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Demographic predictors of nonHDL-C increase during COVID-19 pandemic stay-at-home period

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ABSTRACT

The onset of the coronavirus 2019 (COVID-19) pandemic prompted unique public health measures including stay-at-home (SAH) orders that provoked altered dietary and exercise patterns and may have affected medication access and use. Although these impacts have the potential to influence lipid levels, little is known of the consequences of COVID-19 SAH on objective atherosclerotic cardiovascular disease (ASCVD) risk factors. We performed a patient-level analysis of the primary measure of atherogenic lipid-associated risk, nonHDL-C during the 2020 SAH period and the same time period in 2019, in patients within a large health system in New York City. We found that women and racial and ethnic minority group members were more likely to exhibit substantial worsening of atherogenic lipid profile (≥38 mg/dL increase in nonHDL-C) during this period. Our results suggest that the pandemic and subsequent public health measures may have produced unintended negative consequences on already at-risk groups.

The onset of the coronavirus 2019 (COVID-19) pandemic prompted unique public health measures including stay-at-home (SAH) orders that provoked altered dietary and exercise patterns and may have affected medication access and use.[1,2] Although these impacts have the potential to influence lipid levels, little is known of the consequences of COVID-19 SAH on objective atherosclerotic cardiovascular disease (ASCVD) risk factors. Our objective was to assess changes in the primary measure of atherogenic lipid-associated risk, nonHDL-C,[3] in patients within a large health system in New York City over the strict SAH period enforced early in the COVID-19 pandemic.

Following IRB approval, the electronic medical record was queried to identify all adults with outpatient lipid panels obtained immediately following the strict SAH period in New York City (May 15th - August 31st, 2020; post-SAH) with a corresponding lipid panel in the three months preceding SAH (December 15, 2019 – March 15, 2020; pre-SAH). Age, demographics, medical history, and medications from visits temporally closest to the time of available lab values were extracted. An identical query for the same periods one year prior (May 15 – August 31, 2019; post-2019 and December 15, 2018 – March 15, 2019; pre-2019) served as a reference given known seasonal variation in cholesterol profiles.[4]

Lipid data were available from both pre-SAH and post-SAH for 30,667 patients. Average age was 65.2 ± 13.5 years, 52.0% were female, 8.9% Hispanic and 26.5% non-White. A diagnosis of ASCVD was present in 24.5%, 30.5% of patients had a diagnosis of diabetes and 68.1% were prescribed lipid lowering medication(s) in pre-SAH. Additional lipid panel results from both pre-2019 and post-2019 were available in 15,538 of these patients and they were included in analyses described below.

Average pre-SAH total cholesterol was 174±42 mg/dL and nonHDL-C 120±38 mg/dL, with similar values pre-2019 (175±42 mg/dL and nonHDL-C 122±38 mg/dL, respectively). While mean change in nonHDL-C over SAH (pre-SAH to post-SAH) was modest, there were significant differences between the changes during SAH (+0.9 ± 24.7 mg/dL) and for the same time period in 2019 (−5.0 ± 28.0 mg/dL; $p<0.0001$ by paired t-test). Further, there were large variances within the sample which skewed toward increases during SAH – 55% of the cohort exhibited increases in nonHDL-C during SAH relative to 2019 (Fig.- top).

Simple linear regression analyses found that younger age, a diagnosis of hyperlipidemia, pre-SAH treatment with lipid-lowering agent(s), female sex, non-White race, and Hispanic ethnicity were predictive of increases in nonHDL-C during SAH. These same variables were associated with nonHDL-C increase during SAH relative to the 2019 comparison period. As small changes are likely of limited clinical significance, but

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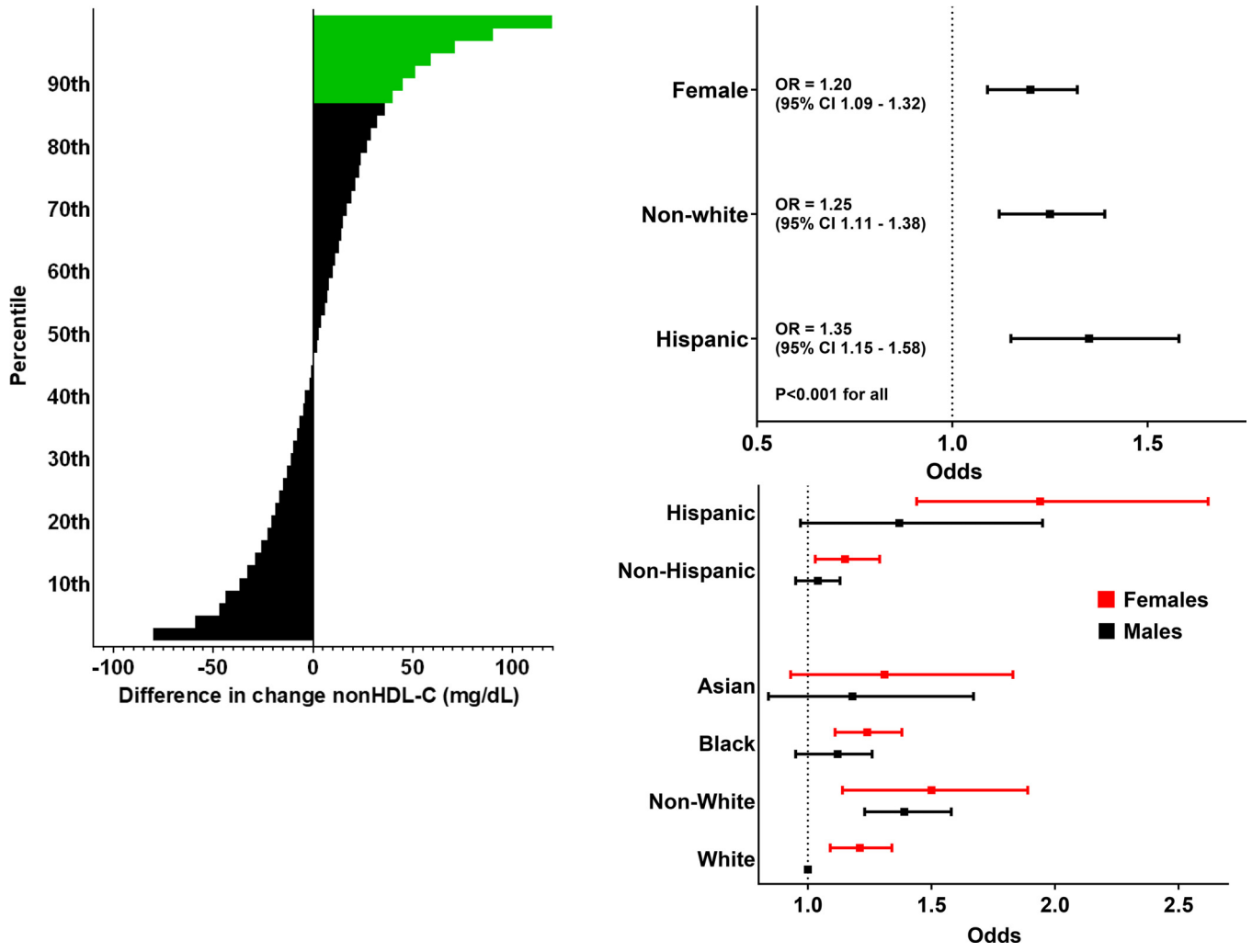

Fig. 1. Comparisons of changes in nonHDL-C during the COVID-19 stay-at-home period with the same period in 2019.
Top. Distribution of patient-level differences between change in nonHDL-C during SAH and the same period in 2019. Green shading identifies portion with ≥38 mg/dL greater increase during SAH vs 2019.
Middle. Multivariable adjusted odds ratios (± 95% CI) for ≥38 mg/dL greater increase in nonHDL-
during SAH relative to the 2019 period.
Bottom. Multivariable adjusted odds ratios (± 95% CI) for ≥38 mg/dL greater increase in nonHDL-C during SAH relative to the 2019 period for individual demographic groups relative to white males.
Regression models adjusted for age, medical history (diagnosis of ASCVD, diabetes, hypertension, hyperlipidemia, tobacco-use), lipid-lowering and anti-depressant medication use and pre-SAH nonHDL-C.

each standard deviation change in circulating atherogenic lipoproteins is associated with a 20 – 30% difference in relative ASCVD risk,[3,5] we focused on individuals with marked increases of non-HDL-C (at least one standard deviation of the population mean, 38 mg/dL) during SAH. After correction for age, medical history (diagnosis of ASCVD, diabetes, hypertension, hyperlipidemia, tobacco-use), lipid-lowering and anti-depressant medication use, and pre-SAH nonHDL-C in logistic regression analyses, female sex (1.42 [1.27 – 1.58]), Hispanic ethnicity (1.36 [1.15 – 1.61]) and non-White race (1.24 [1.10 – 1.40]) portended greater odds of ≥38 mg/dL increase in nonHDL-C during SAH (p<0.001 for all). We investigated variables associated with $a \geq 38$ mg/dL nonHDL-C increase during SAH relative to the same period in 2019 (observed in 13.9% of the sample – green in Fig.- top) and found that they were similar to SAH alone (Fig.- middle). Finally, we determined odds for experiencing ≥38 mg/dL increase in nonHDL-C during SAH vs 2019 using white males as the reference group. These data are presented in Fig.- bottom. Notably, the results were unaltered when restricted to individuals with unchanged lipid-lowering medication prescriptions across the observation periods (n = 13,816).

We performed a patient-level analysis of changes in serum lipids before and after the imposition of COVID-19 pandemic-associated SAH orders and found that women and racial and ethnic minority group members were more likely to exhibit substantial worsening of atherogenic lipid profile during this period. Although the detrimental consequences of substantial increases in nonHDL-C generally require extended periods to manifest, there is evidence that variability in blood cholesterol is independently associated with adverse ASCVD outcomes [6], pointing to the potential importance of the changes we report, even if transient.

There has been a well-recognized disproportionate impact on racial and ethnic minority communities by the COVID-19 pandemic.[7,8] This includes adverse cardiovascular outcomes.[9] While excess morbidity and mortality during the pandemic have afflicted minority groups, negative economic and social repercussions have had an inordinate impact on women as well.[10] Prior to the pandemic, disparities in cardiovascular outcomes in women and racial and ethnic minorities in the United States existed.[11] The results of our study suggest that the pandemic and subsequent public health measures may have produced unintended negative consequences on already at-risk groups – exacerbating dispar-

ities in cardiovascular health and serving to highlight the tenuous position of particular populations. Further research on social determinants of health and the impact of pandemic-related public health interventions[6] is needed to inform policy considerations to enhance the multifaceted recovery from the COVID-19 pandemic and to minimize unforeseen consequences of interventions taken in future public health emergencies.

Author statement

AM and SPH: conceptual development of study; SK and SPH: data analysis and curation; all authors: data acquisition, critical interpretation of analyses, writing and editing of the manuscript.

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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