stop the 311 requester from repeatedly calling out city workers, who were incented by the response time metric to continue revisiting the issue as fast as possible. In this case, the responsiveness incentives of 311 did not seem to be particularly constructive.

The potential macro trends for 311 patterned uptake are much more worrisome. In one city, an official discovered that some communities, often places populated predominantly by historically-disadvantaged groups, were distrustful of government intrusion. These communities, therefore, tended to take advantage of the 311 system much less often than wealthier, whiter neighborhoods. The more the city came to rely on 311 as its eyes and ears as well as its central routing mechanism, the more it

[1] As quoted in Johnson 2010

would exacerbate existing unequal access to safe and comfortable assets and services typically provided by local government.

> "Despite the rise of such systems, experts and practitioners worry that they do not attract people from diverse demographic backgrounds, a perennial issue in coproduction…"
> ~ Clark et al. 2013

The validity of these anecdotes is reinforced by statistically significant relationships uncovered in academic literature. Bryer (2010) finds that blacks and Latinos are less likely to participate in e-government. Nash (2011) finds that digital exclusion disproportionately hits older, poorer, less educated people.[2]

These general concerns with demographic minorities' use of newer information technology also extend to the particular case of 311. While Clark et al., who examined 2010 data from Boston's CRM, reported "little concern that 311 systems (non-emergency call centers) may benefit one racial group over another," they did find "some indication that Hispanics may use these systems less as requests move from call centers to the Internet and smartphones" (p. 687). Levine and Gershenson (2014) find "neighborhoods with high concentrations of first-generation immigrants less likely to request services, relative to need" when looking at Boston's snowplow requests data from 2010-11 (p. 607). When looked at through the coproduction lens, it seems logical that when the government shifts production costs to citizens, those who are better-off will do more of the producing.

These patterns of use and non-use are no doubt due to a wide variety of factors, only some of which may be impacted by policy decisions at the city hall level. The analysis in this paper should help Boston consider a variety of options for proactively targeting city services to underserved communities. While the body of work concerning impact of such policies is young, it is not non-existent. Nabatchi and Mergel (2010) report how a district in London allows citizens to report concerns using text message or MMS, which may extend options beyond smartphone users and those who prefer not to call in on the 311 line. Other efforts to be more inclusive involve making internet resources easier to access in public locations, such as libraries.

OUR APPROACH

Our analysis builds on a handful of relatively recent pieces in academic and popular press pieces, which take advantage of geographic variation of 311 ticket origination (i.e., calls made to the 311 office for service request or to complain) and geographic variation in demographic traits of the people that live in specific areas (Clark et al. 2013; Minkoff 2015; Cavallo et al. 2014; Levine and Gershenson 2014). The method involves examining the correlation between demographic traits of a census tract and the rate at which that tract is using 311.

[2] We were turned onto Nash 2011, Bryer 2010, and many other useful pieces by the Clark et al. paper. If you read only one piece of literature on this topic, we'd recommend the Clark piece.

For a citizen to contact the 311 Office, she must 1) have a reason to call (request for service/information or complaint to make), 2) know that 311 exists, and 3) want to make the contact. The scope of this paper is limited to inferences on 2 and 3, as we do not attempt to determine beyond basic assumptions whether reasons to call (i.e., physical infrastructure problems) are randomly distributed across census blocks or not. That said, we might expect that poorer neighborhoods have a higher motivation to call (1) as wealthier folks will choose where to live, in part, based on the quality and status of physical infrastructure and other visible problems that can lead citizens to open a 311 ticket. When we report our finding, later in the paper, that wealthier neighborhoods actually open 311 tickets *more* often, we suspect that this is actually an underestimate of the effect, as poorer areas should contact 311 more often if tickets were simply correlated with the amount of observable neighborhood problems.

Given our, albeit mild, findings of unequal use of 311 along income and demographic lines, the city should consider how to increase underserved populations' propensity to contact the 311 Office. It is in the city's mandate to reduce #1 by addressing issues as quickly as possible. It may be exceedingly difficult to enhance #3 without being able to work on an individual-to-individual basis. It may be, then, that Boston should focus on #2, by proactively targeting marketing and knowledge campaigns at neighborhoods with low take-up of 311. Extrapolating from our findings, the city can anticipate that geographies with high proportions of historically disadvantaged communities are most in need of these campaigns.

The main limitation to this analysis is its reliance on things being broken before a citizen will report the issue, ultimately leading to a data-point. But even if one could collect an objective, accurate idea of every single issue in the city, it would still leave out a crucial piece of the puzzle--of what makes or breaks city neighborhoods. Current initiatives are only just starting to look beyond what is broken to *what is missing*. As one commenter put it, "when people gripe about their neighborhood, it's usually not the potholes or clogged storm drains they have in mind; it's the fact that there isn't a dog run nearby or a playground or a good preschool with space available" (Johnson 2010).

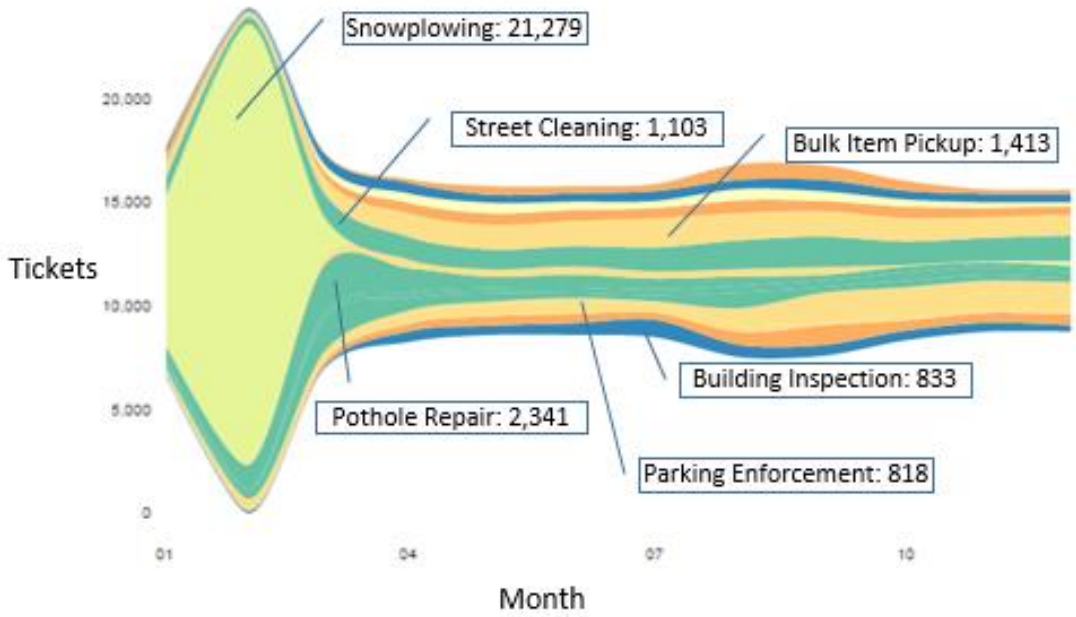
> "The question is whether these platforms can also address the more subtle problems of big-city neighborhoods—the sins of omission, the holes in the urban fabric where some crucial thread is missing."
> ~ Johnson 2010

What this project really comes down to is an endorsement of either the techno-optimist or techno-pessimist position. The "key argument of the optimistic position is based on the mobilization hypothesis, which postulates that the development of ICTs will not only reduce the costs of information and communication for citizen participation but also get citizens—particularly those who are inactive in the current system—more involved and engaged in public life" (Clark et al. 2013, 691). For the pessimist position ring true, on the other hand, the 'reinforcement hypothesis' must hold. This posits that "technological innovations merely reinforce participation of those who are already informed and motivated through traditional channels and thus exacerbate existing social inequities between the information haves and have-nots" (Clark et al. 2013, p. 691).

2. ANALYSIS OF BOSTON AS SEEN THROUGH 311

Requests made to the 311 system exhibit variability by geography, by season, by week, by time of day, and so on. In this chapter we begin by looking at the basics of understanding the data. We will then use optical and correlational methods to examine whether disparate 311 ticket origination is related to demographics of the originating census tract.

Figure 1 Streamgraph of 311 tickets opened in 2015

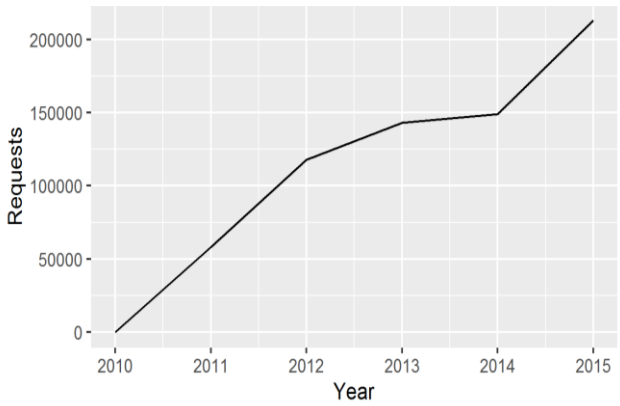


2.1 USAGE TRENDS AND PATTERNS

2.1.1 REQUESTS OF SERVICE

Over the past few years, Boston residents' use of the 311 line to report non-emergencies and request information from the city's departments has grown steadily. In 2015, there were 212,916 tickets (the term we will use throughout the report to refer to individual 311 reports generated in response to a call or app entry to the system) initiated.

Figure 2 311 Tickets by year, 2010 - 2015



Even though the 311 line was officially "launched" in August of 2015, Boston residents have had the ability to submit their queries through a 311 type system or consolidated answering service within City Hall for several years. The relevant dataset also contains tickets originated by city employees. In this report we generally refer to ticket origination across these sources. The end of the chapter will add nuance to our analysis in part through distinguishing tickets by the source used to create them.

2.1.2 GEOGRAPHIC VARIANCE

Most of the expansion over this time period has taken place geographically. While original take-up was focused in the downtown area, today 311 tickets are initiated across greater Boston.

Figure 3 Tickets opened in 2012 ('000)

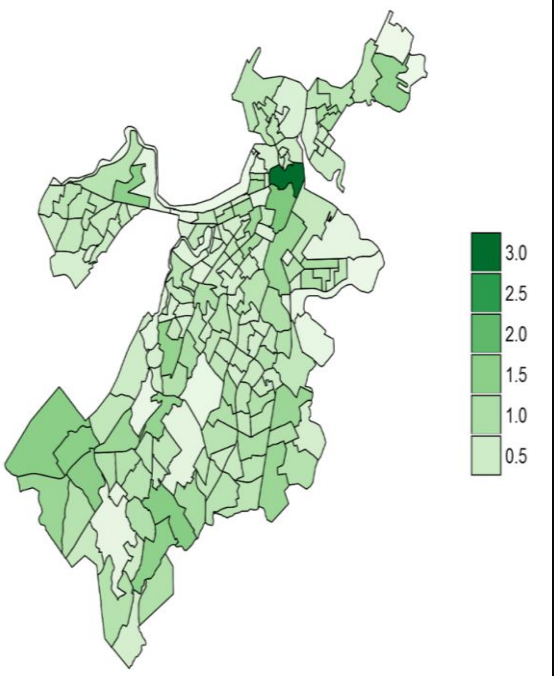
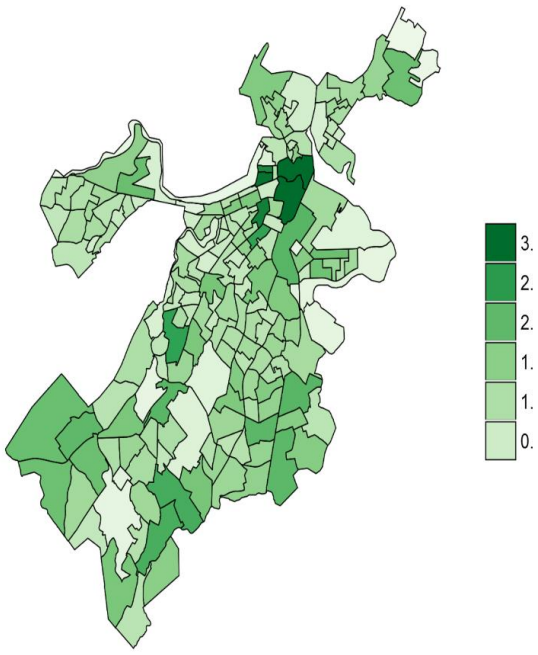


Figure 4 Tickets opened in 2015 ('000)



2.1.3 SEASONALITY AND DAYS OF THE WEEK

Over the course of 2015, 311 tickets hovered around 16,000 per month, with the exception of February, when tickets related to snow plowing bumped up tickets to nearly 40,000.

Figure 5 Tickets by month opened (2015)

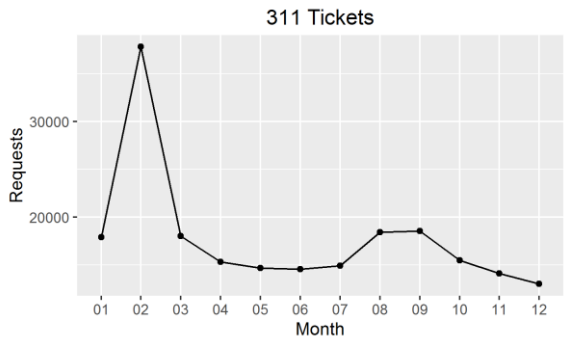
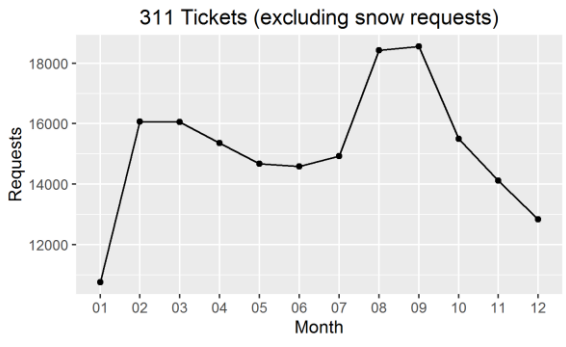


Figure 6 Tickets by month opened, snow requests excluded



Monthly trends mask oscillations at the weekly scale. On average, 311 tickets tend to be created in significantly larger numbers during the week, with requests dying down during the weekend.

Figure 7 Tickets by day of year (excluding snow requests; 2015)

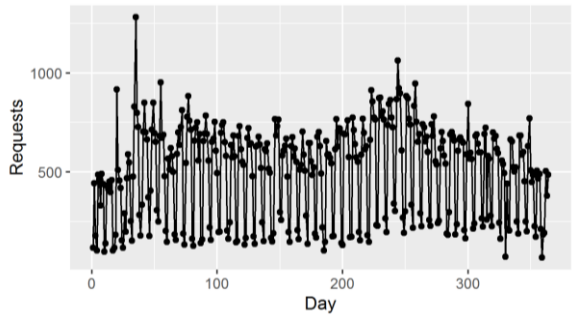
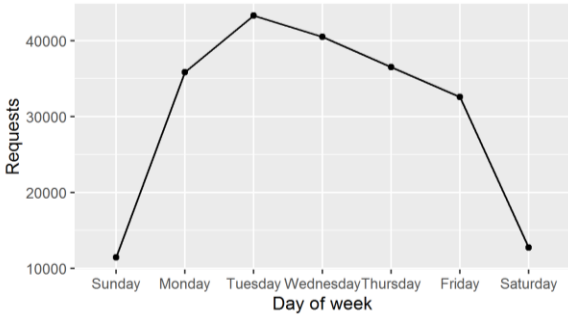


Figure 8 Tickets by day of the week (2015)



2.1.4 VARIANCE BY SOURCE

Tickets out of the 311 system originate from several different sources. In 2015, a large majority of tickets came from constituents' calls, with the smartphone app (labeled as Citizen's Connect in the data, but rebranded "BOS:311" this past fall).

Table 1 Most frequent tickets by type (2015)

Source	Citizens Connect	City Worker	Constituent Call	Employee
Public Works Department	24,063	17,808	63,298	11,158
Transportation - Traffic Division	8,691	3,130	9,732	979
Property Management	3,666	-	361	8
Parks & Recreation Department	2,061	411	4,155	2,847
Mayor's 24 Hour Hotline	624	62	8,340	18
Inspectional Services	578	-	22,285	20
Animal Control	-	-	3,155	8
Boston Police Department	-	-	137	-
Boston Water & Sewer Commission	-	191	1,128	5
City Hall Truck	-	-	32	-
Civil Rights	-	-	2,644	170
Consumer Affairs & Licensing	-	-	12	-
CRM Application	-	-	-	1
Disability Department	-	-	847	10
Neighborhood Services	-	-	22	-
Veterans	-	-	6	-
Women's Commission	-	-	-	-
Youthline	-	-	2	-

2.2 SCOPING THE EQUITY CHALLENGE

Given how young the program is, 311's success in rolling up constituent-use is commendable--every census tract in the 311 catchment area took advantage of the system at least a few times. Even while celebrating this success, however, the 311 office knows that, despite their best efforts, use of the reporting system is not perfect. While uneven take-up is not, in and of itself, a problem, concerns of unequal use based on income and other indicators of privilege are noted with the utmost attention. As 311 increasingly becomes the intake system for all citizen requests and routing system for work-orders to address these requests, any indication of inequality can serve as a helpful tool for Boston to send resources, proactively addressing inequality in a targeted, efficient way. On the other hand, such information can help the city evaluate when patterns of 311 service requests, and resulting resource assignment, is exacerbating existing inequality.

In this section, we perform a series of simple analyses to test for the presence of unequal distributions of 311-use.

2.2.1 REQUESTS AND RACE

In a Journal of Public Administration article, three professors used 2010 data from Boston's 311 system to investigate hints of disparate service request by key demographic indicators (Clark, Brudney and Jang). The authors find that block groups with higher percentages of black/African Americans are correlated with fewer requests on the hotline and internet channels. These relationships are statistically significant, but the coefficients are so small as to make little practical difference.

As a first step, we mapped census blocks using a heatmap to distinguish among areas of Boston that are mostly populated by white people and those mostly populated by non-whites. As the map indicates, most of the census blocks in Roxbury, western Dorchester, and Mattapan are non-white majority areas. As a basic litmus test, we set this demographic map side-by-side with a map of per capita use of the 311 system (total 311 tickets in a census tract divided by total population in that tract). While some hotspots overlap, it is far from obvious whether a strong relationship between non-white majority blocks and high- or low-per-capita-ticket blocks.

Figure 9 Percent of tract non-White (2015)

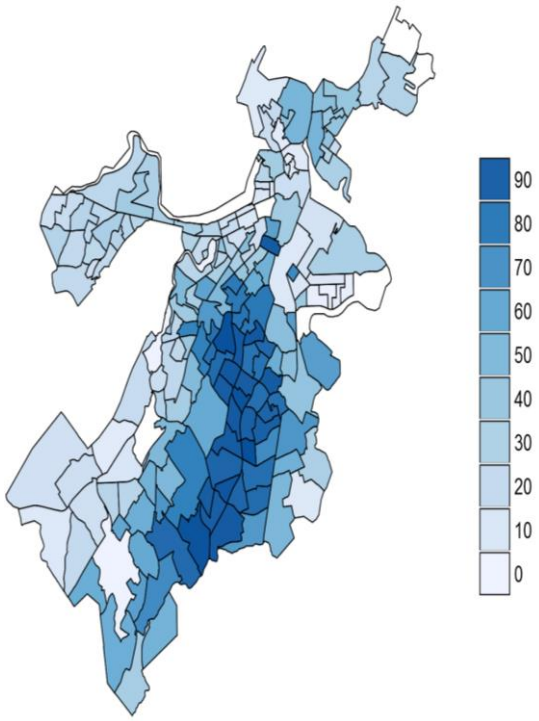
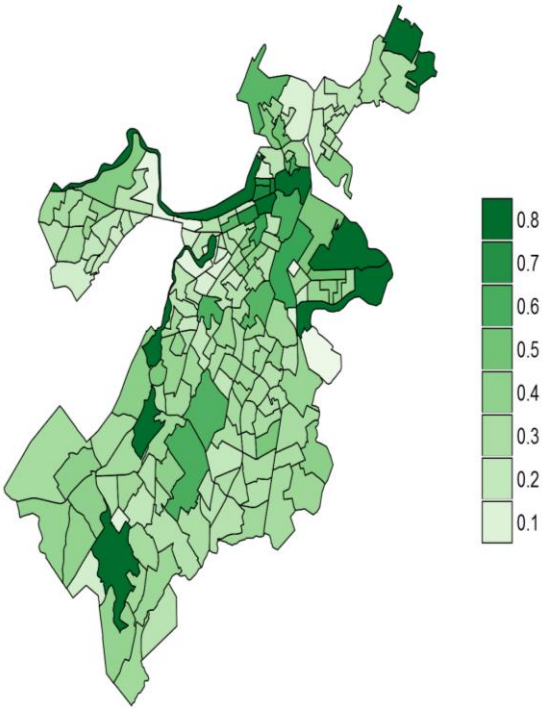


Figure 10 Per capita tickets by tract (2015)



Using a simple linear model (regression) with 2015 data, we can see that there was indeed a statistically significant relationship between a census tract's per capita ticket origination and the percent of the tract reporting non-white for race on the American Community Survey. However, just as Clark, Brudney and Jang found in their investigation of 2010 data, the coefficient on percent non-white is very small. A 1 percentage point increase in the non-white population of a tract is associated with a 0.001 decrease in the number of 311 tickets per person in that block. With an average of 3,600 people per tract, this means that each 1 percentage point increase in non-white population predicts 3.6 (3,600 * 0.001) fewer calls over the course of an entire year for an average tract.

Figure 12 Per capita tickets and % non-White (outliers removed)

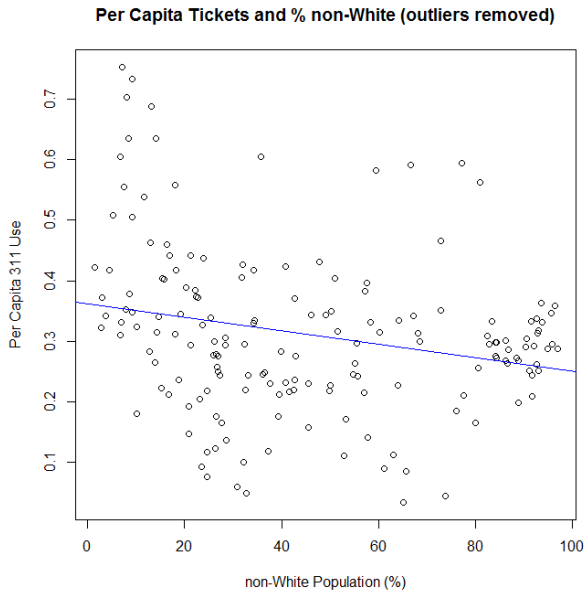


Figure 11 Regression: per capita tickets and % non-White (outliers removed)

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.3625118	0.0188897	19.191	< 2e-16 ***
pct_nonwhite	-0.0011186	0.0003514	-3.184	0.00174 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1327 on 167 degrees of freedom
Multiple R-squared: 0.05722, Adjusted R-squared: 0.05157
F-statistic: 10.14 on 1 and 167 DF, p-value: 0.001735

Further confirmation of a demographic trend is observed when modeling the relationship between percent of a tract claiming Hispanic or Latino origins and per capita 311 tickets.

Figure 14 Per capita tickets and % Hispanic/Latino origin (outliers removed)

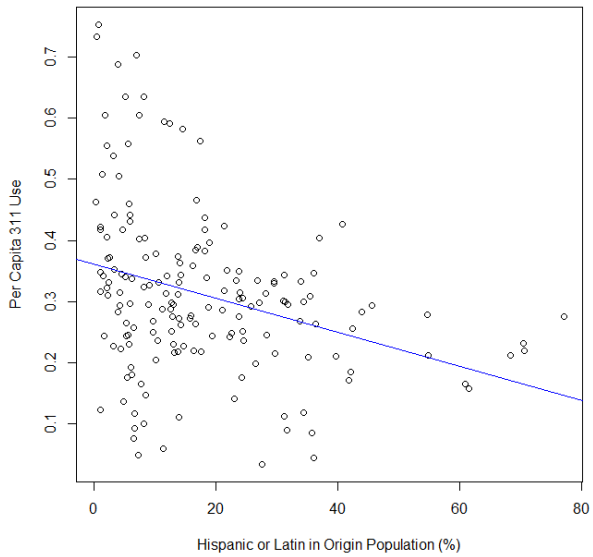


Figure 13 Regression: per capita tickets and % Hispanic/Latino origin

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.3617337	0.0151890	23.815	< 2e-16 ***
pct_hisp_latin	-0.0027883	0.0006415	-4.346	2.4e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1295 on 167 degrees of freedom
Multiple R-squared: 0.1016, Adjusted R-squared: 0.09624
F-statistic: 18.89 on 1 and 167 DF, p-value: 2.399e-05

When looked at together in the same regression, the percent claiming Hispanic or Latino origins turns out to be the more meaningful predictor of 311 tickets per capita, both in statistical significance and in magnitude of the coefficient.

Figure 15 Regression: per capita tickets and non-White vs. Hispanic/Latino

```
Coefficients:
                Estimate     Std. Error   t value     Pr(>|t|)
(Intercept)     0.3824217    0.0192599    19.856      < 2e-16 ***
pct_hisp_latin -0.0023277    0.0006910    -3.368      0.00094 ***
pct_nonwhite   -0.0006393    0.0003695    -1.730      0.08544 .
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1288 on 166 degrees of freedom
Multiple R-squared: 0.1175,     Adjusted R-squared: 0.1069
F-statistic: 11.05 on 2 and 166 DF,  p-value: 3.111e-05
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2.2.2 REQUESTS AND INCOME

When Clark et al. investigated the relationship between 311 tickets and income, they found only weak relationships. This is probably due to a few factors, including relatively few data points, their use of only 4 bins of median income averaged by block group, and their use of many other control variables that may better explain variation that would otherwise have been associated with income differences.

Examining 311's 2015 data, there seems to be an overlap of high-per-capita-311-ticket tracts and those tracts with higher median income. Tracts without income data in the ACS are marked in grey and excluded from this analysis.

Figure 16 Per capita tickets by tract (2015)

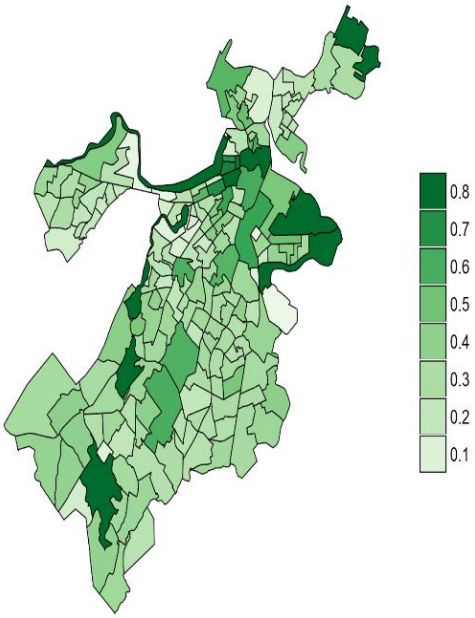
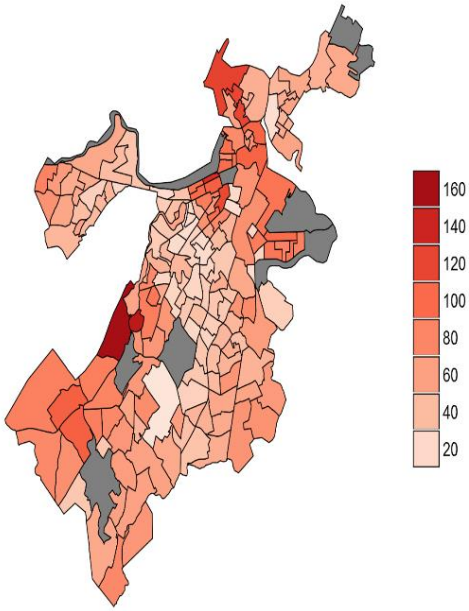


Figure 17 Average median income in '000 dollars



The model below compares the average median income of a tract (in thousands of dollars) with the average per capita ticket origination of that tract. Once again, we find that the relationship, while statistically significant, has little overall impact on total 311 use at the thousand dollar level. Each additional $1,000 in median income of a tract is associated with 0.0024 additional per capita tickets in that tract. For the average tract, this means each additional thousand dollars of median income is associated with 8.6 more calls over the course of a year.

On the other hand, this model does shed some light on the inequality between extremes of the income spectrum. We would predict a tract at the low end, around $25,000 median income, would generate 0.23 calls per person over the course of a year. A tract at the high end, around $100,000, would originate 0.31 requests for service, or about a third more per person, over the course of a year.

Figure 19 Per capita tickets and median income in '000 dollars

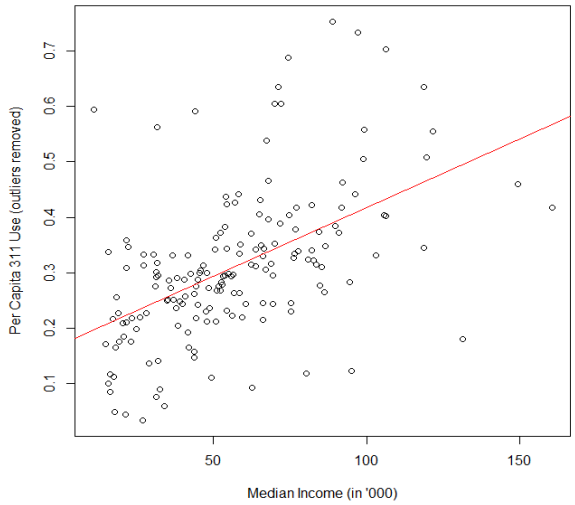


Figure 18 Regression: per capita tickets and median income in '000 dollars

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.1704660	0.0201350	8.466	1.28e-14 ***
Med_Inc_k	0.0024721	0.0003188	7.754	8.52e-13 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1161 on 166 degrees of freedom
(1 observation deleted due to missingness)
Multiple R-squared: 0.2659, Adjusted R-squared: 0.2615
F-statistic: 60.12 on 1 and 166 DF, p-value: 8.515e-13

To look at this relationship through a different lens, we also looked for a potential correlation between the natural log of median income and per capita ticket origination. Interpreting the coefficient, we find that a 1% increase in median income is associated with a 0.0012 increase in ticket origination per tract resident.

Figure 21 Per capita tickets and log of median income

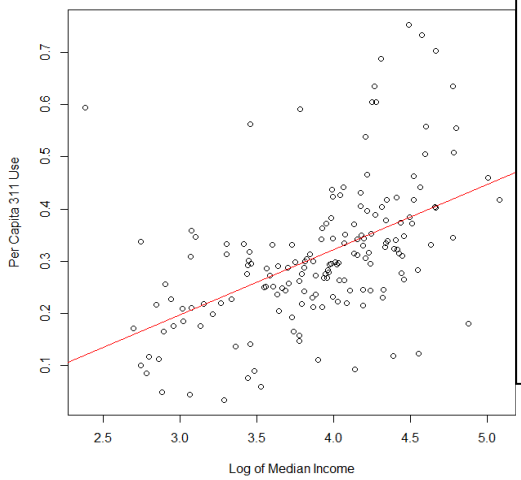


Figure 20 Regression: per capita tickets and log of median income

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.17630	0.06615	-2.665	0.00845 **
log(Med_Inc_k)	0.12470	0.01679	7.426	5.57e-12 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1174 on 166 degrees of freedom
(1 observation deleted due to missingness)
Multiple R-squared: 0.2494, Adjusted R-squared: 0.2448
F-statistic: 55.15 on 1 and 166 DF, p-value: 5.569e-12

Finally, we observe a coefficient of similar magnitude and significance when looking at the relationship between poverty rate and per capita 311 ticket origination. Every additional percentage point of

population under the poverty line is associated with 0.003 fewer calls per citizen over the course of a year.

Figure 23 Per capita tickets and % below poverty line

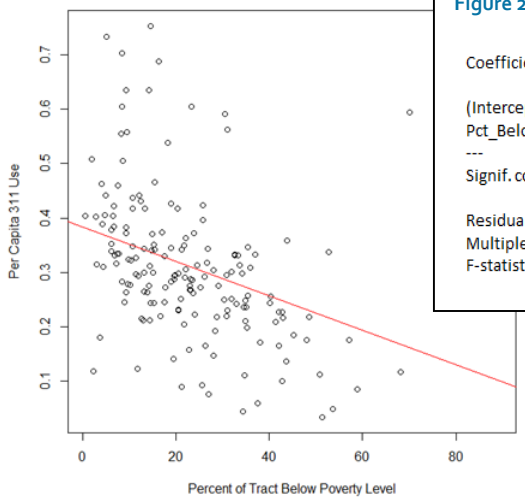


Figure 22 Regression: per capita tickets and % below poverty line

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.3841497	0.0180227	21.315	< 2e-16 ***
Pct_Below_Pov_lev	-0.0031777	0.0006637	-4.788	0.00000369 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1282 on 167 degrees of freedom
Multiple R-squared: 0.1207, Adjusted R-squared: 0.1154
F-statistic: 22.92 on 1 and 167 DF, p-value: 0.000003692

Figure 24 Poverty rate (% below poverty line)

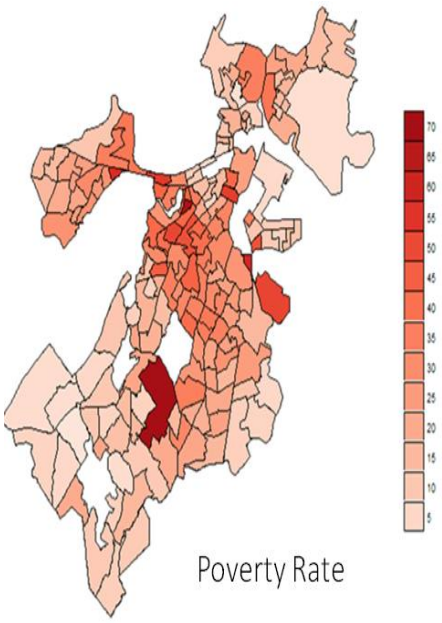
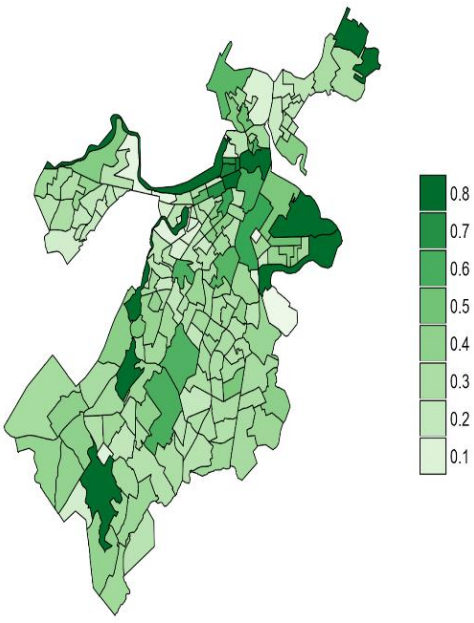


Figure 25 Per capita tickets by tract (2015)



2.2.3 REQUESTS AND EDUCATION

Our model indicated some relationship between educational attainment and per capita 311 ticket origination. There is a significant relationship between the percent of the population with a bachelor's degree or higher. The higher the proportion of the census tract with this attainment, the more 311 tickets per person predicted. Each additional percentage point with this attainment is associated with 0.0018 more tickets per person over the course of a year.

Figure 26 Regression: per capita tickets and educational attainment ('some HS' omitted)

```
Coefficients:
                Estimate   Std. Error  t value   Pr(>|t|)
(Intercept)     0.3021563  0.0703767   4.293     2.99e-05 ***
hs_grad         0.0002876  0.0011181   0.257     0.7973
some_college   -0.0009844  0.0008015  -1.228     0.2211
bach_or_higher  0.0017679  0.0007905   2.236     0.0267 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1287 on 165 degrees of freedom
Multiple R-squared:  0.1235,    Adjusted R-squared:  0.1075
F-statistic: 7.747 on 3 and 165 DF,  p-value: 7.152e-05
```

2.2.4 MULTIPLE REGRESSIONS

As a further test on the importance of the above relationships, we ran a multiple regression to disentangle potentially-correlated covariates. Once again, higher median income and percentage reporting Hispanic or Latino origins are the more significant and highest magnitude influences on predicted 311 tickets per capita.

Figure 27 Regression: per capita tickets and various indicators

```
Coefficients:
                Estimate   Std. Error  t value   Pr(>|t|)
(Intercept)     2.139e-01  1.140e-01   1.876     0.0625 .
pct_white       2.525e-04  9.635e-04   0.262     0.7936
pct_black       1.128e-03  8.919e-04   1.265     0.2077
pct_hisp_latin -1.457e-03  7.395e-04  -1.971     0.0505 .
Med_Inc_k       2.206e-03  4.438e-04   4.970     1.73e-06 ***
hs_grad         2.756e-04  1.205e-03   0.229     0.8194
some_college   -9.832e-04  9.942e-04  -0.989     0.3242
bach_or_higher  4.927e-04  1.135e-03   0.434     0.6648
popdens        -1.546e+01  2.068e+01  -0.748     0.4558
age18to64      -4.475e-06  1.059e-05  -0.423     0.6732
age65plus      -2.077e-05  5.257e-05  -0.395     0.6932
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1134 on 157 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.3375,    Adjusted R-squared:  0.2953
F-statistic: 7.997 on 10 and 157 DF,  p-value: 2.373e-10
```

As a check on our methodology, we used 311 tickets per square mile of census tract.

Figure 28 Per square mile tickets (2015, log-scale)

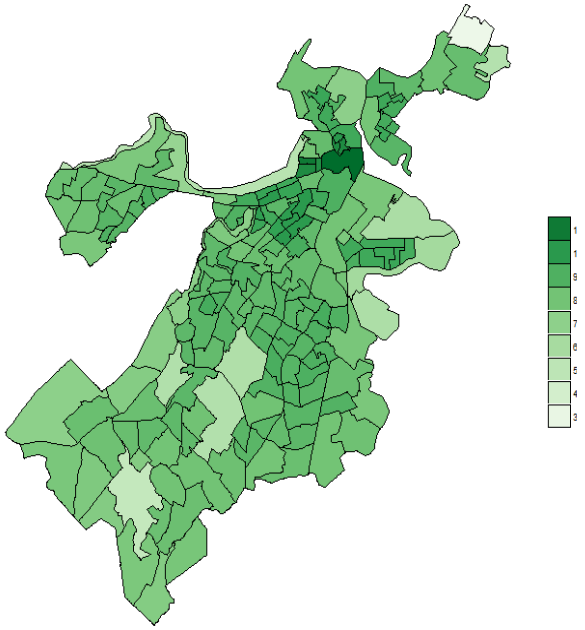


Figure 29 Regression: per square mile tickets and various indicators

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	7.320e+03	6.669e+03	1.098	0.2741	
pct_white	2.970e+01	5.635e+01	0.527	0.5989	
pct_black	1.897e+01	5.216e+01	0.364	0.7165	
pct_hisp_latin	-1.419e+01	4.325e+01	-0.328	0.7432	
Med_Inc_k	1.060e+01	2.595e+01	0.408	0.6836	
hs_grad	-4.963e+01	7.046e+01	-0.704	0.4822	
some_college	-4.284e+01	5.814e+01	-0.737	0.4623	
bach_or_higher	8.314e+01	6.638e+01	1.253	0.2122	
popdens	-3.003e+06	1.209e+06	-2.484	0.0140	*
age18to64	5.395e-01	6.193e-01	0.871	0.3849	
age65plus	-6.787e+00	3.074e+00	-2.208	0.0287	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6630 on 157 degrees of freedom
(1 observation deleted due to missingness)
Multiple R-squared: 0.2392, Adjusted R-squared: 0.1907
F-statistic: 4.935 on 10 and 157 DF, p-value: 3.327e-06

2.3 ASSESSING THE APP

The Open311 App and direct citizen calls to the 311 office are the two primary channels for citizens to open 311 tickets. of the 213 thousand tickets opened in 2015, 116 thousand were citizens calling the 311 office, and 39 thousand were created in the 311 app. The remaining tickets were a combination of other channels, with the city worker app, and employee opened tickets representing the bulk of them. As we discussed in the introduction, The 311 app is a relatively new method of direct citizen-government communication, and we have reason to believe that the demographic profile of those using the app is different from those using the phone line. As part of our attempt to understand the demographics of the use of 311 we assessed each source separately along our demographic variables of interest.

Figure 30 Regression: per capita tickets and various indicators, Constituent Calls only

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	2.374e-02	2.096e-01	0.113	0.9100	
pct_white	-5.150e-04	1.772e-03	-0.291	0.7717	
pct_black	9.281e-04	1.640e-03	0.566	0.5722	
pct_hisp_latin	7.856e-05	1.359e-03	0.058	0.9540	
Med_Inc_k	1.989e-03	8.142e-04	2.443	0.0157	*
hs_grad	-4.299e-04	2.215e-03	-0.194	0.8464	
some_college	-2.008e-04	1.828e-03	-0.110	0.9127	
bach_or_higher	4.827e-04	2.087e-03	0.231	0.8174	
popdens	-1.358e+01	3.802e+01	-0.357	0.7214	
age18to64	-1.097e-05	1.947e-05	-0.564	0.5738	
age65plus	2.212e-04	9.510e-05	2.326	0.0213	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2085 on 158 degrees of freedom
(10 observations deleted due to missingness)
Multiple R-squared: 0.1176, Adjusted R-squared: 0.06176
F-statistic: 2.106 on 10 and 158 DF, p-value: 0.02688

Figure 31 Regression: per capita tickets and various indicators, App only

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	8.284e-02	5.704e-02	1.452	0.1484	
pct_white	-1.185e-04	4.822e-04	-0.246	0.8061	
pct_black	-6.176e-04	4.463e-04	-1.384	0.1683	
pct_hisp_latin	-7.545e-04	3.699e-04	-2.040	0.0430	*
Med_Inc_k	3.799e-04	2.216e-04	1.714	0.0884	.
hs_grad	-2.523e-04	6.028e-04	-0.419	0.6761	
some_college	-3.850e-04	4.975e-04	-0.774	0.4402	
bach_or_higher	4.435e-04	5.680e-04	0.781	0.4361	
popdens	-9.780e+00	1.035e+01	-0.945	0.3460	
age18to64	1.431e-06	5.298e-06	0.270	0.7874	
age65plus	5.381e-06	2.588e-05	0.208	0.8356	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05674 on 158 degrees of freedom
(10 observations deleted due to missingness)
Multiple R-squared: 0.3083, Adjusted R-squared: 0.2645
F-statistic: 7.043 on 10 and 158 DF, p-value: 4.199e-09

It is also important to note that the 311 app is structured in such a way that it prioritizes citizen reporting of problems in public space over personal issues such as the scheduling of bulk trash pickup which are common tickets from the phone hotline.

Table 3 Top tickets from 311 app

Requests for Street Cleaning	6257
Request for Snow Plowing	5948
Parking Enforcement	5581
Graffiti Removal	3666
Street Light Outages	3469
Request for Pothole Repair	2404
Empty Litter Basket	2252
Sidewalk Repair (Make Safe)	2186
Sign Repair	1728
Tree Maintenance Requests	982
Traffic Signal Inspection	928
Pick up Dead Animal	654
Missed Trash/Recycling/Yard Waste/Bulk Item	560
Equipment Repair	480
Ground Maintenance	462
Abandoned Vehicles	454
Needle Pickup	364
PWD Graffiti	302
Rodent Activity	288
Abandoned Bicycle	228

The two primary channels for citizens to make request to the city are through the direct phone line to the 311 office, and the Open311 smartphone app. In 2015 there were 116,156 constituent call tickets, and 39,683 citizen's connect (Open311) tickets. The Open311 app is structured such that there are twenty categories for reporting specific problems such as scheduling show plowing or indicating downed tree limbs. All other requests are placed under the other category. As such there is a strong pull for using

Table 2 Top tickets from constituent calls

Request for Snow Plowing	20937
Missed Trash/Recycling/Yard Waste/Bulk Item	12307
Schedule a Bulk Item Pickup	12067
Building Inspection Request	4855
General Comments For a Program or Policy	4830
Animal Generic Request	2583
Unsatisfactory Living Conditions	2525
OCR Front Desk Interactions	2465
Parking Enforcement	2415
Requests for Street Cleaning	2121
Traffic Signal Repair	1725
Rodent Activity	1660
Abandoned Vehicles	1551
Request for Recycling Cart	1512
Unsafe Dangerous Conditions	1358
Request for Pothole Repair	1355
Tree Maintenance Requests	1338
Pick up Dead Animal	1283
Electrical	1276
Heat - Excessive Insufficient	1276

the app in the public interest. The top categories are requests for snow plowing and street cleaning, parking enforcement, and graffiti removal. All of the top 20 request categories in our data-set are solidly within the realm of the public interest, highlighting problems in public areas for the municipal government to solve. The 311 phone line's open ended request interface in which citizens are able to state their issue to an employee of the 311 office had more requests that could be classified as useful to the constituent calling, but not to the public interest. Examples of these type of calls were scheduling a bulk garbage pickup, building inspection requests, and requests for recycling bins to be provided by the city. In general, the 311 app's top categories leaned toward the public interest more than constituent calls. There were also relatively more tickets that affected a broader swath of the public. Sign repair and graffiti removal are categories that are more likely to benefit a broader population than missed trash pickup.

This dichotomy is likely driven by more than just the demographics of the two sources of 311 tickets. The strongest factor in the top uses of the 311 app are the aforementioned pre generated categories that draw the app user toward reporting certain types of problems.

In order to focus our analysis on problems that affect the public interest, and to provide an easier comparison between app tickets and phone tickets, we limited the data-set to ticket types that were present for both app and phone users in 2015. This subset of the data has a much stronger emphasis on citizen co-production rather than transactional uses of the 311 service. Under 100 app tickets were removed using this methodology, but around half of phone tickets were removed. Of these, many were informational or transactional, but there were also many citizen co-production tickets that were removed. Due to the open ended nature of classification of phone tickets, the categories of tickets do not overlap perfectly. This may be a methodological weakness, as we will remove data points that we would otherwise like to include. However, we do not believe that removing these data points will introduce bias into our regressions as we do not believe the removal of data correlates with the variables in our regressions.

When we analyzed this subset of the regression we found that constituent calls had a significant income effect as seen in previous regressions. Higher income tracts predicted higher use of the service. App tickets did have any significant effect of income. App tickets did show a negative relationship between high Hispanic/Latino population and use of the app. This was seen in previous literature, and the trend held up in our regressions. While these effects are interesting, and somewhat support our hypothesis that income is a predictor of constituent calls more than app use, it is important to note that the magnitude of the difference is quite low, and that for the purpose of policy decision making we do not believe that there is strong evidence to indicate that equity is a major problem for 311, and that there is little difference between the app and constituent calls in terms of equity.

Figure 32 Multiple regression, selected ticket types, constituent calls only

```
Coefficients:
                Estimate      Std. Error    t value       Pr(>|t|)
(Intercept)     3.444e-02     5.018e-02     0.686         0.4935
pct_white       -1.943e-04    4.241e-04     -0.458        0.6475
pct_black       7.235e-04     3.925e-04     1.843         0.0672 .
pct_hisp_latin  -1.559e-04    3.254e-04     -0.479        0.6324
Med_Inc_k       8.000e-04     1.949e-04     4.104         6.48e-05 ***
hs_grad         -2.717e-05    5.302e-04     -0.051        0.9592
some_college    -1.051e-04    4.376e-04     -0.240        0.8105
bach_or_higher  1.913e-04     4.996e-04     0.383         0.7024
popdens         -9.602e+00    9.101e+00     -1.055        0.2930
age18to64       -4.488e-06    4.660e-06     -0.963        0.3369
age65plus       4.215e-05     2.277e-05     1.852         0.0660 .
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.04991 on 158 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared: 0.2444,     Adjusted R-squared: 0.1965
F-statistic: 5.109 on 10 and 158 DF,  p-value: 1.874e-06
```

Figure 33 Multiple regression, selected ticket types, app only

```
Coefficients:
                Estimate      Std. Error    t value       Pr(>|t|)
(Intercept)     8.270e-02     5.704e-02     1.450         0.1491
pct_white       -1.185e-04    4.821e-04     -0.246        0.8062
pct_black       -6.171e-04    4.462e-04     -1.383        0.1686
pct_hisp_latin  -7.526e-04    3.699e-04     -2.035        0.0435 *
Med_Inc_k       3.814e-04     2.216e-04     1.721         0.0871 .
hs_grad         -2.518e-04    6.027e-04     -0.418        0.6767
some_college    -3.848e-04    4.975e-04     -0.774        0.4404
bach_or_higher  4.403e-04     5.679e-04     0.775         0.4393
popdens         -9.759e+00    1.034e+01     -0.943        0.3470
age18to64       1.407e-06     5.297e-06     0.266         0.7908
age65plus       5.529e-06     2.588e-05     0.214         0.8311
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05673 on 158 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared: 0.3077,     Adjusted R-squared: 0.2639
F-statistic: 7.022 on 10 and 158 DF,  p-value: 4.476e-09
```

3. ALTERNATIVES

[insert chapter summary]

3.1 CHOOSING ALTERNATIVES

After scoping our goal to the twin goals of improving equity in city service delivery, and improving overall service delivery we identified a number of alternatives to have a meaningful impact on these goals. In order to pursue the space of possible alternatives we employed a backwards mapping process to trace back a causal chain to points of intervention that fall within the 311 office's abilities and mandate. The process is described below and a visualization of our backwards map can be found in Appendix B, figures xx and xx (xx)

Given an ultimate goal of providing better service to citizens, we identified our two problem statements as subsidiary to this overall goal, improving service in general and improving equity in service. Through meeting with Boston 311 and expert interviews, we identified two possible points of intervention into these problems:

Using existing 311 data as an analytical tool to guide service delivery independent of individual caller problems, this can take the form of various interventions that improve service delivery such as high call volume alerts sent to relevant departments, tools that assess Boston's performance against other similar municipalities, using historical 311 data for predictive analytics and budgeting, and data dashboard items that flag potential equity issues in 311 service delivery;

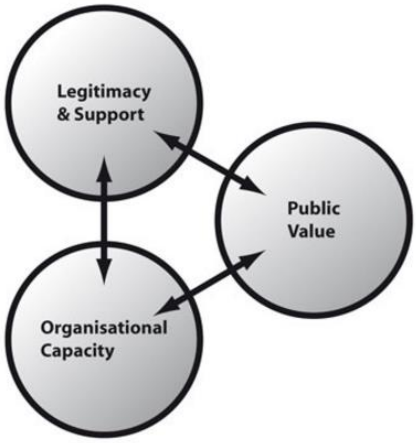
Increasing utilization of 311 in areas that have been identified as having low utilization of 311, and with disadvantaged demographics. We further differentiated this category by distinguishing between tickets that are originated by callers on the 311 line and those who use the 311 app. These two inbound services are the primary activities of the 311 office, and they nominally provide the same service to citizens through different channels. However, the demographic profile and the types of service requests of those using the two services are different. In addition, the cost and feasibility of policy changes differs using the two services. For each of these services it is possible to improve or increase service delivery through marketing the service to increase utilization or to improve the delivery of service. We could further differentiate these intervention points, but believe that this will be the correct level of decision to guide the strategic decision made by the 311 office of what path to pursue for greater equity and service delivery.

We discuss these alternatives in further detail in section 3.3 - 3.5, both in terms of the potential strategies for implementing them and the feasibility and tradeoffs of each of the the above strategies.

3.2 CRITERIA FOR EVALUATION

To determine a best alternative for Boston 311 to pursue we utilized the strategic triangle (Moore, 1995). This creates a framework for targeting a policy intervention that has both strong value to a public institution and a feasible plan of implementation. The three pillars of which are organization capacity, legitimacy and support, and public value. Organizational capacity indicates that the institution has the resources, personnel, and budget to implement the policy. Legitimacy and support describes the political environment, and stakeholders who are needed for a policy to be implemented as well as the feasibility of mobilizing those stakeholders. Public value is a measure of the degree to which a policy alternative achieves the stated goal of the intervention.

Figure 34 Strategic Triangle (Moore 1995)



For our assessment we chose criteria of evaluation that fell within these pillars.

- Public value we split into two criteria that are described by our twin problem statements. the degree to which a policy has the potential to improve equity in city service delivery, and the degree to which it can improve overall city service delivery. Our primary measurements for these criteria were in our econometric analysis of 311 and census data described in section 2, a review of the relevant literature, and expert interviews that provided us with additional knowledge regarding other programs that have been implemented.
- Our next criteria was cost of implementation. The 311 office's budget is the biggest constraint on implementing new policies, and was the primary variable on which the alternatives we considered differed strongly within the area of organizational capacity. For this criteria we compared similar policies undertaken by other organizations and reviewed relevant sections of The City of Boston, and the Boston 311 office budgets to price out comparable initiatives.
- Finally, we assessed the legitimacy and support of a policy by conducting a stakeholder analysis to determine the resources that would need to mobilized outside of the 311 office.

Thus we have four criteria on which we are assessing each policy alternative, improving equity in service delivery, improving overall service delivery, cost of implementation, and legitimacy and support. In the following sections we will explore each alternative on these dimensions.

3.3 PRIORITIZE 311 PHONE LINE

Process map for alternative assessments: Questions and Sources

Background

Brief description of alternative

- Where has the alterative been implemented in other cities?
- What are the different ways to pursue the alternative/specific policy choices that can be made?
- What policy choice within the area of interest do we want to focus on for the purpose of comparison?
- Why did we decide on a particular choice?

Legitimacy and Support

- Who are stakeholders?
- What are their interests and positions?
- How do these affect the implementation of the alternative?
- What must be done to get the buy in of important stakeholders?
- What concessions might have to be made?

Cost of Implementation

- What is a good estimate for how much the alternative would cost?
- Are there any ways to scale up or scale down the alternative in cost?

Equity

- What is the impact of implementing the chosen alternative on the equity of service delivery in Boston?
- How do we measure equity of an alternative?
    - Is there empirical evidence that this source of calls is more equitable (app?)?
    - Can the alternative be targeted to specific neighborhoods that we know are lower income?

City Services

- How long is the value chain to impacting citizens' lives? (i.e., how strong/immediate is the connection between the alternative under consideration and the impact)
- How much option value is there? (ability to try many alternatives)

How we plan on resolving the above topics:

- Interview Question List for other 311
- What Innovative actions have you taken within your organization?
- Have you done significant advertising/marketing campaigns for App/phone service?
- How successful were the campaigns?
- How did you measure success?

- How expensive were they? (sensitive)
- What efforts have you made to improve your 311 service/App?
- How has the service you deliver changed over time?

Questions for Client

- Above list +
- What are your interactions with other departments in the city?
- How do you handle outbound requests to other departments?
- How do you handle when a department performs poorly at resolving tickets?
- Are there any inter-department conflicts around resolving tickets?
- Is there a feedback mechanism/do you know when other departments are not performing well?
- Who has budgetary authority over your office?
- What is the process for approving new initiatives that require additional appropriations?
- How has the office of the Mayor interacted with your office?
- Have you collaborated with the Mayor on press releases, or publicity?
- What is your interaction with department of innovation and technology?
- What would the mayor/DOIT think about a marketing initiative for the phone service targeted to poor neighborhoods?, increased spending on app development? A targeted google adwords buy targeting poor neighborhoods/demographics? Hiring a data analyst?
- How can you leverage data analysis at DOIT for purposes of improving policy?
- Have you considered running a hackathon?
- What initiatives are currently underway?
- How are you measuring the success of those initiatives?
- If you have done marketing campaigns in the past, how much have they cost you?
- Have you tracked their success? How successful have they been?

Desk Research

- What 311 initiatives have won awards and why?
- Have any 311 programs actively addressed equity concerns?
- How do 311 programs typically fit into city budget and/or org chart hierarchies (or create typology of budgetary and authority arrangements)
- Are there any consistent opponents or skeptics when it comes to 311?
- Rate of growth for 311 programs? (number of new 311 programs per year, budget dollars going to 311 programs per year, etc.)
- Are there implications in terms of different demographic groups' use of smartphones or not?
- Cost targeted google adword buy?
- Which alternatives have ways to change scale, what are they?
- Use regression output to discuss equity implications

- Break out Marketing vs. Improving service/operations
- Benchmarking current capability of the 311 office

Example Table 1:

	Prioritizing 311 phone service
Legitimacy and Support	
Cost of Implementation	
Equity Impact	
Improved Service	

3.4 PRIORITIZE THE APP

[insert]

3.5 DEVELOPING TOOLS THAT USE 311 DATA

[insert]

4. RECOMMENDATIONS AND NEXT STEPS

4.1 Recommended policies

We intend to give a top recommendation, and list the policy alternatives that we feel would be viable alternatives given the criteria above. We have not filled out this section yet as our recommendations are somewhat dependant on analysis of interviews that we haven't completed in section 3.

4.2 Next steps

Here we will further develop the top recommendation with an implementation plan.

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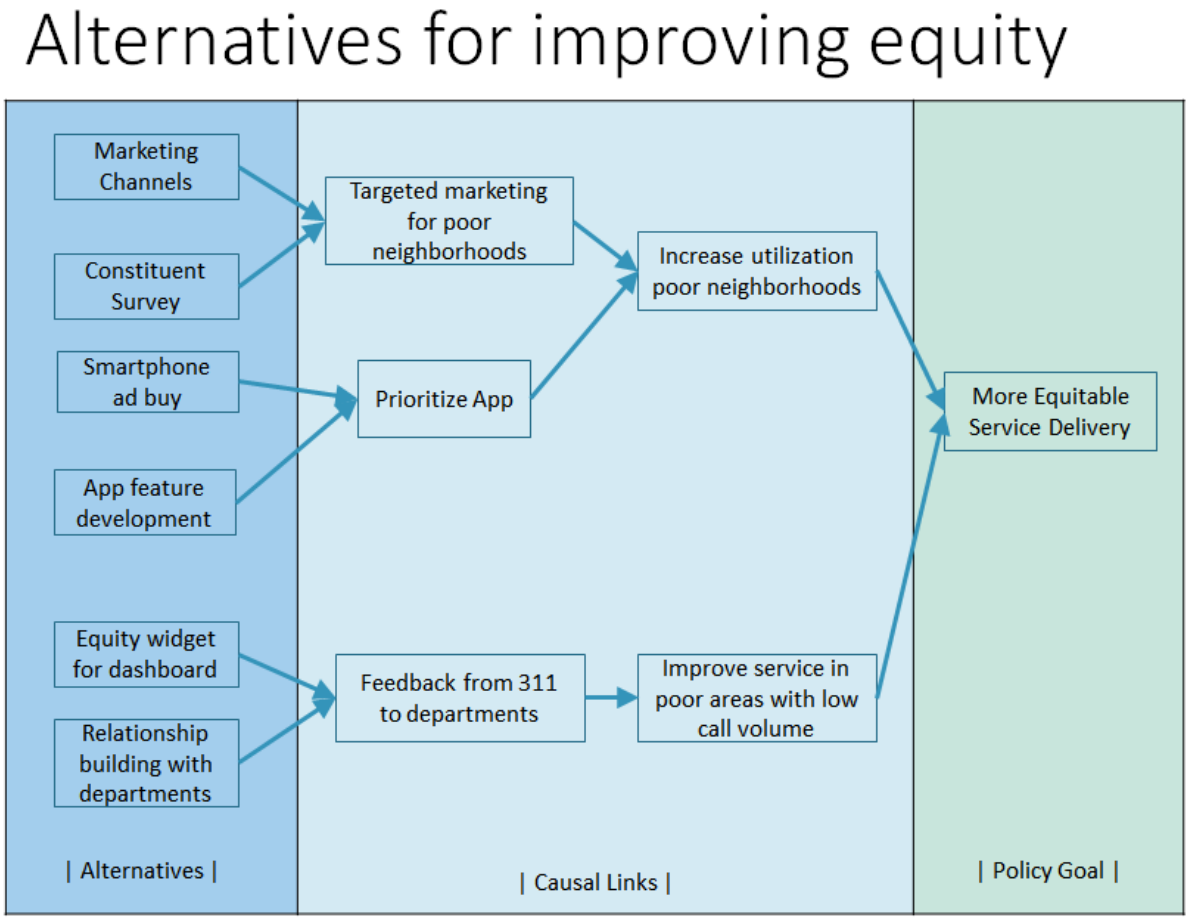
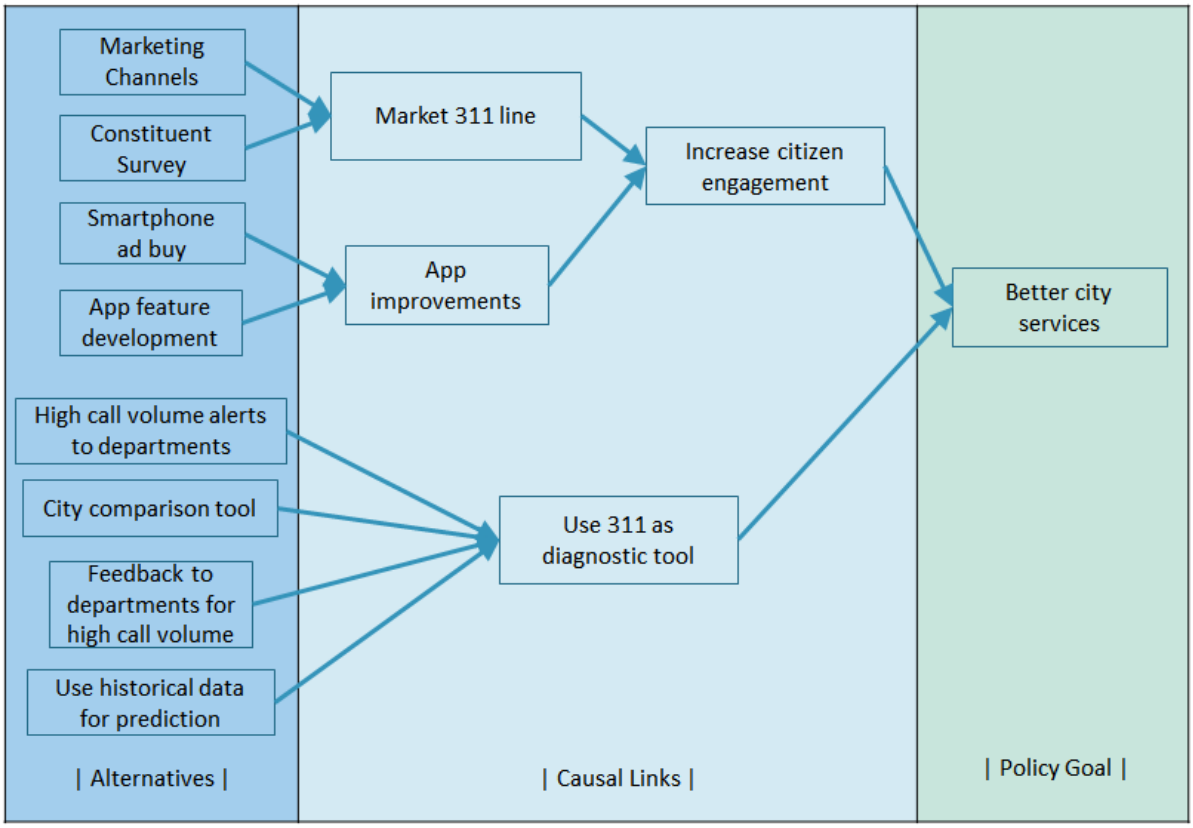
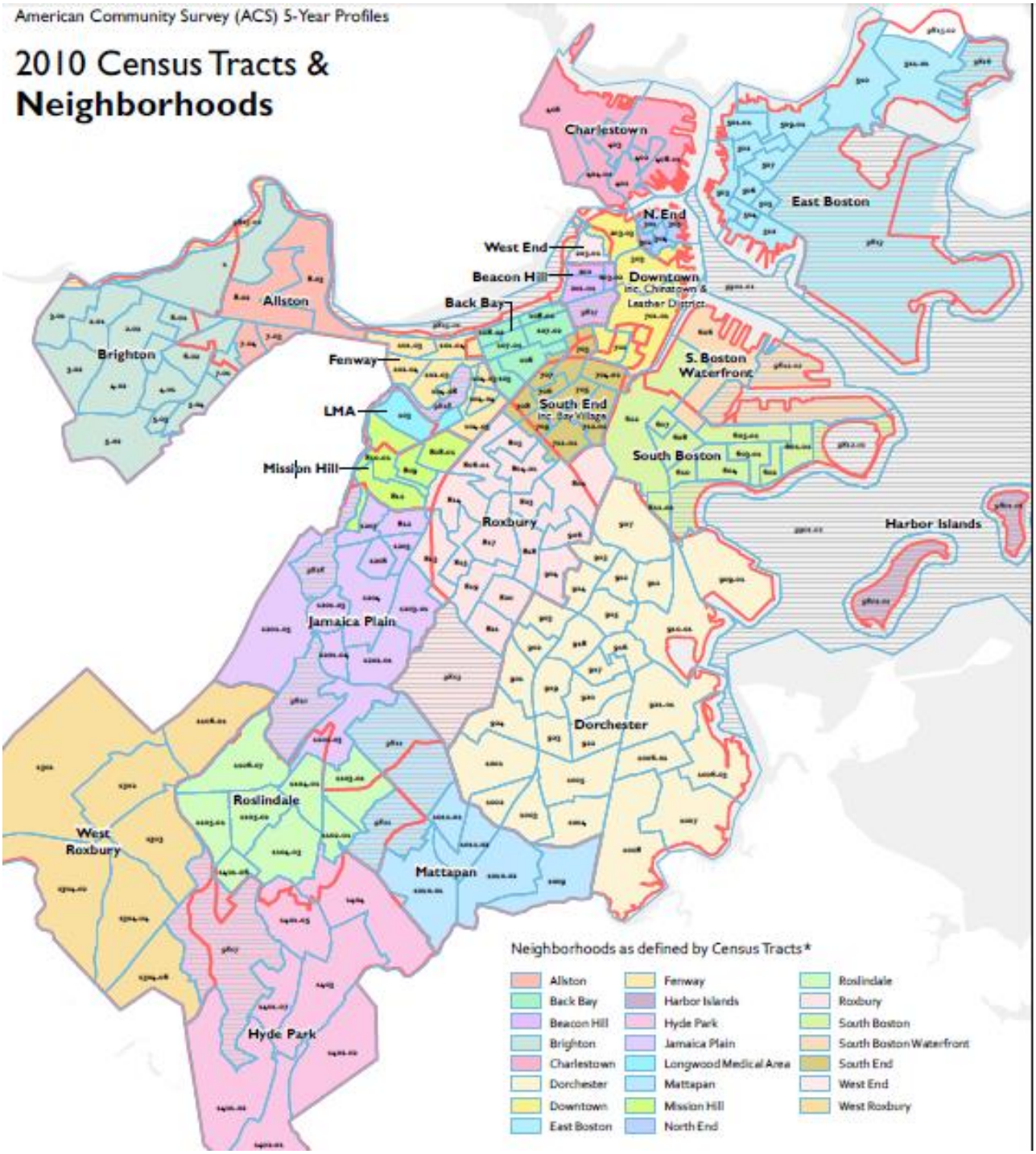
APPENDIX B: ADDITIONAL FIGURES



Alternatives for improving overall city services



Census tracts by neighborhood (source: Boston Redevelopment Authority)



Total tickets by tract

Tract	Tickets
100	1425
201	974
202	954
301	824
302	670
401	1062
402	1047
502	753
503	433
504	856
601	1141
602	822
701	564
703	474
704	822
802	1885
803	343
10103	196
10104	1178
10203	1124

Tract	Tickets
10204	458
10300	389
10403	628
10404	687
10405	563
10408	137
10500	822
10600	726
10701	1635
10702	1658
10801	576
10802	863
20101	2937
20200	2694
20301	281
20302	907
20303	767
30100	691
30200	888
30300	24124

Tract	Tickets
30400	1454
30500	879
40100	1153
40200	418
40300	1440
40401	1134
40600	1604
40801	423
50101	936
50200	1153
50300	376
50400	647
50500	416
50600	678
50700	1061
50901	1140
51000	1308
51101	1862
51200	998
60101	1177

Tract	Tickets
60200	882
60301	1308
60400	1843
60501	1874
60600	1140
60700	105
60800	1553
61000	590
61101	178
61200	2063
70101	3384
70200	1252
70300	2796
70402	580
70500	2397
70600	1019
70700	1211
70800	1174
70900	1415
71101	1348

Tract	Tickets
71201	757
80100	1698
80300	571
80401	650
80500	523
80601	822
80801	408
80900	836
81001	1095
81100	1052
81200	632
81300	1134
81400	1737
81500	586
81700	1175
81800	1012
81900	967
82000	939
82100	1029
90100	1589

Total tickets by tract (continued)

Tract	Tickets
90200	775
90300	1120
90400	1055
90600	746
90700	1617
90901	135
91001	1100
91100	1281
91200	1224
91300	723
91400	786
91500	1251
91600	914
91700	918
91800	1054
91900	1205
92000	1589
92101	2065
92200	1395
92300	984

Tract	Tickets
92400	1649
100100	1250
100200	771
100300	874
100400	1354
100500	2040
100601	1541
100603	776
100700	1550
100800	2023
100900	1407
101001	1742
101002	1243
101101	890
101102	1316
110103	2047
110201	666
110301	1004
110401	1059
110403	1074

Tract	Tickets
110501	1000
110502	1287
110601	830
110607	1715
120103	728
120104	659
120105	980
120201	1258
120301	1684
120400	2415
120500	679
120600	1010
120700	628
130100	1890
130200	2004
130300	1873
130402	1863
130404	1184
130406	647
140102	1713

Tract	Tickets
140105	1201
140106	175
140107	871
140201	803
140202	1492
140300	2205
140400	2229
980300	216
980700	121
981000	109
981100	248
981201	137
981202	212
981300	58
981501	65
981502	8
981600	49
981700	476
981800	325

APPENDIX C: METHODS

[include tutorial for R methodology]

APPENDIX D: 311-STORIES FROM OTHER CITIES

Programs complementing 311

- SCOUT in NYC (Johnson 2010)
    - Street Conditions Observation Unit sends 15 inspectors into the streets of NYC to collect data on quality-of-life problems which complement normal 311 reports.
- Contests
    - Boston's HUB
    - NYC BigApps (Johnson 2010)

Insights driven by 311 data

- Somerville Rats
- New York Maple Syrup
    - 311 reports of strong maple syrup smell in the air helped officials identify a group of industrial plants in New Jersey, where a flavor compound manufacturer had been processing a specific maple-like spice (Johnson 2010).
- New York Food-Patrol
    - "Clusters of calls about food-borne illness or sanitary problems from the same restaurant now trigger a rapid response from the city's health department" (Johnson 2010).

Startups using this data

- SeeClickFix
- FixMyStreet
- BlockChalk
- CitySourced
- UncivilServants