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Heterogeneous burden of the COVID-19 pandemic in central Texas

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Overview

The heterogeneous burden of the COVID-19 pandemic within and across US cities has been linked to myriad risk factors including occupation, socioeconomic status, and race [1–3]. Here we use fine-grain, anonymized hospitalization data to estimate the heterogeneous impact of the COVID-19 pandemic on Austin, Texas across age groups and ZIP codes. We provide estimates for (1) the percent of the population infected as of January 11, 2021 and (2) the reporting rate of infections, and relate these estimates to the CDC Social Vulnerability Index (SVI) for each ZIP code [4–6].

As of January 11, 2021, our estimates suggest the following for the five-county Austin-Round Rock Metropolitan Statistical Area (MSA):

- An estimated 13% (95% CrI: 11-17%) of the MSA has been infected, corresponding to an overall reporting rate of 34% (95% CrI: 27-43%) in the MSA.
- The estimated age-specific proportions infected range from 5% (95% CrI: 3-9%) for adults 60-69y to 30% (95% CrI: 17-49%) for the 10-19y age group across the MSA.
- The estimated age-specific reporting rates in Travis County[1] range from 6% (95% CrI: 3-10%) for the 0-9y age group to 67% (95% CrI: 36%-96%) for adults 50-59y.

[1] Age-stratified case report data were not available to estimate reporting rates outside of Travis county.

- Across the top 50 most populous ZIP codes of the MSA, infection rates ranged from 4% (95% CrI: 2-9%) in 78613 to 41% (95% CrI: 28-52%) in 78724.
- Across the 46 ZIP codes primarily within Travis Country, reporting rates ranged from 14% (95% CrI: 10-19%) in 78723 to 45% (95% CrI: 21-78%) in 78705.
- Social vulnerability was significantly correlated with COVID-19 burden, with the 25% most vulnerable ZIP codes in the MSA having an estimated 26% (95% CrI: 17-35%) infected as of January 11th, and the 25% least vulnerable having an estimated 9% (95% CrI: 4-17%) infected.

We are posting these results prior to peer review to provide intuition for both policy makers and the public regarding the disparate impacts of the pandemic across the metropolitan region and to inform the allocation of vaccines as well as testing, contact tracing, isolation and other mitigation resources.

Methodology

Since reported cases may be biased by spatial, temporal, and socioeconomic variation in testing priorities, testing availability, and test-seeking behavior, we use patient hospitalization data stratified by age and ZIP code provided by the city of Austin to estimate the burden of COVID-19 in the Austin MSA. In short, we use published estimates for the age-stratified infection hospitalization rate (IHR) to infer the prevalence of infection from reported hospitalizations and then compare these estimates with reported cases to estimate the reporting rate [7,8]. We use linear regression methods to evaluate whether social vulnerability is a predictor of ZIP code-level COVID-19 burden. ZIP code- and age-stratified case counts were obtained from the Austin COVID-19 public data hub [9], population estimates were taken from the 2015-2019 American Community Survey (ACS) [10,11], and Social Vulnerability Indices were obtained from the CDC [4]. The Appendix provides additional methodological details.

COVID-19 burden in the Austin-Round Rock MSA

As of January 11, 2021, 6,444 individuals have been hospitalized with COVID-19 in the Austin-Round Rock MSA. Of these, 4,003 patients resided in Travis County at the time of their hospitalization. We estimate that 13% (95% CrI: 11-17%) of the five-county MSA population has been infected, indicating an overall reporting rate of 34% (95% CrI: 27-43%).

COVID-19 hospitalizations, cases and reporting rates by age group

Although hospitalization rates increase with age (Figure 1A), the estimated cumulative infection rates are highest for 10-19 year olds and lowest for those in the 60-69 age group (Figure 1B, Table 1). Focusing on Travis County where age-stratified case data are available (Figure 1C), we find that reporting rates are highest in adults over 30 and significantly lower in children (Figure 1D, Table 1).

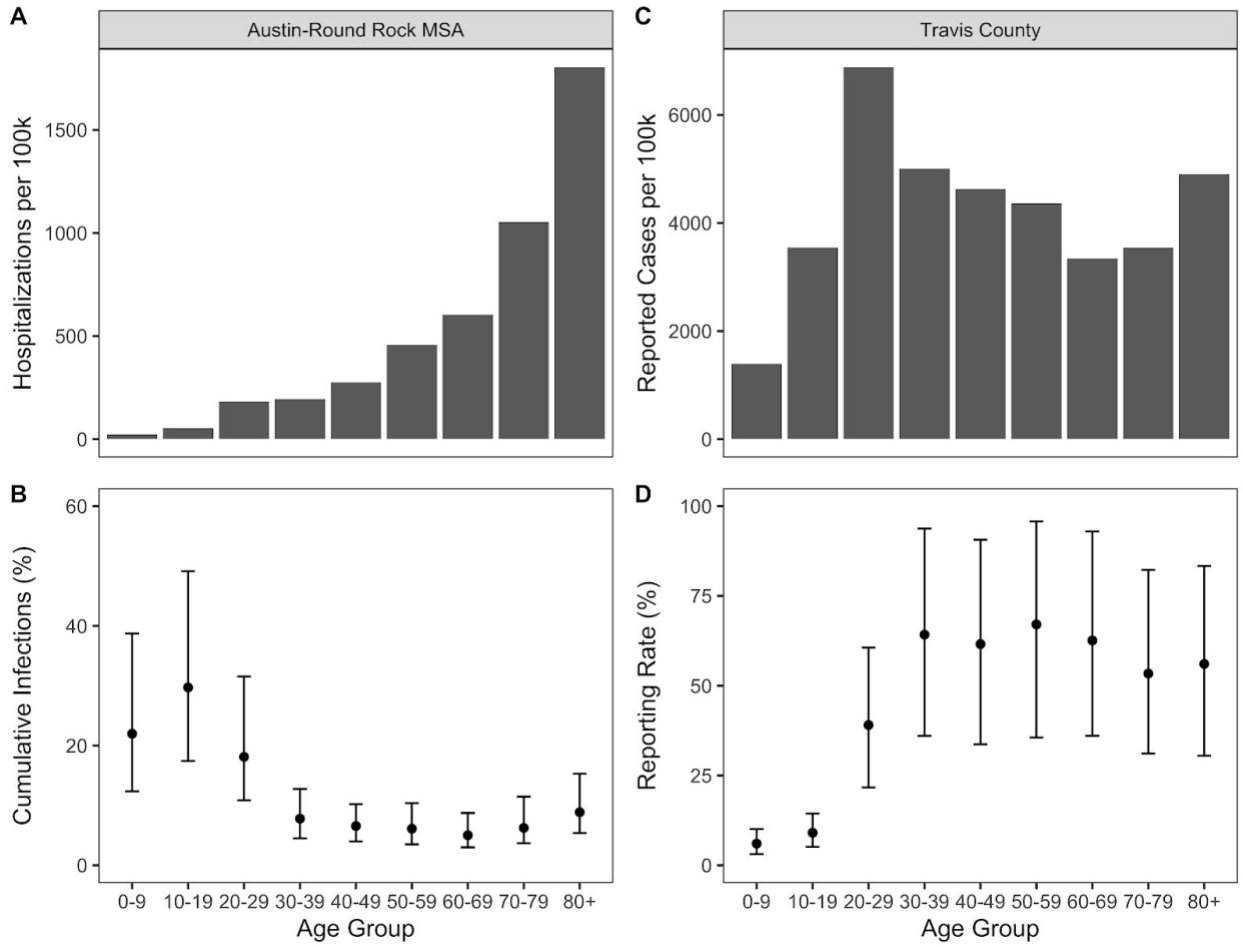

Figure 1. Reported and estimated COVID-19 burden by age group for Austin-Round Rock MSA and Travis County. (A) Reported COVID-19 hospitalization rates by age across the MSA. (B) Estimated percent of each age group infected by January 11, 2021 derived from hospitalization rates and age-specific IHRs. (C) Travis County COVID-19 case reports through January 4, 2021. (D) Estimated COVID-19 case reporting rates in Travis County based on a comparison between the estimated cumulated infections and the reported case counts. The large uncertainty in estimated cumulative infections for younger age groups stems from lower hospitalization counts.

Table 1. Age-stratified COVID-19 burden estimates for Travis County and the Austin-Round Rock MSA.

Age Group	Travis County				Austin-Round Rock MSA	
	Hospital. per 100k	Cumulative infections (95% CrI)	Cases per 100K	Reporting Rate (95% CrI)	Hospital. per 100k	Cumulative infections (95% CrI)
0-9	24	26% (14%-46%)	1,396	6% (3%-10%)	22	22% (12%-39%)
10-19	73	42% (25%-68%)	3,544	9% (5%-14%)	53	30% (17%-49%)
20-29	201	19% (11%-32%)	6,879	39% (22%-60%)	183	18% (11%-32%)
30-39	210	8% (5%-14%)	5,005	64% (36%-94%)	194	8% (5%-13%)
40-49	317	8% (5%-14%)	4,630	62% (34%-91%)	275	7% (4%-10%)
50-59	523	7% (4%-12%)	4,365	67% (36%-96%)	457	6% (4%-10%)
60-69	673	6% (3%-9%)	3,344	63% (36%-93%)	603	5% (3%-9%)
70-79	1,208	7% (4%-11%)	3,540	53% (31%-82%)	1,053	6% (4%-12%)
80+	1,942	9% (6%-16%)	4,901	56% (31%-83%)	1,803	9% (5%-15%)

COVID-19 hospitalizations, cases and reporting rates by ZIP code

COVID-19 burden also varies significantly across ZIP codes (Figure 2 and Table 2) and exhibits distinct geographic clustering with higher burden concentrated in eastern ZIP codes (Figure 3). Across the 50 largest ZIP codes (by population), the estimated proportion infected by January 11, 2021 ranged from 4% (95% CrI: 2-9%) in 78613 (Cedar Park, west of I-35) to 41% (95% CrI: 28-52%) in 78724 (Austin and Daffan, east of US-183 including the Walter E. Long Metropolitan Park) (Figure 2B). We estimate that over 35% of the population has been infected in 6 ZIP codes (78725, 78753, 78742, 78724, 78616, 76573) and between 30% and 35% have been infected in six
(78612, 78744, 78656, 78615, 76578, 78617).

Within Travis County, reported cases per 100,000 residents ranged from 1,621 in 78739 to 8,998 in 78725 (Figure 2C). Across the 46 ZIP codes of Travis County we estimated reporting rates as low as 14% (95% CrI: 10-19%) in 78723 (East Austin, including the Mueller planned community, Windsor Park, MLK and University Hills) and as high as 45% (95% CrI: 21-78%) in 78705 (Central Austin, predominantly UT Austin student housing) (Figure 2D).

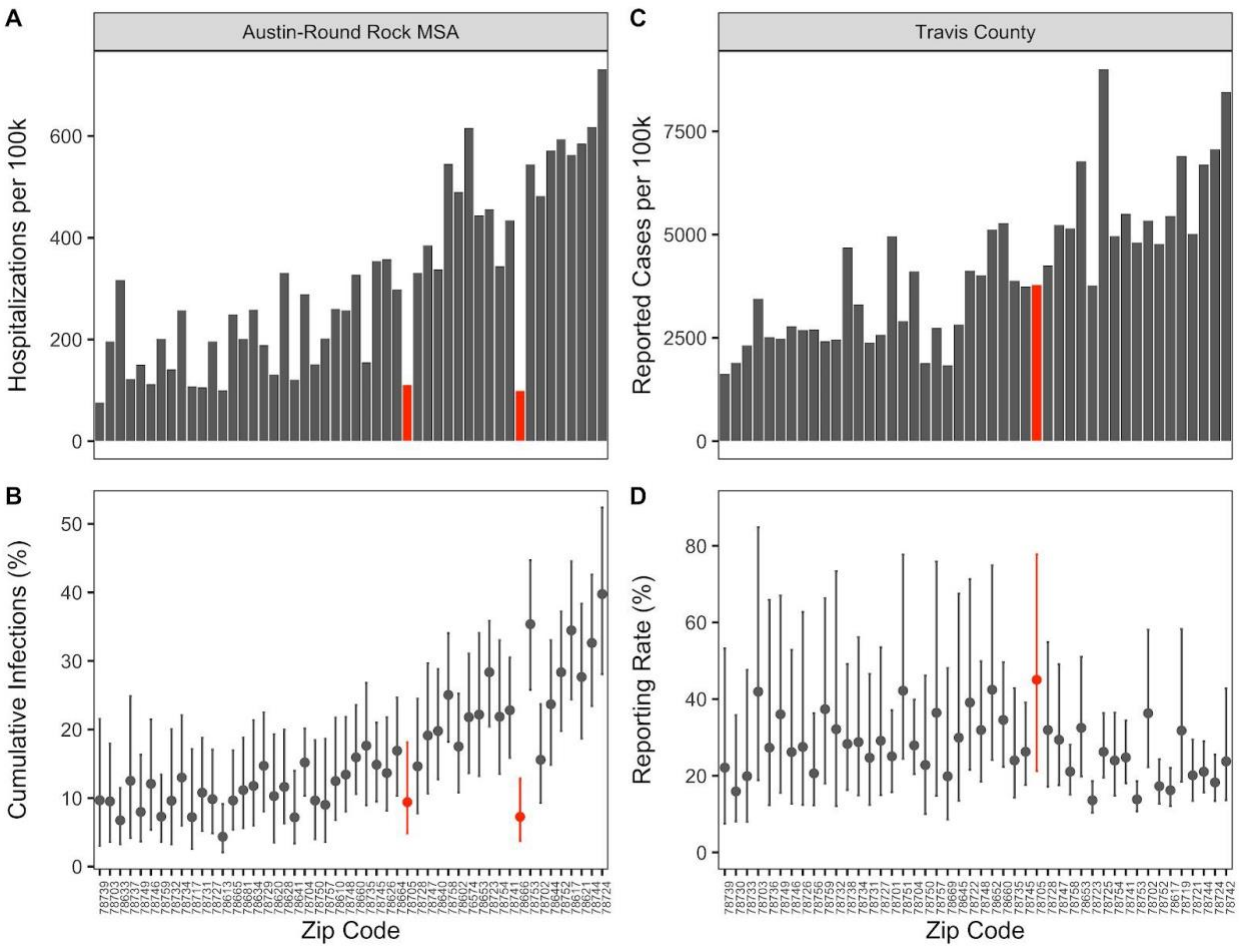

Figure 2. Reported and estimated COVID-19 burden by ZIP code for Austin-Round Rock MSA and Travis County. In all graphs, the ZIP codes are arranged along the x-axis by increasing CDC Social Vulnerability Index (SVI), from left to right. (A) Reported COVID-19 hospitalizations between March 6, 2020 and January 11, 2021 in the 50 largest ZIP codes (by population size) in the MSA. (B) Estimated percent infected by January 11, 2021 derived from age-specific hospitalization data. (C) COVID-19 case reports in the 46 ZIP codes of Travis County through January 4, 2021. (D) Estimated COVID-19 case reporting rates in Travis County derived from comparing reported cases to the estimated total infections. The two ZIP codes highlighted in red (78705 and 78666) are adjacent to the University of Texas at Austin and Texas State University and likely have high proportions of student residents. However, we do not have detailed data on the composition of these populations. The SVI metric may be misleadingly high in these two ZIP codes, since university students are transient residents that may not have the same risk factors as long-term residents and may receive support from family living elsewhere.

Table 2: ZIP code-level COVID-19 burden estimates for the Austin-Round Rock MSA.

County	ZIP Code	Hospitalizations per 100k	Cumul. Infections (95% CrI)	Social Vulnerability Index	Cases per 100K	Reporting Rate (95% CrI)
Williamson	76527	707	29 (16-42)	0.25	NA	NA
Williamson	76530	800	28 (17-41)	0.54	NA	NA
Williamson	76537	536	27 (15-42)	0.19	NA	NA
Williamson	76573	0	42 (10-76)	0.55	NA	NA
Williamson	76574	616	22 (14-31)	0.48	10	0.08 (0.01-0.2)
Williamson	76578	1,012	34 (20-50)	0.29	NA	NA
Bastrop	78602	490	18 (11-25)	0.46	NA	NA
Hays	78610	260	12 (7-22)	0.26	247	2 (1-4)
Bastrop	78612	536	31 (18-44)	0.53	261	0.9 (0.5-2)
Williamson	78613	100	4 (2-9)	0.16	157	4 (2-8)
Williamson	78615	618	33 (18-49)	0.33	1,545	5 (2-10)
Caldwell	78616	594	41 (29-54)	0.52	90	0.3 (0.1-0.5)
Travis	78617	563	34 (24-45)	0.61	5451	16 (12-22)
Hays	78619	200	21 (10-33)	0.10	NA	NA
Hays	78620	131	10 (4-19)	0.18	114	1 (0.5-4)
Bastrop	78621	585	28 (19-38)	0.62	1,078	4 (3-6)
Williamson	78626	358	14 (8-22)	0.35	8	0.09 (0.02-0.2)
Williamson	78628	331	12 (6-20)	0.19	3	0.05 (0.007-0.2)
Williamson	78633	317	7 (3-11)	0.07	NA	NA
Williamson	78634	258	12 (6-21)	0.17	93	0.9 (0.4-1.8)
Hays	78640	338	20 (13-29)	0.39	26	0.1 (0.07-0.3)
Williamson	78641	121	7 (3-14)	0.20	179	3 (1-5)
Williamson	78642	299	17 (8-27)	0.24	0	0.06 (0.001-0.2)
Caldwell	78644	571	24 (15-33)	0.58	22	0.1 (0.04-0.3)
Travis	78645	104	11 (4-21)	0.22	2,824	30 (14-67)
Caldwell	78648	724	25 (15-37)	0.59	NA	NA
Bastrop	78650	184	26 (12-42)	0.45	NA	NA
Travis	78652	130	13 (7-20)	0.28	5,117	42 (24-75)
Travis	78653	444	22 (13-34)	0.49	6,778	33 (20-51)
Caldwell	78655	176	20 (9-33)	0.61	NA	NA
Caldwell	78656	414	33 (17-50)	0.62	NA	NA
Bastrop	78659	420	26 (17-36)	0.27	NA	NA
Travis	78660	327	16 (11-24)	0.31	5,278	35 (22-50)
Bastrop	78662	227	19 (9-31)	0.53	NA	NA
Williamson	78664	298	17 (10-25)	0.35	162	1 (0.6-2)
Williamson	78665	249	10 (5-17)	0.17	22	0.3 (0.1-0.6)
Hays	78666	99	7 (4-13)	0.56	NA	NA
Travis	78669	178	11 (4-21)	0.21	1,837	20 (9-48)
Hays	78676	91	11 (5-20)	0.15	NA	NA
Williamson	78681	201	11 (6-19)	0.17	89	0.9 (0.4-2)
Travis	78701	682	21 (14-31)	0.18	4,959	25 (16-37)
Travis	78702	482	16 (9-24)	0.57	5,340	36 (22-58)
Travis	78703	196	10 (4-18)	0.07	3,445	42 (19-85)
Travis	78704	289	15 (10-20)	0.20	4,111	28 (20-40)

Travis	78705	110	9 (5-18)	0.36	3,777	45 (21-78)
Williamson	78717	108	7 (3-17)	0.12	414	7 (2-17)
Travis	78719	410	24 (12-36)	0.63	6,905	32 (18-58)
Travis	78721	528	26 (17-37)	0.67	5,021	20 (13-29)
Travis	78722	265	12 (6-19)	0.23	4,123	39 (22-71)
Travis	78723	456	28 (20-36)	0.49	3,765	14 (10-19)
Travis	78724	731	40 (28-52)	0.77	7,068	18 (13-26)
Travis	78725	697	35 (25-46)	0.51	8,998	26 (20-36)
Travis	78726	114	12 (4-22)	0.10	2,692	28 (12-63)
Travis	78727	196	10 (5-17)	0.16	2,572	29 (15-54)
Travis	78728	331	15 (8-24)	0.36	4,251	32 (17-55)
Williamson	78729	189	15 (8-22)	0.17	918	7 (4-11)
Travis	78730	82	14 (5-23)	0.05	1,897	16 (8.1-36)
Travis	78731	106	11 (5-19)	0.14	2,381	25 (12-47)
Travis	78732	141	10 (3-20)	0.11	2,463	32 (12-73)
Travis	78733	112	15 (5-28)	0.05	2,319	20 (8-48)
Travis	78734	257	13 (6-22)	0.12	3,311	29 (15-56)
Travis	78735	155	18 (9-27)	0.31	3,885	24 (14-43)
Travis	78736	128	11 (4-20)	0.07	2,519	27 (12-66)
Hays	78737	122	13 (4-25)	0.08	809	8 (3-20)
Travis	78738	388	18 (10-29)	0.12	4,685	28 (16-49)
Travis	78739	76	10 (3-22)	0.02	1,621	22 (7.5-53)
Travis	78741	434	23 (16-31)	0.55	5,498	25 (18-34)
Travis	78742	789	38 (20-59)	0.81	8,455	24 (14-43)
Travis	78744	618	33 (23-43)	0.67	6,692	21 (16-29)
Travis	78745	354	15 (9-21)	0.33	3,741	26 (18-39)
Travis	78746	112	12 (5-21)	0.10	2,782	26 (13-53)
Travis	78747	385	19 (11-30)	0.38	5,233	29 (18-49)
Travis	78748	257	13 (8-22)	0.26	4,015	32 (18-50)
Travis	78749	150	8 (4-16)	0.10	2,476	36 (16-67)
Travis	78750	151	10 (4-18)	0.21	1,888	23 (10-46)
Travis	78751	105	7 (3-12)	0.19	2,908	42 (24-78)
Travis	78752	594	28 (20-37)	0.60	4,775	17 (13-24)
Travis	78753	544	35 (26-45)	0.56	4,806	14 (11-19)
Travis	78754	344	22 (14-33)	0.52	4,967	24 (15-36)
Travis	78756	196	14 (8-21)	0.10	2,703	21 (12-36)
Travis	78757	202	9 (4-19)	0.21	2,739	36 (15-76)
Travis	78758	545	25 (18-34)	0.43	5,148	21 (15-28)
Travis	78759	201	7 (4-13)	0.11	2,416	37 (18-66)
Bastrop	78953	428	22 (11-34)	0.30	NA	NA
Bastrop	78957	309	20 (11-30)	0.41	NA	NA

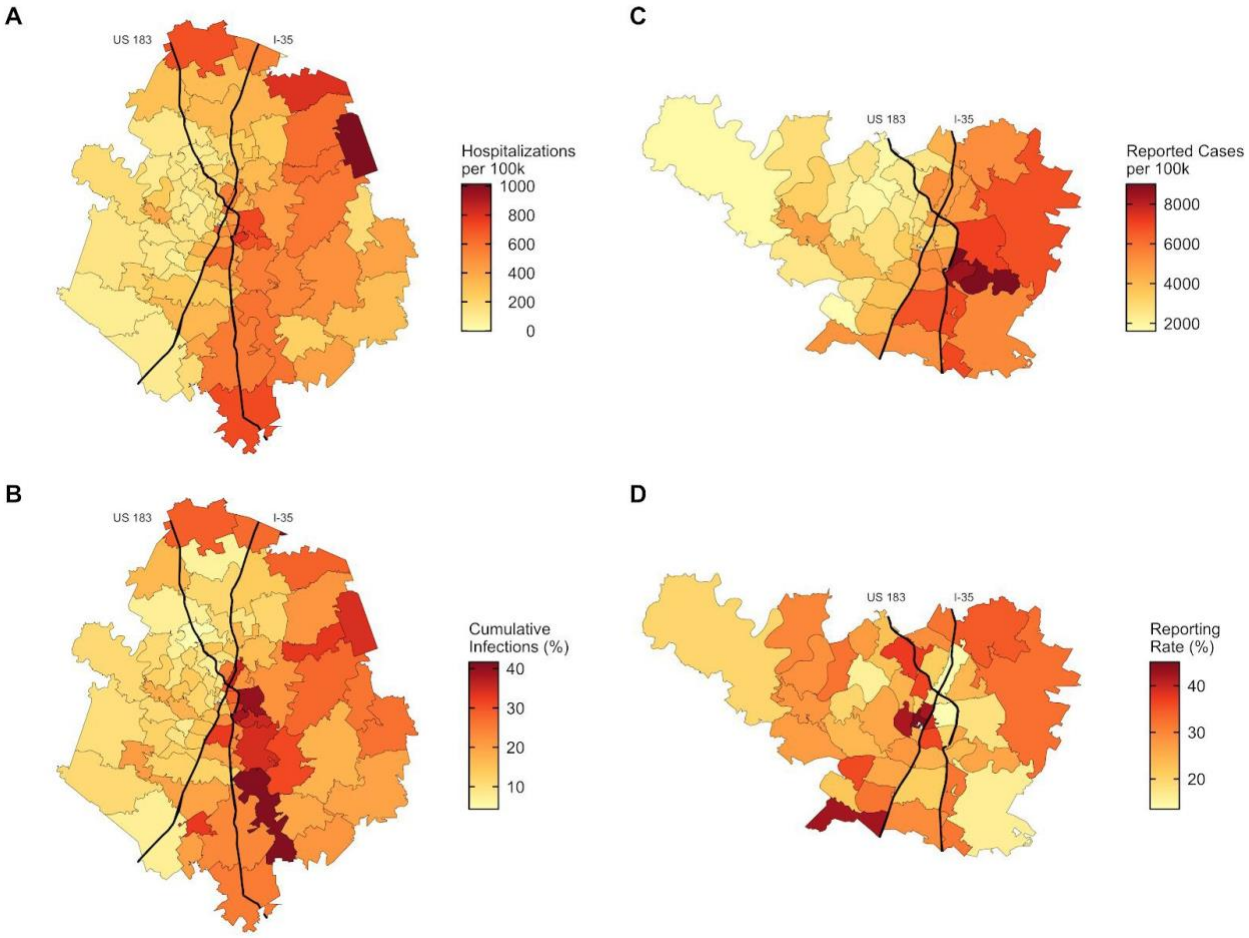

Figure 3. Reported and estimated COVID-19 burden by ZIP code for Austin-Round Rock MSA and Travis County. (A) Reported COVID-19 Hospitalizations per 100,000 in the MSA. (B) Estimated percent of each ZIP code that has been infected with COVID-19 as of January 11, 2021 derived from age-specific hospitalization data. (C) Reported COVID-19 cases per 100,000 in Travis County. (D) Estimated percent of COVID-19 infections that were reported in Travis County derived by comparing reported cases with estimated infections. Black curves indicate I-35 and highway US 183. I-35 roughly divides East and West Austin.

Correlation with the Social Vulnerability Index (SVI)

The CDC's Social Vulnerability Index (SVI) is a single indicator based on 15 different American Community Survey variables that estimates a community's ability to withstand environmental, biological and other stressors [4]. SVI values are provided by the CDC at the level of census tract and are based on poverty, lack of access to transportation, crowded housing and other factors that increase the likelihood of human suffering and economic loss. The values are percentile ranks of census tracts within each state. For example, a census tract in Texas with an SVI of 0.6 is more vulnerable than 60% of census tracts in Texas.

The SVI map for the Austin-Round Rock MSA reflects prominent geographic disparities (Figure 4A).The population-weighted average SVI within the Austin-Round Rock MSA is lower (less vulnerable) than the average across the state of Texas (0.32 vs. 0.48). The estimated cumulative COVID-19 incidence is positively correlated with SVI across Austin's 85 ZIP codes (R^2 = 53%, p<0.001; Figures 2B and 4B). For every 0.1 increase in SVI, the expected cumulative infections increased by 3.5%. Within Travis County, there is a slight but significant correlation between SVI and COVID-19 case reporting rate, with the expected reporting rate decreasing by 1.1% for every 0.1 increase in SVI (R^2=9%, p=0.046, Figures 2D and 4C).

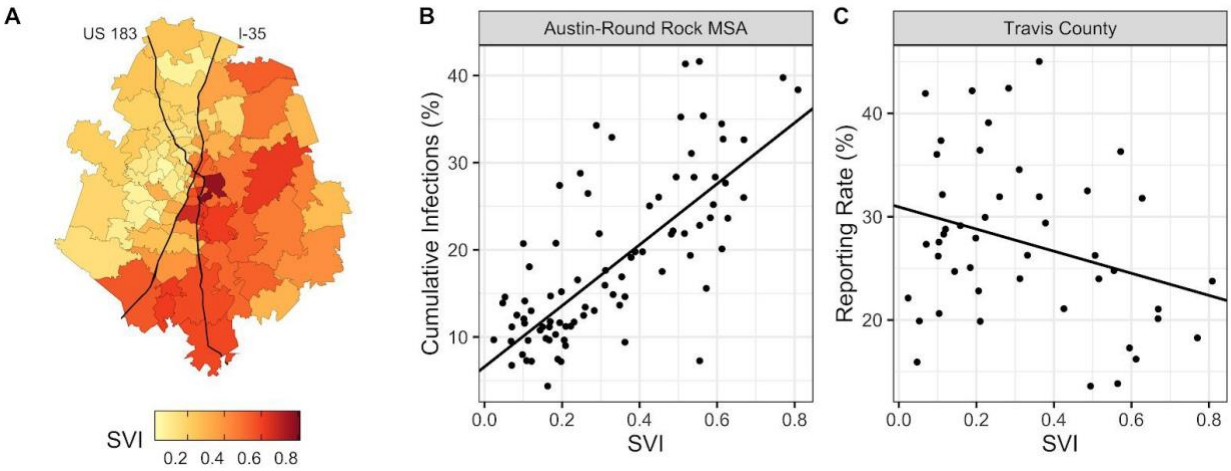

Figure 4. Social Vulnerability Index (SVI) correlates with cumulative COVID-19 infections across the 85 ZIP codes in the Austin-Round Rock MSA. (A) ZIP code level SVI ranged from 0.04 to 0.81 across the MSA, with high vulnerability ZIP codes concentrated in Austin, east of or surrounding the I-35 corridor (black line). (B) SVI is a significant predictor of estimated cumulative infections as of January 11, 2021 (R^2=53%, p<0.001; black line). For every 0.1 increase in SVI, the expected cumulative infections increases by 3.5%. (C) Within the 46 ZIP codes of Travis County, the estimated COVID-19 case reporting rate had a weakly significant decrease as SVI increased (R^2=9%, p=0.046; black line).

Limitations

We note several assumptions of analysis. First, we use published age-stratified infection hospitalization rates (IHR) that were estimated during the early first wave in China and subsequently calibrated for the United States based on country-wide vulnerabilities that could impact hospitalization risk, such as obesity, chronic illnesses, or occupational and environmental exposures [12]. This could lead to underestimation of cumulative infections and overestimation of the reporting rate if Austin is generally less vulnerable than the country as a whole. Further, we assume all ZIP codes have similar risk, which could lead to overestimation of infections and underestimation of reporting rates in ZIP codes with the most vulnerable populations [13]. The population composition of each ZIP code is based on 2015-2019 ACS data, which does not account for annual fluctuations in ZIP codes with large numbers of university student residents (78705 for UT Austin and 78666 for Texas State University). Estimates for these ZIP codes have additional uncertainty and should be considered with caution. In addition, our estimates for age groups and ZIP codes with small numbers of hospitalizations have a high level of uncertainty, reflected in the large error bars in Figures 1 and 2. Finally, the case and hospitalization data does not include individuals who were tested or required hospitalization for COVID-19 while traveling outside of the MSA or whose addresses were not correctly recorded. For example, residents living on the periphery of the MSA may be more likely to seek care outside of the MSA or vulnerable populations, such as people experiencing homelessness or undocumented residents, may be less likely to provide addresses. Such omissions would lead to underestimation of the cumulative infections and overestimation of the reporting rates.

Appendix

Data

We carried out the analyses using a combination of private and public data. Anonymized age and ZIP code-level hospitalization counts were obtained from the City of Austin from March 6, 2020 to January 11, 2021. The dataset includes COVID-19 hospitalized patients from 17 hospitals across the five-county (Bastrop, Caldwell, Hays, Travis, and Williamson) Austin-Round Rock Metropolitan Statistical Area (MSA) including their age and ZIP code of residence. There are a total of 85 residential ZIP codes within the MSA. Patient readmissions were excluded.

ZIP code-level COVID-19 case counts through January 4, 2021 were obtained from the City of Austin COVID-19 public data hub [9]. We lagged case data one week behind hospitalization data to account for the delay between symptom onset and hospital admission. Case data was reported for 71 ZIP codes in and near Travis County. We assigned each ZIP code to the county containing the majority of its residential addresses, according to the 3rd quarter 2020 crosswalk from the U.S. Department of Housing and Urban Development (HUD) [14]. As a result, 46 ZIP codes were classified as Travis County.

Age-stratified ZIP code population estimates were obtained using the R package ‘tidycensus’, from the 2015-2019 American Community Survey (ACS) [10,11]. Estimates for the CDC Social Vulnerability Index (SVI) were obtained at the census tract level for the state of Texas but were based on the 2014-2018 rather than 2015-2019 ACS [4].
However, population estimates did not change substantially between the two different ACS databases since they are five year averages. SVI values range from 0 to 1 with 0 being the least vulnerable to suffering and economic loss from disaster. The values are percentile ranks across census tracts with the state, with the average set to 0.5. We aggregated SVI’s to the level of ZIP codes using the percent of residential addresses in each census tract based on the 3rd quarter 2020 HUD crosswalk [14].

Estimating total infections and reporting rates

We estimate the total infections and reporting rate using age-stratified hospitalization data. We first estimate the total infections in an age group within a region, which is a latent, discrete parameter that governs two independent processes: (1) hospitalization and (2) reporting of cases. We assume that hospitalizations are a binomial sample of

the total infections governed by the age-specific IHR, and that reported cases are a binomial sample of the total infections governed by the reporting rate. We use an informative prior for the age-specific IHR, derived from fitting a beta distribution to the mean and 95% confidence interval estimated for the United States in [7,8] (Table 3). We use a uniform beta prior for the reporting rate for a region or age group, and we use a uniform discrete prior to bound total infections from a minimum of the total number of hospitalizations to a maximum of the total population size. Mathematically, we assume

$$
\begin{aligned}
&p(\rho_{k,z}) \sim beta(1,1)\\
&p(\mu_{k,z}) \sim beta(a_k, b_k)\\
&p(I_{k,z}) \sim unif(H_{k,z}, N_{k,z})\\
&p(H_{k,z}|I_{k,z}, \mu_{k,z}) \sim binom(I_{k,z}, \mu_{k,z})\\
&p(C_{k,z}|I_{k,z}, \rho_{k,z}) \sim binom(I_{k,z}, \rho_{k,z})
\end{aligned}
$$

Where k indicates the age group, z indicates the region, $\rho_{k,z}$ is the reporting rate, $\mu_{k,z}$ is the age-specific IHR, a_k and b_k are the shape parameters for the beta distribution, $I_{k,z}$ are the infections, $H_{k,z}$ are the hospitalizations, and $C_{k,z}$ are the case data. In such a setup, we can solve for the conditional posterior distributions for all parameters analytically as:

$$
\begin{aligned}
&p(I_{k,z}|H_{k,z}, \mu_{k,z}) \sim nbinom(\text{size} = H_{k,z}+1, \text{prob} = \mu_{k,z}) + H_{k,z}\\
&p(\mu_{k,z}|H_{k,z}, I_{k,z}) \sim beta(\text{shape1} = a_k + H_{k,z}, \text{shape2} = b_k + I_{k,z} - H_{k,z})\\
&p(\rho_{k,z}|C_{k,z}, I_{k,z}) \sim beta(\text{shape1} = 1 + H_{k,z}, \text{shape2} = 1 + I_{k,z} - C_{k,z})
\end{aligned}
$$

We initialize the estimated infections at $I_{k,z} = \frac{H_{k,z}}{\bar{\mu}_{k,z}}$, which we round to the nearest digit and expect to be roughly the mean of the posterior for the infections. Initial IHR and reporting rates are then sampled conditional on the starting infections. We then sample from each posterior 500 times to burn-in the sampling process, and then sample 10,000 from each posterior with a thinning rate of 10 to obtain 1,000 samples for each posterior distribution overall. Throughout the report we summarize the posterior distributions through their mean and 95% credible intervals.

We carried out multiple variations of the estimation procedure based on the available data. For the overall Austin MSA and age-based estimates, we carried out estimation as described above, but for the ZIP code analysis we did not have age-stratified case data for the ZIP codes. Therefore rather than calculate reporting rates for each age group

within the ZIP code, we only calculated an overall reporting rate for the ZIP code based on the total estimated infections across age groups.

Comparing infections to the Social Vulnerability Index

We carried out a linear regression analysis to relate ZIP code level SVI to the estimated heterogeneity in cumulative percent infected and reporting rates. Analysis for cumulative percent infected was performed using the 'heavyLm' function to account for distribution longer tails that violate the normality of residuals. Reporting rates were modeled with 'lm'.

Table 3: Age-stratified infection hospitalization rate (IHR) as estimated for the US in [7,8] **with our estimated beta distribution parameters.**

Age group	Hospitalization rate (%)	Estimated Beta Shape 1	Estimated Beta Shape 2
0-9	0.1 (0.06-0.2)	16.3	15,551
10-19	0.2 (0.1-0.4)	16.4	8,411
20-29	1.2 (0.7-2.4)	16.2	1,373
30-39	2.8 (1.7-5.7)	15.9	556
40-49	4.4 (2.6-9.1)	15.6	337
50-59	8.3 (4.9-16.9)	15.0	167
60-69	12.9 (7.7-26.3)	14.3	96.3
70-79	18.0 (10.7-36.7)	13.7	62.3
80+	22.0 (13.2-45.0)	13.4	47.3

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