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1 Correlation Between New York City Hot Spotting Policy and Mobility to Reduce COVID-19 Spread

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Study Objective: In October 2020, New York State initiated a micro-cluster strategy ("hot spotting") that divides into three categories based on COVID-19 cases and hospital capacity, each with successively more restrictions: Yellow, Orange, and Red Zones. Our objectives were to evaluate the influence of hot spotting on mobility and subsequent mortality, and then to identify underlying social determinants of health associated with the neighborhoods most affected by hot spotting.

Study Design: We combine several data sources in our analysis. Time-dependent data were obtained from SafeGraph for cellphone mobility at the Census Block Group, New York State Governor's Office for hot spotting, school and indoor dining, and NYC Department of Health and Mental Hygiene (DOHMH) for COVID-19 cases and mortality. Using the DOHMH's "Modified Zip Code Tabulation Areas" (MODZCTA), we matched these to community-level data obtained from 2018 American Community Survey 5-year estimates for population density. Our main outcomes are Average Median Percentage Time Home (AMPTH) and Device-Weighted Average Median Percentage Time Home (DWAMPTH) from SafeGraph Social Distancing Metrics summarized to MODZCTA boundaries. Home is defined as the common nighttime location of each mobile device over a 6-week period to a Geohash-7 granularity (~153m x ~153m). We implemented the Wilcoxon rank-sum test with a <0.05 p-value threshold for each day since hot spotting policy to compare MODZCTA with any of the Zone's designation to those without designation. Our main outcomes are Average Median Percentage Time Home (AMPTH) and Device-Weighted Average Median Percentage Time Home (DWAMPTH) from SafeGraph Social Distancing Metrics summarized to MODZCTA boundaries.

Population Studied: NYC residents from October 5, 2020, to December 31, 2020 (87 days total) using the 177 MODZCTA within NYC as geographic unit of analysis.

Results: For the AMPTH measurement, MODZCTAs with hot spotting Zone's designation had 84 days (95% of the days) with statistically significantly lower mobility than non-intervention MODZCTAs, and for the DWAMPTH measurement, 83 days (97% of the days) had statistically significantly lower mobility. 58 of the days had p-value<0.001 for AMPTH and 49 had p-value<0.001 for DWAMPTH, and only a minority of days had p-value>0.1 (2 days for AMPTH and 3 for DWAMPTH). Looking at individual boroughs, Brooklyn had 42 statistically significant days for AMPTH and 49 for DWAMPTH, while Queens had 12 statistically significant days for AMPTH and 7 for DWAMPTH.

Conclusions: New York State's micro-cluster focus Zones is associated with decreased mobility in high COVID-19 prevalence areas. Our study suggests that shutdowns targeted at small geographic areas may reduce mobility and thus can potentially help control COVID-19 spread.

2 Racial Disparities in Patients Hospitalized for COVID-19: An Observational Cohort Study

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Study Objectives: To study the impact of COVID-19 hospitalizations on patients from differing ethnic and racial groups.

Study Design and Methods: This is an IRB-exempt observational cohort study of de-identified patient data obtained from our central billing system comprising greater than 8.6 million emergency visits annually in over 175 United States hospitals. Inclusion criteria were adults aged 18 years and older, a presentation to one of our hospital emergency departments, and an admission for COVID-19 infection. Outcome variables were length of stay, in-hospital mortality, disease severity, and discharge disposition. Discharge disposition was further categorized into home, skilled nursing facility, hospice. Outcomes were stratified by racial groups: White, Black, Hispanic and Other. Statistical analysis consisted of summary statistics (distributions) with medians and interquartile ranges reported for non-normally distributed variables. Linear regression analyses determined factors predictive of outcome. A p-value of <0.05 was considered statistically significant. All statistical analyses were performed using JMP Pro 14.1 for Windows (R).

Results: The dataset consisted of 45,360 patients. The cohort was 22% Black, 35% Hispanic, 37% White, and 6% Other. The mortality was 15% for all groups. White patients had the highest mortality rate at 17% compared to 10% in Blacks, 14% in Hispanics, and 15% in Other (ANOVA, $p<0.0001$). Whites were significantly older (Wilcoxon rank sum, <0.0001) with a median age of 71 years (IQR 59-80), compared to Blacks with a median age of 60 (IQR 46-71), Hispanics with a median age of 57 (IQR 44-70), and other races with a median age of 61 (IQR 48-73). Race was statistically significant in a multivariable model including age, sex, and race, with women having an odds ratio of 1.35 for survival. 6484 patients required ICU admission and intubation with hemodynamic support. This burden was disproportionate across racial groups, with 15.6% of Blacks and 13.9% of non-Blacks having such critical disease ($P<0.0001$, z-test for proportions). The overall median hospital length of stay (HLOS) for all races was 5 days (IQR 3-11). The median HLOS for all non-Whites was 5 days, whereas for Whites it was 6 days ($p<0.0001$). Whites were significantly less likely to be discharged home ($P<0.001$). A significantly higher proportion of Blacks and Hispanics were on Medicaid compared to Whites ($p<0.0001$).

Conclusion: White patients had a higher mortality rate than non-White patients hospitalized for COVID-19; however, Black and other non-White patients were hospitalized for COVID-19 at a younger age than White patients. Black patients were significantly more likely to require admission to the ICU. These data suggest there is a multifactorial etiology behind the varying impact of COVID-19 on patients. Further examination of other social determinants of health are warranted to fully understand COVID-19 health disparities.

3 MyCOVIDrisk: User Experience Study Of COVID-19 Risk Assessment and Mitigation Application

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Background: MyCOVIDRisk app is a free, publicly available COVID-19 risk estimation and mitigation tool. The MyCOVIDRisk app has since been accessed almost 1.3 million times since launch, demonstrating the acceptability of a free and simple web-based mobile application to estimate risk of COVID-19 transmission. Little is known about how mobile apps influence assessments of risk. User experience ("UX") studies are a key strategy for examining usability and influence of digital technology.

Study Objectives: Our primary objectives were to (1) describe how the app informs interpretation of COVID-19 risk, (2) describe motivations for use and patterns of use, (3) to inform future app design.

Methods: This UX study consisted of two parts. Part 1 focused on new users' experiences, particularly navigation of the user interface across various operating systems and devices. Part 2 focused on repeat users' experiences, particularly how they interpreted risk, what motivated their use of the app, and whether it modified behavior. Participants were recruited remotely via social media advertisements on Facebook, Instagram, and Twitter. To reach existing users, Part 2 additionally included emailing MyCOVIDRisk users who previously sent unsolicited feedback on the app. Study participants were entered into raffles to win one of two $50 Amazon gift codes. For Part 1, users completed a series of tasks during a semi-structured 30-minute video interview using the app while sharing first impressions, likes, and dislikes. Live notes taken tracked common user errors, points of confusion, and other insights. Part 2 consisted of 40-minute semi-structured video interviews with repeat users. Participants shared their personal pandemic experiences, related health decisionmaking processes, and their experience with the MyCOVIDRisk app. Interviews were audio recorded, transcribed, and analyzed to find common themes and subthemes.

Results: Recruitment continued until thematic saturation was reached. Part 1 and Part 2 included 8 and 5 unique participants, respectively. Participants varied in terms of background (age range: 21-73 years), geography, prior use of the app, and goals of usage. Key use cases were as a teaching tool, source of authority and objectivity, and resource for personal decisionmaking (Fig 1). Nearly all pointed to simplicity and ease of use as key design strengths. Repeat users highlighted the interactive nature and ability to change parameters, eg, "when it [MyCOVIDRisk App] came out, I used it you know like a hundred times-like what if I do this or what if I do that? Like almost like a video game!" Challenges included difficulty in estimating number of people present and percent that would be masked, and desire for more complex activities than the prepopulated options. Users nearly unanimously suggested integration of vaccine status as an input parameter. Other common recommendations included more customization options (eg, ability to change font size), having more information when hovering over icons, and options to send inputs and risk score results to others or to print them for documentation.

Conclusion: This UX testing of a COVID-19 risk assessment and mitigation app confirmed key principles for design: clear imagery, interactivity, and interpretable science. Future work should incorporate new data in real-time and improve customizability.

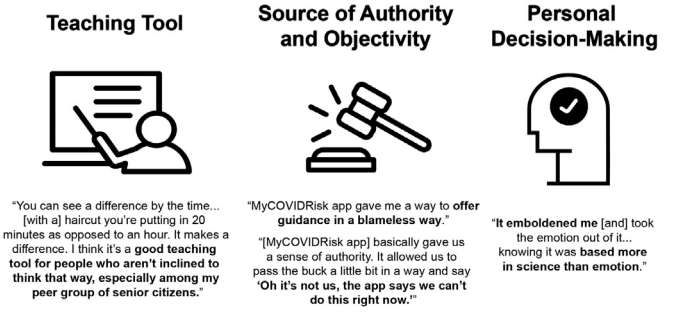

Figure 1. Primary cases for MyCOVIDRisk app based on interview responses from repeat users.

4 Association of the Initial Clinical Characteristics With the Need for the Intensive Care Unit And Hospitalization in Patients Presenting to the Emergency Department With Acute Symptomatic COVID-19

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Study Objective: Acute infection with COVID-19 is associated with a wide variety of symptoms and a range of clinical severity from benign to life-threatening. Certain ED presenting symptoms may be associated with either a severe or a benign outcome. The objective of this study was to evaluate the association of initial clinical symptoms with need for hospitalization, intensive care or death in ED patients within 30 days after presenting with acute symptomatic COVID-19.

Methods: This study is a retrospective case-series of patients presenting to a single ED with acute symptomatic COVID-19 from March 7–August 9, 2020. Symptomatic patients with laboratory-confirmed SARS-CoV-2 infection were eligible for this study. Patients who tested positively for COVID-19 due to screening tests but had no reasonably associated symptoms were excluded. Structured chart review was performed, and participants were analyzed by three categories representative of clinical severity: intensive care unit (ICU) care/death, general ward admission, and ED discharge /convalescence at home. Outcomes were ascertained 30 days after initial presentation to account for escalation in severity after the ED visit. We conducted univariate and multivariable logistic regression analyses to report odds ratios and adjusted odds ratios (aOR) with 95% confidence intervals (95% CI) between hospital or ICU care/death versus convalescence at home and between ICU care/death versus general ward admission. Multivariable models were developed using stepwise selection in logistic regression.

Results: In total, 994 patients were included in the study, of which, 551 (55.4%) patients convalesced at home, 314 (31.6%) patients required general ward admission, and 129 (13.0%) required ICU care or died. In the adjusted models, ED patients requiring hospital admission were more likely to be aged $\geq$ 65 years (aOR 7.4, 95% CI: 5.0, 10.8), Black/African American (aOR 3.0, 95% CI: 1.6, 5.8) or Asian/American Indian/Alaska Native/Other (aOR 2.2, 95% CI: 1.1, 4.3), and experience dyspnea (aOR 2.7, 95% CI: 2.0, 3.7) or diarrhea (aOR 1.6, 95% CI: 1.1, 2.2). However, they were less likely to experience sore throat (aOR 0.4, 95% CI: 0.2, 0.6), myalgia (aOR 0.5, 95% CI: 0.4, 0.7), headache (aOR 0.5, 95% CI: 0.4, 0.8), or olfactory/taste disturbance (aOR 0.5, 95% CI: 0.3, 0.8). ED patients who