

Seroprevalence of SARS-CoV-2 Antibodies Among Adults and Children in Maricopa County, Arizona

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Study Aim

Use the CDC CASPER methodology to accurately estimate the prevalence of SARS-CoV-2 antibodies in Maricopa County, Arizona



Maricopa County Serosurvey



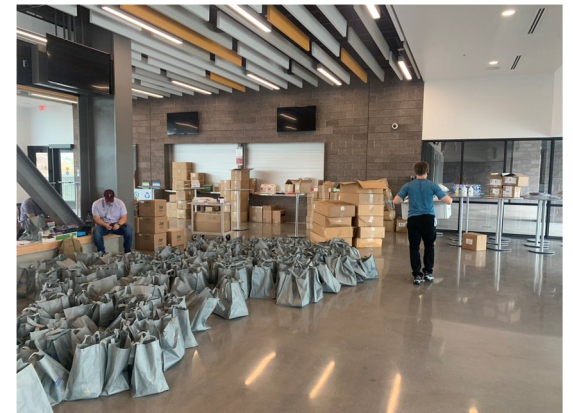
Systematic sample of Maricopa County residents using CDC
CASPER methodology from September 1-September 12, 2020



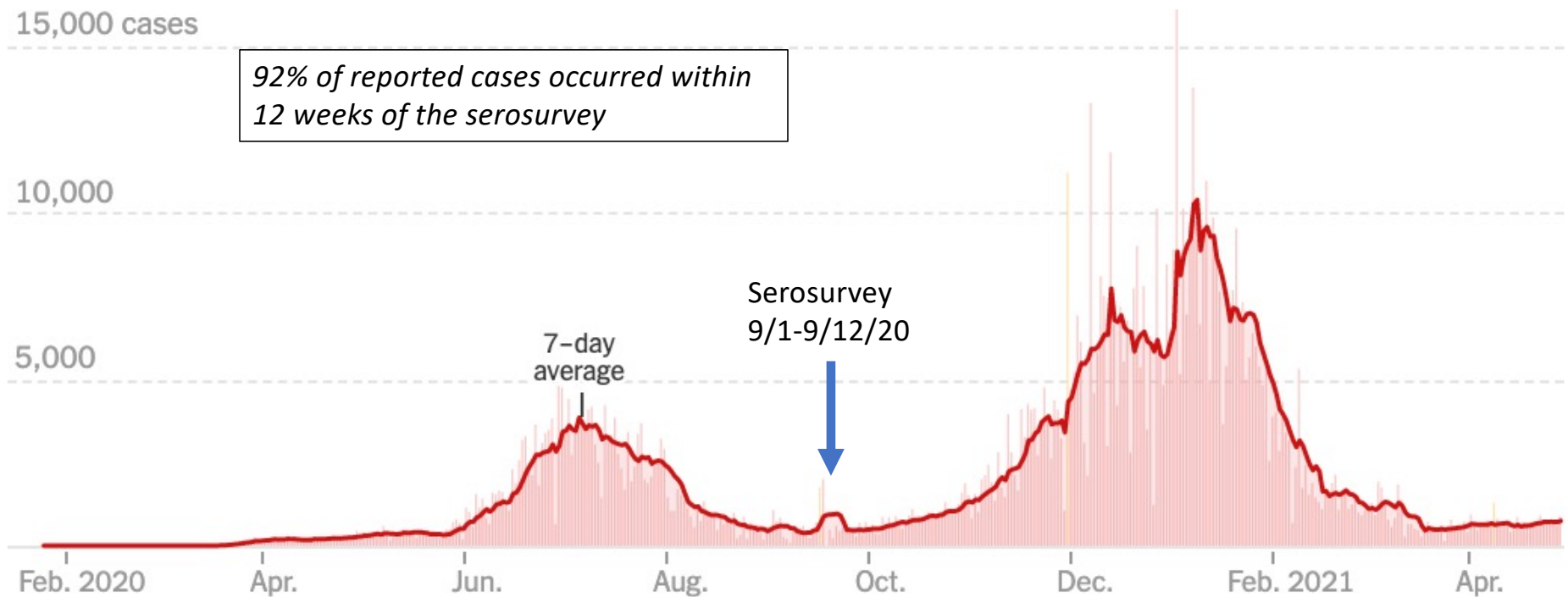
Sociodemographic household survey



Antibody testing performed on venous blood samples collected in the field

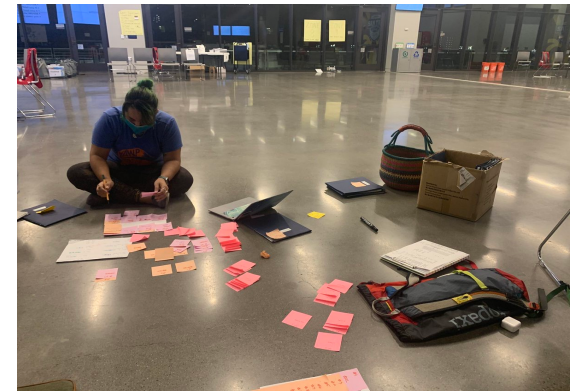
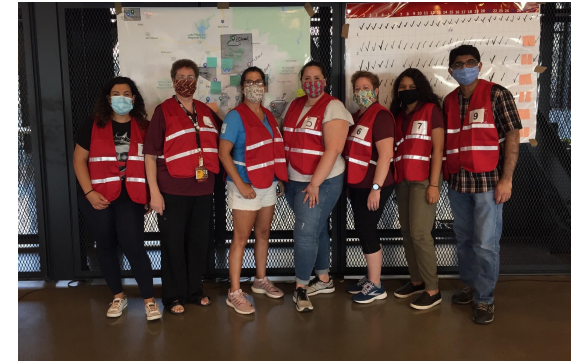


Maricopa County Serosurvey



Serosurvey Volunteer Positions

Field Team	Command Center
Field Interviewer	Project Leader
Nurse/Phlebotomist	Zone Leader
Runner	Sample Collection Manager
Mobile Lab Tech	Data Manager
Clinical Preceptor/ Clinical Faculty	Translator



Antibody Test

- Roche Elecsys Anti-SARS-CoV-2 Assay
- Sensitivity >99% >14 day post PCR positive
 - 91% sensitive for asymptomatic and mildly symptomatic cases at 8 months
- Specificity >99%
- Samples were centrifuged and monitored in the field using a Barcode Scan to Web app
- Samples were processed by Mayo Clinic Scottsdale

Choe P, Kim K, Kang C, Suh H, Kang E, Lee S, et al. Antibody Responses 8 Months after Asymptomatic or Mild SARS-CoV-2 Infection. Emerg Infect Dis. 2021;27(3):928-931. <https://doi.org/10.3201/eid2703.204543>

Michael J. Peluso, Saki Takahashi, Jill Hakim, et al. SARS-CoV-2 antibody magnitude and detectability are driven by disease severity, timing, and assay. medRxiv; doi: <https://doi.org/10.1101/2021.03.03.21251639>

Study Design: CASPER Sampling

- **Sampling frame:** occupied housing units in Maricopa County, Arizona, excluding tribal lands (1,407,207 households)
- **Cluster identification:** 2010 census block data were used to select randomly select 30 census block groups
- **Households:** Field teams systematically sampled households within each cluster and residents >6 years invited to participate

CASPER Methodology: <https://www.cdc.gov/nceh/casper/default.htm>



Analytical Methods: Calculating Household and Individual Weights

$$\text{Household Weight} = \frac{(\text{Total \# of Households in the Sampling Frame})}{(\text{\# of Surveys Completed in Cluster}) * (\text{\# Clusters Selected})}$$

$$\text{Individual Weight} = \text{Household Weight} * \frac{\text{\# of HH members}}{\text{\# Blood samples taken from HH}}$$

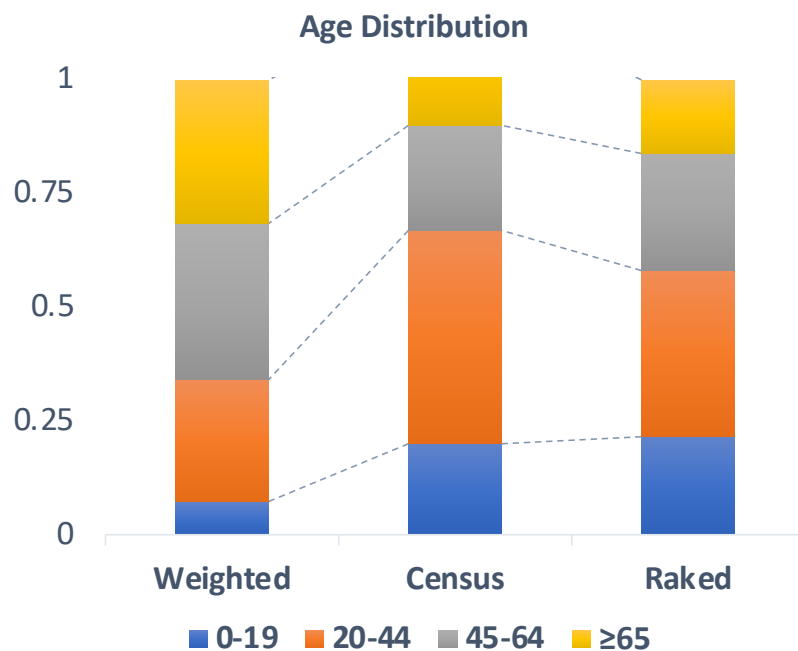
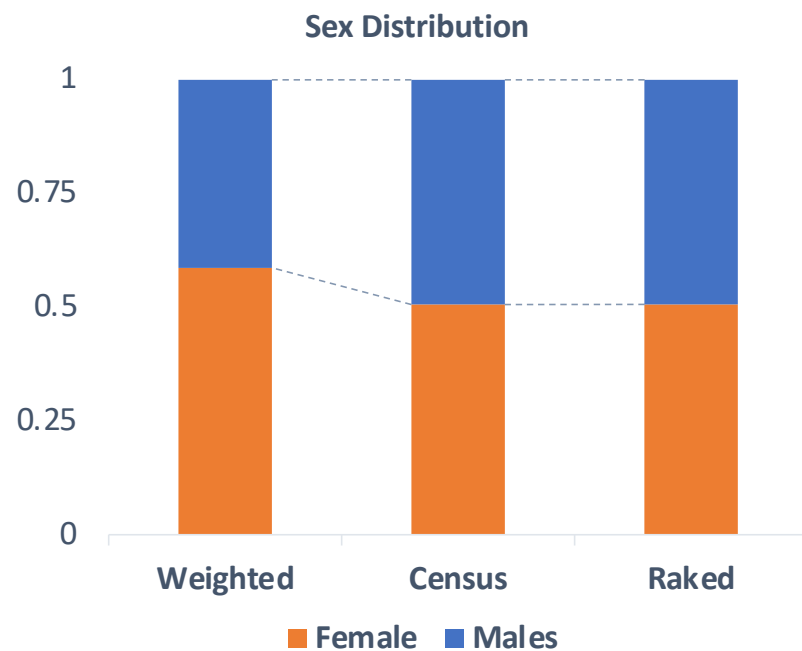
Note:

- The individual weight is the household weight multiplied by the inverse probability of providing blood sample in the household.
- The probability of providing a blood sample is the number eligible to give blood divided by the number that gave blood in each household.

Analytical Methods: Raking

- Since sampling individuals for blood samples was not random or systematic, we expect our individual sample to be biased.
- We need to correct for this to obtain a more representative sample
- We used “raking” to adjust our sample weight to match the Maricopa County population.
- Adjusted sample weights were then used to calculate the overall seroprevalence

Weighted and Raked Weights as compared to Maricopa County's population



Note: Census data is based on 2019 estimates for ages 5 and older.

Maricopa Serosurvey Team

Our Volunteer and Staff Workforce by Numbers



169

Households

169 households were reached and interviewed



260

**Samples
Collected**

260 blood samples collected in the field and sent for antibody testing



225

Volunteers

225 volunteers participated in the field and command center over 10 days



29

Neighborhoods

29 neighborhoods representing 9,224 mi²



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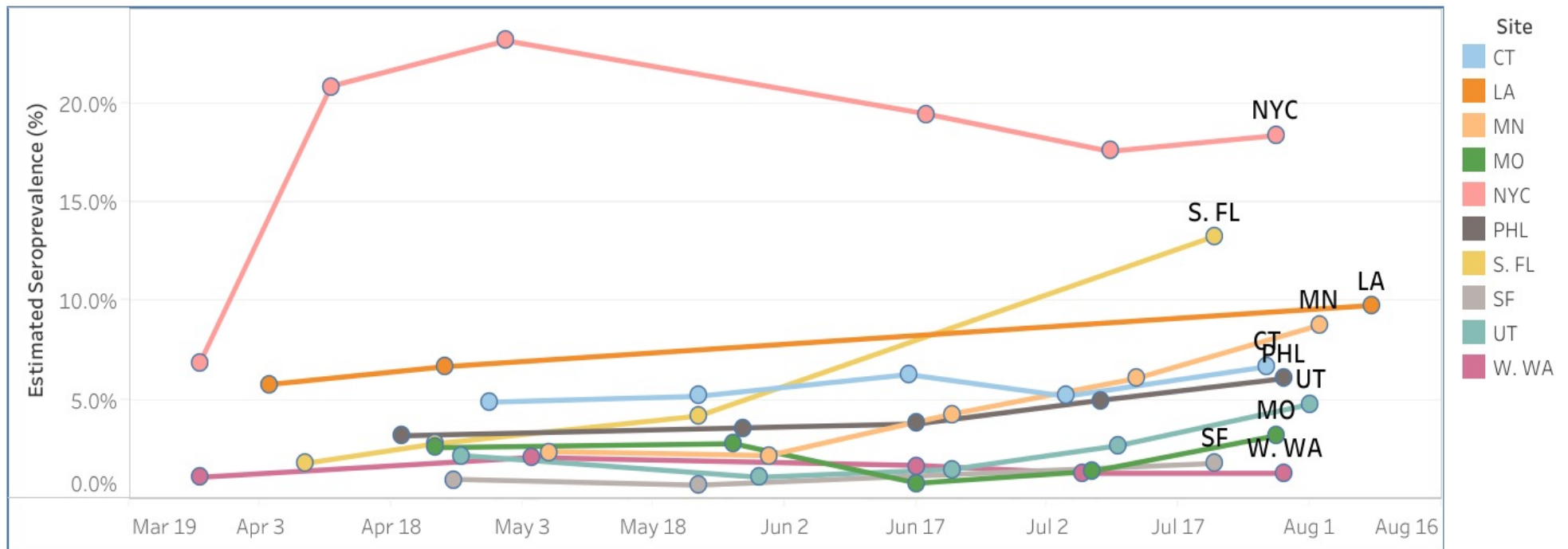
Maricopa County Serosurvey- Results

- **14.0% (95%CI: 5.5%-22.5%)** of population of Maricopa County have detectable antibodies to SARS-CoV-2 through August 31, 2020
- This estimate is **4.5 times higher** than reported cases
- As of September 2020, the population in Maricopa County remained largely immunologically naive to the virus.
- Cooperation rate (number of completed interviews/all households where contact was made)= **29.5%**

Maricopa County Serosurvey- Results

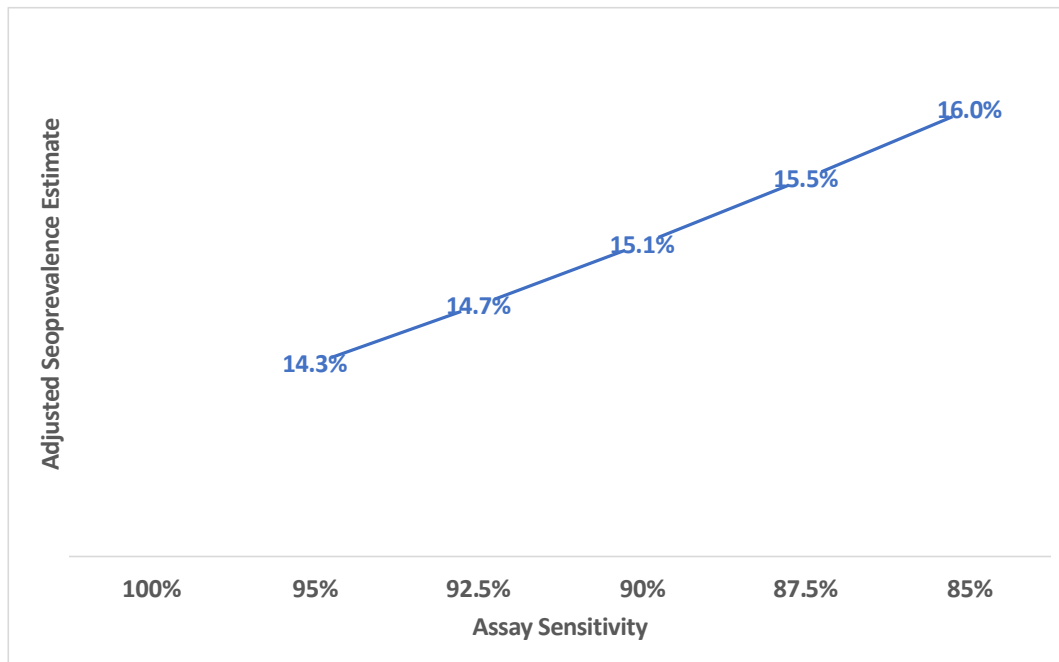
- Higher seroprevalence in households where the primary language spoken was not English: 37.5% (95%CI:18.3-61.7) vs. 16.5% (95%CI: 9.1-27.9), p-value=0.02
- 54% of households with covid-like-illness did not get tested
- The most commonly reported reasons for not being tested were: concerns about the cost (24%), uncertainty as to where to get a test (24%), inaccessibility of testing sites (19%), difficulty scheduling (19%), concerns about eligibility (5%) and concerns about citizenship status (2%)

Seroprevalence Estimates Across the US



Limitations: A full list of limitations interpreting this data can be found at <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/commercial-lab-surveys.html#interpreting-serology-results>

Seroprevalence Adjusted for Assay Sensitivity



- Our seroprevalence estimate is 14.0%...
- But true seroprevalence is probably higher due to seroreversion:
 - if sensitivity is 95% ~ 14.3%
 - if sensitivity is 90% ~ 15.1%

$$\text{adjusted prevalence} = \frac{\text{crude prevalence} + \text{specificity} - 1}{\text{sensitivity} + \text{specificity} - 1}$$

Challenges and Limitations

- Managing blood samples in the field is extremely difficult and labor intensive
- SARS-CoV-2 antibody magnitude and detectability are driven by disease severity, timing, and assay choice
- Small sample, less precision in our seroprevalence estimate
- CASPER design resulted in small clusters in rural areas
 - AZ also has a large seasonal population
- We excluded persons who were living on tribal lands or in institutionalized settings—populations that have been disproportionately impacted by COVID
- Possibility of selection bias can not be excluded

Research Team

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- **Rebecca Sunenshine, MD, FIDSA, Medical Director, Disease Control, Maricopa County Department of Public Health**

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