Racial/Ethnic Disparities in Exposure, Disease Susceptibility, and Clinical Outcomes during COVID-19 Pandemic in National Cohort of Adults, United States

Appendix

Appendix Table 1. Demographic and Socioeconomic Characteristics of the Chasing COVID Cohort (C3) Participants who were Seronegative and Retested - United States, Enrolled from March 28 - April 20, 2020 (N = 3,422)*

| Characteristic | Total | Hispanic | Black NH | Asian/Pacific Islander NH | White NH | Other NH | p value† |
|----------------|-------|----------|----------|---------------------------|----------|----------|----------|
| Total, n (%)   | 3,422 (100.00) | 500 (14.61) | 279 (8.15) | 219 (6.4) | 2,312 (67.56) | 112 (3.28) | <0.001 |
| Age Mean (SD)  | 44 (15.16) | 39.51 (13.13) | 40.5 (12.90) | 33 (13.18) | 46.62 (15.43) | 44.33 (13.57) | <0.001 |
| Median (IQR)   | 42 (32.56) | 37 (30.48) | 37 (30.51) | 33 (26.41) | 45 (34.60) | 43 (35.53) | <0.001 |
| Age Category, n (%) | | | | | | | |
| 18–29          | 617 (18.03) | 120 (24.00) | 57 (20.43) | 84 (38.36) | 342 (14.79) | 14 (12.50) | <0.001 |
| 30–39          | 934 (27.29) | 166 (33.20) | 100 (35.84) | 76 (34.70) | 566 (24.48) | 26 (23.21) | <0.001 |
| 40–49          | 654 (19.11) | 104 (20.80) | 50 (17.92) | 30 (13.70) | 430 (18.60) | 40 (35.71) | <0.001 |
| 50–59          | 514 (15.02) | 82 (16.40) | 40 (14.34) | 11 (5.02) | 430 (18.60) | 40 (35.71) | <0.001 |
| 60+            | 703 (20.54) | 48 (9.60) | 32 (11.47) | 18 (8.22) | 586 (25.35) | 19 (16.96) | <0.001 |
| Sex, n (%)     | | | | | | | |
| M              | 1,516 (44.30) | 219 (43.80) | 124 (44.44) | 88 (38.36) | 1,033 (44.68) | 52 (46.43) | <0.001 |
| F              | 1,810 (52.89) | 267 (53.40) | 112 (40.14) | 128 (58.45) | 1,221 (52.81) | 47 (41.96) | <0.001 |
| Non-Binary     | 96 (2.81) | 14 (2.80) | 8 (2.87) | 3 (1.37) | 58 (2.51) | 13 (11.61) | <0.001 |
| Education, n (%) | | | | | | | |
| Less than 12th grade | 37 (1.08) | 10 (2.00) | 2 (0.72) | 2 (0.91) | 22 (0.95) | 1 (0.89) | <0.001 |
| 12th grade/GED | 278 (8.12) | 71 (14.20) | 33 (11.83) | 6 (2.74) | 155 (6.70) | 13 (11.61) | <0.001 |
| Some college (1–3 y) | 815 (23.82) | 151 (30.20) | 112 (40.14) | 38 (17.35) | 488 (21.11) | 26 (23.21) | <0.001 |
| College (>4 years) | 2,292 (66.98) | 268 (53.60) | 132 (47.31) | 173 (79.00) | 1,647 (71.24) | 72 (64.29) | <0.001 |
| Employment Status, n (%) | | | | | | | |
| Employed       | 2,102 (61.43) | 284 (56.80) | 181 (64.87) | 131 (59.82) | 1,436 (62.11) | 70 (62.50) | <0.001 |
| Out of Work    | 402 (11.75) | 88 (17.60) | 42 (15.05) | 26 (11.87) | 229 (9.90) | 17 (15.18) | <0.001 |
| Other          | 918 (26.83) | 126 (25.60) | 56 (20.97) | 62 (28.91) | 647 (27.98) | 25 (22.32) | <0.001 |
| Income, n (%)  | | | | | | | |
| Less than $35,000 | 870 (25.42) | 174 (34.80) | 113 (40.50) | 47 (21.46) | 494 (21.37) | 42 (37.50) | <0.001 |
| $35,000 - $49,999 | 383 (11.19) | 77 (15.40) | 43 (15.41) | 16 (7.31) | 231 (9.99) | 16 (14.29) | <0.001 |
| $50,000 - $69,999 | 505 (14.76) | 75 (15.00) | 56 (20.07) | 30 (13.70) | 333 (14.40) | 11 (9.82) | <0.001 |
| $70,000 - $99,999 | 592 (17.30) | 73 (14.60) | 50 (19.63) | 43 (19.63) | 436 (18.86) | 10 (8.93) | <0.001 |
| $100,000+      | 993 (28.02) | 90 (18.00) | 33 (11.83) | 72 (32.88) | 768 (33.22) | 30 (26.79) | <0.001 |
| Don't know     | 79 (2.31) | 11 (2.20) | 4 (1.43) | 11 (5.02) | 50 (2.16) | 3 (2.68) | <0.001 |
| Any Children <18, n (%) | | | | | | | |
| No             | 2,596 (75.86) | 326 (65.20) | 183 (65.59) | 154 (70.32) | 1,853 (80.15) | 80 (71.43) | <0.001 |
| Yes            | 826 (24.14) | 174 (34.80) | 96 (34.41) | 65 (29.68) | 459 (19.85) | 32 (28.57) | <0.001 |

*IQR: Interquartile Range, NH: non-Hispanic, n: number, SD: standard deviation, U.S.: United States, and %: percentage.
†p value based on the Kruskal-Wallis test for means and Chi square for frequencies.
Appendix Table 2. Measures of Exposure, Susceptibility and Access to Care – Among Participants who were Seronegative and Retested (N = 3,422)*

| Category                                                   | Overall (N = 6,740) | Hispanic (N = 1,308) | Black NH (N = 899) | Asian/ Pacific Islander (N = 465) | White NH (N = 3,846) | Other (N = 222) | p value† |
|------------------------------------------------------------|---------------------|----------------------|--------------------|-----------------------------------|----------------------|----------------|----------|
| Measures of potential exposure: inability to impose social distance |                     |                      |                    |                                   |                      |                |          |
| Built environment measures                                 |                     |                      |                    |                                   |                      |                |          |
| Living in an urban area                                    | 1,430 (41.79)       | 219 (43.80)          | 140 (50.18)        | 116 (52.97)                      | 906 (39.19)          | 49 (43.75)     | <0.001   |
| Living in a multideveloped building                        | 1,348 (39.39)       | 206 (41.20)          | 144 (51.61)        | 93 (42.47)                       | 859 (37.15)          | 46 (41.07)     | <0.001   |
| Ability to avoid public transportation                     | 218 (6.37)          | 38 (7.60)            | 37 (13.26)         | 7 (3.20)                         | 128 (5.54)           | 8 (7.14)       | <0.001   |
| Sum built-environment                                        | 1 (0.2)             | 1 (0.2)              | 1 (0.2)            | 1 (0.2)                          | 1 (0.1)              | 1 (0.2)        | <0.001   |
| Work-related measures                                       | 849 (24.81)         | 134 (26.80)          | 87 (31.18)         | 42 (19.18)                       | 554 (23.96)          | 32 (28.57)     | 0.01     |
| Not able to work from home                                 | 632 (18.47)         | 104 (20.80)          | 70 (25.09)         | 38 (17.35)                       | 398 (17.21)          | 22 (19.64)     | 0.01     |
| Will not get paid if at home                               | 746 (21.80)         | 116 (23.20)          | 82 (29.39)         | 46 (21.00)                       | 474 (20.50)          | 28 (25.00)     | 0.01     |
| Does not have sick leave                                   | 597 (17.45)         | 113 (22.60)          | 69 (24.73)         | 38 (17.35)                       | 353 (15.27)          | 24 (21.43)     | <0.001   |
| Could lose job or business if unable to go to work         | 911 (26.62)         | 157 (31.40)          | 98 (35.13)         | 50 (22.83)                       | 577 (24.96)          | 29 (25.89)     | <0.01    |
| Job can only be done in workplace                          | 282 (8.24)          | 34 (6.80)            | 32 (11.47)         | 15 (6.85)                        | 189 (8.17)           | 12 (10.71)     | 0.15     |
| Essential worker                                           | 1 (0.2)             | 1 (0.3)              | 2 (0.3)            | 1 (0.2)                          | 0 (0.2)              | 1 (0.3)        | <0.001   |
| Sum work-related measures                                   | 2 (1.3)             | 2 (1.4)              | 3 (1.4)            | 2 (1.3)                          | 2 (1.3)              | 2 (1.4)        | <0.001   |
| More potential exposure risk: index >2                     | 1,115 (32.58)       | 189 (37.80)          | 130 (46.59)        | 69 (31.51)                       | 687 (29.71)          | 40 (35.71)     | <0.001   |
| Measures of Susceptibility                                 | 703 (20.54)         | 48 (9.60)            | 32 (11.47)         | 18 (8.22)                        | 586 (25.35)          | 19 (16.96)     | <0.001   |
| Age 60+                                                     | 103 (3.01)          | 17 (3.40)            | 9 (3.23)           | 5 (2.28)                         | 64 (2.77)            | 8 (7.14)       | 0.10     |
| Chronic Lung Disease                                       | 389 (11.37)         | 62 (12.40)           | 35 (12.54)         | 10 (4.57)                        | 261 (11.29)          | 21 (18.75)     | <0.01    |
| Asthma (current)                                           | 231 (6.75)          | 44 (8.80)            | 29 (10.39)         | 5 (2.28)                         | 140 (6.06)           | 13 (11.61)     | <0.01    |
| T2 Diabetes                                                 | 865 (25.28)         | 115 (23.00)          | 89 (31.90)         | 20 (9.13)                        | 613 (26.51)          | 28 (25.00)     | <0.001   |
| Serious heart condition                                    | 50 (1.46)           | 7 (1.40)             | 2 (0.72)           | 1 (0.46)                         | 39 (1.69)            | 1 (0.89)       | 0.45     |
| Kidney disease                                             | 108 (3.16)          | 13 (2.60)            | 7 (2.51)           | 3 (1.37)                         | 80 (3.46)            | 5 (4.46)       | 0.34     |
| Immunocompromised                                          | 161 (4.70)          | 25 (5.00)            | 30 (10.75)         | 3 (1.37)                         | 97 (4.20)            | 6 (5.36)       | <0.001   |
| HIV                                                        | 343 (10.02)         | 58 (11.60)           | 49 (17.56)         | 8 (3.65)                         | 202 (8.74)           | 26 (23.21)     | <0.001   |
| Daily smoker                                               | 1 (0.1)             | 0 (0.1)              | 1 (0.1)            | 0 (0.1)                          | 1 (0.1)              | 1 (0.2)        | <0.001   |
| Sum susceptibility measures                                 | 795 (23.23)         | 98 (19.60)           | 78 (27.96)         | 15 (6.85)                        | 570 (24.65)          | 34 (30.36)     | <0.001   |
| Measures of healthcare access                              |                      |                      |                    |                                   |                      |                |          |
| Does not have one person as doctor                         | 808 (23.61)         | 145 (29.00)          | 74 (26.52)         | 69 (31.51)                       | 483 (20.89)          | 37 (33.04)     | <0.001   |
| Did not see doctor due to cost                             | 510 (14.90)         | 94 (18.80)           | 58 (20.79)         | 41 (18.72)                       | 295 (12.76)          | 22 (19.64)     | <0.001   |
| Did not see doctor due to immigration                       | 27 (0.79)           | 13 (2.60)            | 4 (1.43)           | 5 (2.28)                         | 2 (0.99)             | 3 (2.68)       | <0.001   |
| No insurance                                               | 384 (11.22)         | 88 (17.60)           | 56 (20.07)         | 27 (12.33)                       | 195 (8.43)           | 18 (16.07)     | <0.001   |
| Sum healthcare access measures                              |                      |                      |                    |                                   |                      |                |          |
| Median (IQR)                                               | 0 (0.1)             | 1 (0.2)              | 1 (0.2)            | 0 (0.1)                          | 0 (0.1)              | 1 (0.1)        | <0.001   |
| More difficulty with access: index >0                      | 1,213 (35.45)       | 217 (43.40)          | 121 (43.37)        | 97 (44.29)                       | 726 (31.40)          | 52 (46.43)     | <0.001   |

*IQR: interquartile range, SD: standard deviation.
†p value statistic is based on the chi-square test for categorical data or the Kruskal-Wallis for the summative indices.
### Appendix Table 3. Proportion Hospitalized (Yes) or Seroconverted (Yes) By Exposure Level Within Race/Ethnicity Strata

| Category                      | Overall (N = 3,422) | White NH (N = 2,312) | Hispanic (N = 500) | Black NH (N = 279) | API NH (N = 219) | Other NH (N = 112) | Chi-Square p value for Differences by Race/Ethnicity |
|-------------------------------|----------------------|-----------------------|--------------------|--------------------|------------------|--------------------|------------------------------------------------------|
| **Seroconversion - N(%)**     | 161 (4.70)           | 93 (4.02)             | 37 (7.40)          | 17 (6.09)          | 7 (3.20)         | 7 (6.25)          | <0.01                                                |
| Potential exposure            |                      |                       |                    |                    |                  |                    |                                                      |
| Less exposure risk            | 86 (3.73)            | 53 (3.26)             | 20 (6.43)          | 6 (4.03)           | 5 (3.33)         | 2 (2.78)          | <0.001                                               |
| More exposure risk            | 75 (6.73)            | 40 (5.82)             | 17 (8.99)          | 11 (8.46)          | 2 (2.90)         | 5 (12.50)         |                                                      |
| Susceptibility                |                      |                       |                    |                    |                  |                    |                                                      |
| Less susceptible              | 130 (4.95)           | 76 (4.36)             | 30 (7.46)          | 13 (6.47)          | 7 (3.43)         | 4 (5.13)          | 0.03                                                 |
| More susceptible              | 31 (3.90)            | 17 (2.98)             | 7 (7.14)           | 4 (5.13)           | 0                | 3 (8.82)          |                                                      |
| Healthcare Access             |                      |                       |                    |                    |                  |                    | 0.02                                                 |
| Less barriers to access       | 93 (4.21)            | 58 (3.66)             | 21 (7.42)          | 8 (5.06)           | 3 (2.46)         | 3 (5.00)          |                                                      |
| More barriers to access       | 68 (5.61)            | 35 (4.82)             | 16 (7.37)          | 9 (7.44)           | 4 (4.12)         | 4 (7.69)          |                                                      |

### Appendix Table 4. Modification of the association between race/ethnicity and seroconversion by potential SARS-CoV-2 exposure risk, susceptibility, and healthcare access – N = 3,086*

| Measure of Exposure | N Hospitalized /Denominator (%) | AOR (95% CI) for race/ethnicity effect within exposure strata; Hispanic/Latino/a or Black NH Versus White | AOR (95% CI) | N Hospitalized /Denominator (%) | AOR (95% CI) |
|---------------------|---------------------------------|----------------------------------------------------------------------------------------------------------|-------------|---------------------------------|-------------|
| Less exposure risk  | 53/1625 (3.26)                  | 1.00-------------------------------------------------------------------------------------------------------| 1.67 (1.02, 2.75) | 26/460 (5.65)                  | 1.67 (1.02, 2.75) |
| More exposure risk  | 40/687 (5.82)                   | 1.64 (1.06, 2.54)-------------------------------------------------------------------------------------------------| 2.46 (1.47, 4.12) | 28/319 (8.78)                  | 2.46 (1.47, 4.12) |
| AORs (95% CI) for less versus more within strata of race/ethnicity | p = 0.02 | 1.64 (1.06, 2.54)------------------------------------------------------------------------------------------------- | p = 0.18 | 1.47 (0.84, 2.60) | 1.47 (0.84, 2.60) |
| RERI (95% CI): measure of interaction on the additive scale | 0.15 (−1.16, 1.46) | p = 0.82 | 0.15 (−1.16, 1.46) | p = 0.82 |
| Susceptibility      |                                 |                                                                                                         |             |                                |             |
| Less susceptible    | 76/1,742 (4.36)                 | 1.00-------------------------------------------------------------------------------------------------------| 1.59 (1.07, 2.37) | 43/603 (7.13)                  | 1.59 (1.07, 2.37) |
| More susceptible    | 17/570 (2.98)                   | 0.72 (0.42, 1.25)-------------------------------------------------------------------------------------------------| 1.43 (0.74, 2.78) | 11/176 (6.25)                  | 1.43 (0.74, 2.78) |
| AORs (95% CI) for more versus less within strata of race/ethnicity | p = 0.24 | 0.72 (0.42, 1.25)------------------------------------------------------------------------------------------------- | p = 0.76 | 0.90 (0.45, 1.78) | 0.90 (0.45, 1.78) |
| RERI (95% CI): measure of interaction on the additive scale | 0.11 (−0.97, 1.190) | p = 0.84 | 0.11 (−0.97, 1.190) | p = 0.84 |
| Healthcare          |                                 |                                                                                                         |             |                                |             |
| Less barriers to access | 58/1,586 (3.66)              | 1.00-------------------------------------------------------------------------------------------------------| 1.67 (1.04, 2.68) | 29/441 (6.58)                  | 1.67 (1.04, 2.68) |
| More barriers to access | 35/726 (4.82)               | 1.20 (0.77, 1.87)-------------------------------------------------------------------------------------------------| 1.80 (1.07, 3.03) | 25/338 (7.40)                  | 1.80 (1.07, 3.03) |
| AORs (95% CI) for less versus more within strata of race/ethnicity | p = 0.43 | 1.20 (0.77, 1.87)------------------------------------------------------------------------------------------------- | p = 0.55 | 1.08 (0.61, 1.89) | 1.08 (0.61, 1.89) |
| RERI (95% CI): measure of interaction on the additive scale | −0.07 (−1.15, 1.02) | p = 0.89 | −0.07 (−1.15, 1.02) | p = 0.89 |

*Chi-square assessed differences in proportion by White NH and Non-White.

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“Chi-square assessed differences in proportion by White NH and Non-White.

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“AOR, adjusted odds ratio. Shown are Model adjusted for age, presence of children in the household, employment, income, race/ethnicity; Model adjusted for employment, income, race/ethnicity; and Model adjusted for age, employment, sex, income, race/ethnicity.
Appendix Figure 1. Directed acyclic graph depicting the relationship between potential SARS-CoV-2 exposure and COVID outcomes.

Appendix Figure 2. Directed acyclic graph depicting the relationship between susceptibility and COVID outcomes.
Appendix Figure 3. Directed acyclic graph depicting the relationship between access to care and COVID outcomes.