

1 **Regional Association of Disability and SARS-CoV-2 Infection in 369 Counties of the United States**

2 **Running Title:** SARS-CoV-2 Infection among non-institutionalized disabled population

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32

33 **Abstract**

34 **Background:** There have been outbreaks of SARS-CoV-2 in long term care facilities and recent reports of
35 disproportionate death rates among the vulnerable population. The goal of this study was to better understand
36 the impact of SARS-CoV-2 infection on the non-institutionalized disabled population in the United States using
37 data from the most affected states as of April 9th, 2020.

38 **Methods:** This was an ecological study of county-level factors associated with the infection and mortality rate
39 of SARS-CoV-2 in the non-institutionalized disabled population. We analyzed data from 369 counties from the
40 most affected states (Michigan, New York, New Jersey, Pennsylvania, California, Louisiana, Massachusetts) in
41 the United States using data available by April 9th, 2020. The variables include changes in mobility reported by
42 Google, race/ethnicity, median income, education level, health insurance, and disability information from the
43 United States Census Bureau. Bivariate regression analysis adjusted for state and median income was used to
44 analyze the association between death rate and infection rate.

45 **Results:** The independent sample t-test of two groups (group 1: Death rate \geq 3.4% [median] and group 2:
46 Death rate < 3.4%) indicates that counties with a higher total population, a lower percentage of Black males
47 and females, higher median income, higher education, and lower percentage of disabled population have a
48 lower rate (< 3.4%) of SARS-CoV-2 related mortality (all p -values < 4.3E-02). The results of the bivariate
49 regression when controlled for median income and state show counties with a higher White disabled
50 population (est: 0.19, 95% CI: 0.01-0.37; p -value: 3.7E-02), and higher population with independent living
51 difficulty (est: 0.15, 95% CI: -0.01-0.30; p -value: 6.0E-02) have a higher rate of SARS-CoV-2 related
52 mortality. Also, the regression analysis indicates that counties with higher White disabled population (est: -
53 0.22, 95% CI: -0.43-(-0.02); p -value: 3.3E-02), higher population with hearing disability (est: -0.26, 95% CI: -
54 0.42- (-0.11); p -value: 1.2E-03), and higher population with disability in the 18-34 years age group (est: -0.25,
55 95% CI: -0.41-(-0.09); p -value: 2.4E-03) show a lower rate of SARS-CoV-2 infection.

56 **Conclusion:** Our results indicate that while counties with a higher percentage of non-institutionalized disabled
57 population, especially White disabled population, show a lower infection rate, they have a higher rate of
58 SARS-CoV-2 related mortality.

59 **Keywords:** Disability disparities, Healthcare disparities, Non-institutionalized disabled population, Racial
60 disparity, Health disparity, Socioeconomic factors, COVID19, United States, Population-based analysis,
61 Ecological study.

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64 INTRODUCTION

65 The continuous spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has highlighted
66 disparities in the infection and mortality rates of this disease.¹ The outbreak in a nursing home in Kirkland,
67 Washington² was the first to report death due to SARS-CoV-2 in the United States (U.S). As of May 26, 2020,
68 there are over 5.6 million confirmed cases worldwide, with over 1.6 million SARS-CoV-2 cases and 99,123
69 deaths in the U.S.³ SARS-CoV-2 initially attacks the respiratory system;⁴ with groups most susceptible to the
70 infection and death being people aged 65 years and older, as well as people with certain chronic conditions and
71 comorbidities. People living in nursing homes or long-term care facilities are more prone to the infection.^{5,6}
72 Recently, states are releasing data on the number of deaths from long term care facilities⁷ with the most recent
73 report stating that more than 10,000 patients and staff in long term facilities have died,⁸ accentuating the
74 disparities in the outcomes of the disabled population in the U.S. The populations with higher disability are
75 affected by the lower quality of care and increased comorbidities^{9,10} even before the evidence of disparities in
76 the SARS-CoV-2 outcomes was reported. However, there have been few reports concerning the non-
77 institutionalized disabled population and the risk of mortality and infection by SARS-CoV-2.¹¹ To provide
78 targeted preventive strategies, adequate resources for the disabled population and their care providers, an
79 examination into the infection among the non-institutionalized disabled population is a necessary first step.
80 The goal of this ecological study was to determine the association between county-level non-institutionalized
81 disability rates, socioeconomic factors, and SARS-CoV-2 infection and death; we hypothesized that non-
82 institutionalized disability rates in counties are associated with the rate of SARS-CoV-2 infection and death.

83 METHODOLOGY:

84 We conducted an ecological analysis of demographic, mobility, socioeconomic, and disability information, in
85 the context of SARS-CoV-2 data in 369 counties in California, Michigan, New York, New Jersey, Louisiana,
86 Pennsylvania, and Massachusetts with the initial highest SARS-CoV-2 infection and death rates as of April 9th,
87 2020.

88 Data source:

89 Data sources in this study include publicly available data from United States Census Bureau data estimated for
90 2018 for demographic data per county^{12,13} *USAFACTS* for SARS-CoV-2 cases estimated for the year 2020,¹⁴
91 and mobility data provided by Google, as of April 5th, 2020.¹⁵

92 According to Social Security, individuals who cannot engage in substantial productive activity due to
93 medically diagnosable physical or mental impairment which is expected to lead to death or last for over twelve
94 months are legally defined as disabled.¹⁶ The non-institutionalized disabled population was defined as
95 individuals not in a nursing home, prisons, or confined to any other facilities.

96 The data elements in this study included: 1) mobility data for each county, reported by Google on April 5th,
97 2020, that captured percent increase or decrease in mobility (grocery mobility, retail mobility, transit mobility,
98 park mobility, work mobility, and resident mobility); 2) county-level data for total disabled population by
99 race/ethnicity, age, gender, and type of disability along with data on total population, median income,
100 education level, and access to health insurance, all data elements extracted from the United States Census
101 Bureau. Table 1 summarizes a detailed description of the data elements used in this study. The outcome
102 variables, infection and mortality rates were reported by USAFACTS.¹⁴ County-level SARS-CoV-2 infection and
103 mortality cases were extracted from the state's health departments through data from hospitals, nursing homes,
104 and other health organizations as reported on April 9th, 2020.

105 Outcome Measures

106 The outcome measure is the county-level SARS-CoV-2 infection and mortality rates for the non-
107 institutionalized disabled population. The infection and mortality rates were based on CDC guidelines¹⁷
108 (numerator: confirmed cases or death; denominator: total population per county). The mean of the infection
109 rates or death rates were used for the comparative analysis as described below.

110 Statistical Analysis

111 The data elements in this study were described using their mean \pm standard deviation unless otherwise stated.
112 An independent sample t-test was used to determine statistical significance in SARS-CoV-2 infection and
113 death rates in comparison to the mobility, race/ethnicity, disability, median income, insured population, and
114 total populations in the 369 counties. Bivariate regression adjusted for the state, and median income, \pm total

115 population was used to analyze the association between death rate or infection rate. Statistical analyses were
116 performed using the IBM SPSS Statistics 26¹⁸ and R version 3.6.2.¹⁹

117 **RESULTS**

118 **SARS-CoV-2 infection and mortality in the seven states during the first peak of infection in the U.S.**

119 The county-level data from 369 counties from Michigan, New York, New Jersey, Pennsylvania,
120 Massachusetts, California, and Louisiana (mean population: 276,905.5±683,001.8) with the highest number
121 of SARS-CoV-2 infection (as of April 9th, 2020) in the U.S. were included in this study.

122 The mean and 95% confidence interval (CI) for race/ethnicity, disability age group, and disability by gender
123 are available in Table S1. The mean rate of disability in the U.S. population for the states used in the study was
124 15.0% ±3.7%; this rate for males was 13.1%±3.1% and for the female population was at 13.4%±2.8%.

125 Disability in the race/ethnic groups ranged differently with the average of disability in the Black population
126 (15.4% ±6.1%) as the highest; disability in the Asian population (7.9% ±3.9%) was the lowest; disability rate
127 in the white population was at 14.0%±2.9%. The age of the disabled population varied with the majority being
128 75 years or older (47.1%±6.0%) and lowest in disability age group 5 to 17 years at 6.3%±2.5%. Lastly, the
129 disability types also varied within the population, ambulatory disability represents the highest type of disability
130 at 7.0%±1.7% on average, while individuals with self-care difficulty were on average at 2.7%±0.7%. The
131 hearing difficulty was at 3.7% ±1.1%, while vision difficulty was at 2.2%±0.8%, cognitive difficulty at
132 5.4%±1.4%, and independent living disability was at 6.1%±1.4%. The mean infection rate was
133 1593.0±2768.9 per million with a median of 555.5, [IQR: 245.2-1486.6] while the mean mortality rate was
134 3.8%±2.2% and median of 3.4% [IQR: 2.2%-5.4%].

135 The independent sample t-test of the two groups (group 1: Death rate ≥ 3.4% [median] and group 2: Death rate
136 < 3.4%; Table 2) indicated that counties with a higher total population, reduction in retail mobility, a lower
137 percentage of Black males and females, higher median income, higher education, lower percentage of disabled
138 population, and a lower percentage of disabled in the age group of 35 to 64 years had a lower rate (< 3.4%) of
139 SARS-CoV-2 related mortality (all *p*-values < 4.3E-02). Additionally, a higher rate of SARS-CoV-2 infection
140 was observed in counties with a higher population, a higher percentage of Black males and females, a higher

141 median income, higher percentage of bachelor or graduate degree, a lower percentage of the disabled
142 population, specifically a lower percentage of disabled individuals with hearing difficulty, and a lower
143 percentage of disabled in the age group of 35 to 64 and 65 to 74 years (Table 3, all p -values<2.3E-02).
144 **Regression analysis showed a higher white disabled population, and independent living difficulty had a**
145 **higher rate of SARS-CoV-2 related mortality.**

146 The results of the bivariate regression analysis (Figure 1, Table S2) estimate the effect size of disability sub-
147 groups associated with SARS-CoV-2 related mortality when controlled for the median income and state.
148 Counties with a higher percentage of White disabled population (est: 0.19, 95% CI: 0.01-0.37; p -value:3.7E-
149 02), higher population with independent living difficulty (est: 0.15, 95% CI: -0.01-0.30; p -value: 6.0E-02), and
150 higher disability in the age group 18-34 years (est:0.17, 95% CI: 0.02-0.31; p -value:2.4E-02) showed a higher
151 rate of SARS-CoV-2 related mortality. The same trend is observed when controlling for the total population,
152 median income and state in the bivariate regression model (Figure S1, Table S3).

153 **Regression analysis indicates no significant difference in SARS-CoV-2 related Infection rates among**
154 **counties with different disability rates.**

155 The bivariate regression analysis was controlled for median income and state (Figure 2, Table S4), we
156 observed that counties with higher percentage of White disabled population (est: -0.22, 95% CI: -0.43-(-0.02);
157 p -value: 3.3E-02), higher percentage of people with hearing disability (est: -0.26, 95% CI: -0.42-(-0.11); p -
158 value:1.2E-03), and higher percentage of people with disability in the 18-34 years age group (est: -0.25, 95%
159 CI: -0.41-(-0.09); p -value:2.4E-03) showed a lower rate of SARS-CoV-2 infection. The bivariate regression
160 analysis of the SARS-CoV-2 Infection rate when controlled for the total population, median income, and state
161 showed no observed statistical significance in disability or any of the disability types (Figure S2, Table S5).

162 **DISCUSSION**

163 Our results indicate that counties with a higher percentage of non-institutionalized White disabled and a higher
164 rate of independent living difficulty show a higher rate of SARS-CoV-2 related mortality. These results are
165 plausible with the knowledge that the disabled population has a higher rate of obesity,²⁰⁻²³ lack of physical
166 activity,^{20,22,23} diabetes,^{9,23,24} higher rates of cardiovascular diseases^{9,23,24} that limits their body's ability to fight
167 the SARS-CoV-2 infection, which can ultimately lead to a poor outcome.^{9,10} Another reason for the high

168 mortality rates could be due to the independent living difficulty that may have been compounded by the
169 pandemic such as transportation limitations, grocery access, reduced opportunity for daily care, and essential
170 services.²⁵ Additionally, in anticipation of a supply crisis, many health departments around the U.S. considered
171 options on how to triage patients who should be given the most aggressive life-saving therapies in the event of
172 a supply shortage.²⁶ In Washington state, a plan was put forward to withhold advanced care for patients with
173 heart failure, chronic lung and liver disease among other organ dysfunctions; diseases that are common co-
174 morbidities with the adult disabled population.²⁶⁻²⁸ Although this action was not officially taken in the U.S.,
175 there is a history of systematic discrimination in policies and treatment of disabled patients and lack of
176 adequate preparedness for disabled patients during a pandemic.²³

177 The center for disease control and prevention (CDC) cautioned that difficulty to understand information,
178 limited mobility, and inability to communicate symptoms/illness may put the disabled patient population at
179 risk.²⁹ Alternatively, our results when adjusted for state and median income show counties with higher White
180 disabled population and higher hearing disabled population have a lower rate of SARS-CoV-2 infection. There
181 is a possibility that people with a hearing disability are overcompensated with visual information,³⁰ which
182 could potentially increase their attentiveness to the visual information concerning the spread of SARS-CoV-2
183 and their adherence to the enforced state-wide recommendations for the pandemic. Nonetheless, understanding
184 how this sub-population is potentially better-protected needs further investigation.

185 Additionally, there was no significant difference in any of the disability groups when the analysis was
186 controlled for population size, median income, and state. Although our bivariate regression analysis results on
187 SARS-CoV-2 infection rate show there is no significance among states with different disability rates, this
188 finding is not consistent with reports that the disabled population is at a higher risk of infection,^{27,31} we
189 emphasize that the studied population was non-institutionalized disabled, so the trends may be different from
190 studies that include both the institutionalized and non-institutionalized disabled population.³¹ The influenza
191 pandemics showed that disabled patients are at an increased risk of infection, but also less likely to have access
192 to vaccinations or be educated on their medical needs.³¹ The disabled population are at an increased risk of
193 exposure, complication, and death due to their reliance on health services that may be on hold during
194 pandemics, and if those services are available, they run the risk of exposure to the virus.³¹

195 This study provides some insight into how the counties with higher non-institutionalized disabled population
196 may be affected by SARS-CoV-2 in the most affected states during the first wave of infection in the United
197 States. SARS-CoV-2 is a call to pay more attention to this sub-population of non-institutionalized disabled
198 civilians that are 12.7%³² of the total U.S population especially since the population is expected to see a 20%
199 increase in adults over 65 years or older within the next decade,³³ this age group is currently 40%³⁴ of the
200 disabled population. It is imperative that policies and programs are being put in place to avoid a public health
201 crisis in the future for this group.³¹

202 Several limitations were observed in this study; the data used in this study was based on the county level. The
203 data on the infection rate is likely an underestimate of the true cases, especially for the healthier population. In
204 the future, we will continue to monitor and study the impact of the infection on this vulnerable population.

205 In conclusion, our results indicate that while counties with a higher percentage of the non-institutionalized
206 disabled population, especially White disabled population, show a lower infection rate, they have a higher rate
207 of SARS-CoV-2 related mortality.

208

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298 **Figure and Table Legends:**

299 **Table 1.** Description of Data Elements

300 **Table 2.** Independent sample t-test comparing counties with a higher and lower median death rate

301 **Table 3.** Independent sample t-test comparing counties with a higher and lower median infection rate

302 **Figure 1.** Death due to SARS-CoV-2 when controlled for state and median income

303 **Figure 2.** Infection due to SARS-CoV-2 when controlled for the state and median income

304

305 **Table S1.** Independent sample t-test with comprehensive summary statistics comparing counties data element:
306 mean, minimum, maximum, confidence interval lower and upper bound

307 **Table S2.** Detailed results of the bivariate analysis of risk of death by SARS-CoV-2 when controlled for state,
308 and median income

309 **Table S3.** Detailed results of the bivariate analysis of the risk of death by SARS-CoV-2 when controlled for
310 the state, median income, and total population

311 **Table S4.** Detailed results of the bivariate analysis of the risk of infection by SARS-CoV-2 when controlled
312 for state, and median income

313 **Table S5.** Detailed results of the bivariate analysis of the rate of infection by SARS-CoV-2 when controlled
314 for the state, median income, and total population

315

316 **Figure S1.** Death due to SARS-CoV-2 controlled for state, median income and total population

317 **Figure S2.** Infection due to SARS-CoV-2 controlled for the state, median income and total population

318

Table 1: Description of Data Elements

Data Elements	Description
Total population	Total population
SARS-CoV-2 infection rate	Rate of SARS-CoV-2 infection in one per million
SARS-CoV-2 infection death rate	Rate of SARS-CoV-2 infection related death (percent)
Retail mobility	Google retail recreation mobility
Grocery mobility	Google grocery pharmacy mobility
Park mobility	Google parks mobility
Transit mobility	Google transit mobility
Work mobility	Google workplace mobility
Resident mobility	Google residential mobility
Black male	Percent Black alone male
Black female	Percent Black alone female
Asian male	Percent Asian alone male
Asian female	Percent Asian alone female
White male	Percent Non-Hispanic White alone male
White female	Percent Non-Hispanic White alone female
Hispanic male	Percent Hispanic male
Hispanic female	Percent Hispanic female
Median income	Median family income; past 12 months 2018
Poverty	Percent below poverty level population for whom poverty status is determined
High school	Percent below poverty level population for whom poverty status is determined RACE and HISPANIC OR LATINO ORIGIN White alone
Bachelors	Percent population 25 years and over bachelor's degree or higher
Insured male	Percent insured civilian noninstitutionalized population SEX male
Insured female	Percent insured civilian noninstitutionalized population SEX female
Insured Black	Percent insured civilian noninstitutionalized population RACE and HISPANIC OR LATINO ORIGIN Black or African American alone

Insured Asian	Percent insured civilian noninstitutionalized population RACE and HISPANIC OR LATINO ORIGIN ASIAN alone
Insured Hispanic	Percent insured civilian noninstitutionalized population RACE and HISPANIC OR LATINO ORIGIN Hispanic or Latino of any race
Insured White alone	Percent insured civilian noninstitutionalized population RACE and HISPANIC OR LATINO ORIGIN White alone not Hispanic or Latino
Medicaid	Percent public coverage Medicaid means tested public coverage alone or in combination
Disability	Percent with a disability total civilian non-institutionalized population
Disability male	Percent with a disability SEX Male
Disability female	Percent with a disability SEX Female
Disability Black	Percent with a disability RACE AND HISPANIC OR LATINO ORIGIN Black or African American
Disability Asian	Percent with a disability RACE AND HISPANIC OR LATINO ORIGIN Asian alone
Disability White	Percent with a disability RACE AND HISPANIC OR LATINO ORIGIN White alone, not Hispanic or Latino
Disability Hispanic	Percent with a disability RACE AND HISPANIC OR LATINO ORIGIN Hispanic or Latino (of any race)
Disability 5 to 17 years	Percent with a disability AGE 5 to 17 years
Disability 18 to 34 years	Percent with a disability AGE 18 to 34 years
Disability 35 to 64 years	Percent with a disability AGE 35 to 64 years
Disability 65 to 74 years	Percent with a disability AGE 65 to 74 years
Disability 75 years and over	Percent with a disability AGE 75 years
Disability hearing difficulty	Percent with a disability with a hearing difficulty
Disability vision difficulty	Percent with a disability with a vision difficulty
Disability cognitive difficulty	Percent with a disability with a cognitive difficulty
Disability ambulatory difficulty	Percent with disability with an ambulatory difficulty
Disability self-care difficulty	Percent with a disability with self-care difficulty
Disability independent living	Percent with a disability with independent living difficulty

Table 2: Independent sample t-test comparing counties with higher and lower median death rate

Data Elements	Total		Group 1: SARS-CoV-2 death rate \geq 3.4		Group 2: SARS-CoV-2 death rate $<$ 3.4		Significance
	Mean ⁺	Std. Deviation	Mean ⁺	Std. Deviation	Mean ⁺	Std. Deviation	
Total population	276905.47	683001.80	295707.40	476086.20	605705.70	1113765.30	9.9E-03
SARS-CoV-2 infection Rate*	1593.00	2768.90	2483.40	3390.40	2306.30	3275.70	7.0E-01
Retail mobility	-0.46	0.16	-0.46	0.14	-0.52	0.11	1.9E-03
Grocery mobility	-0.16	0.15	-0.16	0.13	-0.20	0.14	3.3E-02
Park mobility	0.05	0.59	0.02	0.60	0.21	0.61	5.3E-02
Transit mobility	-0.47	0.20	-0.48	0.21	-0.48	0.20	9.7E-01
Work mobility	-0.37	0.10	-0.38	0.09	-0.40	0.07	7.5E-02
Resident mobility	0.14	0.06	0.15	0.06	0.14	0.04	8.1E-02
Black male	5.30	6.60	7.30	7.40	5.20	4.60	1.6E-02
Black female	4.90	6.90	7.30	8.00	5.40	5.30	4.3E-02
Asian male	1.50	2.50	1.65	2.35	2.80	3.50	6.2E-03
Asian female	1.60	2.70	1.80	2.50	3.10	3.80	5.8E-03
White male	37.10	9.90	34.00	10.70	33.30	9.50	6.3E-01
White female	37.60	10.00	34.70	10.80	34.70	10.80	9.4E-01
Hispanic male	5.20	6.70	6.00	8.10	7.20	6.90	2.3E-01
Hispanic female	4.80	6.60	5.80	8.10	7.00	6.80	2.4E-01
Median income	69910.10	19295.80	69778.60	19887.00	83430.40	20397.10	2.0E-06
Poverty	15.10	5.80	16.00	5.70	12.70	4.70	5.0E-06
High school	87.60	5.50	86.40	6.10	88.60	4.70	3.0E-03
Bachelors	24.70	10.80	24.50	10.80	31.80	10.90	2.0E-06
Insured male	91.50	3.40	91.10	3.20	92.50	3.00	1.5E-03
Insured female	93.60	3.00	93.20	3.10	94.40	2.50	2.8E-03
Insured Black	91.30	6.30	90.40	6.40	92.20	3.00	1.2E-02
Insured Asian	90.30	12.20	90.00	11.10	92.50	4.20	2.9E-02
Insured Hispanic	86.00	10.30	84.80	9.70	86.00	7.40	3.0E-01
Insured White alone	93.90	2.70	93.80	2.60	95.30	2.00	1.0E-05
Medicaid	23.20	6.60	24.30	7.30	20.60	6.40	1.7E-04
Disability	15.00	3.70	14.30	3.30	12.90	3.00	8.1E-04
Disability male	13.10	3.10	13.10	3.30	12.30	2.80	1.4E-01
Disability female	13.40	2.80	13.50	2.80	12.80	2.60	1.3E-01

Disability Black	15.40	6.10	15.50	4.70	14.80	6.40	4.9E-01
Disability Asian	7.90	3.90	7.30	3.00	7.80	4.10	5.2E-01
Disability White	14.00	2.85	14.20	3.10	13.30	2.50	5.0E-02
Disability Hispanic	11.40	4.90	11.70	6.10	11.10	4.20	5.2E-01
Disability 5 to 17 years	6.30	2.50	6.30	2.80	6.00	2.00	4.8E-01
Disability 18 to 34 years	7.10	2.30	7.20	2.30	6.70	2.20	1.4E-01
Disability 35 to 64 years	13.00	3.90	13.20	4.00	12.00	3.60	2.9E-02
Disability 65 to 74 years	23.30	5.20	23.60	5.50	22.60	5.00	2.4E-01
Disability 75 years and over	47.10	6.00	47.80	6.70	46.70	5.60	2.6E-01
Disability hearing difficulty	3.70	1.10	3.50	1.10	3.50	0.88	7.0E-01
Disability vision difficulty	2.20	0.77	2.30	0.89	2.10	0.67	1.5E-01
Disability cognitive difficulty	5.40	1.40	5.50	1.50	5.20	1.30	1.9E-01
Disability ambulatory difficulty	7.00	1.70	7.10	1.70	6.60	1.60	6.3E-02
Disability self-care difficulty	2.70	0.71	2.80	0.63	2.70	0.64	1.2E-01
Disability independent living difficulty	6.10	1.40	6.10	1.30	5.90	1.30	1.6E-01

+ All reported numbers are in percent except total population, SARS-CoV-2 infection rate, and median income.

* Rate of SARS-CoV-2 infection in one per Million

Table 3: Independent sample t-test comparing counties with higher and lower median infection rate

Data Elements	Total (N:352)		Group 1: SARS-CoV-2 Infection Rate $\geq 555.6^*$		Group 2: SARS-CoV-2 Infection Rate $< 555.6^*$		Significance
	Mean ⁺	Std. Deviation	Mean ⁺	Std. Deviation	Mean ⁺	Std. Deviation	
Total population	276905.47	683001.80	382607.10	858300.10	196740.20	468817.40	1.2E-02
SARS-CoV-2 death Rate	3.83	2.20	3.50	2.00	4.60	2.60	5.0E-03
Retail mobility	-0.46	0.16	-0.49	0.15	-0.44	0.15	3.0E-03
Grocery mobility	-0.16	0.15	-0.17	0.14	-0.14	0.13	9.1E-02
Park mobility	0.05	0.59	0.24	0.52	-0.20	0.57	6.4E-08
Transit mobility	-0.47	0.20	-0.47	0.21	0.47	0.17	8.6E-01
Work mobility	-0.37	0.10	-0.39	0.09	-0.36	0.07	3.1E-02
Resident mobility	0.14	0.06	0.15	0.06	0.14	0.06	5.7E-01
Black male	5.30	6.60	8.20	7.30	2.60	4.30	1.8E-16
Black female	4.90	6.90	8.20	7.70	1.90	3.90	1.8E-19
Asian male	1.50	2.50	1.90	2.90	1.20	2.10	1.0E-02
Asian female	1.60	2.70	2.00	3.10	1.30	2.30	1.5E-02
White male	37.10	9.90	34.20	8.70	39.40	10.40	5.3E-07
White female	37.60	10.00	35.10	9.10	39.70	10.50	1.4E-05
Hispanic male	5.20	6.70	4.70	4.60	5.80	8.40	1.3E-01
Hispanic female	4.80	6.60	4.50	4.70	5.40	8.20	2.2E-01
Median income	69910.10	19295.80	76027.50	22996.80	65111.50	12876.50	8.9E-08
Poverty	15.10	5.80	14.90	6.30	15.30	5.10	5.1E-01
High school	87.60	5.50	87.40	5.40	87.60	5.60	7.9E-01
Bachelors	24.70	10.80	28.10	12.30	21.90	8.10	4.3E-08
Insured male	91.50	3.40	91.50	3.70	91.50	2.70	7.7E-01
Insured female	93.60	3.00	93.60	3.30	93.70	2.60	6.2E-01
Insured Black	91.30	6.30	90.70	5.50	91.80	6.90	9.7E-02
Insured Asian	90.30	12.20	90.00	13.10	90.10	11.50	9.5E-01
Insured Hispanic	86.00	10.30	84.20	10.60	87.50	9.10	2.7E-03
Insured White alone	93.90	2.70	94.20	2.90	93.70	2.30	1.0E-01
Medicaid	23.20	6.60	22.30	6.60	24.00	6.40	1.4E-02
Disability	15.00	3.70	14.10	3.70	15.60	3.40	2.3E-04
Disability male	13.10	3.10	12.60	3.10	13.80	3.00	6.2E-03
Disability female	13.40	2.80	13.10	2.80	13.80	2.80	8.6E-02
Disability Black	15.40	6.10	14.80	6.20	16.90	5.50	6.7E-02

Disability Asian	7.90	3.90	7.60	4.00	8.50	3.60	2.5E-01
Disability White	14.00	2.85	13.20	2.70	15.20	2.60	6.9E-07
Disability Hispanic	11.40	4.90	11.60	5.00	11.00	5.00	3.9E-01
Disability 5 to 17 years	6.30	2.50	6.40	2.40	6.20	2.70	6.7E-01
Disability 18 to 34 years	7.10	2.30	6.90	2.20	7.50	2.50	1.0E-01
Disability 35 to 64 years	13.00	3.90	12.50	4.10	13.70	3.50	2.3E-02
Disability 65 to 74 years	23.30	5.20	22.40	5.30	24.70	4.80	2.3E-03
Disability 75 years and over	47.10	6.00	46.60	6.20	47.70	5.60	1.8E-01
Disability hearing difficulty	3.70	1.10	3.40	0.96	4.10	1.10	9.0E-06
Disability vision difficulty	2.20	0.77	2.20	0.78	2.30	0.74	2.3E-01
Disability cognitive difficulty	5.40	1.40	5.30	1.50	5.50	1.30	3.0E-01
Disability ambulatory difficulty	7.00	1.70	6.80	1.70	7.20	1.60	1.3E-01
Disability self-care difficulty	2.70	0.71	2.80	0.70	6.00	1.40	8.3E-01
Disability independent living difficulty	6.10	1.40	6.00	1.40	6.20	1.30	4.2E-01

+ All reported numbers are in percent except total population, SARS-CoV-2 infection rate, and median income.

* Rate of SARS-CoV-2 infection in one per Million

Table S5: Detailed results of the bivariate analysis of the rate of infection by SARS-CoV-2 when controlled for the state, median income, and total population

Risk Factors	Estimate	Standard Error	Statistic	p-value	Conf.low	Conf.high	Estimate_95CI
Disability	-8.40E-02	8.27E-02	-1.02E+00	3.11E-01	-2.47E-01	7.91E-02	-0.08 (-0.25 - 0.08)
Disability male	-8.90E-02	9.70E-02	-9.21E-01	3.59E-01	-2.81E-01	1.02E-01	-0.09 (-0.28 - 0.10)
Disability female	-1.60E-02	9.34E-02	-1.72E-01	8.64E-01	-2.01E-01	1.69E-01	-0.02 (-0.20 - 0.17)
Disability Black	-1.14E-01	8.94E-02	-1.28E+00	2.04E-01	-2.92E-01	6.32E-02	-0.11 (-0.29 - 0.06)
Disability Asian	1.40E-01	1.09E-01	1.28E+00	2.05E-01	-7.81E-02	3.58E-01	0.14 (-0.08 - 0.36)
Disability White alone	-5.80E-02	1.01E-01	-5.70E-01	5.69E-01	-2.58E-01	1.43E-01	-0.06 (-0.26 - 0.14)
Disability Hispanic	-7.00E-03	8.94E-02	-8.28E-02	9.34E-01	-1.85E-01	1.70E-01	-0.01 (-0.19 - 0.17)
Disability 5 to 17 Years	7.80E-02	7.46E-02	1.04E+00	2.99E-01	-6.98E-02	2.25E-01	0.08 (-0.07 - 0.23)
Disability 18 to 34 Years	-1.40E-01	7.84E-02	-1.78E+00	7.71E-02	-2.95E-01	1.54E-02	-0.14 (-0.30 - 0.02)
Disability 35 to 64 Years	-6.30E-02	1.02E-01	-6.13E-01	5.41E-01	-2.65E-01	1.40E-01	-0.06 (-0.265 - 0.14)
Disability 65 to 74 Years	-1.10E-02	8.94E-02	-1.18E-01	9.06E-01	-1.87E-01	1.66E-01	-0.01 (-0.19 - 0.17)
Disability 75 Years and Over	7.10E-02	7.25E-02	9.82E-01	3.28E-01	-7.22E-02	2.15E-01	0.07 (-0.07 - 0.22)
Disability hearing difficulty	-8.80E-02	8.40E-02	-1.05E+00	2.97E-01	-2.54E-01	7.82E-02	-0.09 (-0.25 - 0.08)
Disability vision difficulty	1.20E-02	7.96E-02	1.46E-01	8.84E-01	-1.46E-01	1.69E-01	0.01 (-0.15 - 0.17)
Disability cognitive difficulty	-7.00E-02	8.96E-02	-7.83E-01	4.35E-01	-2.47E-01	1.07E-01	-0.07 (-0.25 - 0.11)
Disability ambulatory difficulty	3.50E-02	9.06E-02	3.87E-01	7.00E-01	-1.44E-01	2.14E-01	0.04 (-0.14 - 0.21)
Disability self-care difficulty	4.90E-02	7.47E-02	6.52E-01	5.15E-01	-9.91E-02	1.97E-01	0.05 (-0.10 - 0.20)
Disability independent living difficulty	6.50E-02	7.89E-02	8.30E-01	4.08E-01	-9.05E-02	2.21E-01	0.07 (-0.091 - 0.22)

Table S4: Detailed results of the bivariate analysis of the risk of infection by SARS-CoV-2 when controlled for state, and median income

Risk Factors	Estimate	Standard error	Statistic	p-value	Conf.low	Conf.high	Estimate_95CI
Disability	-1.69E-01	8.64E-02	-1.95E+00	5.24E-02	-3.39E-01	1.78E-03	-0.17 (-0.34 - 0.002)
Disability male	-2.53E-01	9.75E-02	-2.60E+00	1.04E-02	-4.46E-01	-6.03E-02	-0.25 (-0.45 - -0.06)
Disability female	-8.10E-02	1.00E-01	-8.02E-01	4.24E-01	-2.79E-01	1.18E-01	-0.08 (-0.28 - 0.12)
Disability Black	-1.33E-01	9.67E-02	-1.37E+00	1.73E-01	-3.24E-01	5.91E-02	-0.13 (-0.32 - 0.06)
Disability Asian	6.90E-02	1.16E-01	5.93E-01	5.55E-01	-1.62E-01	3.00E-01	0.07 (-0.16 - 0.3)
Disability White alone	-2.23E-01	1.03E-01	-2.15E+00	3.30E-02	-4.27E-01	-1.82E-02	-0.22 (-0.43 - -0.02)
Disability Hispanic	-7.60E-02	9.63E-02	-7.93E-01	4.29E-01	-2.67E-01	1.14E-01	-0.08 (-0.27 - 0.11)
Disability 5 to 17 Years	-1.90E-02	8.14E-02	-2.33E-01	8.16E-01	-1.80E-01	1.42E-01	-0.02 (-0.18 - 0.14)
Disability 18 to 34 Years	-2.52E-01	8.16E-02	-3.09E+00	2.44E-03	-4.13E-01	-9.05E-02	-0.25(-0.41 - -0.09)
Disability 35 to 64 Years	-7.80E-02	1.11E-01	-7.00E-01	4.85E-01	-2.97E-01	1.41E-01	-0.08 (-0.30 - 0.14)
Disability 65 to 74 Years	6.70E-02	9.76E-02	6.83E-01	4.96E-01	-1.26E-01	2.60E-01	0.07 (-0.13 - 0.26)
Disability 75 Years and Over	1.20E-01	7.94E-02	1.52E+00	1.31E-01	-3.65E-02	2.77E-01	0.12 (-0.04 - 0.28)
Disability hearing difficulty	-2.63E-01	7.99E-02	-3.29E+00	1.25E-03	-4.21E-01	-1.05E-01	-0.26 (-0.42 - -0.11)
Disability vision difficulty	6.40E-02	8.72E-02	7.38E-01	4.62E-01	-1.08E-01	2.37E-01	0.06 (-0.108 - 0.24)
Disability cognitive difficulty	-1.22E-01	9.78E-02	-1.25E+00	2.14E-01	-3.15E-01	7.13E-02	-0.12 (-0.32 - 0.07)
Disability ambulatory difficulty	2.20E-02	9.86E-02	2.20E-01	8.26E-01	-1.73E-01	2.17E-01	0.02 (-0.17 - 0.22)
Disability self-care difficulty	1.15E-01	8.10E-02	1.42E+00	1.59E-01	-4.53E-02	2.75E-01	0.12 (-0.05 - 0.28)
Disability independent living difficulty	1.01E-01	8.64E-02	1.16E+00	2.47E-01	-7.03E-02	2.71E-01	0.10 (-0.07 - 0.27)

Table S3: Detailed results of the bivariate analysis of the risk of death by SARS-CoV-2 when controlled for the state, median income, and total population

Risk Factors	Estimate	Standard Error	Statistic	p-value	Conf.low	Conf.high	Estimate_95CI
Disability	5.30E-02	1.05E-01	5.03E-01	6.16E-01	-1.54E-01	2.59E-01	0.05 (-0.15 - 0.26)
Disability male	1.59E-01	9.97E-02	1.60E+00	1.12E-01	-3.75E-02	3.56E-01	0.16 (-0.04 - 0.36)
Disability female	1.48E-01	9.73E-02	1.52E+00	1.31E-01	-4.46E-02	3.40E-01	0.15 (-0.05 - 0.34)
Disability Black	1.11E-01	7.28E-02	1.53E+00	1.30E-01	-3.31E-02	2.55E-01	0.11 (-0.03 - 0.26)
Disability Asian	-6.00E-02	7.56E-02	-7.90E-01	4.32E-01	-2.10E-01	9.07E-02	-0.06 (-0.21 - 0.09)
Disability White alone	2.08E-01	9.93E-02	2.10E+00	3.77E-02	1.20E-02	4.05E-01	0.21 (0.012 - 0.41)
Disability Hispanic	-3.30E-02	8.39E-02	-3.91E-01	6.96E-01	-1.99E-01	1.33E-01	-0.03 (-0.20 - 0.13)
Disability 5 to 17 Years	-5.70E-02	8.11E-02	-7.03E-01	4.83E-01	-2.17E-01	1.03E-01	-0.06 (-0.22 - 0.10)
Disability 18 to 34 Years	1.95E-01	8.19E-02	2.38E+00	1.89E-02	3.27E-02	3.57E-01	0.20 (0.03 - 0.36)
Disability 35 to 64 Years	1.46E-01	1.06E-01	1.37E+00	1.72E-01	-6.43E-02	3.56E-01	0.15 (-0.06 - 0.36)
Disability 65 to 74 Years	7.50E-02	9.46E-02	7.91E-01	4.30E-01	-1.12E-01	2.62E-01	0.08 (-0.11 - 0.26)
Disability 75 Years and Over	-4.50E-02	7.65E-02	-5.88E-01	5.57E-01	-1.96E-01	1.06E-01	-0.05 (-0.20 - 0.11)
Disability hearing difficulty	9.00E-02	8.58E-02	1.05E+00	2.97E-01	-7.99E-02	2.59E-01	0.09 (-0.08 - 0.26)
Disability vision difficulty	7.40E-02	8.21E-02	8.99E-01	3.70E-01	-8.84E-02	2.36E-01	0.07 (-0.09 - 0.24)
Disability cognitive difficulty	1.04E-01	9.48E-02	1.10E+00	2.73E-01	-8.30E-02	2.92E-01	0.10 (-0.08 - 0.30)
Disability ambulatory difficulty	1.17E-01	9.51E-02	1.23E+00	2.21E-01	-7.12E-02	3.05E-01	0.12 (-0.07 - 0.31)
Disability self-care difficulty	7.70E-02	7.82E-02	9.84E-01	3.27E-01	-7.76E-02	2.32E-01	0.08 (-0.08 - 0.23)
Disability independent living difficulty	1.62E-01	8.21E-02	1.97E+00	5.04E-02	-2.82E-04	3.24E-01	0.16 (0 - 0.32)

Table S2: Detailed results of the bivariate analysis of risk of death by SARS-CoV-2 when controlled for state, and median income

Risk Factors	Estimate	Standard Error	Statistic	p-value	Conf.low	Conf.high	Estimate_95CI
Disability	9.40E-02	9.87E-02	9.51E-01	3.43E-01	-1.01E-01	2.88E-01	0.09 (-0.10 - 0.29)
Disability male	1.37E-01	8.52E-02	1.61E+00	1.09E-01	-3.11E-02	3.06E-01	0.14 (-0.03 - 0.31)
Disability female	1.43E-01	9.00E-02	1.59E+00	1.14E-01	-3.49E-02	3.21E-01	0.14 (-0.04 - 0.32)
Disability Black	9.50E-02	6.85E-02	1.39E+00	1.67E-01	-4.04E-02	2.31E-01	0.10 (-0.04 - 0.23)
Disability Asian	-7.00E-02	7.13E-02	-9.79E-01	3.30E-01	-2.12E-01	7.19E-02	-0.07 (-0.21 - 0.07)
Disability White alone	1.89E-01	8.98E-02	2.11E+00	3.67E-02	1.18E-02	3.66E-01	0.19 (0.012 - 0.37)
Disability Hispanic	-3.00E-02	7.92E-02	-3.83E-01	7.02E-01	-1.87E-01	1.26E-01	-0.03 (-0.19 - 0.13)
Disability 5 to 17 Years	-5.10E-02	7.63E-02	-6.67E-01	5.05E-01	-2.02E-01	9.99E-02	-0.05(-0.20 - 0.1)
Disability 18 to 34 Years	1.66E-01	7.30E-02	2.27E+00	2.43E-02	2.18E-02	3.10E-01	0.17 (0.02 - 0.31)
Disability 35 to 64 Years	1.31E-01	9.81E-02	1.33E+00	1.84E-01	-6.28E-02	3.25E-01	0.13 (-0.06 - 0.33)
Disability 65 to 74 Years	6.70E-02	9.06E-02	7.38E-01	4.62E-01	-1.12E-01	2.46E-01	0.07 (-0.11 - 0.25)
Disability 75 Years and Over	-4.40E-02	7.41E-02	-5.98E-01	5.51E-01	-1.91E-01	1.02E-01	-0.04 (-0.191 - 0.10)
Disability hearing difficulty	8.80E-02	7.12E-02	1.23E+00	2.20E-01	-5.30E-02	2.28E-01	0.09 (-0.05 - 0.23)
Disability vision difficulty	6.70E-02	7.88E-02	8.51E-01	3.96E-01	-8.86E-02	2.23E-01	0.07 (-0.09 - 0.22)
Disability cognitive difficulty	9.00E-02	8.79E-02	1.03E+00	3.06E-01	-8.33E-02	2.64E-01	0.09 (-0.08 - 0.26)
Disability ambulatory difficulty	1.19E-01	9.00E-02	1.32E+00	1.87E-01	-5.85E-02	2.97E-01	0.12 (-0.06 - 0.30)
Disability self-care difficulty	6.10E-02	7.48E-02	8.17E-01	4.15E-01	-8.67E-02	2.09E-01	0.06 (-0.09 - 0.21)
Disability independent living difficulty	1.49E-01	7.85E-02	1.89E+00	6.02E-02	-6.47E-03	3.04E-01	0.15 (-0.01 - 0.30)

Table S1: Independent sample t-test with comprehensive summary statistics comparing counties data elements: mean, minimum, maximum, confidence interval lower and upper bound

Data Elements	Mean ⁺	Minimum	Maximum	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Total population	276905.5	1129.0	10039107.0	206987.7	346823.2
SARS-CoV-2 infection rate*	1593.0	15.4	20458.0	1302.8	1883.3
SARS-CoV-2 related death rate	3.8	0.3	10.1	3.5	4.1
Retail mobility	-0.5	-1.0	0.4	-0.5	-0.4
Grocery mobility	-0.2	-0.7	0.3	-0.2	-0.1
Park mobility	0.0	-0.9	1.8	0.0	0.1
Transit mobility	-0.5	-0.9	0.7	-0.5	-0.4
Work mobility	-0.4	-0.7	0.5	-0.4	-0.4
Resident mobility	0.1	0.0	0.3	0.1	0.1
Black male	5.3	0.0	37.5	4.6	6.0
Black female	4.9	0.1	32.8	4.2	5.6
Asian male	1.5	0.0	19.0	1.2	1.7
Asian female	1.6	0.0	19.3	1.4	1.9
White male	37.1	4.5	50.3	36.1	38.1
White female	37.6	4.7	49.0	36.5	38.6
Hispanic male	5.2	0.4	42.3	72.6	76.7
Hispanic female	4.8	0.4	42.3	4.1	5.5
Median income	69910.1	30717.0	147878.0	67934.9	71885.4
Poverty	15.1	4.6	48.6	14.5	15.7
High school	87.6	68.5	96.1	87.0	88.1
Bachelors	24.6	7.4	60.8	23.5	25.7
Insured male	91.5	72.4	97.5	91.1	91.8
Insured female	93.6	80.1	98.4	93.3	93.9
Insured Black	91.4	46.7	100.0	90.7	92.0
Insured Asian	90.3	0.0	100.0	89.0	91.5
Insured Hispanic	85.9	30.3	100.0	84.9	87.0
Insured White alone	93.9	80.9	98.4	93.6	94.1
Medicaid	23.2	6.9	48.4	22.5	23.9
Disability	15.0	6.5	28.5	14.6	15.4
Disability male	13.1	7.1	22.3	12.6	13.5
Disability female	13.4	7.7	20.5	13.0	13.8
Disability Black	15.4	4.5	57.7	14.4	16.4
Disability Asian	7.9	2.3	33.1	7.1	8.6
Disability White	14.0	7.2	20.7	13.6	14.4
Disability Hispanic	11.4	3.6	33.0	10.6	12.2
Disability 5 to 17 years	6.3	1.9	13.9	6.0	6.7
Disability 18 to 34 years	7.1	2.3	16.4	6.8	7.4
Disability 35 to 64 years	13.0	4.9	25.6	12.5	13.6
Disability 65 to 74 years	23.3	10.0	36.1	22.6	24.1
Disability 75 years and over	47.1	32.3	67.7	46.2	47.9

Disability hearing difficulty	3.7	1.7	7.2	3.5	3.8
Disability vision difficulty	2.2	0.8	4.8	2.1	2.4
Disability cognitive difficulty	5.4	2.6	10.5	5.2	5.6
Disability ambulatory difficulty	7.0	3.4	11.2	6.7	7.2
Disability self-care Difficulty	2.7	1.1	6.1	2.6	2.8
Disability independent living difficulty	6.1	2.9	10.7	5.9	6.3

+ All reported numbers are in percent except total population, SARS-CoV-2 infection rate, and median income.

* Rate of SARS-CoV-2 infection in one per Million

Fig S2: Infection due to SARS-CoV-2 controlled for the state, median income, and total population

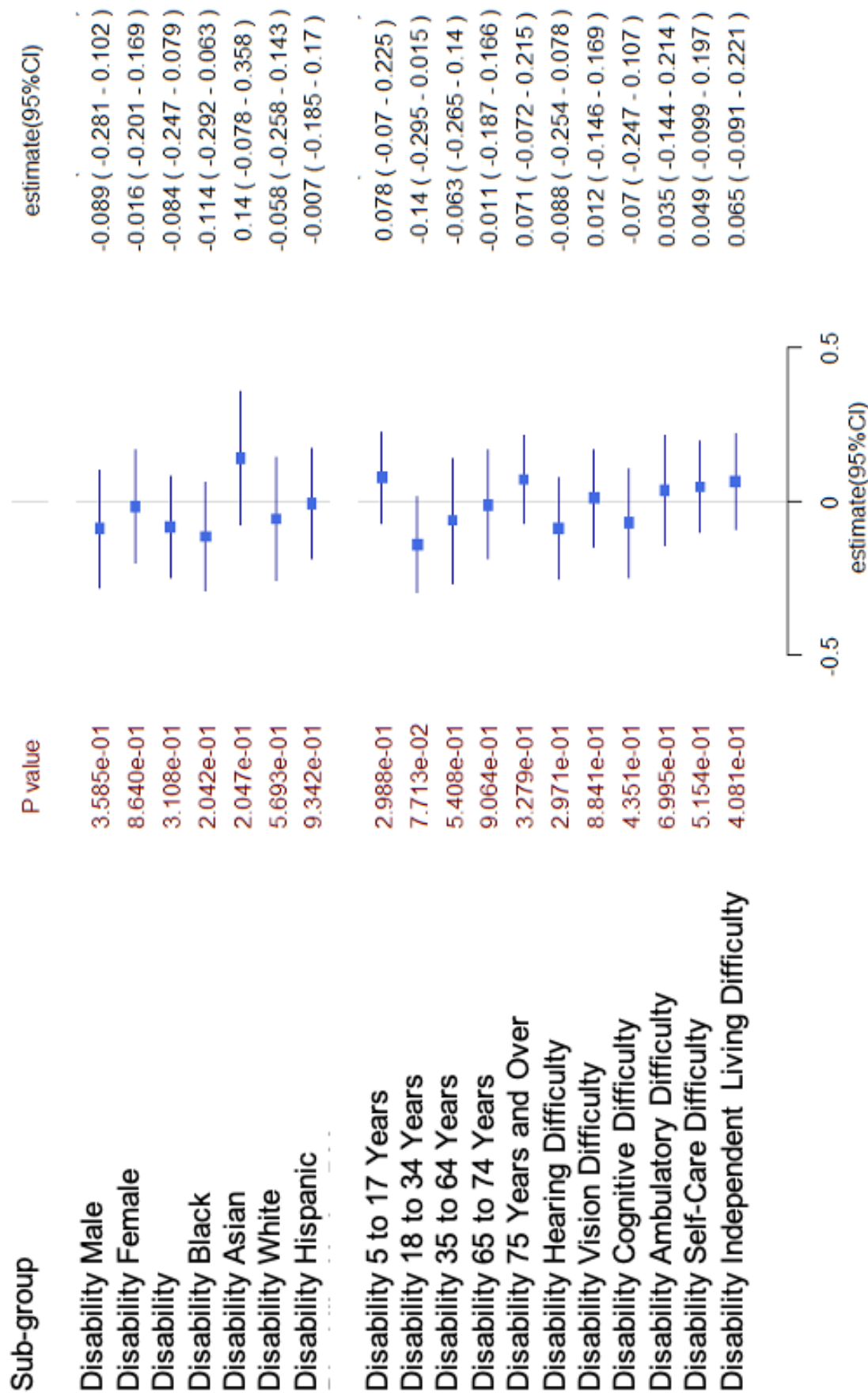


Fig S1: Death due to SARS-CoV-2 controlled for the state, median income, and total population

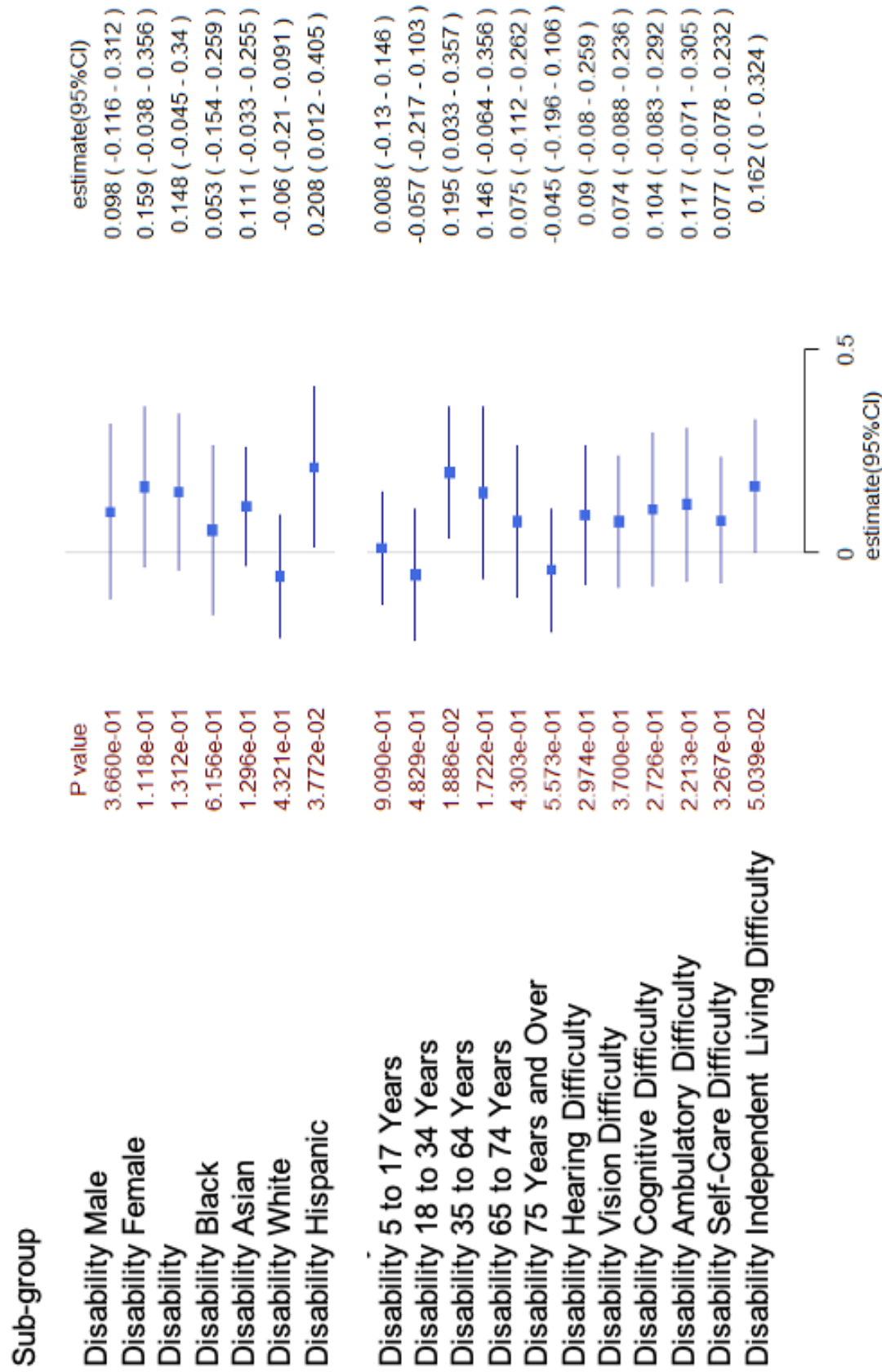


Fig 2: Infection due to SARS-CoV-2 when controlled for state, and median income

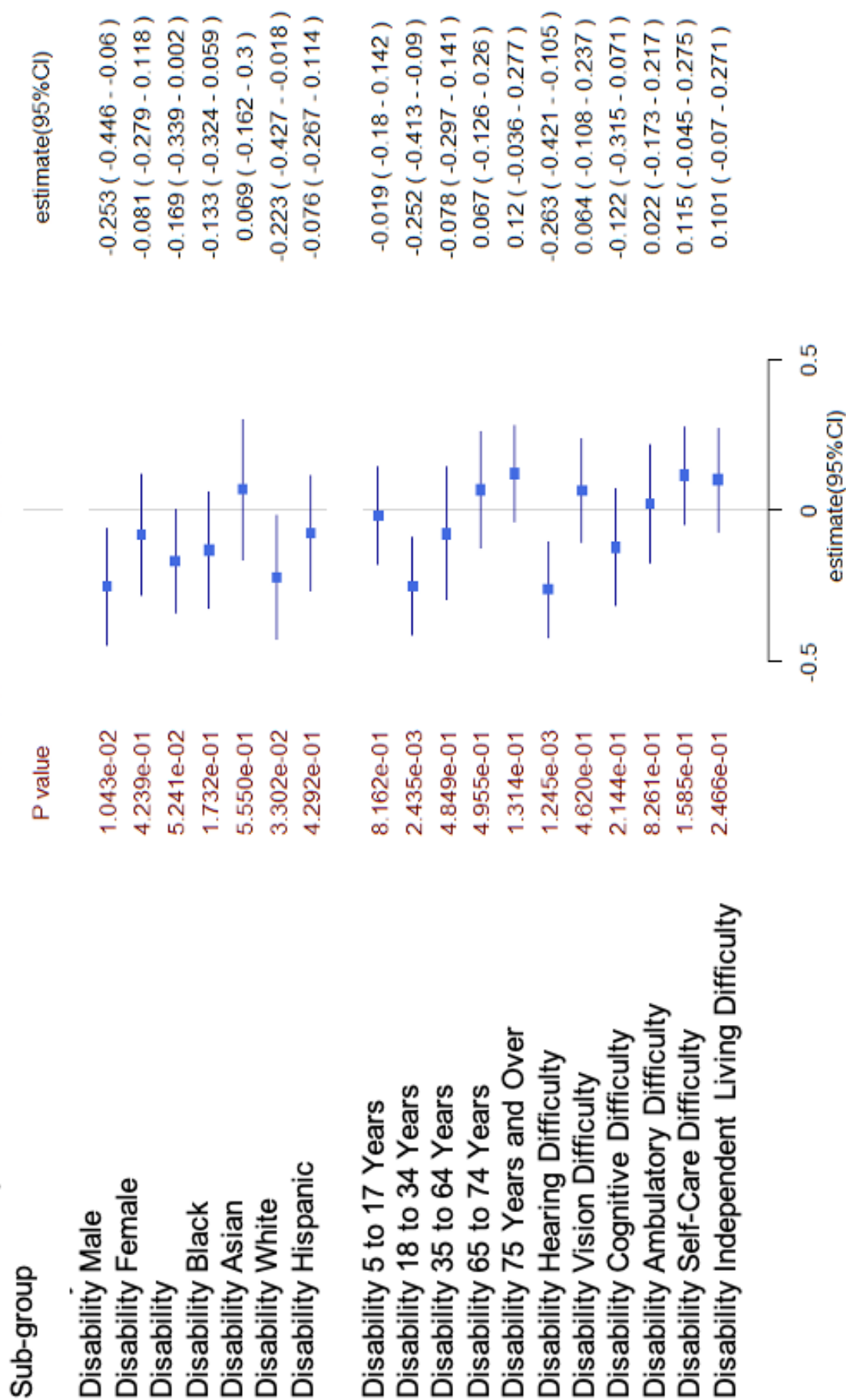


Fig 1: Death due to SARS-CoV-2 when controlled for state and median income

