Living in Boston During COVID-19: Lifestyle, Ideology, and Context Drive Attitudes

Report #4 in a Series

Boston Area Research Initiative

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The Boston Area Research Initiative is an interuniversity partnership based at Northeastern University that convenes researchers, policymakers, practitioners, and community leaders to envision and realize the future of the city. Our primary goal is to leverage data and technology to better understand and serve cities, with a focus on enhancing equity, justice, and democracy.

The Center for Survey Research (CSR) at the University of Massachusetts Boston is a full-scale academic survey research center. CSR conducts basic and applied research that contributes to knowledge and understanding of important social issues and supports public and private agencies and university scholars in carrying out high quality policy-related research. Its projects include Beacon, a panel study on Boston neighborhoods.

Boston Public Health Commission, the country's oldest health department, is an independent public agency providing a wide range of health services and programs. Public service and access to quality health care are the cornerstones of our mission—to protect, preserve, and promote the health and well-being of all Boston residents, particularly those who are most vulnerable.

The Team for this Report

Daniel T. O'Brien, PhD, Associate Professor in the School of Public Policy and Urban Affairs; Director, Boston Area Research Initiative; Northeastern University

Russell K. Schutt, PhD, Professor, Department of Sociology, University of Massachusetts Boston; Clinical Research Scientist I, Beth Israel Deaconess Medical Center, Harvard Medical School.

Lee Hargraves, PhD, Interim Director, Center for Survey Research, University of Massachusetts Boston

Dan Dooley, Director, Research and Evaluation Office, Boston Public Health Commission

Floyd (Jack) Fowler, PhD, Senior Research Fellow, Center for Survey Research, University of Massachusetts Boston

Ryan Qi Wang, PhD, Assistant Professor of Civil and Environmental Engineering; Associate Director of Research on Social Media, Boston Area Research Initiative; Northeastern University

Alina Ristea, PhD, Postdoctoral Associate, Boston Area Research Initiative, Northeastern University

Anthony Roman, MA, Senior Research Fellow, Center for Survey Research, University of Massachusetts Boston

Mehrnaz Amiri, Research Assistant and Student in the Masters of Science in Urban Informatics, Boston Area Research Initiative, Northeastern University

Sage Gibbons, Research Assistant and Student in the Masters of Science in Urban Informatics, Boston Area Research Initiative, Northeastern University

Hannah Grabowski, Research Assistant and Student in Graduate Program in Applied Sociology, Dept. of Sociology, University of Massachusetts Boston

Nikola Kovacevic, MA, Assistant Study Director, Center for Survey Research, University of Massachusetts Boston

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Executive Summary

In the Summer of 2020, the Boston Area Research Initiative (BARI) at Northeastern University, the Center for Survey Research (CSR) at University of Massachusetts Boston, and the Boston Public Health Commission (BPHC) conducted a survey that captures the experiences of 1626 Bostonians during the first months of the COVID-19 pandemic, including: their ability and tendency to follow social distancing recommendations; attitudes towards regulations; and the economic and personal impacts of the pandemic. The survey provides unique insights into how these factors varied across the populations and neighborhoods of a single city—something not currently available from any other source, in Boston or otherwise.

In second report in this series, we identified a variety of differences across ethnicities and neighborhood in attitudes toward infection risk and social distancing guidelines, habits of mask-wearing, and understanding of asymptomatic spread of COVID-19. Here we focus on related factors that might be driving these differences, including sex, age, being at high risk for infection, income, education, household composition (e.g., marital status, number of children), and political ideology. Doing so revealed multiple new lessons about how we might understand and support differences across communities.

Main Findings

- **Being at high risk for infection had the strongest effect on perceived risks of exposure and importance of guidelines,** though individuals at high risk for infection were not more likely to wear masks.
- **There were vulnerabilities at each end of the socioeconomic spectrum,** with higher income, more educated respondents expressing more ambivalence about risk, guidelines, and masks. Meanwhile, fewer lower income, less educated respondents believed that COVID-19 could be spread by asymptomatic individuals. Even after taking other factors into account, the latter relationship remained, but the ambivalence among those with higher socioeconomic status was driven by other factors.
- **Household composition was a major factor, with lifestyle and attitudes being closely aligned.**
    - **Living with a significant other was a protective factor,** associated with greater endorsement of social distancing guidelines and mask-wearing.
    - **Having more adults and children in the house was associated with lower understanding of asymptomatic spread and endorsement of**

guidelines, respectively, possibly because of the trade-offs between safety and basic needs and mental health for a larger household.

- **Political polarization of the pandemic was visible in Boston,** with those identifying as Independents and Republican seeing the guidelines as less important, wearing masks less often, and being less likely to believe in asymptomatic spread of the disease relative to Democrats. These effects were nearly as large as the effects of being at high risk for infection.
- Even when controlling for these other factors, **the cultural contexts of ethnicity and neighborhood still mattered,** especially for perceptions of guidelines and beliefs about asymptomatic spread of COVID-19. This suggests additional social mechanisms that are perpetuating certain attitudes.

Conclusions and Next Steps

These findings provide us with a more precise understanding of the factors that are driving attitudes toward and knowledge about the pandemic, infection risk, and social distancing guidelines. Importantly, they give policymakers and practitioners the tools to support and educate communities based on the specific vulnerabilities and challenges they are facing. In a future report we will expand upon this to better understand the implications these attitudes have for activities that create potential exposure.

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1. Living in Boston during COVID-19: A Neighborhood Survey

The NSF-Beacon survey captures the experiences of 1626 Bostonians during the first months of the COVID-19 pandemic, including: their ability and tendency to follow social distancing recommendations; attitudes toward regulations; and the economic and personal impacts of the pandemic. It provides unique insights into how these factors varied across the populations and neighborhoods of a single city—something not currently available from any other source, in Boston or otherwise. The survey was conducted over the summer as a collaboration of the Boston Area Research Initiative (BARI) at Northeastern University, the Center for Survey Research (CSR) at University of Massachusetts Boston, and the Boston Public Health Commission (BPHC). It was funded by the National Science Foundation's Human-Environment and Geographical Sciences (HEGS) program through a grant for rapid-response research (RAPID). The survey used a probability-based random sample stratified by 25 neighborhoods and the results presented here were weighted to match the demographic composition of the city as a whole. More detail on the survey methodology can be found in Appendix A.

This is the fourth in a series of reports describing key insights from the survey. The series focuses especially on the racial and socioeconomic inequities that have exacerbated—and may continue to exacerbate—differential impacts of the pandemic and the associated shutdown. In doing so, we consider four crucial classes of factors. The first class is personal characteristics, including race, ethnicity, socioeconomic status, pre-existing health, family structure (e.g., number of children), and political ideology. Second are attitudes about the risk of infection and social distancing guidelines, such as mask-wearing. Third are the types of activities that might expose a person to infection. For instance, how often a person goes to work, the grocery store, rides public transit, or visits in other people's

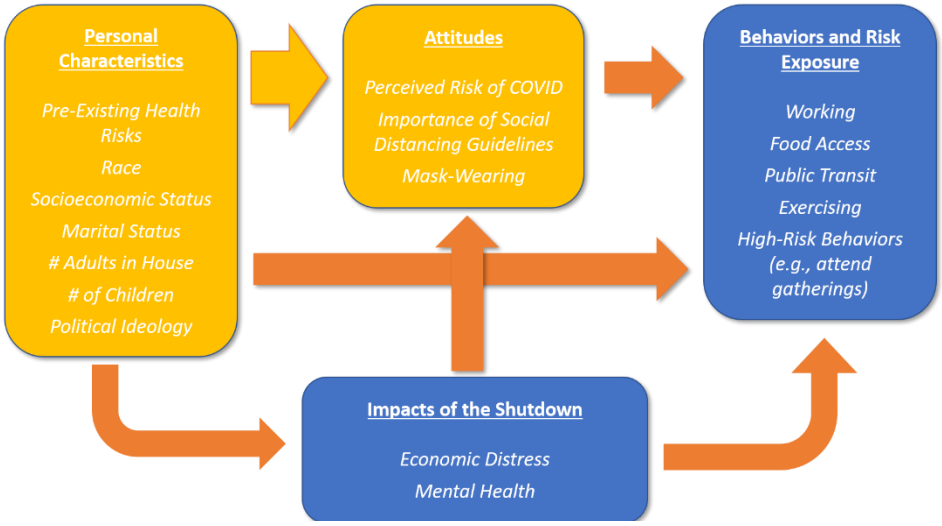

Figure 1. Relationships between personal characteristics, attitudes, behaviors, and the impacts of the shutdown to be explored by reports. Content for this report highlighted in yellow.

houses influences their exposure risk. Fourth, the survey included items on the impacts of the pandemic: employment, economic insecurity, and mental health.

We have designed the series to walk through the relationship between these features, as illustrated in Figure 1. Our first report described inequities in how Bostonians of different racial and socioeconomic backgrounds engaged in necessary day-to-day activities in April and the Summer. This second report examined how attitudes, beliefs and risky behaviors were distributed across communities. The third report described economic impacts of the pandemic on individuals and neighborhoods. This fourth report is an important transition as it begins to look at the ways that multiple personal characteristics best predict and explain differences by race, income, and neighborhood that we have observed in previous reports. We begin here with attitudes toward risk and social distancing guidelines and mask-wearing. Future reports will continue in this theme with analyses of receptivity to a vaccine, mental health, and risk exposure through weekly activities.

2. Attitudes and Mask-Wearing by Ethnicity and Geography

In the second report in this series[1], we introduced a series of measures capturing attitudes toward risk and social distancing guidelines and how they manifest in the form of mask-wearing (see Table 1).[2]

- **Perceived Risk:** How much of a risk respondents felt that certain behaviors posed to their health, including being close to others outside of their home and attending gatherings.
- **Importance of Guidelines:** How important the respondent felt it was for them and others in their neighborhood to comply with social distancing suggestions and regulations, like staying home as much as possible.
- **Mask-wearing:** How often the respondent wore a mask when leaving the home in April and the Summer. We focus here on April because nearly all respondents said they wore masks in the Summer.
- **Asymptomatic Spread:** Whether the respondent believed that COVID-19 can be spread by people not showing symptoms.

[1] https://cssh.northeastern.edu/bari/wp-content/uploads/sites/30/2020/12/Report-2-Fear-and-Ambivalence-1.pdf

[2] Perceived risk and guideline importance featured strong internal consistency according to Cronbach's alpha ($\alpha = .80$ and $\alpha = .81$, respectively). Though the alpha for high-risk behaviors was somewhat lower ($\alpha = .65$ in April and .54 in Summer), we maintained the scale owing to conceptual similarity between the items.

In that second report, we discussed how these attitudes varied by neighborhood, race, and income, highlighting some noteworthy trends.

First, nearly all Black and Asian respondents saw gatherings and being near to people outside their household as a "large" risk; described social distancing guidelines as "extremely" important; and reported they always wore masks in April (see Figure 2). Latinx respondents were similar, though some saw the guidelines as somewhat less important. Meanwhile, among White respondents there were more individuals who expressed

Perceived Risk of Infection: How much of a risk to your health and well-being is/are…
…Gatherings with friends that you do not live with?
…It to be close to people outside your home?
…It to be within 6 feet of people in public?
Importance of Guidelines: How important is it for people in your neighborhood to…
…Avoid gatherings with friends that you do not live with?
…Wear a mask or face covering when coming close to people outside the home?
…Stay at least 6 feet apart from other people in public?
…Stay at home as much as possible?
Mask-Wearing
In a typical week in April / the last seven days, when you left your home, how often did you wear a face mask or covering?
Asymptomatic Spread
In your opinion, can people who have no symptoms of COVID-19 give it to others?

Table 1. Survey items measuring attitudes and behaviors pertaining to risk, by category.

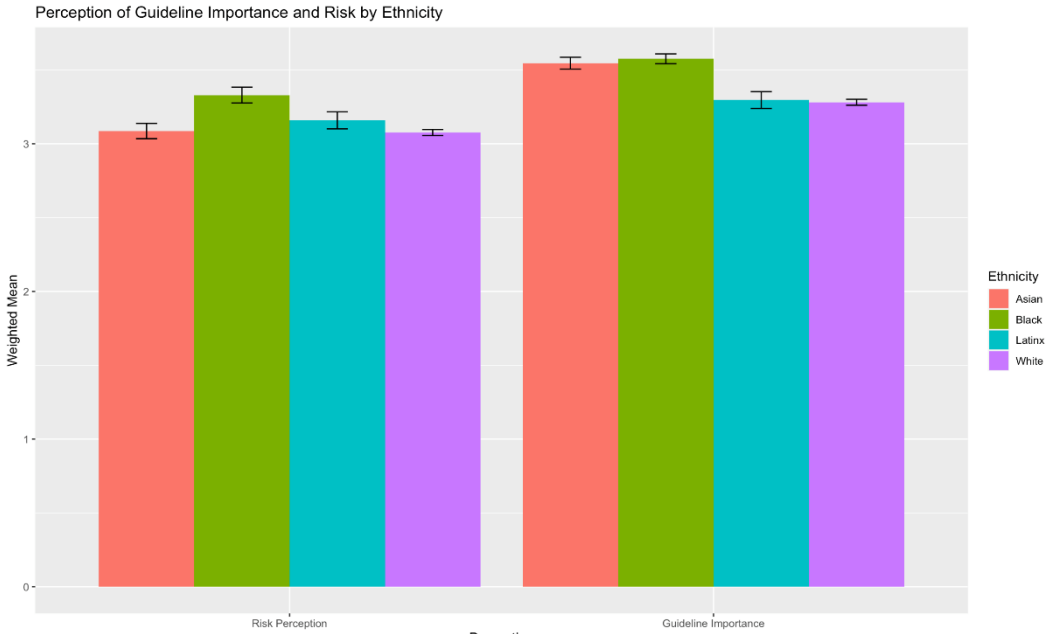

Figure 2. Differences by ethnic background in perceived risk of infection (left panel) and the importance of social distancing guidelines (right panel). Note: Bars represent 95% standard errors.

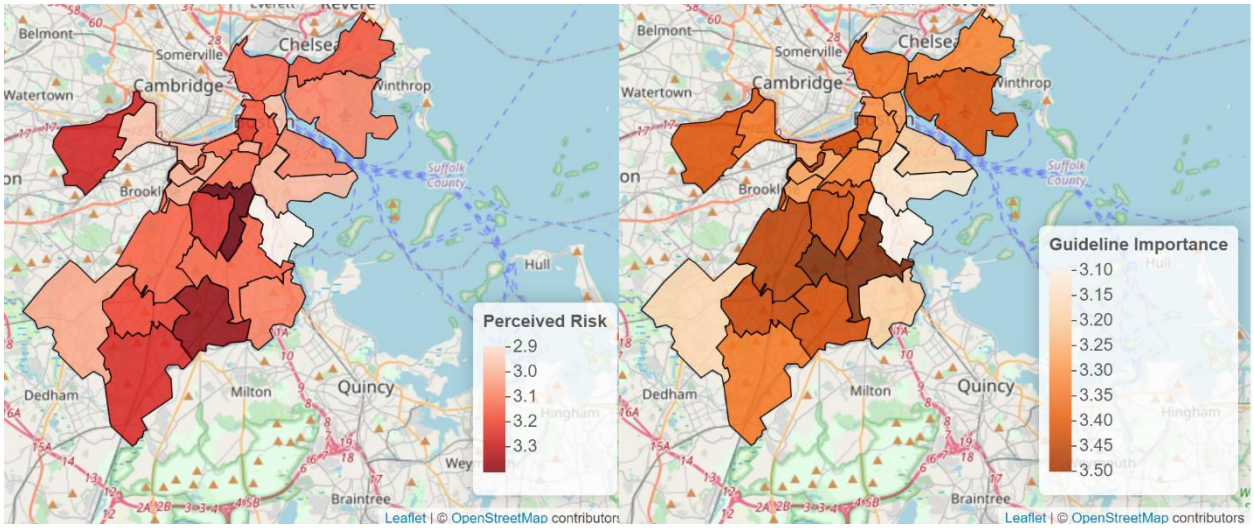

Figure 3. Differences across neighborhoods in perceived risk of infection (left panel) and the importance of social distancing guidelines (right panel). Both measures are on a 4-point scale, with 4 equal to highest perceived risk / importance of guidelines.

ambivalence on these subjects, perceiving less risk, seeing the guidelines as less critical, and reporting less consistent mask-wearing in April.

Second, these differences by ethnicity translated into neighborhood differences in attitudes. As might be expected, nearly all majority-minority neighborhoods reported high levels of perceived risk, endorsement of the guidelines, and mask-wearing in April. Meanwhile, the ambivalence appeared to be concentrated in some, but not all, majority-White neighborhoods. As shown in Figure 3, the neighborhoods that stood out as scoring lower on these measures were South Boston, West Roxbury, and parts of Dorchester that have more White residents. This suggests that at least some of the variation by ethnicity might be in fact geographic in nature, being driven by local context and social dynamics.

Third, we noted an opposing trend in terms of who believed that COVID-19 could be spread by asymptomatic individuals. These individuals were concentrated in majority-minority neighborhoods, but the relationship was most striking when visualized across the socioeconomic spectrum, as in Figure 4. About 25% of those in the lowest income bracket were either uncertain or did not believe in asymptomatic spread, whereas ~5% of respondents with annual income greater than $75,000 felt the same way. In combination with the other results, this finding highlighted that each community might have its own characteristic set of behavioral and attitudinal vulnerabilities that could increase spread that merit attention as the city is buffeted by a second wave of cases.

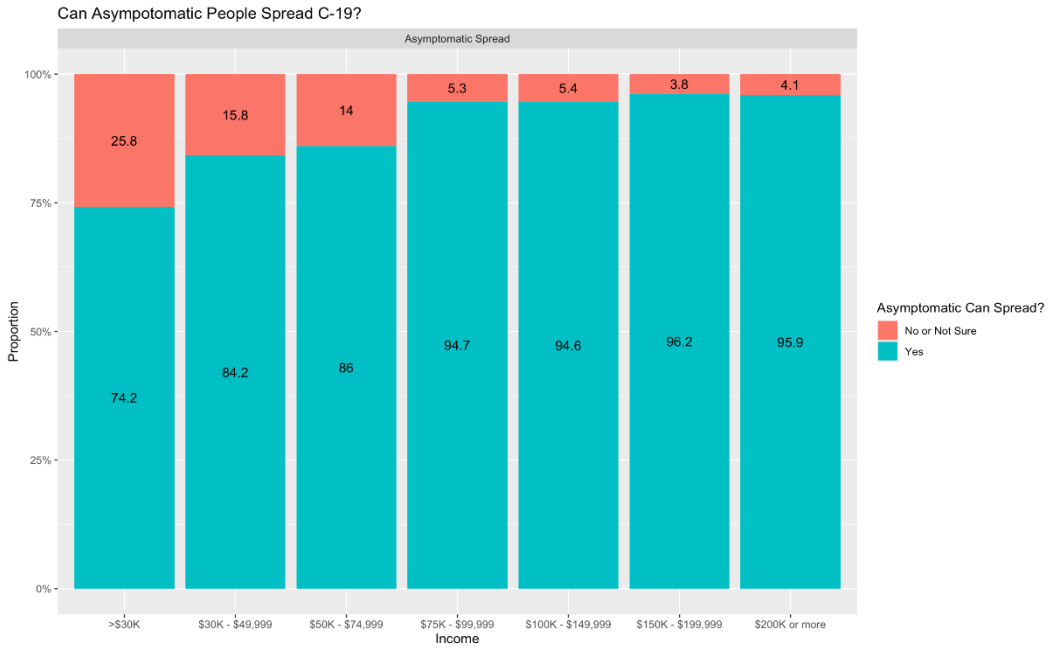

Figure 4. Proportion of individuals who did not believe that asymptomatic individuals could spread COVID-19, by income level.

We speculated in the second report about various explanations for why these differences arose. We test a variety of them in the sections that follow, including: basic motivators, like sex, age, and being high risk for severe infection; the direct impacts of income and education; household composition, like living with a partner or having children; and political ideology. We conclude by reassessing just how much of an effect race and neighborhood still play. Note that we test all relationships using regression models, which evaluate the ability of each factor to predict an outcome *independent* of all other factors that were taken into consideration. For example, if we say that those at high risk for infection see social distancing guidelines as more important, it means that they do so *taking into account* any other relevant features of that individual, be it income, race, household composition, or otherwise. Also, we only note results that reach a traditional level of statistical significance (i.e., p-value < .05).

3. Some Basic Motivators: Sex, Age, and High-Risk Status

We begin by looking at the implications of some of the basic personal characteristics that we would expect to influence attitudes about the pandemic: sex, age, and pre-existing conditions that put someone at high risk for severe infection (or *high-risk*, from hereon).

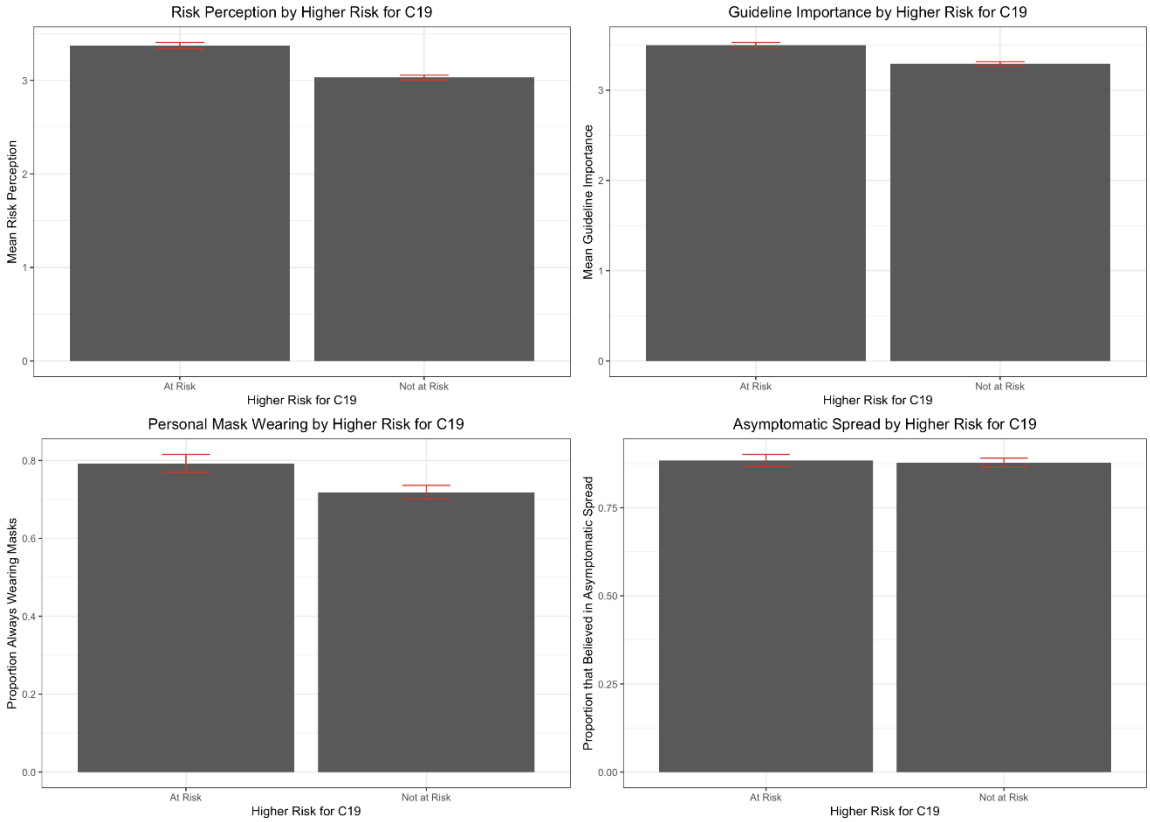

Figure 5. Differences between those at high-risk for severe infection and those who are not in perceived risk (top left), guideline importance (top right), likelihood of wearing masks at all times in April (bottom left), and likelihood of believing in asymptomatic spread of the disease (bottom right).

Unsurprisingly, high-risk individuals generally perceived more risk to their own health and saw social distancing guidelines as more important, as shown in Figure 5. They were not more likely, however, to have worn masks in April or to believe in asymptomatic spread. Meanwhile, females were more likely than males to perceive greater risk, to endorse the guidelines, *and* to wear masks (see Figure 6). This is consistent with other examinations of sex differences in risk-taking behavior, both during the pandemic and otherwise. What is potentially striking here is that, if one looks closely at Figures 5 and 6, the difference between female and male attitudes was nearly equal to the effect of being at-risk.[3] Further, there was an additional relationship with mask-wearing in April, suggesting that the average female was overall taking the pandemic more seriously and being more compliant with guidelines than her average male counterpart.

[3] In the regressions the effect size of being at-risk was ~30% larger for guideline importance and <10% larger for perceived risk.

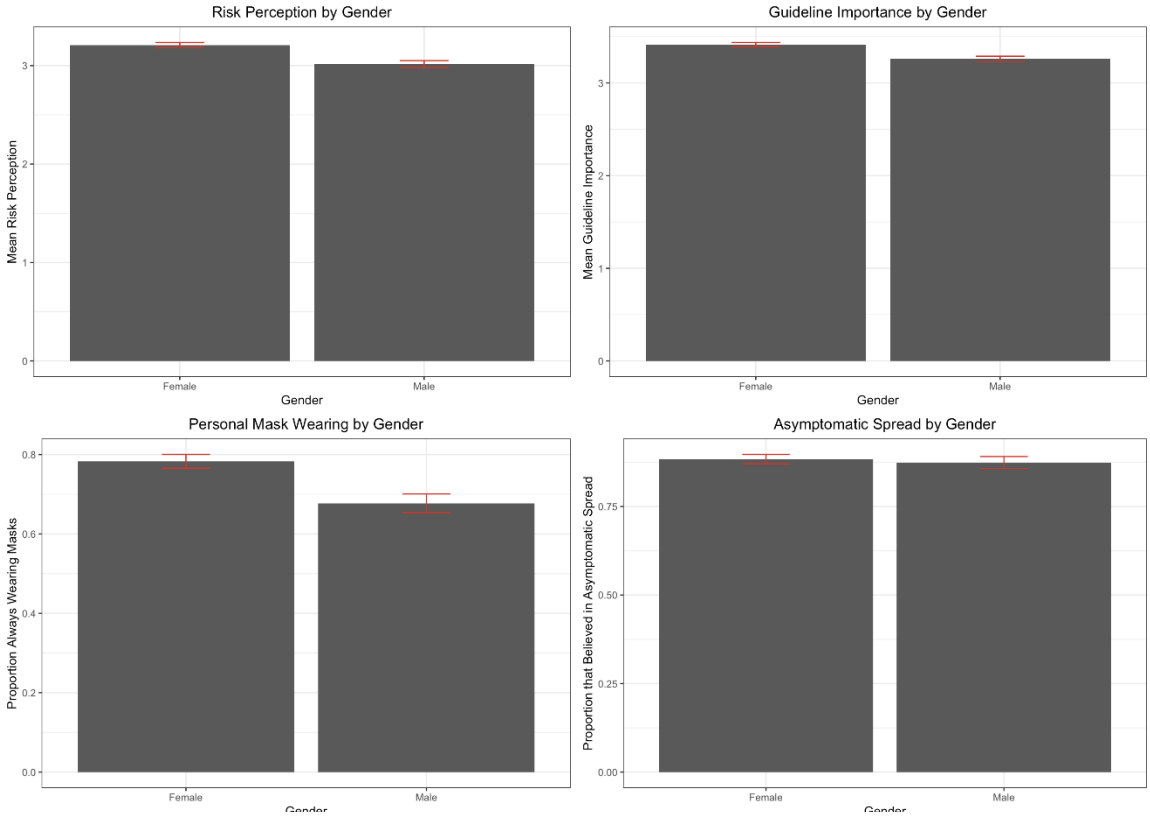

Figure 6. Differences between males and females in perceived risk (top left), guideline importance (top right), likelihood of wearing masks at all times in April (bottom left), and likelihood of believing in asymptomatic spread of the disease (bottom right).

Last, age was a minor factor in explaining certain differences, though not in the ways necessarily expected. Specifically, all other things held equal, those who were younger were slightly more likely to endorse social distancing guidelines and to believe in asymptomatic spread (see Figure 7). And age did not predict perceptions of risk. Although these results control for at-risk status, it is still notable in that one might have expected older individuals to perceive more direct risk to their own health. There has also been the public perception that younger individuals have taken the pandemic less seriously, but that might be limited to only the youngest portion of our sample (18-29 years old).

4. Income and Education: Two Forms of Vulnerability

Turning to income and education levels, one of our main themes persisted in this more in-depth analysis: different types of vulnerability at the two ends of the socioeconomic spectrum. At the one end, we see that those with higher income and greater education were

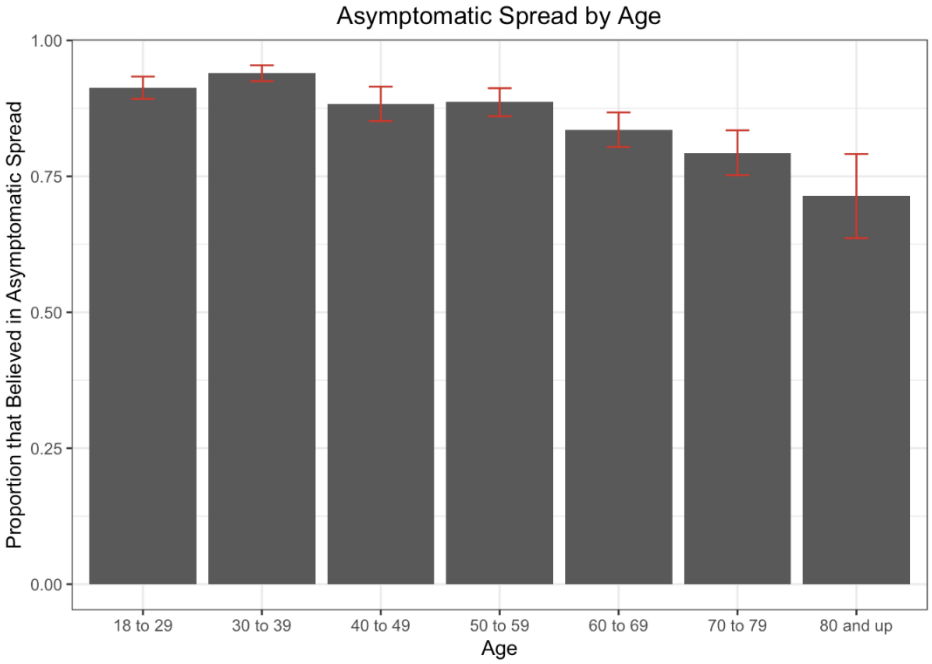

Figure 7. Belief in asymptomatic spread by age bracket.

more aware of asymptomatic spread (see Figure 4 for relationship with income). Note that these were independent effects, meaning that an individual was more likely to believe in asymptomatic spread than someone else with the same income but less education, or the same education level but less income. At the other end of the spectrum, those with lower incomes were more likely to wear masks in public in April. The effect of education was less consistent. We see college graduates wearing masks most often, but those with only some college *or* with a higher degree (i.e., Masters, Doctorate) wore them significantly less often than others. Why this is true for the latter group is unclear. It may be a function of these individuals living in less densely populated neighborhoods, being less concerned because there have been fewer infections in their communities, or some other dynamic.

A second observation from above that the perception of risk and endorsement of guidelines were lowest in some—but not all—more affluent, majority-White neighborhoods, potentially reflecting a vulnerability to containing spread in those communities. The mixed nature of this observation persisted here as neither income nor education were associated with these perceptions, implying that some other set of factors was driving differences across neighborhoods.

In the second report in this series, we highlighted the different vulnerabilities experienced across communities and how these tracked with socioeconomic status. Some

on the higher end of the spectrum were more ambivalent about risk and the importance of guidelines. On the lower end of the spectrum, there appeared to be less understanding about the potential for asymptomatic spread. Here we have confirmed that some of these relationships, namely with the understanding of asymptomatic spread and mask-wearing, were directly associated with income and education. In contrast, it appears that differences in perceptions of risk and the importance of guidelines were a function of other factors, not of income or education themselves. This does not change the fact that communities on different ends of the economic spectrum have different types of vulnerability, but it does help us to understand the mechanisms needed to support each. Whereas we still need to learn more about why some more affluent neighborhoods are ambivalent, policymakers are faced with the challenge of helping those with lower levels of education to understand how COVID-19 can be spread via asymptomatic individuals.

5. Household Characteristics: How Lifestyle Impacts Attitudes

A major aspect of quarantining is who you live with. We have all spent an unprecedented amount of time with our housemates—be they partners, children, roommates, pets, or, for those living alone, one's own company. The results from the survey indicate that who we live with might impact our attitudes toward the pandemic and social distancing.

The most critical aspect of household composition we identified was whether a respondent was married or living with a partner. As shown in Figure 8, those who were living with a partner perceived greater risk, endorsed social distancing guidelines more strongly, were more likely to wear masks in April, and were more aware of asymptomatic spread than their single-living counterparts. We suggest two ways of interpreting these relationships. First, it might be that living with a partner allowed for a pooling of information about the pandemic, deepening understanding of the science and commitment to mitigatory measures. Second, living with a partner might act as a buffer against the stark isolation created by the shutdown, and thus a greater acknowledgment of the risk and solidarity in accepting the necessary social distancing measures.

How many adults and children were living in the house also mattered, though these effects were fewer and less comprehensive in nature. First, those with more adults living in the house were less likely to say they believed that asymptomatic spread was possible. If we treat this question as a function of education about the virus, then it is unclear why someone with more adult housemates would be less knowledgeable, especially because we are accounting for the effects of income and educational attainment noted above. But this

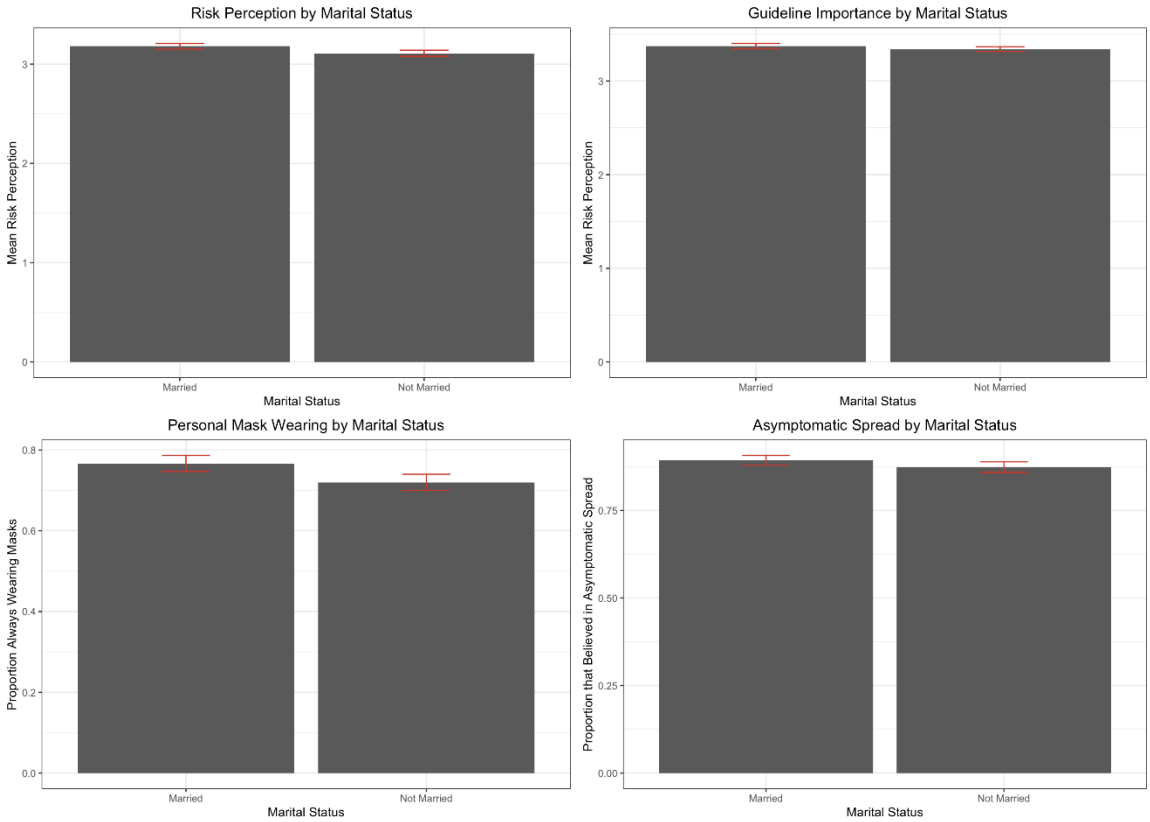

Figure 7. Differences between those who were married or living as such as those who were not in perceived risk (top left), guideline importance (top right), likelihood of wearing masks at all times in April (bottom left), and likelihood of believing in asymptomatic spread of the disease (bottom right).

question might also capture "belief"; even if someone had heard about asymptomatic spread it might be counterintuitive to a lay understanding of germ theory. With that in mind, those living with multiple other adults could find the idea of asymptomatic spread hard to conceptualize because of the greater amount of immediate and indirect exposure they have through their housemates. It might also be inconvenient to a lifestyle they cannot easily change, leading them to be less likely to affirm it.

Second, those with fewer children in the house also saw social distancing guidelines as more important. Again, this might then be a factor of attitudes fitting one's lifestyle—those with multiple children may find it difficult to "stay at home as much as possible" or avoid all gatherings, and their attitudes have come to reflect those compromises. It is worth keeping in mind, however, that the difference implied by the analysis is a fraction of a point per child on our 4-point scale. The practical upshot is that those with multiple children were more likely to respond that guidelines were "very" rather than "extremely" important.

Social distancing has been treated as a one-size-fits-all set of prescriptions for behavior and activities. We noted in the first report in this series[4] that this has equity implications. People of certain ethnic and socioeconomic backgrounds are less able to stay home and avoid exposure to people outside of their households. Here we see a similar-but-less-discussed dynamic regarding household structure. Living with a partner appears to be a protective factor that enables individuals to better understand the seriousness of the pandemic and operate accordingly. Meanwhile, living alone or having more adults and children in the house might lead to a greater acceptance of trade-offs between safety and activities that they deem necessary, either for basic needs or for mental health.

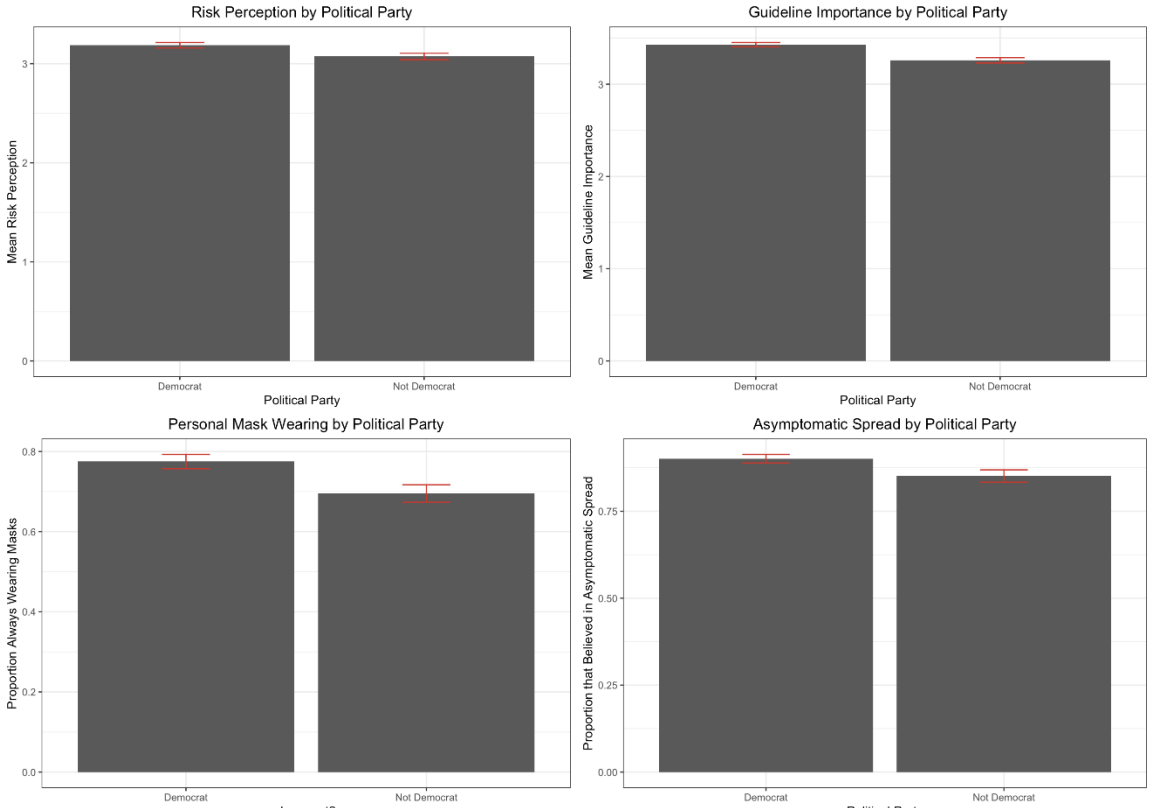

Figure 8. Differences between those identifying as Democrat or liberal and those who did not in perceived risk (top left), guideline importance (top right), likelihood of wearing masks at all times in April (bottom left), and likelihood of believing in asymptomatic spread of the disease (bottom right).

[4] https://cssh.northeastern.edu/bari/wp-content/uploads/sites/30/2020/12/Report-1-Inequities-in-Navigating-a-Pandemic-6.pdf

6. Political Polarization of the Pandemic Exists within Boston, Too

There has been a national debate about the severity of COVID-19 and the necessity for social distancing guidelines, masks, and other precautions. This debate has largely conformed to the country's existing ideological divides, with liberals and Democrats arguing for greater precautions and conservatives and Republicans questioning their value. Our survey finds that the same polarization is present in Boston.

Consistent with Boston's heavily liberal tilt, the majority of respondents identified as Democrat, with 43% identifying as Independent, Republican, or "something else". As shown in Figure 9, there was a sharp divergence in attitudes when we divide the data in this way: non-Democrats saw guidelines as less important, were less likely to wear masks, and less likely to believe in asymptomatic spread. Importantly, these relationships were true when accounting for age, ethnicity, family structure, and other features described in this report, meaning they were unique to the political ideology of the respondent. These effects were substantial, similar in size to the effects we saw for sex, income, and education on various outcomes, and almost as strong as being at high risk for infection.

On the one hand, this result may come as little surprise. Still, there are three lessons worth noting. The first is that the political polarization of the pandemic has permeated even in highly liberal Boston. The second is that these effects are not a byproduct of some other set of personal characteristics, like age or ethnicity, but appear to be specific to political ideology itself. Third is the magnitude of these effects. The effects of being an independent or conservative on beliefs and behavior were nearly as impactful as socioeconomic status and even being at high risk for a severe COVID infection.

7. Cultural Context Still Matters: The Impacts of Ethnicity and Geography Persist

We began this report by describing initial differences in attitudes by ethnicity and by neighborhood we reported in our second report. We then conducted a series of analyses that examined whether these differences might be attributed to other factors that might have a more direct role in shaping knowledge and attitudes—income, education, age, sex, at-risk status, and household composition. Even then, we continue to see considerable variation by race and by neighborhood.

Beginning with race, we see multiple noteworthy remaining relationships after accounting for other factors. In fact, nearly all relationships described above and depicted in Figure 2 remained. Asian and Black respondents continued to be more likely to endorse

the importance of social distancing guidelines and to wear masks. Black respondents also tended to perceive greater risk. This may reflect greater cultural sensitivities in each of these groups, especially arising from the higher infection rates in Black communities. Meanwhile, Latinx respondents continued to be less likely to believe in asymptomatic spread, even when taking education level, income, and household structure into account. This might reflect difficulties in multilingual communication of the unorthodox nature of COVID-19's patterns of transmission, calling for improved public messaging.

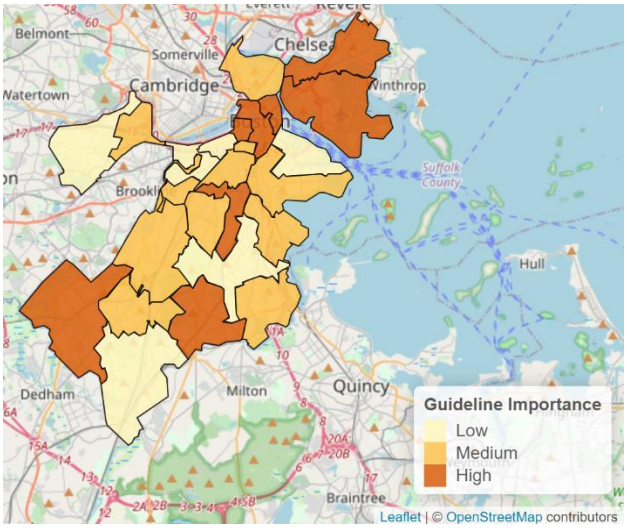

Figure 10. Differences between neighborhoods on endorsement of social distancing guidelines after controlling for

In addition, geographic variation persisted for attitudes toward social distancing guidelines. However, as we see in Figure 10, the maps have changed somewhat. Whereas residents of the Seaport were still some of the least like to be proponents of the guidelines and residents of East Boston, Mattapan, and Roxbury were still some of the most supportive, other places stand out that did not before. Most notably, residents of Downtown neighborhoods were more positive about guidelines than their personal characteristics would otherwise suggest. Meanwhile, the opposite was true of the neighborhoods just to the west—Back Bay, Fenway-Kenmore, and Mission Hill.

In contrast, neighborhood differences in whether respondents perceived risk, wore masks in April, or believed in asymptomatic spread were no longer present once we accounted for all the other factors. In other words, what we previously observed as some neighborhoods being higher or lower on these measures was primarily a function of the different types of individuals and households that reside in each.

8. Conclusion

We began this report with a series of ethnic and geographic differences in attitudes toward infection and social distancing, habits of mask-wearing, and understanding of asymptomatic spread. We have since articulated a variety of other crucial factors in determining how Bostonians are reacting to the pandemic. Age, sex, being at-risk for infection, marital status, number of adults and children in the house, and political ideology

were all influential. At the same time, certain differences by ethnicity and neighborhood persist. These insights provide us greater facility to support and meet the needs of individuals and communities as the second wave continues into 2021.

Appendix A. NSF Beacon Survey Methodology

The NSF-Beacon survey is a collaboration of the Boston Area Research Initiative (BARI) at Northeastern University, the Center for Survey Research (CSR) at University of Massachusetts Boston, and the Boston Public Health Commission (BPHC), funded by the National Science Foundation's Human-Environment and Geographical Sciences (HEGS) program through a grant for rapid-response research (RAPID) for collecting ephemeral data during or following a crisis. The survey captures the experiences of 1370 Bostonians during the first months of the COVID-19 pandemic, including ability and tendency to follow social distancing recommendations, attitudes towards regulations, and economic and personal impacts of the pandemic. The design allows for a unique observation of neighborhood-level estimates for these factors.

I. Sample Design and Final Sample

The NSF-Beacon survey used a stratified random sample that divided the city of Boston into 25 distinct neighborhoods. The neighborhoods were defined in collaboration with members of the Mayor's Office and other experts based on social, demographic, and historical salience. They were constructed to conform to census block group boundaries, meaning that metrics associated with census geographies (including from the U.S. Census Bureau) could be linked with the data. The Marketing Systems Group (MSG) was contracted to draw a simple random sample of residential addresses from within each neighborhood. They used the most recent United States Postal Service Computerized Delivery Sequence File (CDSF) to draw Address-Based Samples (ABS) of residential addresses. Four neighborhoods with a higher proportion of Black or Latinx populations were oversampled (Hyde Park, Mattapan, Lower Roxbury, and East Boston-Eagle Hill). As shown in Table 1, there were unbalanced sample sizes and selection probabilities across neighborhoods, meaning analysis of the data requires survey weights to correct for these differences. In addition to the survey being administered to the sample obtained for the NSF-Beacon study, we also invited participants in the previously-constructed Beacon panel, which had been recruited using the same 25 neighborhood stratified sample design.

II. Data Collection Methodology

Paper copies of the survey, plus instructions for completing and returning, and a $2 cash incentive were mailed to all sampled addresses. For three neighborhoods known to have higher percentages of Hispanic households, the materials mailed, including the survey instrument, were in both English and Spanish. All recipients were also given the option of completing the survey online and an associated URL. A randomly assigned half of the mailed questionnaires had instructions for the oldest adult 18+ in the household to complete the survey while the other random half had instructions for the youngest adult 18+ to complete the survey. In this manner,

an attempt was made to randomize the age of the respondent within the household completing the survey. Approximately two weeks after the initial mailing of materials, a second mailing was sent to nonrespondents, though with no additional incentive.

Table 1. NSF-Survey neighborhood sampling specifications

Neighborhood	# of Sampled Addresses	Prob. of Selection	# of Completed Surveys	Response Rate[1]
Allston	192	0.01702	51	28.81%
Back Bay	194	0.01871	53	31.36
Beacon Hill	204	0.03593	53	30.11
Brighton	187	0.00839	58	31.87
Central	198	0.06119	50	27.78
Central Northeast	196	0.02839	58	33.14
Central West	200	0.01665	55	32.35
Charlestown	190	0.02286	62	34.25
Dorchester Central	189	0.01042	39	21.08
Dorchester North	188	0.02661	42	23.86
Dorchester South	191	0.01671	60	32.97
East Boston	189	0.02501	43	24.29
East Boston-Eagle Hill	355	0.04189	93	27.84
Fenway/Kenmore	195	0.01169	39	21.91
Hyde Park	364	0.02967	59	17.10
Jamaica Plain	188	0.01138	71	39.66
Jamaica Plain-Mission Hill	191	0.02737	55	30.73
Lower Roxbury	372	0.05977	57	17.59
Mattapan	362	0.02704	61	17.58
Roslindale	188	0.01820	73	40.11
Roxbury	188	0.01511	37	20.67
Seaport	192	0.04554	40	22.47
South Boston	191	0.01150	45	24.86
South End	188	0.01070	57	32.02
West Roxbury	189	0.01407	59	32.24
Total	**5481**		**1370**	**26.88%**

[1] Response rates computed using AAPOR Method 3.

III. Data Collection Results

The final sample included 1370 completed surveys (1208 paper, 162 online; 30 were completed in Spanish). The number of completed surveys ranged from 37 in Roxbury to 93 in East Boston-Eagle Hill. Overall response rate was 26.88% and ranged from a low of 17.10% in Hyde Park to a high of 40.11% in Roslindale. Full details on each neighborhood sample are presented in Table 1. An additional 256 completed surveys were obtained from members of the previously-constructed Beacon panel, bringing the total number of completed surveys to 1626.

IV. Weighting of survey data

The sample requires weighting to account for both differing probabilities of selection and response rates across neighborhoods, especially insofar as these differences create a sample that is demographically and geographically non-representative. We created two survey weights, one for sample design factors including probability of selection and number of adults in the household adjusted for nonresponse bias across neighborhoods, the other which adds a post-stratified weight to account for demographic non-representativeness. Additionally, we conducted this process twice. First, we did it only for respondents to the NSF-Beacon survey. Second, we replicated the procedures for the dataset that combined the NSF-Beacon survey responses with respondents from the previously-constructed Beacon panel (values reported in Table 2 for weighting are highly similar for the NSF-Beacon responses alone and the merged data set).

Weights for Nonresponse Bias

Weighting for nonresponse began by neighborhood with the inverse of the probabilities of selection adjusted for the response rates displayed by neighborhood according to the equation (see Table 1 for values):

W_b = (Inverse of probability of selection) / (neighborhood response rate)

The final nonresponse adjusted weight further multiplies the base weight by the number of adults 18+ in the household (capped at 4 to prevent excessively large weights). Finally, these weights are adjusted so that the percentage of the total 18+ population in Boston that belongs in each neighborhood agreed with control percentages computed from the 2014-2018 5-year American Community Survey (ACS) data from the Census Bureau. These weights sum to the ACS estimate of the total 18+ population in the city of Boston. Therefore, the final nonresponse adjusted weight can be defined as:

$W_{NR} = (W_b)$(number of adults in household)(ACS population adjustment factor)

Post-Stratified Weights

As shown in Table 2, even after nonresponse weights, the respondents to the survey were not demographically representative of Boston's population. Most notably, people with education beyond 4-year college degrees were overrepresented and those with a high school education or less were underrepresented. Women were also overrepresented relative to men and White non-Hispanics were overrepresented relative to Blacks and Hispanics. There was also a smaller age bias with too many 65+ people and too few 18-34. A final adjustment to the survey weights was implemented to adjust for differential survey nonresponse by age, gender, race/Hispanic origin, and education. Control percentages for these categories were computed from the 2014-2018 5-year ACS data. Post-stratification factors were then computed to match weighted survey data to citywide percentages. The final post-stratified weight can be expressed as:

$W_{PS} = (W_{NR})$(post-stratified factors)

It should be noted, though, that a small amount of trimming of weights, less than one percent of all sample cases, was employed to prevent some extreme values in the post-stratified weights. As shown in Table 2, this additional adjustment process brought the weighted survey estimates much more in line with ACS citywide estimates.

Table 2. Comparison of ACS controls to nonresponse and post-stratified weights

	ACS	Nonresponse	Post-stratified
Age			
18-34	46.90%	38.40%	46.20%
35-49	21.3	20.1	21.5
50-64	18.4	22.1	18.6
65+	13.4	19.4	13.7
Gender			
Male	47.60%	38.00%	47.60%
Female	52.4	62	52.4
Education			
High School including GED or less	33.60%	16.40%	32.50%
Some college including 2-year degree	17.8	14.8	18
4-year college degree	26.5	29.3	27
Beyond 4-year college degree	22.1	39.5	22.5
Race/Hispanic origin			
White non-Hispanic	49.40%	57.50%	49.40%
Black non-Hispanic	20.6	15.8	20.6
Hispanic	16.9	12.4	16.9
Other	13.1	14.3	13.1