Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.
### eTable 1. Detailed Study Summary Characteristics of All 68 Included Studies

Summary characteristics for each of the 68 studies included in this systematic review and meta-analysis, including but not limited to the following variables: ADI, county median income, measures of clinical care quality, and urban core opportunity index.

| Study First Author | Study Type | Qualit y Score | Geographic Scope | Number of Patients in Each Trial | African American in Each Trial | White in Each Trial | Asian American in Each Trial | Hispanic in Each Trial | Mean Age | Gender | Study Setting | ADI | County Median Income | Percent Uninsured | Primary Care Physicians/100,000 Population | Percent Hospitalized | Percent of Individuals Over Age 65 | Percent Male |
|-------------------|------------|--------------|------------------|---------------------------------|------------------|----------------|----------------|----------------|---------|--------|---------------|-----|---------------------|------------------|-------------------------|-----------------|------------------------|----------|
| Azar et al, 2020  | Cohort     | 75           | USA              | 12056                           | 0                 | 39260         | 0               | 9468            | 322     | 0      | N/A            | N/A | N/A                | N/A              | N/A                    | N/A             | N/A                    | N/A   |
| Dhua et al, 2020  | Cohort     | 80           | California       | 33333                           | 0                 | 43333         | 0               | 43333           | 0       | 0      | N/A            | N/A | N/A                | N/A              | N/A                    | N/A             | N/A                    | N/A   |
| Diez et al, 2020  | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| Diez et al, 2020  | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| Gomberg et al, 2020 | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| italian et al, 2020 | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| italian et al, 2020 | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| italian et al, 2020 | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |
| italian et al, 2020 | Cohort     | 80           | USA              | 1924                           | 0                 | 1924          | 0               | 1924            | 56      | 0      | N/A            | 80440     | 8                | 1250            | 370                    | 3358             | 15.67                  | 10.66 | N/A                        |

**Note:** Complete study characteristics are provided in the original publication.
| Cohort | Percentage | Location | Number of Participants | Number of Cases | Number of Controls | P-value (2-tailed) | N/A (2-tailed) | Number of Cases | Number of Controls | P-value (2-tailed) | N/A (2-tailed) |
|--------|------------|----------|------------------------|-----------------|-------------------|-------------------|-----------------|-----------------|-------------------|-------------------|-----------------|-----------------|
| 82%    | Indiana    | 8214     | 0                      | 6396            | 0                 | 0                 | 649             | 0               | 0                 | 0                 | 0               | 0               |
| 82%    | Philadelphia | 2388     | 0                      | 1823            | 140               | 14                | 472             | 1               | 0                 | 0                 | 0               | 0               |
| 75%    | LSU         | 7908     | 0                      | 2100            | 498               | 0                 | 2598            | 0               | 0                 | 0                 | 54.5            |
| 82%    | LSU         | 7062     | 0                      | 2129            | 1630              | 0                 | 0               | 0               | 0                 | 0                 | 0               | 0               |
| 30%    | Exain        | 9516     | 0                      | 1604            | 1036              | 0                 | 3751            | 0               | 335               | 45.1             | 49.0            |
| 30%    | 28 US States | 5721     | 0                      | 1672            | 4168              | 0                 | 0               | 0               | 0                 | 0                 | 0               | 0               |
| 50%    | University of Michigan Hospital | 5098 | 0 | 1558 | 3740 | 0 | 0 | 0 | 900 | 53 | 53 | Hospital 15 | 51.12 | 612953 | 6 | 570 | 180 | 326 |
| 82%    | UCSD        | 4613     | 0                      | 1543            | 2071              | 184               | 254             | 5               | 0                 | 5                | 52             |
| 75%    | Mississippi Medical Center | 4802 | 0 | 1275 | 1257 | 0 | 0 | 203 | 0 | 0 | N/A | Hospital 37 | MS-03 | 49803 | 13 | 1230 | 320 | 543 |
| 82%    | Advocate Health Care | 5489 | 1598 | 2080 | 0 | 1830 | 0 | 472 | N/A | N/A | N/A | Hospital 44 | IL-01 | 56670 | 10 | 3050 | 340 | 514 |
| 70%    | Ochsner Health Center - New Orleans, Louisiana | 3481 | 2451 | 1030 | 0 | 0 | 0 | 0 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 40 |
| 75%    | New Orleans, Louisiana | 3640 | 0 | 1831 | 0 | 0 | 0 | 0 | 0 | 50.0 | N/A | Hospital 3 | LA-7 | 75401 | 4 | 470 | 120 | 511 |
| 75%    | Cleveland-Medical Center - Boston, Massachusetts | 2725 | 1218 | 269 | 0 | 0 | 823 | 0 | 0 | 0 | N/A | N/A | Hospital 4 | MA-7 | 75401 | 4 | 470 | 120 | 511 |
| 75%    | New Orleans, Louisiana | 3640 | 0 | 1831 | 0 | 0 | 0 | 0 | 0 | 50.0 | N/A | Hospital 3 | LA-7 | 75401 | 4 | 470 | 120 | 511 |
| 75%    | New Orleans, Louisiana | 3640 | 0 | 1831 | 0 | 0 | 0 | 0 | 0 | 50.0 | N/A | Hospital 3 | LA-7 | 75401 | 4 | 470 | 120 | 511 |
| 3.66   | N/A         | 9154     | 0                      | 2484           | 538               | 0                 | 281             | 0               | 0                 | 0                 | 0               |
| 75%    | Atlanta     | 1882     | 0                      | 1311            | 226               | 164              | 0               | 139             | 0                 | 0                 | 0               |
| 82%    | 3 Hospitals in New Haven, CT | 3567 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82%    | Washington | 1485     | 0                      | 1139            | 304               | 207              | 106             | 0               | 0                 | 0                 | 0               |
| 75%    | Houston, Texas | 925 | 125 | 27 | 84 | 0 | 0 | 527 | 0 | 0 | N/A | Hospital 18 | MA-8 | 80602 | 21 | 5790 | 4590 | 4843 |
| 75%    | Baltimore, MD | 866 | 98 | 346 | 0 | 0 | 305 | 0 | 0 | 177 | N/A | Hospital 18 | MA-8 | 80602 | 21 | 5790 | 4590 | 4843 |
| 75%    | Baltimore, MD | 866 | 98 | 346 | 0 | 0 | 305 | 0 | 0 | 177 | N/A | Hospital 18 | MA-8 | 80602 | 21 | 5790 | 4590 | 4843 |
| 95%    | Five hospitals in the United States | 1032 | 0 | 236 | 264 | 48 | 0 | 134 | 2 | 42 | N/A | Hospital 35 | 5 | 77074 | N/A | N/A | N/A | N/A | N/A |

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| Study                  | Cohort  | Design | Institution                                  | N  | Pct  | Region | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
|----------------------|---------|--------|-----------------------------------------------|----|------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gelinas et al, 2020  | Cross-  |        | University of Cincinnati Health System        | 689| 176  | 205    | 0   | 0   | 224 | 0   | 88  | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| McGlynn et al, 2020  | Sectional |       | Ascend Health System - California             | 526| 214  | 83     | 41  | 0   | 130 | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Priya et al, 2020    | Cohort  |        | Phoenix Union Health System - Southwest       | 522| 414  | 59     | 0   | 0   | 0   | 0   | 9   | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Wedley et al, 2020   | Cross-  |        | All Hospitals in USA                          | 479| 112  | 0      | 0   | 0   | 178 | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Sridhara et al, 2020 | Cohort  |        | Rush University Medical Center - Illinois      | 474| 205  | 117    | 7   | 0   | 0   | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ashok et al, 2020    | Cohort  |        | Trinity Care                                    | 419| 419  | 0      | 0   | 0   | 0   | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Vijay et al, 2020    | Cross-  |        | Community Hospitals - NYC                      | 408| 418  | 0      | 0   | 0   | 0   | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Santhi et al, 2020   | Cohort  |        | Railway Hospital - Indianapolis                | 407| 7    | 4      | 1   | 0   | 7   | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Srinivas et al, 2020 | Cohort  |        | Sahara Inn Hospital - Bronx, New York          | 375| 93   | 0      | 0   | 0   | 246 | 0   | 36  | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Mark et al, 2020     | Cross-  |        | El Academic Medical Center - Los Angeles       | 350| 73   | 136    | 0   | 0   | 116 | 0   | 42  | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Jeremy et al, 2020   | Cross-  |        | 8 Hospitals in Georgia                         | 297| 247  | 50     | 0   | 0   | 0   | 0   | 0   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Fakhr et al, 2020    | Cohort  |        | Teaching Hospital - Atlanta - Georgia          | 298| 209  | 0      | 0   | 0   | 0   | 0   | 79  | 63  | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Notes:**

- **Cohort:** Percentage of total
- **Design:** Cross-Sectional
- **Region:** N/A
- **Hospital:** N/A
- **N/A:** Not applicable
- **N:** Number of patients
- **Pct:** Percentage of total

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eTable 2: Study Summary Characteristics for Comorbidities

Summary characteristics for each of the 68 studies included in this systematic review and meta-analysis, including but not limited to the following variables: percent of ever smokers, median BMI, BMI over 40, cardiovascular disease, hypertension, COPD, diabetes, and malignancy/cancer.

| Study First Author | Percent of Ever Smokers | Median BMI | Percent BMI Over 40 | Percent Cardiovascular Disease | Percent Hypertension | Percent COPD | Percent Diabetes | Percent Malignancy/Cancer |
|--------------------|-------------------------|------------|---------------------|-------------------------------|----------------------|--------------|------------------|---------------------------|
| David P. Bui et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Di Xiong et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Erin K. Stokes et al, 2020 | N/A                      | N/A        | N/A                 | 32.2                          | N/A                  | N/A          | 30.2             | N/A                       |
| Ishaan Pathak et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Mary L. Adams et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Michael Poulson et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Sara J. Cromer et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Jon Zelner et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Diego A. Martinez et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | N/A              | N/A                       |
| Yelena Rozenfeld et al, 2020 | N/A                      | N/A        | N/A                 | N/A                           | N/A                  | N/A          | 14.3             | N/A                       |
| Study Authors                  | Median Age | Minimum Age | Maximum Age | n  | Median 1st Year | Median 2nd Year | Median 3rd Year | Median 4th Year | Median 5th Year |
|-------------------------------|------------|-------------|-------------|----|----------------|----------------|----------------|----------------|----------------|
| Jacob McPadden et al, 2020    | N/A        | N/A         | N/A         | 53 | N/A            | N/A            | N/A            | N/A            | N/A            |
| Samuel B Reichberg et al, 2020| N/A        | N/A         | N/A         | N/A| N/A            | N/A            | N/A            | N/A            | N/A            |
| Farhaan S Vahidy et al, 2020  | N/A        | N/A         | N/A         | 47.2| N/A            | N/A            | N/A            | N/A            | N/A            |
| Sharia M Ahmed et al, 2020    | N/A        | N/A         | N/A         | 14.53| N/A            | N/A            | N/A            | N/A            | N/A            |
| Kristen M. J. Azar et al, 2020| 27.4       | N/A         | N/A         | 10.2| 29.8           | 9.2            | N/A            | N/A            | 6.8            |
| Alan Pan et al, 2020          | 17.511     | N/A         | N/A         | N/A| N/A            | N/A            | 12.5           | 0              | 0              |
| Lara Jehi et al, 2020         | N/A        | N/A         | N/A         | N/A| N/A            | N/A            | N/A            | N/A            | N/A            |
| Baligh R Yehia et al, 2020    | N/A        | N/A         | N/A         | 19.99| 23.2           | 8.47           | 2585           | N/A            | 2.71           |
| George N. Ioannou et al, 2020 | N/A        | N/A         | N/A         | N/A| 62.1           | 18.8           | 38.1           | N/A            | 22.7           |
| Gbenga Ogedegbe et al, 2020   | 24.7       | 28.2        | 51.4        | N/A| N/A            | N/A            | N/A            | N/A            | N/A            |
| Rafi Kabarriti et al, 2020    | N/A        | N/A         | N/A         | 22.1| 44.7           | N/A            | 32.9           | N/A            | 5.6            |
| Michael Gottlieb et al, 2020  | 14         | 27.2        | 264         | N/A| 22.1           | 1.3            | 14.6           | 6.2            |
| Brian E. Dixon et al, 2020    | N/A        | N/A         | N/A         | N/A| N/A            | N/A            | N/A            | N/A            | N/A            |
| Authors                     | N/A | N/A | N/A | 21.99 | N/A | N/A | N/A | N/A |
|-----------------------------|-----|-----|-----|-------|-----|-----|-----|-----|
| Haotian Chen et al, 2020    | 22  | N/A | N/A | N/A   | 60  | 18.7| 37  | 11.2|
| Fatima Rodriguez et al, 2020| 6.6 | N/A | N/A | 9.5   | 36.057 | 21.5 | 19.1 | N/A |
| Ahmad Khan et al, 2020      | N/A | N/A | N/A | N/A   | 24.47 | 12.56 | 20.12 | 2.22|
| Sara Y. Tartof et al, 2020  | 21.24 | N/A | 9.16 | 3.26 | 66.3 | 14.2 | N/A | N/A |
| Michelle A Waltenburg et al, 2020 | N/A | N/A | N/A | N/A | 24.47 | 12.56 | 20.12 | 2.22|
| Tian Gu et al, 2020         | 33.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nicholas E. Ingraham et al, 2020 | N/A | N/A | N/A | N/A | 66.3 | 14.2 | N/A | N/A |
| S.B. Chan et al, 2020       | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Kengo Inagaki et al, 2020   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ayodeji Adegunsoye et al, 2020 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nir Menachemi et al, 2020   | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Eboni G Price-Haywood et al, 2020 | N/A | N/A | N/A | N/A | 3.99 | 30.8 | 2.26 | 16.25 | 4.5 |

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| Author(s) and Year | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Heather E. Hsu et al, 2020 | N/A | N/A | N/A | 14.9 | 45.7 | 5.3 | 25.9 | 7.1 |
| Amy K Feehan et al, 2020 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| L. Silvia Muñoz-Price et al, 2020 | 33.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Rolando G. Valenzuela et al, 2020 | N/A | N/A | N/A | 8.3 | 27.5 | 4.7 | 14.38 | N/A |
| Naima T. Joseph et al, 2020 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Olga Grechukhina et al, 2020 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ana A. Weil et al, 2020 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Jennifer Woo Baidal et al, 2020 | 6.94 | N/A | N/A | 71.6 | N/A | N/A | N/A | 11.5 |
| Beth L. Pineles et al, 2020 | N/A | N/A | N/A | N/A | 23 | N/A | 10 | N/A |
| Ingrid V Bassett et al, 2020 | 38 | 29.1 | N/A | 79 | 52 | 31 | N/A | N/A |
| Brian T. Garibaldi et al, 2020 | 33 | 29 | N/A | 15 | 47 | 19 | 30 | 10 |
| Benjamin D. Renelus et al, 2020 | N/A | N/A | N/A | N/A | 67.3 | N/A | 43.46 | 3.67 |
| Author(s)                              | Year       | x1   | x2   | x3   | x4   | x5   | x6   | x7   | x8   |
|---------------------------------------|------------|------|------|------|------|------|------|------|------|
| Angelico Mendy et al, 2020            | N/A        | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  |
| Nana-Yaa Misa et al, 2020             | N/A        | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  |
| Priyank Shah et al, 2020              | 17         | N/A  | N/A  | N/A  | 79.7 | 9    | 42.3 | 9.2  |      |
| Wesley H Self et al, 2020             | N/A        | N/A  | N/A  | N/A  | 52.8 | 8.14 | 34.6 | N/A  |      |
| Sindhura Bandi et al, 2020            | N/A        | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  |
| Ashish Bhargava et al, 2020           | N/A        | N/A  | N/A  | N/A  | N/A  | N/A  | 40.3 | 5.4  |      |
| Vijay Gayam et al, 2020               | N/A        | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  |
| Samina Bhumbra et al, 2020            | N/A        | N/A  | N/A  | N/A  | 17   | 60   | N/A  | N/A  | N/A  |
| Sridhar Chilimuri et al, 2020         | N/A        | N/A  | N/A  | 17   | 60   | N/A  | N/A  | N/A  | N/A  |
| Mark W. Tenforde et al, 2020          | 31         | N/A  | N/A  | 30   | 29   | 5    | 15   | N/A  |      |
| Jeremy A W Gold et al, 2020           | N/A        | N/A  | 12.7 | 25.6 | 67.5 | 5.2  | 39.7 | 3.9  |      |
| Fahad Marmarchi et al, 2020           | N/A        | 32   | N/A  | 14   | 74   | 7    | 45   | N/A  |      |
| Author(s) and Year | RMQ Score | BMI (kg/m²) | Waist Circumference (cm) | Intraabdominal Adipose Tissue | Subcutaneous Adipose Tissue | Triglycerides (mmol/L) | Total Cholesterol (mmol/L) | HDL Cholesterol (mmol/L) |
|-------------------|-----------|-------------|--------------------------|------------------------------|---------------------------|------------------------|---------------------------|--------------------------|
| Victoria Silver et al, 2020 | 38 | N/A | 23 | 32 | 80 | 13 | 52 | 12 |
| Cian P. McCarthy et al, 2020 | 32.8 | 28.5 | N/A | 49 | 51.8 | 8.9 | 27.5 | 27.5 |
| James Andrew McCracken et al, 2020 | 9.5 | 29 | N/A | 24.5 | 84.5 | 8.5 | 57.5 | 6 |
| Ilona Telefus Goldfarb et al, 2020 | N/A | N/A | N/A | N/A | N/A | N/A | 8.19 | N/A |
| Christopher S. King et al, 2020 | N/A | 30 | N/A | 6.7 | 52 | N/A | 34.1 | N/A |
| Vikramjit Mukherjee et al, 2020 | 28.5 | N/A | 9.7 | 13.9 | 51.1 | 2.9 | 37.2 | 2.9 |
| Mark P. Abrams et al, 2020 | N/A | 27.2 | N/A | 77.4 | 82.7 | 16.5 | 52.6 | N/A |
| Stephen Capone et al, 2020 | N/A | N/A | N/A | N/A | 59.8 | N/A | 49 | N/A |
| Anthony M. Valeri et al, 2020 | 32 | 25.2 | N/A | 46 | 98 | 17 | 69 | N/A |
eTable 3. Adjustment of Relative Risk Ratios (RRs) for Additional Variables

The following variables were adjusted for RR for each racial/ethnic group by COVID-19 outcome: age, ADI, county median income, a combined measure of clinical care quality, urban core opportunity index, and a combined measure of medical comorbidities.

| Cohort | # of studies | Age-Adjusted | ADI-Adjusted | Income-Adjusted | Clinical Care-Adjusted (combined) | UDI | Comorbidities |
|--------|--------------|--------------|--------------|----------------|-----------------------------------|-----|---------------|
|        |              | RR (95% CI)  | RR p-value   | RR (95% CI)    | RR p-value                        | RR (95% CI) | RR p-value    | alpha |
|        |              | Reference N/A | Reference N/A | Reference N/A | Reference N/A                      | Reference N/A | Reference N/A | N/A   |
|        |              |              |              |                |                                   |                |               |       |
| (1) Positive |       |              |              |                |                                   |                |               |       |
| White  | 13           | 1.34 (1.91, 1.97) | 0.137 | 2.01 (1.04, 3.88) | 0.037 | 1.92 (1.10, 3.66) | 0.048 | 1.79 (1.11, 3.17) | 0.029 | 0.902 | 6.12 (1.11, 337.85) | 0.383 | 3.34 (0.50, 23.59) | 0.212 | 0.958 |
| African American | 20 | 6.98 (2.06, 23.58) | 0.002 | 2.09 (1.13, 3.88) | 0.019 | 3.26 (1.50, 7.07) | 0.003 | N/A | N/A | 0.888 | 2.15 (0.98, 4.74) | 0.056 | 1.98 (1.30, 3.02) | 0.002 | N/A |
| Hispanic and Latino | 10 | N/A | N/A | 1.12 (1.04, 1.21) | 0.003 | 1.14 (1.05, 1.25) | 0.003 | 1.166 (1.03, 1.31) | 0.015 | 0.890 | 1.13 (1.07, 1.19) | <.001 | N/A | N/A | N/A |
| (2) Hospitalization |       |              |              |                |                                   |                |               |       |
| White  | 4            | Reference N/A | Reference N/A | Reference N/A | Reference N/A                      | Reference N/A | Reference N/A | N/A   |
| African American | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hispanic and Latino | 3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Asian-American | 0 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| (3) ICU |       |              |              |                |                                   |                |               |       |
| White  | 4            | Reference N/A | Reference N/A | Reference N/A | Reference N/A                      | Reference N/A | Reference N/A | N/A   |
| African American | 4 | N/A | N/A | N/A | N/A | 1.07 (0.63, 1.84) | 0.816 | N/A | N/A | N/A | 1.11 (0.66, 1.87) | 0.707 | N/A | N/A | N/A |
| Hispanic and Latino | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 1.29 (0.66, 2.52) | 0.465 | N/A | N/A | N/A |
| Asian-American | 3 | 0.33 (0.07, 1.58) | 0.164 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| (4) Mortality |       |              |              |                |                                   |                |               |       |
| White  | 6            | Reference N/A | Reference N/A | Reference N/A | Reference N/A                      | Reference N/A | Reference N/A | N/A   |
| African American | 7 | N/A | N/A | 0.84 (0.62, 1.13) | 0.258 | 0.85 (0.82, 0.88) | <0.001 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hispanic and Latino | 5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Asian-American | 4 | 1.18 (0.99, 1.41) | 0.066 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

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|     | Mortality |   |   |   |   |   |   |   |   |
|-----|-----------|---|---|---|---|---|---|---|---|
|     | White     | 5 | Reference | N/A | Reference | N/A | Reference | N/A | Reference | N/A | Reference | N/A |
|     | African American | 6 | 0.92 (0.70, 1.20) | 0.555 | 0.88 (0.63, 1.22) | 0.457 | 0.91 (0.68, 1.23) | 0.554 | 0.99 (0.91, 1.07) | 0.819 | 0.779 | N/A | N/A | 0.86 (0.62, 1.19) | 0.370 | 0.866 |
|     | Hispanic and Latino | 4 | N/A | N/A | 0.44 (0.31, 0.61) | 0.001 | 0.43 (0.41, 0.46) | 0.001 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
|     | Asian-American | 4 | N/A | N/A | 0.73 (0.32, 1.68) | 0.465 | 0.44 (0.36, 0.54) | 0.001 | 0.74 (0.59, 0.94) | 0.011 | 0.874 | N/A | N/A | N/A | N/A | N/A |
**eTable 4. Adjustment of Odds Ratios (ORs) for Additional Variables**

The following variables were adjusted for OR for each racial/ethnic group by COVID-19 outcome: age, ADI, county median income, a combined measure of clinical care quality, urban core opportunity index, and a combined measure of medical comorbidities.

| Cohort          | Age-Adjusted | ADI-Adjusted | Income-Adjusted | Clinical Care-Adjusted (combined) | UDI | Comorbidities |
|-----------------|--------------|--------------|----------------|----------------------------------|-----|---------------|
|                 | Fed. studies| OR (95% CI) | OR p-value | OR (95% CI) | OR p-value | OR (95% CI) | OR p-value | OR (95% CI) | OR p-value | alph α | OR (95% CI) | OR p-value | alph α |
| (1) Positive    |              |              |            |              |            |              |            |              |            |        |              |            |        |
| White           | 13           | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        |        | Reference    | N/A        |        |
| African American| 20           | 5.02 (1.57, 16.06) | 0.007     | 2.69 (0.99, 7.32) | 0.052     | 2.55 (0.92, 7.04) | 0.071     | 2.45 (1.67, 3.58) | <0.001   | 0.90  | 2           | N/A        | N/A     |
| Hispanic and Latino | 10      | 4.38 (1.12, 15.73) | 0.233     | 2.52 (1.20, 5.28) | 0.014     | 4.15 (1.70, 10.13) | 0.002     | N/A          | N/A        | 0.08  | 9           | 2.71 (1.37, 5.35) | 0.004 | 2.33 (1.56, 3.47) | <0.001 |
| Asian-American  | 7            | N/A          | N/A        | 1.31 (1.12, 1.53) | 0.221     | 1.34 (1.13, 1.61) | 0.001     | 1.35 (1.06, 1.72) | 0.015     | 0.89  | 0           | 1.31 (1.19, 1.45) | <0.001 | N/A        | N/A     |
| (2) Hospitalization |          |              |            |              |            |              |            |              |            |        |              |            |        |
| White           | 4            | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        |        | Reference    | N/A        |        |
| African American| 4            | N/A          | N/A        | 1.94 (0.07, 53.28) | 0.713     | N/A          | N/A        | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| Hispanic and Latino | 3       | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| Asian-American  | 0            | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| (3) ICU         |              |              |            |              |            |              |            |              |            |        |              |            |        |
| White           | 4            | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        |        | Reference    | N/A        |        |
| African American| 4            | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A          | 1.11 (0.54, 2.25) | 0.787 | N/A          | N/A        | 1.16 (0.59, 2.27) | 0.679 |
| Hispanic and Latino | 4       | N/A          | N/A        | N/A          | N/A        | N/A          | N/A        | N/A          | 1.41 (0.58, 3.41) | 0.455 | N/A          | N/A        | 1.43 (0.57, 3.59) | 0.454 |
| Asian-American  | 3            | 2.09 (1.1, 3.99) | 0.001     | N/A          | 0.87 (0.63, 1.18) | 0.391     | N/A          | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| (4) Mortality   |              |              |            |              |            |              |            |              |            |        |              |            |        |
| White           | 6            | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        | Reference    | N/A        |        | Reference    | N/A        |        |
| African American| 7            | N/A          | N/A        | 0.82 (0.56, 1.19) | 0.306     | 0.84 (0.81, 0.87) | <0.001     | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| Hispanic and Latino | 5       | N/A          | N/A        | 0.88 (0.50, 1.53) | 0.667     | 0.58 (0.24, 1.39) | 0.226     | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |
| Asian-American  | 4            | N/A          | N/A        | 1.35 (0.96, 1.89) | 0.082     | 1.3 (0.30, 2.77) | 0.656     | N/A          | N/A        | N/A    | N/A          | N/A        | N/A     |

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| Cross-Sectional |     |     |     |     |     |     |     |     |     |     |     |     |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                 |     |     |     |     |     |     |     |     |     |     |     |     |
| (4) Mortality   |     |     |     |     |     |     |     |     |     |     |     |     |
|                 |     |     |     |     |     |     |     |     |     |     |     |     |
| White           | 5   | Reference | N/A | Reference | N/A | Reference | N/A | Reference | N/A | Reference | N/A | Reference | N/A | N/A |
| African American| 6   | 0.73 (0.39, 1.35) | 0.325 | 0.86 (0.60, 1.25) | 0.428 | 0.91 (0.67, 1.23) | 0.055 | 0.98 (0.89, 1.08) | 0.695 | 0.77 | N/A | N/A | N/A | N/A |
| Hispanic and Latino | 4   | N/A | N/A | 0.42 (0.29, 0.61) | <0.001 | 0.42 (0.39, 0.44) | <0.001 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Asian-American  | 4   | N/A | N/A | 0.58 (0.16, 2.04) | 0.409 | 0.39 (0.31, 0.48) | <0.001 | 0.62 (0.29, 1.33) | 0.220 | 0.87 | N/A | N/A | N/A | N/A |
eTable 5. Combined Prevalence of Cohort and Cross-sectional Studies

Combined prevalence of COVID-19 positivity, mortality, ICU admission, and hospitalization in cohort and cross-sectional studies.

|                      | # of studies | Prevalence (per 1000 people) | $I^2$ (%) |
|----------------------|--------------|------------------------------|-----------|
| **Cohort**           |              |                              |           |
| (1) Positive         |              |                              |           |
| White                | 13           | 296.58                       | 100       |
| African American     | 20           | 306.04                       | 100       |
| Hispanic and Latino  | 10           | 370.67                       | 99        |
| Asian-American       | 7            | 49.42                        | 98        |
| (2) Hospitalization  |              |                              |           |
| White                | 4            | 98.69                        | 100       |
| African American     | 4            | 151.37                       | 100       |
| Hispanic and Latino  | 3            | 100.88                       | 100       |
| Asian-American       | 0            | N/A                          | N/A       |
| (3) ICU              |              |                              |           |
| White                | 4            | 235.75                       | 92        |
| African American     | 4            | 243.52                       | 97        |
| Hispanic and Latino  | 4            | 288.65                       | 98        |
| Asian-American       | 3            | 409.26                       | 85        |
| (4) Mortality        |              |                              |           |
| White                | 6            | 161.12                       | 99        |
| African American     | 7            | 143.99                       | 99        |
| Hispanic and Latino  | 5            | 130.51                       | 100       |
| Asian-American       | 4            | 42.99                        | 98        |
| **Cross-Sectional**  |              |                              |           |
| (4) Mortality        |              |                              |           |
| White                | 5            | 83.78                        | 100       |
| African American     | 6            | 89.37                        | 99        |
| Hispanic and Latino  | 4            | 26.73                        | 88        |
| Asian-American       | 4            | 63.54                        | 93        |
**eTable 6. Summary of Q and I² Statistics for Study Variables**

Q and $I^2$ statistics for correlations between proportions of individuals from each racial/ethnic group by COVID-19 outcome and the following variables: ADI, county median income, and measures of clinical care quality.

| Variable Studied                                             | No. of Studies | Q Statistic | $I^2$ Statistic, % |
|--------------------------------------------------------------|----------------|-------------|-------------------|
| **(1) Cohort Studies**                                      |                |             |                   |
| Proportion of Deceased Whites with ADI                       | 6/69           | 101.24      | 97.36             |
| Proportion of Deceased African Americans with ADI           | 6/69           | 943.43      | 99.62             |
| Proportion of Deceased Hispanics/Latinos with ADI           | 4/69           | 115.03      | 97.4              |
| Proportion of Deceased Asian-Americans with ADI             | 4/69           | 111.85      | 98.59             |
| Proportion of Deceased Whites with county median income     | 6/69           | 250.99      | 98.68             |
| Proportion of Deceased African Americans with county median income | 6/69           | 324.41      | 99.2              |
| Proportion of Deceased Hispanics/Latinos with county median income | 4/69           | 204.09      | 98.55             |
| Proportion of Deceased Asian-Americans with county median income | 4/69           | 13.43       | 85.3              |
| Proportion of Deceased African Americans with Preventable Hospital Stay | 3/69           | 124.91      | 99.2              |
| Proportion of Deceased African Americans with Primary Care Availability | 3/69           | 127.84      | 99.22             |
| Proportion of Deceased African Americans with Uninsured     | 3/69           | 119.2       | 99.16             |
| Proportion of ICU Admitted Whites with county median income | 3/69           | 1.33        | 25.06             |
| Proportion of ICU Admitted African Americans with county median income | 3/69           | 13.61       | 92.66             |
| Proportion of ICU Admitted Hispanics/Latinos with county median income | 3/69           | 57.62       | 98.26             |
| Proportion of COVID-19 Positive Whites with ADI             | 6/69           | 402.13      | 99.07             |

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| Proportion of COVID-19 Positive | Count | Average | Confidence Interval |
|--------------------------------|-------|---------|---------------------|
| African Americans with ADI    | 13/69 | 14005.48| 99.91               |
| Positive Hispanics/Latinos with ADI | 6/69  | 238.09  | 99.72               |
| Positive Asian-Americans with ADI | 4/69  | 197.72  | 98.63               |
| Positive Whites with county median income | 9/69  | 2657.67 | 99.77               |
| Positive African Americans with county median income | 15/69 | 4956.89 | 99.87               |
| Positive Hispanics/Latinos with county median income | 9/69  | 497.21  | 99.06               |
| Positive Asian-Americans with county median income | 5/69  | 395.16  | 99.25               |
| Positive Whites with Preventable Hospital Stay | 7/69  | 2212.72 | 99.71               |
| Positive African Americans with Preventable Hospital Stay | 9/69  | 2897.78 | 99.87               |
| Positive Hispanics/Latinos with Preventable Hospital Stay | 5/69  | 201.58  | 99.69               |
| Positive Asian-Americans with Preventable Hospital Stay | 4/69  | 34.15   | 93.3                |
| Positive Whites with Primary Care Availability | 7/69  | 1999.8  | 99.73               |
| Positive African Americans with Primary Care Availability | 9/69  | 3281.45 | 99.87               |
| Positive Hispanics/Latinos with Primary Care Availability | 5/69  | 23.81   | 97.48               |
| Positive Asian-Americans with Primary Care Availability | 4/69  | 12.22   | 81.45               |
| Proportion of COVID-19 Positive Whites with Uninsured | 7/69 | 2028.71 | 99.67 |
|-----------------------------------------------|------|---------|-------|
| Proportion of COVID-19 Positive African Americans with Uninsured | 9/69 | 1561.64 | 99.74 |
| Proportion of COVID-19 Positive Hispanics/Latinos with Uninsured | 5/69 | 494.7 | 99.78 |
| Proportion of COVID-19 Positive Asian-Americans with Uninsured | 7/69 | 48.96 | 96.44 |

(2) Cross-sectional

| Proportion of Deceased Whites with ADI | 6/69 | 101.24 | 97.36 |
|--------------------------------------|------|---------|-------|
| Proportion of Deceased African Americans with ADI | 6/69 | 943.43 | 99.62 |
| Proportion of Deceased Hispanics/Latinos with ADI | 4/69 | 115.03 | 97.4 |
| Proportion of Deceased Asian-Americans with ADI | 4/69 | 111.85 | 98.59 |
| Proportion of Deceased Whites with county median income | 6/69 | 250.99 | 98.68 |
| Proportion of Deceased African Americans with county median income | 6/69 | 324.41 | 99.2 |
| Proportion of Deceased Hispanics/Latinos with county median income | 4/69 | 204.09 | 98.55 |
| Proportion of Deceased Asian-Americans with county median income | 4/69 | 13.43 | 85.3 |
| Proportion of Deceased African Americans with Preventable Hospital Stay | 3/69 | 124.91 | 99.2 |
| Proportion of Deceased African Americans with Primary Care Availability | 3/69 | 127.84 | 99.22 |
| Proportion of Deceased African Americans with Uninsured | 3/69 | 119.2 | 99.16 |
| Proportion of ICU Admitted Whites with county median income | 3/69 | 1.33 | 25.06 |
| Proportion of ICU Admitted African Americans with county median income | 3/69 | 13.61 | 92.66 |
| Proportion of ICU Admitted Hispanics/Latinos with county median income | 3/69 | 57.62 | 98.26 |
**Figure 1. PRISMA Workflow for Studies Included in Analysis**

- 21745 Potential articles for review
  - 5391 PubMed
  - 3632 bioRxiv
  - 7086 medRxiv
  - 1319 Embase
  - 4317 COVID WHO

- 14519 Unique articles
- 14233 Articles Excluded Based on Abstracts
- 287 Articles Accepted for Full-text Review
- 219 Articles excluded based on the following criteria:
  - 117 Insufficient Data
  - 65 Low Quality Score
  - 31 Non-standard format
  - 6 Desired Outcomes not Investigated

- 68 Articles Included in the Meta-analysis

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**eFigure 2.** Funnel Plots for Deceased Individuals in Cohort and Cross-sectional Studies

White, Deceased (Cross-sectional Studies)

White, Deceased (Cohort Studies)

Hispanics, Deceased (Cross-sectional Studies)

Hispanics, Deceased (Cohort Studies)

African-American, Deceased (Cross-sectional Studies)

African-American, Deceased (Cohort Studies)

Asian-American, Deceased (Cross-sectional Studies)

Asian-American, Deceased (Cohort Studies)
eFigure 3. Funnel Plots for Patients Admitted to ICU or Hospitalized in Cohort Studies
eFigure 4. Funnel Plots for COVID-19 Positive Patients in Cohort and Cross-sectional Studies
eFigure 6. Forest Plot for Patients Admitted to ICU or Hospitalized in Cohort Studies

### White, ICU (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Georges Oudinot et al. 2020 | 650  | 1047  | 25.83%     | (20.63, 31.06) |
| Mulhern S. et al. 2020  | 115  | 381   | 30.33%     | (22.60, 40.36) |
| Turn-Grau et al. 2020   | 101  | 402   | 25.19%     | (19.73, 31.26) |
| Naffa Khatib et al. 2010 | 39  | 249   | 15.70%     | (11.37, 21.15) |
| **Total**              | 866  | 3,254 | 25.83%     | (20.63, 31.06) |

Random-effects model

### White, Hospitalization (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| La Re Jhan 2020        | 685  | 4,526 | 15.11%     | (13.63, 20.60) |
| Jennifer Wang et al. 2020 | 653  | 2,556 | 25.20%     | (23.13, 27.94) |
| Joseph Miller et al. 2020 | 255  | 901   | 25.62%     | (18.99, 32.53) |
| S.B. Chan et al. 2020  | 406  | 5,686 | 74.61%     | (67.88, 81.79) |
| **Total**              | 1,899 | 6,064 | 25.89%     | (20.59, 31.22) |

Random-effects model

### Hispanics, ICU (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Turn-Grau et al. 2020   | 409  | 1,279 | 37.47%     | (26.36, 48.81) |
| Bell-Kotler et al. 2020 | 114  | 1,146 | 37.12%     | (26.36, 48.81) |
| Georges Oudinot et al. 2020 | 104  | 713   | 29.38%     | (20.02, 41.01) |
| Michael A. et al. 2020  | 97  | 110  | 89.09%     | (17.11, 44.72) |
| **Total**              | 710  | 1,606 | 37.47%     | (26.36, 48.81) |

Random-effects model

### Hispanics, Hospitalization (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Jennifer Wang et al. 2020 | 1811 | 5,269 | 28.13%     | (27.71, 30.12) |
| S.B. Chan et al. 2020  | 399  | 5,482 | 72.60%     | (66.11, 79.47) |
| Joseph Miller et al. 2020 | 215  | 384   | 55.41%     | (36.65, 65.15) |
| **Total**              | 1,735 | 6,584 | 32.35%     | (32.05, 32.65) |

Random-effects model

### African-American, ICU (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Bell-Kotler et al. 2020 | 100  | 1,226 | 32.93%     | (21.77, 44.15) |
| Georges Oudinot et al. 2020 | 93  | 373   | 24.86%     | (16.61, 33.09) |
| Michael A. et al. 2020  | 68  | 172  | 39.35%     | (35.35, 43.40) |
| **Total**              | 261  | 1,871 | 32.93%     | (21.77, 44.15) |

Random-effects model

### African-American, Hospitalization (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Joseph Miller et al. 2020 | 1240 | 3,638 | 35.10%     | (34.93, 35.27) |
| Jennifer Wang et al. 2020 | 720  | 2,308 | 31.10%     | (26.91, 35.29) |
| S.B. Chan et al. 2020  | 150  | 293  | 51.24%     | (47.05, 55.46) |
| **Total**              | 2,110 | 6,259 | 35.10%     | (34.93, 35.27) |

Random-effects model

### Asian-American, ICU (Cohort Studies)

| Study                  | Cases | Total | Prevalence | 95% C.I.   |
|------------------------|-------|-------|------------|------------|
| Turn-Grau et al. 2020   | 81   | 195   | 42.26%     | (35.20, 49.63) |
| Michael A. et al. 2020  | 84   | 161   | 52.16%     | (44.67, 59.74) |
| Bell-Kotler et al. 2020 | 22   | 81    | 27.63%     | (19.62, 37.67) |
| **Total**              | 187  | 552   | 42.26%     | (35.20, 49.63) |

Random-effects model

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**eFigure 7. Forest Plot for Deceased Individuals in Cohort and Cross-sectional Studies**

**White, Deceased (Cross-sectional Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Di Xiong 2020          | 4929  | 104144 | 47.33      | [46.46, 48.44] |
| Jon Zhitnir 2020       | 3764  | 21371  | 17.95      | [17.53, 18.37] |
| V.S. Teitel 2020       | 65    | 1210   | 52.89      | [48.51, 57.02] |
| Heathert E. Hsu 2020  | 21    | 908    | 56.91      | [52.80, 61.52] |
| Freysich Shih 2020    | 19    | 235    | 220.84     | [32.47, 341.43] |

Random-effects model: I² = 89.8%, τ² = 0.021, χ² = 213.57 (p < 0.001)

**Hispanics, Deceased (Cross-sectional Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Di Xiong 2020          | 7959  | 13634 | 23.67      | [23.16, 24.18] |
| Jon Zhitnir 2020       | 1278  | 1057  | 34.97      | [30.76, 42.95] |
| V.S. Teitel 2020       | 76    | 415    | 30.27      | [24.20, 36.59] |
| Heathert E. Hsu 2020  | 117   | 402    | 29.21      | [23.62, 34.91] |
| Freysich Shih 2020    | 17    | 202    | 22.16      | [11.89, 41.57] |

Random-effects model: I² = 37.7%, τ² = 0.0285, χ² = 248.52 (p < 0.001)

**African-American, Deceased (Cross-sectional Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Di Xiong 2020          | 1237  | 21515 | 48.48      | [41.51, 51.15] |
| Ahsan Shafique 2020    | 122   | 419    | 29.17      | [24.99, 33.36] |
| Dipak Shuk 2020        | 79    | 414    | 37.61      | [31.41, 43.37] |
| Heathert E. Hsu 2020  | 46    | 1218   | 33.41      | [29.62, 37.19] |
| Sura Y. Teitel 2020   | 35    | 584    | 59.93      | [45.38, 73.31] |
| Anthony M. Veltier 2020 | 4     | 59     | 67.60      | [28.51, 161.74] |

Random-effects model: I² = 59.7%, τ² = 0.0231, χ² = 436.13 (p < 0.001)

**Hispanic, Deceased (Cohort Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Ilhan Patak 2020       | 1537  | 15354 | 71.80      | [71.24, 71.60] |
| Reosta-Ramirez-Manar 2020 | 277   | 1151  | 179.54     | [175.60, 183.60] |
| Benjamin D. Renick 2020 | 11    | 214   | 53.28      | [47.22, 60.37] |
| Brian T. Garfield 2020 | 79    | 284   | 222.48     | [217.26, 227.70] |
| Tian Gu 2020          | 15    | 482    | 71.16      | [66.51, 76.80] |
| Freysich Shih 2020    | 13    | 33     | 221.24     | [212.47, 230.40] |

Random-effects model: I² = 61.1%, τ² = 0.0231, χ² = 613.12 (p < 0.001)

**African-American, Deceased (Cohort Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Ilhan Patak 2020       | 1526  | 15354 | 71.78      | [71.24, 71.60] |
| George N. Turner, MD, NC 2020 | 277   | 1151  | 75.21      | [69.32, 81.66] |
| Siddhar Chaudhuri 2020 | 109   | 346    | 468.08     | [432.72, 505.79] |
| Benjamin D. Renick 2020 | 11    | 214   | 58.43      | [53.28, 63.68] |
| Brian T. Garfield 2020 | 79    | 284   | 222.48     | [217.26, 227.70] |
| Tian Gu 2020          | 15    | 482    | 71.16      | [66.51, 76.80] |
| Freysich Shih 2020    | 13    | 33     | 221.24     | [212.47, 230.40] |

Random-effects model: I² = 95.9%, τ² = 0.0231, χ² = 139.51 (p < 0.001)

**Asian-American, Deceased (Cross-sectional Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Di Xiong 2020          | 1014  | 13842 | 57.61      | [54.80, 60.95] |
| Jon Zhitnir 2020       | 76    | 1362  | 55.72      | [44.72, 66.92] |
| Sura Y. Teitel 2020   | 25    | 1036  | 24.13      | [18.36, 35.47] |
| Christopher S. King 2020 | 8     | 23    | 347.60     | [184.42, 517.11] |

Random-effects model: I² = 95%, τ² = 0.0231, χ² = 436.13 (p < 0.001)

**Asian-American, Deceased (Cohort Studies)**

| Study                  | Cases | Total | Prevalence | 95% C.I.     |
|------------------------|-------|-------|------------|--------------|
| Ilhan Patak 2020       | 4475  | 10108 | 230.81     | [224.54, 237.08] |
| Brian T. Garfield 2020 | 10    | 832   | 12.02      | [9.69, 21.08] |
| Benjamin D. Renick 2020 | 11    | 50    | 220.02     | [116.22, 355.15] |
| Missa 2020            | 1     | 124   | 1.99       | [0.27, 13.37] |

Random-effects model: I² = 89.8%, τ² = 0.0231, χ² = 412.99 (p < 0.001)

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**eFigure 8. Meta-regression for County Median Income**

Meta-regression for county median income in (A) Asian Americans and Whites who are deceased (cohort and cross-sectional studies) and (B) Whites who were admitted to the ICU (cohort studies).
eFigure 9. Spearman Correlations for Measures of Clinical Care Quality
Spearman Correlations for ADI and county median income in respect to the following variables: urban core opportunity index, population per one primary care physician, preventable hospital stays, and amount of uninsured individuals.
**eFigure 10. Metaregression for Clinical Care Measures**

Meta-regression for measures of clinical care quality in the following cohorts: meta-regression for preventable hospital stays in correlation with Asian Americans who tested positive for COVID-19 in cohort studies; meta-regression for primary care physician availability in correlation with Asian Americans and Hispanics who tested positive for COVID-19 (cohort studies) and Whites who are deceased (cross-sectional studies); and meta-regression for the amount of uninsured individuals in correlation with African Americans who tested positive for COVID-19 (cohort studies) and Whites who are deceased (cross-sectional studies).
eFigure 11. Leave-One-Out Sensitivity Analysis for Deceased Individuals in Cohort and Cross-sectional Studies

**White, Deceased (Cross-sectional Studies)**

| Study                          | Proportion Leaving Out Each Study |
|--------------------------------|-----------------------------------|
| Heather E. Hsa, 2020           | 0.06 (0.04, 0.18)                 |
| Priyank Shah, 2020             | 0.07 (0.06, 0.11)                 |
| Sara Y. Tato, 2020             | 0.09 (0.05, 0.18)                 |
| Di Xiong, 2020                 | 0.10 (0.05, 0.18)                 |
| Jon Zeheer, 2020               | 0.07 (0.04, 0.15)                 |

**Hispanics, Deceased (Cross-sectional Studies)**

| Study                          | Proportion Leaving Out Each Study |
|--------------------------------|-----------------------------------|
| Benjamin D. Renshaw, 2020      | 0.10 (0.02, 0.30)                 |
| Sridhar Chilimuru, 2020        | 0.08 (0.01, 0.26)                 |
| Ishan Pathak, 2020             | 0.15 (0.06, 0.45)                 |
| George N. Isernwe, MBChB, 2020 | 0.15 (0.03, 0.47)                 |
| Brian T. Garibaldi, 2020       | 0.13 (0.03, 0.47)                 |

**African-American, Deceased (Cross-sectional Studies)**

| Study                          | Proportion Leaving Out Each Study |
|--------------------------------|-----------------------------------|
| Priyank Shah, 2020             | 0.06 (0.01, 0.10)                 |
| Ashut Bhargava, 2020           | 0.07 (0.04, 0.12)                 |
| Heather E. Hsa, 2020           | 0.11 (0.05, 0.24)                 |
| Anthony M. Wale, 2020          | 0.09 (0.04, 0.20)                 |
| Sara Y. Tato, 2020             | 0.14 (0.04, 0.23)                 |
| Di Xiong, 2020                 | 0.19 (0.03, 0.21)                 |

**Asian-American, Deceased (Cross-sectional Studies)**

| Study                          | Proportion Leaving Out Each Study |
|--------------------------------|-----------------------------------|
| Ishan Pathak, 2020             | 0.02 (0.00, 0.06)                 |
| Benjamin D. Renshaw, 2020      | 0.02 (0.00, 0.06)                 |
| Nara-Yas Min, 2020             | 0.09 (0.01, 0.15)                 |
| Brian T. Garibaldi, 2020       | 0.06 (0.00, 0.09)                 |

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eFigure 12. Leave-One-Out Sensitivity Analysis for Patients Admitted to ICU or Hospitalized in Cohort Studies

White, ICU (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| Obengs Ogroodabi, 2019         | 0.23 [0.14, 0.36] |
| Rafi Kabbani, MD, 2006         | 0.24 [0.18, 0.35] |
| Tian Gu, M, 2010               | 0.25 [0.18, 0.37] |
| Nicholas E. Ingraham, 2000     | 0.21 [0.17, 0.25] |

Summary proportions leaving out each study

White, Hospitalization (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| SB. Chan, 2020                 | 0.11 [0.03, 0.19] |
| Jennifer Woo Seidel, 2020      | 0.15 [0.06, 0.27] |
| Lao Jie, 2026                  | 0.48 [0.02, 0.32] |
| Joseph Milic, 2020             | 0.48 [0.02, 0.22] |

Summary proportions leaving out each study

Hispanics, ICU (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| Obengs Ogroodabi, 2019         | 0.31 [0.14, 0.55] |
| Rafi Kabbani, MD, 2006         | 0.35 [0.22, 0.51] |
| Tian Gu, M, 2010               | 0.26 [0.12, 0.46] |
| Nicholas E. Ingraham, 2000     | 0.26 [0.11, 0.39] |

Summary proportions leaving out each study

Hispanics, Hospitalization (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| SB. Chan, 2020                 | 0.12 [0.01, 0.2] |
| Jennifer Woo Seidel, 2020      | 0.06 [0.03, 0.19] |
| Joseph Milic, 2020             | 0.15 [0.05, 0.47] |

Summary proportions leaving out each study

African-American, ICU (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| Obengs Ogroodabi, 2019         | 0.24 [0.13, 0.44] |
| Rafi Kabbani, MD, 2006         | 0.29 [0.19, 0.41] |
| Tian Gu, M, 2010               | 0.28 [0.17, 0.44] |
| Nicholas E. Ingraham, 2000     | 0.28 [0.18, 0.31] |

Summary proportions leaving out each study

African-American, Hospitalization (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| SB. Chan, 2020                 | 0.23 [0.10, 0.38] |
| Jennifer Woo Seidel, 2020      | 0.34 [0.04, 0.36] |
| Lao Jie, 2026                  | 0.68 [0.01, 0.35] |
| Joseph Milic, 2020             | 0.11 [0.01, 0.58] |

Summary proportions leaving out each study

Asian-American, ICU (Cohort Studies)

| Study                          | Proportion
|--------------------------------|-------------|
| Rafi Kabbani, MD, 2006         | 0.47 [0.28, 0.66] |
| Tian Gu, M, 2010               | 0.39 [0.18, 0.65] |
| Nicholas E. Ingraham, 2000     | 0.35 [0.22, 0.51] |

Summary proportions leaving out each study

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### eFigure 13. Leave-One-Out Sensitivity Analysis for COVID-19 Positive Patients in Cohort and Cross-sectional Studies

#### White, Positive (Cross-sectional Studies)

| Study | Sensitivity | Odds Ratio | 95% CI | P-Value |
|-------|-------------|------------|--------|---------|
| White, Positive (Cohort Studies) | 0.21 | 0.50 | (0.30, 0.80) | 0.007 |
| White, Positive (Cohort Studies) | 0.30 | 0.40 | (0.20, 0.80) | 0.003 |
| White, Positive (Cohort Studies) | 0.15 | 0.60 | (0.30, 2.00) | 0.03 |
| White, Positive (Cohort Studies) | 0.10 | 0.80 | (0.30, 2.00) | 0.001 |

#### Hispanics, Positive (Cross-sectional Studies)

| Study | Sensitivity | Odds Ratio | 95% CI | P-Value |
|-------|-------------|------------|--------|---------|
| Hispanics, Positive (Cohort Studies) | 0.20 | 0.50 | (0.30, 0.80) | 0.007 |
| Hispanics, Positive (Cohort Studies) | 0.30 | 0.40 | (0.20, 0.80) | 0.003 |
| Hispanics, Positive (Cohort Studies) | 0.15 | 0.60 | (0.30, 2.00) | 0.03 |
| Hispanics, Positive (Cohort Studies) | 0.10 | 0.80 | (0.30, 2.00) | 0.001 |

#### African-American, Positive (Cross-sectional Studies)

| Study | Sensitivity | Odds Ratio | 95% CI | P-Value |
|-------|-------------|------------|--------|---------|
| African-American, Positive (Cohort Studies) | 0.20 | 0.50 | (0.30, 0.80) | 0.007 |
| African-American, Positive (Cohort Studies) | 0.30 | 0.40 | (0.20, 0.80) | 0.003 |
| African-American, Positive (Cohort Studies) | 0.15 | 0.60 | (0.30, 2.00) | 0.03 |
| African-American, Positive (Cohort Studies) | 0.10 | 0.80 | (0.30, 2.00) | 0.001 |

#### Asian-American, Positive (Cross-sectional Studies)

| Study | Sensitivity | Odds Ratio | 95% CI | P-Value |
|-------|-------------|------------|--------|---------|
| Asian-American, Positive (Cohort Studies) | 0.20 | 0.50 | (0.30, 0.80) | 0.007 |
| Asian-American, Positive (Cohort Studies) | 0.30 | 0.40 | (0.20, 0.80) | 0.003 |
| Asian-American, Positive (Cohort Studies) | 0.15 | 0.60 | (0.30, 2.00) | 0.03 |
| Asian-American, Positive (Cohort Studies) | 0.10 | 0.80 | (0.30, 2.00) | 0.001 |

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eFigure 14. Forest Plots for Deceased Patients After Removing Dominating Studies

Adjusted forest plots for deceased patients following removal of outlier studies identified in leave-one-out sensitivity analysis.

White, Deceased (Cross-sectional Studies)

| Study                   | Cases | Total | Prevalence | 95% C.I.       |
|-------------------------|-------|-------|------------|----------------|
| Jon Zelner 2020         | 3064  | 23381 | 131.59     | [127.22; 135.90] |
| Sara Y. Tarof 2020      | 64    | 1270  | 53.89      | [41.61; 67.02]   |
| Heather E. Hsu 2020     | 21    | 509   | 50.91      | [37.08; 65.393]  |
| Priyank Shah 2020       | 13    | 59    | 220.34     | [124.47; 343.43] |

Random effects model,
Homogeneity: $I^2 = 90.8$, $Q= 0.423$, $X^2 = 70.16$ (p < 0.01)

African-American, Deceased (Cross-sectional Studies)

| Study                   | Cases | Total | Prevalence | 95% C.I.       |
|-------------------------|-------|-------|------------|----------------|
| D. Xiong 2020           | 1237  | 25515 | 48.48      | [45.91; 51.10]  |
| Ashraf Aboazeedi 2020   | 122   | 419   | 291.17     | [209.05; 386.5] |
| Priyank Shah 2020       | 79    | 454   | 174.01     | [141.04; 211.68]|
| Sara Y. Tarof 2020      | 35    | 566   | 39.93      | [43.84; 82.33]  |
| Anthony M. Siller 2020  | 4     | 59    | 67.86      | [25.58; 167.14] |

Random effects model,
Homogeneity: $I^2 = 99.1$, $Q^2 = 1.3129$, $X^2 = 432.14$ (p < 0.01)

Asian-American, Deceased (Cross-sectional Studies)

| Study                   | Cases | Total | Prevalence | 95% C.I.       |
|-------------------------|-------|-------|------------|----------------|
| D. Xiong 2020           | 1914  | 33042 | 57.41      | [56.96; 58.96]  |
| Jon Zelner 2020         | 76    | 1501  | 55.72      | [54.72; 56.72]  |
| Christopher S. King 2020| 8     | 820   | 7.82       | [5.92; 15.94]   |

Random effects model,
Homogeneity: $I^2 = 99.1$, $Q^2 = 1.2346$, $X^2 = 38.07$ (p < 0.01)

African-American, Deceased (Cohort Studies)

| Study                   | Cases | Total | Prevalence | 95% C.I.       |
|-------------------------|-------|-------|------------|----------------|
| Jon Zelner 2020         | 2490  | 19862 | 123.99     | [119.06; 128.29]|
| George C. Vanacore 2020 | 925   | 4715  | 56.59      | [52.75; 60.5]   |
| Benjamin O. Kehoes 2020 | 129   | 772   | 235.61     | [241.33; 229.23]|
| Brian T. Gordon 2020    | 30    | 336   | 104.81     | [91.34; 118.01] |
| Tian Gu 2020            | 35    | 898   | 63.32      | [45.96; 87.70]  |
| Sotrelle Chilvers 2020  | 34    | 93    | 41.93      | [29.02; 54.07]  |

Random effects model,
Homogeneity: $I^2 = 99.1$, $Q^2 = 0.0097$, $X^2 = 50.07$ (p < 0.01)

Asian-American, Deceased (Cohort Studies)

| Study                   | Cases | Total | Prevalence | 95% C.I.       |
|-------------------------|-------|-------|------------|----------------|
| Mirble Foth 2020        | 4475  | 78888 | 231.01     | [224.94; 237.82]|
| Brian T. Gordon 2020    | 10    | 862   | 11.02      | [6.46; 22.19]   |
| Benjamin O. Kehoes 2020 | 11    | 59    | 220.00     | [220.00; 220.00]|

Random effects model,
Homogeneity: $I^2 = 99.1$, $Q^2 = 0.0097$, $X^2 = 50.07$ (p < 0.01)

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eFigure 15. Forest Plots for Positive Individuals After Removing Dominating Studies

Adjusted forest plots for COVID-19 positive patients following removal of outlier studies identified in leave-one-out sensitivity analysis.
eMethods 1. Methods Pertaining to Search Criteria and Data Collection

The following keywords were used to search by all fields, which includes full text, author name, journal name, and phrase, in each database: “COVID-19 AND race”, “COVID-19 AND ethnicity”, “COVID-19 AND Asian patients”, “COVID-19 AND Black patients”, “COVID-19 AND White patients”, “COVID-19 AND Hispanic/Latino patients”, “COVID-19 AND American Indian/Alaska Natives patients”, “COVID-19 AND Pacific Islander patients”, “COVID-19 AND multiracial patients”, “income AND COVID-19”; “socioeconomic status AND COVID-19”, and “employment AND COVID-19.”

We used both the keyword and Medical Subject Heading (MeSH) term for the following keywords to increase the scope of our systematic review and meta-analysis: “COVID-19 AND ethnicity (MeSH term: COVID-19 AND ethnic groups)”, “COVID-19 AND race (MeSH term: COVID-19 AND race factors)”, “socioeconomic status AND COVID-19 (MeSH term: COVID-19 AND social class)”. MeSH terms provide controlled vocabulary for searches in databases, such as Pubmed. We chose to use both the MeSH term and the non-MeSH term for these particular keywords, as the non-MeSH term yielded significantly more results than the MeSH term. MeSH terms could not be used for the following keywords, as they were not available on the database: “COVID-19 AND Asian patients”, “COVID-19 AND Black patients”, “COVID-19 AND White patients”, “COVID-19 AND Hispanic/Latino patients”, “COVID-19 AND American Indian/Alaska Natives patients”, “COVID-19 AND Pacific Islander patients”, and “COVID-19 AND multiracial patients”. MeSH terms were solely used for the following keywords: “income AND COVID-19” and “employment AND COVID-19”.

Our original keyword searches yielded 21,745 total results. Of these articles, 14,519 were unique (eFigure 1). We excluded studies based on Abstract if they met one of the following criteria: (1) The article is irrelevant for the study question or has insufficient data, (2) The article does not discuss an outcome that is of interest, (3) The article is published in a non-standard format and/or in a foreign language. Only studies with original clinical data were included. Following the Abstract review, we screened the full text of the remaining 287 articles. After subsequent full-text screening using the same 3 exclusion criteria, a total of 68 studies were included for data analysis.

Study and patient characteristics were collected, including the study type, location, mean and median age, total number of patients in the study, and medical comorbidities. Specifically, we extracted data for the following medical comorbidities and conditions which we observed to be commonly reported across various studies: smoking status (both former and current smokers), median body mass index (BMI), BMI over 40, cardiovascular disease (including other heart conditions such as coronary artery disease), hypertension, chronic obstructive pulmonary disease (COPD), diabetes mellitus or diabetes, and occurrence of malignancy or cancer. For the purposes of this analysis, we considered Hispanics and Latinos as a single cohort. The studies included did

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not differentiate between various Asian populations, so many Asian populations were considered as a single cohort.

Following initial data review, we extracted the zip code, geographic location and/or congressional district from each study included in our meta-analysis in order to identify socioeconomic variables for subsequent analyses. In instances where congressional district information was not provided, we determined this information based on the zip code or geographic location of the study. From this extracted information, we obtained the following data for various measures of socioeconomic disparity from external websites for each study: (1) County median income and the percentage of each race in the district where the study was conducted was taken from the US Census Bureau’s website at the congressional district level. (2) Area Deprivation Index (ADI) was evaluated with The University of Wisconsin's Neighborhood Atlas tool and was constructed based on geographic location. (3) Measures of social determinants of health, including the percent of the population under age 65 that are uninsured, ratio of population to primary care physicians, and rate of hospital stays for ambulatory-care sensitive conditions per 100,000 Medicare enrollees (preventable hospital stays), were evaluated with the County Health Rankings and Roadmaps tool at the congressional district level. Geographic variation and population density were assessed with the Urban Core Opportunity Index as reported in the Social Determinants of Health Atlas. Area unit of analysis was limited to specific location and address level for this particular tool. For county-wide studies, a broader measure of each of these social determinants was calculated, using averages of data from each of the locations indicated in the study.
eMethods 2. Citations of Articles that Appeared to Meet Inclusion Criteria but Were Excluded

Excluded for non-standard format:

1. Bassett, M. T., Chen, J. T., & Krieger, N. (2020). Variation in racial/ethnic disparities in COVID-19 mortality by age in the United States: A cross-sectional study. PLoS medicine, 17(10), e1003402.
2. Hawkins, R. B., Charles, E. J., & Mehaffey, J. H. (2020). Socio-economic status and COVID-19–related cases and fatalities. Public health, 189, 129-134.
3. Egede, L. E., Walker, R. J., Garacci, E., & Raymond Sr, J. R. (2020). Racial/Ethnic Differences In COVID-19 Screening, Hospitalization, And Mortality In Southeast Wisconsin: Study examines racial/ethnic differences in COVID-19 screening, symptom presentation, hospitalization, and mortality among 31,549 adults tested for COVID-19 in Wisconsin. Health Affairs, 39(11), 1926-1934.
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5. Alnababteh, M., Drescher, G., Jayaram, L., Kohli, A., Hashmi, M., Hayat, F., ... & Zaaqoq, A. (2020). INVESTIGATING THE RELATIONSHIP BETWEEN RACE/ETHNICITY AND CLINICAL OUTCOMES IN COVID-19. Chest, 158(4), A2477.
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11. Baquero, B., Gonzalez, C., Ramirez, M., Chavez Santos, E., & Ornelas, I. J. (2020). Understanding and Addressing Latinx COVID-19 Disparities in Washington State. Health Education & Behavior, 47(6), 845-849.
12. Le, T. K., Cha, L., Han, H. R., & Tseng, W. (2020). Anti-Asian Xenophobia and Asian American COVID-19 Disparities.

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13. Kim, H. N., Lan, K. F., Nkyekyer, E., Neme, S., Pierre-Louis, M., Chew, L., & Duber, H. C. (2020). Assessment of disparities in COVID-19 testing and infection across language groups in Seattle, Washington. JAMA network open, 3(9), e2021213-e2021213.

14. Hamidi, S., Ewing, R., & Sabouri, S. (2020). Longitudinal analyses of the relationship between development density and the COVID-19 morbidity and mortality rates: Early evidence from 1,165 metropolitan counties in the United States. Health & place, 64, 102378.

15. Rader, B., Astley, C. M., Sy, K. T. L., Sewalk, K., Hswen, Y., Brownstein, J. S., & Kraemer, M. U. (2020). Geographic access to United States SARS-CoV-2 testing sites highlights healthcare disparities and may bias transmission estimates.

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eMethods 3. Description of Statistical Methods Used in Analyses

All calculations for prevalence, relative risk ratio (RR), odds ratio (OR), and adjustment analysis were conducted using the “meta,” “metafor,” and “multicon” R packages.

The studies were separated into cohort and cross-sectional studies for all data analysis. Cohort studies include a population that is defined prior to the pandemic, while cross-sectional studies only include patients with COVID-19 at a given place/time.

A random-effects model was used to calculate all measures in this study. Random effects models were used to assess summary proportions and account for study heterogeneity, as studies included in the meta-analysis contained diverse patient populations (eFigures 5-7).

Random-effects models do not condition on the true outcomes, but instead the studies in the meta-analysis are assumed to be a random sample of the large population of studies. This is ideal for the purposes of this study, as our study population is a hypothetical population of an infinitely possible subset of study populations that may have been sampled or will be sampled in the future. In a random-effects model, the true outcomes in the studied population are assumed to be normally distributed, with \( \mu \) representing the average true outcome, and \( \tau^2 \) representing the variance of the true outcomes: \( \theta \sim N(\mu, \tau^2) \). The random-effects model may also be represented as a linear combination of the average true outcome and uniformly distributed variables: \( y_i = \mu + \mu_i + \epsilon_i \), where \( \mu_i \sim N(0, \tau^2) \) and \( \epsilon_i \sim N(0, \nu_i) \) (\( \nu_i \) is the sampling variance associated with the observed outcomes).

Logit transformations were applied to all proportional data, and the Cochran’s Q test and the \( I^2 \) index were used to quantify study heterogeneity (eTable 6). Meta-regression analysis was conducted to assess correlations between study effect size and socioeconomic variables. These models were used to further examine the correlations between race/ethnicity and COVID-19 outcomes. Publication bias was assessed using the Egger’s test for publication bias. Leave-one-sensitivity analysis was conducted to examine the impact of dominating studies or outliers on results.

The relative risk ratio (RR) (with 95% confidence interval) and the odds ratio (OR) (with 95% confidence interval) describe the risk (or odds) of COVID-19 severity in different racial and ethnic groups relative to Whites. RR/OR measures were adjusted by fitting a mixed-effects model with Restricted Maximum Likelihood (REML) estimation. 8 different models were used to test for the effect of confounding variables on risk outcomes: Sex-Adjusted (Figure 1, Figure 2); Age-Adjusted (eTable 3, eTable 4); Sex & Age-adjusted (Figure 1, Figure 2); ADI-adjusted (eTable 3, eTable 4); Income-adjusted (eTable 3, eTable 4); Clinical Care-adjusted (eTable 3, eTable 4); Urban Opportunity Index (UOI)-adjusted (eTable 3, eTable 4); Comorbidities-
adjusted (eTable 3, eTable 4). Studies in the unadjusted model that did not include information for one of these variables were excluded from the adjustment analysis of that particular variable. Methods to estimate missing data, such as multiple imputation, were not used as the studies were conducted separately (not a randomized trial) and the number of known outcomes would not be sufficient for accurate imputation. No more than two individual measures were adjusted at once in order to minimize the effects of overfitting (see the composite measures mentioned below).

Additionally, fitting was only calculated if the predictor variable(s) had at least 2 more outcomes than the variables being adjusted for. The mixed-effects models were fitted to the median value(s) of the variable(s) being adjusted for in order to reduce the effects of outliers. We calculated a combined measure for both Comorbidities and Clinical Care using a unit-weighted composite function, as several variables were required to appropriately adjust for these factors. The Comorbidity measure was composed using the following comorbidities that were available in the study group: ever smoker, BMI, cardiovascular disease, hypertension, COPD, diabetes, and cancer. The following variables were used to compose an estimate for the quality of Clinical care: Percent of the population under 65 that are uninsured, ratio of the population to primary care physicians, and the rate of hospital stays for ambulatory-care sensitive conditions per 100,000 Medicare enrollees (preventable hospital stays). In order to test for the similarity of variables used for the combined measures, only composed variables with a Chronbach’s alpha score > 0.7 were used for adjustment (eTable 3, eTable 4). The clinical-care measure for Hispanic/Latino COVID-19 positive RR/OR was the only unit-weighted composite variable which yielded an alpha score < 0.7. Thus, RR/OR adjustment was not implemented for this cohort.