The impact of broadening COVID-19 testing eligibility on communities of color – A lesson for overcoming structural barriers to health care

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ABSTRACT

CDC guidelines for COVID-19 testing in March 2020 did not prioritize underserved communities. We present the effect that expanding COVID-19 testing had for residents of the predominantly Hispanic city of Chelsea, MA, which had the highest case rate in the state. Results were compared to another city with similar demographics, Lynn, MA, where testing eligibility remained unchanged. Institutional data were used to identify outpatient visits for influenza-like illness or COVID-19 exposure, COVID-19 tests, and hospitalizations for confirmed COVID-19 between 3/30/2020–4/28/2020. Multivariable logistic regressions were used to compare outcomes before and after the change in testing eligibility occurred on 4/13/2020. A total of 3,060 patients were included, 1,374 Chelsea residents and 1,686 Lynn residents. After guidelines changed, Chelsea residents were more likely to present as outpatients (adjusted odds ratio [AOR] 4.2, p < 0.001) and less likely to be hospitalized (AOR 0.2, p < 0.001). They were more likely to be tested (AOR 8.8, p < 0.001), but less likely to test positive (AOR 0.6, p = 0.05). Lynn residents were also more likely to be tested after 4/13/2020 (AOR 1.9, p < 0.001), but no significant differences in visit acuity or test positivity were observed. This study demonstrates how broadening testing eligibility for one highly affected, predominantly Hispanic community was associated with an increase in outpatient presentations and a concomitant decrease in test positivity and hospitalizations. These results highlight the impact of improved access to care on utilization of services among underserved communities, a lesson that is especially crucial as we continue to grapple with the COVID pandemic.

1. Introduction

In a statement published in April 2021, the Centers for Disease Control and Prevention (CDC) highlighted the negative and disparate influence that structural barriers to care have on the social determinants of health that affect racial and ethnic minorities. (Statement, 2021) The specific impact of these structural barriers during the COVID-19 pandemic has been well described. (Azar et al., 2020; Munoz-Price et al., 2020) In addition to being over-represented among essential workers and living in multi-family homes located in high-density neighborhoods, Black, Indigenous, and People of Color (BIPOC) face significant barriers to health care access associated with fundamental social determinants of health such as language, health literacy, and socioeconomic status. (Flash et al., 2020) By late March 2020 it became clear that several predominantly Black and Hispanic neighborhoods in Massachusetts were disproportionately experiencing rapidly increasing COVID-19 case rates. (Coronavirus, 2020)

National guidelines issued by the CDC on March 24, 2020 prioritized COVID-19 testing for hospitalized patients and symptomatic healthcare workers (Priority 1), followed by symptomatic first responders, patients older than 65, and those with underlying conditions or living in long-term care facilities (Priority 2). (Interim Guidance, 2021) The CDC additionally recommended that communities surrounding hospitals with rapidly increasing case numbers also be tested as resources allowed (Priority 3), but it did not specifically prioritize underserved communities. (Interim Guidance, 2021) By early April 2020, the predominantly
Hispanic city of Chelsea, MA (population 39,992; 21% non-Hispanic White, 5% non-Hispanic Black, 67% Hispanic; median household income $56,802) (U.S. Census Bureau - ACS Demographic and Housing Estimates, 2019) had emerged as the most affected city out of 351 in the state, with a per capita infection rate of 1,890 per 100,000 residents. (Archive of COVID-19 Weekly Public Health Reports, 2021)

As COVID-19 related hospitalizations among Chelsea residents rapidly increased, our health system’s leadership decided to initiate CDC Priority 3 guidelines and began testing symptomatic Chelsea residents regardless of age, comorbidities, or living setting. This policy went into effect on Monday April 13, 2020, and was announced broadly, including during the city’s weekly coronavirus update broadcasted via Facebook live. (City of Chelsea Massachusetts, 2021) While still struggling to ramp up testing capacity overall, eligibility criteria remained unchanged for another city within our catchment area, Lynn, MA (population 93,743; 36% non-Hispanic White, 11% non-Hispanic Black, 43% Hispanic; median household income $56,181) (U.S. Census Bureau - ACS Demographic and Housing Estimates, 2019), which had also experienced an increase in COVID-19 cases around that time, making it the 12th most affected city in the state. (Archive of COVID-19 Weekly Public Health Reports, 2021) While several public health interventions were implemented at the state and local levels in both cities, testing criteria were expanded for the city of Chelsea only. We sought to study the impact this policy had, beyond testing rates themselves, on the rates of outpatient presentations, hospitalizations, and test positivity among residents of the city of Chelsea and compared these to data for the city of Lynn. We hypothesized that after the change in guidelines, not only would patients from the city of Chelsea be more likely to be tested (in accordance with the expanding testing eligibility criteria) but they would be more likely to present for evaluation early in their disease with milder symptoms, thus leading to a lower proportion of them testing positive and/or requiring hospitalization for severe illness.

2. Methods

2.1. Study design

This project was designed as a retrospective cohort analysis, studying the outcomes of residents of the city of Chelsea(before and after the change in testing eligibility criteria were implemented) and comparing these results to data for residents of the city of Lynn. The reason for this choice of comparator was multifaceted. First, both cities have a high proportion of non-White residents with similarly low median household income (Lynn: 36% non-Hispanic White, 11% non-Hispanic Black, 43% Hispanic – median household income $56,181; Chelsea: 21% non-Hispanic White, 5% non-Hispanic Black, 67% Hispanic – median household income $56,802) (U.S. Census Bureau - ACS Demographic and Housing Estimates, 2019). Second, our health system’s presence within each city is similar, as demonstrated by a comparison of state data with our system’s data that revealed a capture rate of COVID-19 positive individuals diagnosed by April 14, 2020 of 46.9% and 54.1% for the cities of Chelsea and Lynn, respectively. During the study period, testing was available locally to residents of the city of Chelsea at one of our health system’s community health centers located there, which offers both ambulatory and urgent care services. Local testing for Lynn residents was available at one of our health system’s community Hospitals located next door in the city of Salem, MA (Fig. 1). Lastly, and most importantly, although both cities introduced a host of public health measures to address the ongoing pandemic, the change in our health system’s testing guidelines was implemented in Chelsea only and not in the city of Lynn, which is located 4 miles away (Fig. 1). This differential change in testing eligibility was primarily due to ongoing limitations in testing availability, prompting the need to prioritize resource allocation to the area most severely affected first (i.e., Chelsea). This study was approved by the Mass General Brigham Institutional Review Board.

2.2. Data source and cohort identification

Unique encounters for influenza-like illness or COVID-19 exposure taking place between March 30, 2020 and April 28, 2020 were extracted from our institution’s Enterprise Data Warehouse and classified as either non-acute outpatient, acute outpatient, and hospitalizations. Information on patient demographics, diagnoses, and prior immunizations was also extracted. Socioeconomic status was ascertained using the Social Vulnerability Index (SVI), which is a measure of social need at the census tract level created and maintained by the CDC, (CDC’s Social Vulnerability Index (SVI), 2021) with higher SVI values indicating higher need. Patient comorbidities were quantified using the Charlson Comorbidity Index (CCI). (Charlson et al., 1987; Sundararajan et al., 2004) Whether the patient had received the flu vaccine in 2019/20 was used as a surrogate marker for previous access to preventive services.

Outpatient encounters were defined as those where > 60% of diagnosis codes recorded were for influenza-like illness symptoms (Supplementary Table 1) as well as those containing the ICD-10 codes for COVID-19 exposure (Z20.822 and Z20.828). These encounters were further classified as acute if they led to an inpatient admission within the following 24 hours, and non-acute if they did not. Outpatient encounters for confirmed COVID-19 (ICD-10 code U07.1 or a positive PCR result prior to the visit) were excluded from the outpatient classification, as well as those preceded by an inpatient admission within the previous two weeks or those for women who gave birth within the following four weeks. These exclusion criteria were selected to carefully separate outpatient encounters for patients newly seeking evaluation for non-acute COVID-19-related symptoms or exposures, from those seeking evaluation for worsening symptoms of known COVID-19, or due to previous or upcoming (in the case of pregnant women) non-COVID-19-related hospitalizations. Outpatient COVID-19 tests were defined as those sent during a non-acute outpatient encounter. Hospitalizations were defined as inpatient encounters for confirmed COVID-19 as determined by ICD-10 code U07.1, or a positive PCR test prior to or during the encounter. Only the first encounter per patient was included.

2.3. Outcomes

The outcomes of our study were visit acuity (i.e. non-acute outpatient vs acute outpatient vs hospitalizations), likelihood of receiving an outpatient COVID-19 test, and test positivity, before and after the changes in testing eligibility criteria were enacted for residents of the city of Chelsea on April 13, 2020. These outcomes were compared to
data for residents of the city of Lynn to account for time-related and/or state-wide trends.

2.4. Statistical analysis

Univariate statistics were obtained using Student’s T-test for continuous data and Pearson’s chi square for categorical data. Multivariable analysis was performed using standard logistic regression. All tests were two-tailed, with a P value < 0.05 considered statistically significant. Per capita rates (i.e., per 100,000 residents) (U.S. Census Bureau - ACS Demographic and Housing Estimates, 2019) were calculated for graphing purposes. This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. (STROBE Statement, 2021) All statistical analyses were performed using the Stata software package (version 15.1; StataCorp LP, College Station, TX, USA). (StataCorp., 2017)

3. Results

A total of 3,060 patients were included in this study, 1,374 Chelsea residents and 1,686 Lynn residents (Table 1). Among Chelsea residents, patients who presented prior to April 13, 2020 were older (46.8 vs 43.0 years, p < 0.001) than those who presented after that date. Compared to patients who presented prior to April 13, 2020, Chelsea residents presenting prior to that date had more comorbidities (CCI 1.8 vs 1.1, p < 0.001), and a higher proportion of them had Medicare insurance (16.3% vs 8.9%, p < 0.001), DM (20.6% vs 12.8%, p < 0.001), HTN (27.1% vs 16.5%, p < 0.001), DL (23.3% vs 14.9%, p < 0.001), and COPD (29.5% vs 18.3%, p < 0.001). Lastly, more patients who presented prior to April 13, 2020 had received their flu vaccine in the previous year (48.2% vs 28.3%, p < 0.001). There were no significant differences between residents of the city of Lynn who presented for evaluation prior to and after April 13, 2020 (Table 1).

### Table 1

Patient characteristics.

|                      | City of Chelsea (N = 1,374) | City of Lynn (N = 1,686) |
|----------------------|-----------------------------|--------------------------|
|                      | Before                      | After                     | Before                      | After                     |
|                      | N = 369                     | N = 1,005                 | N = 760                     | N = 926                   |
| **Age, mean years (95% CI)** | 46.8 (45.2-48.5)            | 43.0 (42.1-43.9)          | 48.8 (47.5-50.0)            | 48.6 (47.5-49.7)          |
| **Sex, n (%)**       |                             |                           |                             |                           |
| Men                  | 167 (45.3)                  | 494 (49.2)                | >0.1                        | 340 (44.7)                | 414 (44.7)                |
| Women                | 202 (54.7)                  | 511 (50.9)                | >0.1                        | 420 (55.3)                | 512 (55.3)                |
| **Race, n (%)**      |                             |                           |                             |                           |
| White                | 41 (11.1)                   | 117 (11.8)                | >0.1                        | 286 (37.7)                | 328 (35.5)                |
| Black                | 14 (3.8)                    | 36 (3.6)                  | >0.1                        | 86 (11.3)                 | 104 (11.2)                |
| Hispanic             | 305 (82.9)                  | 821 (82.9)                | >0.1                        | 356 (46.9)                | 455 (49.2)                |
| Asian                | <10 (1)                     | <10 (1)                   |                             | 29 (3.8)                  | 36 (3.9)                  |
| **Insurance, n (%)** |                             |                           |                             |                           |
| Private Insurance    | 111 (31.0)                  | 311 (31.0)                | <0.001                      | 294 (38.7)                | 330 (35.6)                |
| Medicare             | 60 (16.3)                   | 89 (8.9)                  |                             | 149 (19.6)                | 198 (21.4)                |
| Medicaid/ConnectorCare | 159 (43.1)          | 409 (40.7)                |                             | 253 (33.3)                | 312 (33.7)                |
| Other                | 39 (10.6)                   | 196 (19.5)                |                             | 64 (8.4)                  | 86 (9.3)                  |
| **Social Vulnerability Index, mean (95% CI)** | 0.86 (0.85-0.87) | 0.87 (0.87-0.88) | >0.1                        | 0.73 (0.71-0.75)          | 0.73 (0.71-0.75)          |
| **Charlson Comorbidity Index, mean (95% CI)** | 1.8 (1.5-2.1) | 1.1 (1.0-1.2) | <0.001                      | 2.3 (2.1-2.5)             | 2.4 (2.2-2.6)             |
| **Tobacco use, n (%)** |                             |                           |                             |                           |
| Never                | 253 (69.5)                  | 675 (73.5)                | 0.06                        | 448 (59.3)                | 580 (63.4)                |
| Former               | 66 (18.1)                   | 119 (13.0)                |                             | 159 (21.1)                | 163 (17.8)                |
| Current              | 45 (12.4)                   | 125 (13.6)                |                             | 148 (19.6)                | 172 (18.8)                |
| Diabetes Mellitus, n (%) | 76 (20.6)                 | 129 (12.8)                | <0.001                      | 156 (20.5)                | 179 (19.3)                |
| Hypertension, n (%)  | 100 (27.1)                  | 166 (16.5)                | <0.001                      | 275 (36.2)                | 316 (34.1)                |
| Dyslipidemia, n (%)  | 86 (23.3)                   | 150 (14.9)                | <0.001                      | 236 (31.1)                | 266 (28.7)                |
| Chronic obstructive pulmonary disease, n (%) | 109 (29.5)            | 184 (18.3)                | <0.001                      | 281 (37.0)                | 329 (35.5)                |
| Received Flu vaccine in 2019/2020, n (%) | 178 (48.2)            | 284 (28.3)                | <0.001                      | 292 (38.4)                | 335 (36.2)                |

3.1. Unadjusted analysis

The proportion of Chelsea residents who presented as non-acute outpatients increased from 76.4% prior to April 13, 2020, to 92.6% after, with a corresponding decrease in hospitalizations from 18.4% to 5.4% (p < 0.001). No such change was observed among Lynn residents (Table 2, Fig. 2). Among Chelsea residents presenting as non-acute outpatients, the rate of COVID-19 testing increased from 46.1% to 89.3% (p < 0.001). Lynn residents also experienced an increase, albeit lower in magnitude, in non-acute outpatient COVID-19 testing from 46.4% to 61.7% (p < 0.001; Table 2, Fig. 3). Prior to April 13, 2020, 63.1% of non-acute outpatient COVID-19 tests sent among Chelsea residents were positive, and this proportion decreased to 55.2% after (p < 0.001). There was no change in the proportion of positive tests among Lynn residents (Table 2).

### Table 2

Unadjusted Outcomes.

|                      | City of Chelsea (N = 1,374) | City of Lynn (N = 1,686) |
|----------------------|-----------------------------|--------------------------|
|                      | Before                      | After                     | Before                      | After                     |
|                      | N = 369                     | N = 1,005                 | N = 760                     | N = 926                   |
| **Presentation acuity, n (%)** |                             |                           |                             |                           |
| Outpatient non-acute | 282 (63.1)                  | 86 (23.3)                 | <0.001                      | 292 (38.4)                | 89.3 (89.3)               |
| Outpatient acute     | 19 (4.3)                    | 38 (11.1)                 |                             | 198 (21.4)                | 316 (34.1)                |
| (admission within 24 hrs) | 130 (29.5)                | 109 (29.5)                | <0.001                      | 236 (31.1)                | 266 (28.7)                |
| **Outpatient non-acute test positive, n (%)** |                             |                           |                             |                           |
| Before               | 131 (28.8)                  | 224 (15.1)                |                             | 131 (28.8)                | 224 (15.1)                |
| After                | 292 (38.4)                  | 335 (36.2)                |                             | 236 (31.1)                | 266 (28.7)                |

Fig. 3. Prior to April 13, 2020, 63.1% of non-acute outpatient COVID-19 tests sent among Chelsea residents were positive, and this proportion decreased to 55.2% after (p < 0.001). There was no change in the proportion of positive tests among Lynn residents (Table 2).
3.2. Adjusted analysis

Multivariable logistic regressions adjusting for patient age, sex, race, primary insurance, SVI, CCI, smoking status, DM, HTN, DL, COPD, and whether they had received the flu vaccine the year prior, revealed Chelsea residents were greater than four times more likely to present as non-acute outpatients (adjusted odds ratio [AOR] 4.2, 95% CI 2.8 – 6.4, \( p < 0.001 \)) and 80% less likely to require immediate hospitalization (AOR 0.2, 95% CI 0.1 – 0.4, \( p < 0.001 \)) after the change in testing eligibility criteria was implemented on April 13, 2020 compared to prior (Table 3). Moreover, they were almost nine times more likely to be tested for COVID-19 (AOR 8.8, 95% CI 6.2 – 12.3, \( p = 0.05 \)). On the other hand, there was no difference in the visit acuity or test positivity rates among Lynn residents presenting before and after April 13, 2020, although they were twice more likely to have a non-acute outpatient COVID-19 test sent (AOR 1.9, 95% CI 1.5 – 2.5, \( p < 0.001 \)).

3.3. Missing data

The only variables with missing data were race (0.6%), SVI (3.5%), and tobacco use (3.5%). They were considered missing completely at random (MCAR), therefore patients with missing data in these variables were included in the overall study but allowed to be excluded automatically by the statistical software from adjusted analyses.

3.4. Discussion

This study demonstrates the immediate increase in non-acute outpatient presentations for COVID-19-related symptoms or exposures among the predominantly Hispanic population of the city of Chelsea, MA after testing eligibility criteria were expanded to include all symptomatic residents regardless of age or other typical risk factors. The observed increase in non-acute outpatient presentations was accompanied by a marked increase in COVID-19 testing along with notable decreases in the rates of test positivity and COVID-19 related hospitalizations. Although the increase in testing was expected, the concomitant increase in non-acute presentations was not, and highlights the close relationship that exists between access to and utilization of health care services by historically underserved populations.

During the study period, both local and state-wide governments, as well as non-profit agencies were rapidly implementing public health measures designed to stop the spread of COVID-19 within underserved communities. (Coronavirus updates, 2020; Promoting equity and community health in the COVID-19 pandemic, 2020; Massachusetts Awarded Over $92 Million in HUD Grants for COVID-19 Relief, 2021; COVID-19 Press Release Archive, 2021) These interventions likely had a positive
impact in both Chelsea and Lynn. However, the sudden changes observed in Chelsea appear to tell a different story. These data suggest that Chelsea residents may indeed have been aware of our health system’s restrictive testing guidelines prior to April 13, 2020 (whether through established information sources or informal ones such as word-of-mouth or social media), and despite having symptoms and/or exposures to COVID-19 did not present for immediate evaluation, instead delaying and ultimately experiencing more severe symptoms. Once the announcement was made that eligibility criteria had been broadened, Chelsea residents promptly presented for testing earlier in the disease course.

The decrease in hospitalization rates among Chelsea residents is noteworthy, and a direct result of the increased number of patients who presented as outpatients early in their disease process, rather than with severe illness (Fig. 2A). Although not captured in our short study period, the expected long term benefits of this increased rate of testing and diagnosis among symptomatic community members cannot be overstated. Increased diagnosis would be expected to lead to better education about quarantining, mask wearing, and social distancing, behavioral changes known to decrease community transmission and hospitalizations. (Subramanian et al., 2021) Importantly, our exclusion of patients who required an inpatient admission within 24 h (i.e. acute outpatients) from the non-acute outpatient classification, means that only individuals with mild enough symptoms to remain in their homes and community would have been included in our analysis of non-acute outpatient visits, further emphasizing the importance of improved detection and education for flattening the infection curve among this severely affected population.

4. Limitations

Our study has several limitations worth noting. While the public health efforts taking place both at the city and state-level during the study period may add a component of unmeasured confounding to our study, the differences between the data from these two cities lends credence to the hypothesis that changes in Lynn were reflective of a more gradual ramping up of testing capacity and community awareness observed elsewhere in the state, while those in Chelsea were more likely related to the immediate change in eligibility criteria implemented by our health system. Another important limitation is the fact that our health system is not the only one with a presence within these two cities, so the possibility that residents presented to other institutions for evaluation, testing, and/or hospitalization exists. Nevertheless, as mentioned above, a comparison of state and our health system’s data revealed our capture rates of COVID-19 positive individuals at that time were 46.9% and 54.1% for the cities of Chelsea and Lynn, respectively, which provides reassurance that the trends observed within our system are likely representative of the overall trends in these two cities.

5. Conclusions

The findings of this study demonstrate the benefit that a small but impactful policy decision to increase access to testing for a predominantly Hispanic community had on their utilization of services, and as a result on their health outcomes. Although this study specifically focuses on access to COVID testing, the findings may apply to other public health initiatives. We believe these data can help guide future policy decisions regarding health care access, especially as we continue to grapple with issues related to vaccination as well as the long term health outcomes of individuals who had COVID-19. Although, the decision to remain unvaccinated may very well be a personal one, we must keep in mind the CDC’s statement published in April 2021 highlighting the role of structural barriers in influencing the social determinants of health that affect the health care choices made by racial/ethnic minorities. (Statement, 2021) Our study demonstrates that improving access can have a positive effect on the choices made by BIPOC communities regarding their health care utilization, and this relationship should not be underestimated.

RediT authorship contribution statement

Numa P. Perez: Conceptualization, Methodology, Software, Formal analysis, Visualization, Writing – original draft, Writing – review & editing. Dean C. Xerras: Data curation, Resources, Writing – original draft, Writing – review & editing. Leslie S. Aldrich: Data curation, Resources, Writing – original draft, Writing – review & editing. Sarah Wilkie: Data curation, Resources, Writing – original draft, Writing – review & editing. Aswita Tan-McGregory: Data curation, Resources, Writing – original draft, Writing – review & editing. Joseph R. Betancourt: Data curation, Resources, Writing – original draft, Writing – review & editing. Peter T. Masiakos: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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