Rapid Systematic Review of Early SARS-CoV-2 Serosurveys Summary

Background

- Members of the Immunity Task Force (including Dr. Evans) have collaborated on a systematic review of early SARS-CoV-2 serosurveys.

- Critical window of opportunity to learn from early SARS-CoV-2 serology studies.

- Limitations in serological study designs and test standards raise concerns about the validity of seroprevalence estimates and their utility in decision-making.

- The Immunity Taskforce has also launched a dashboard that displays the results of these studies by region and population group.

Approach

- The systematic review included completed, ongoing, and proposed serosurveys drawn from:
    - electronic databases (PubMed, MedRXIV, BioRXIV, and WHO ICTPR);
    - five medical journals (NEJM, BMJ, JAMA, The Lancet, Annals of Internal Medicine);
    - reports by governments, NGOs, and health systems; and
    - media reports (Google News).

- Date range: December 1, 2019 to May 1, 2020.

Findings

- Seventy records – **describing 73 studies** – met inclusion criteria[1]. Of these 23 reported prevalence estimates and 50 records reported characteristics of ongoing or proposed serosurveys.

- Overall, **14 countries have reported estimates from completed or ongoing studies**, with six additional countries having proposed studies.

    - Countries reporting data: Austria, China, Denmark, Finland, France, Germany, India, Iran, Italy, Japan, Singapore, Switzerland, United Kingdom, and the United States.

    - Countries intending serosurveys but not yet reporting: Andorra, Australia, Brazil, Canada, Netherlands, and Ukraine.

- The 23 studies reporting prevalence estimates studies had a **total sample size of 35,784** and reported **42 prevalence estimates** with the inclusion of sub-groups in some studies.

[1] Inclusion criteria included factors like study of humans, focused on previous infections, met sero-study definition, employed cross-sectional and cohort study designs and reported or provided data that enabled the calculation seroprevalence estimates. Additional exclusionary criteria included, but was not limited to, active SARS-CoV-2 infection, include patients with previously confirmed COVID-19 infection and studies that employed protocols that did not include an implementation plan that includes a proposed region, sample size, and approximate start date.

- Seroprevalence estimates ranged from **0.4% to 59.3%**.
- **All estimates were found to have a risk of bias** (43% high risk, 21% moderate risk, 36% unclear).
- Two major limitations were common across studies:
    - **Test performance**: only two studies reported using tests with the United States FDA recommended minimum sensitivity and specificity (90% sensitivity, 95% specificity)
    - **Inadequate sampling methods**: 61% of studies employed non-random sampling (e.g., self-referral) or a non-representative sampling frame (e.g., blood donors), and fewer than half of prevalence estimates were obtained from an appropriately sized sample

Reported prevalence estimates by region and population

Region	Test Characteristics	Sampling frame and method	N	Seropositive Prevalence*	Total Cases/ 1M Pop.	Risk of Bias*
Ongoing Study						
Chelsea, US	LFIA (88.7%, 90.6%)	General pop.: convenience	200	31.5%	6,287	High
Brevard County, US	LFIA (100%, 100%)	RT-PCR-tested: self-referred	1,000	1%	1,133	High
New York State , US	NR	Supermarket shoppers: convenience	7,500	14.9%	14,985	Unclear
New York City, US	NR	Supermarket shoppers: convenience	NR	24.7%	14,985	Unclear
Westchester/Rockland, US	NR	Supermarket shoppers: convenience	NR	15.1%	14,985	Unclear
Long Island, US	NR	Supermarket shoppers: convenience	NR	14.4%	14,985	Unclear
New York upstate, US	NR	Supermarket shoppers: convenience	NR	3.2%	14,985	Unclear
Idaho, US	NR	Patients: self-referred	1,946	1.8%	1,046	Moderate
Miami, US	Immunochromatography (88.7%, 90.6%)	General pop.: random	NR	6% (4.4-7.9%)	1,439	Unclear
San Miguel County, US	NR	General pop.: entire population	986	0.8%	1,121	High
Lebanon/Claremont, US	NR	Healthcare workers: self-referred	47	2%	1,442	Unclear
Completed Study						
Denmark	LFIA (83%, 100%)	Blood donors: sequential	9,496	1.7% (0.9-2.3%)	754	Moderate
Oise, France	ELISA, S-FLOW, LIPS (~, 99%)	Teachers: cluster-based	53	43.4%	615	High
		Parents: cluster-based	211	11.4%	615	High
		Students' siblings: cluster-based	127	10.2%	615	High
		Students: cluster-based	240	38.3%	615	High
		Non-teacher staff: cluster-based	27	59.3%	615	High
Paris/Oise, France	ELISA, S-FLOW, LIPS	Blood donors: unclear	200	3%	168	High
Gangelt, Germany	NR	General pop.: unclear	500	14%	1,352	High
Guilan, Iran	RDT (63.3%, 100%)	General pop.: random	551	21% (14-29%)	1,024	High
		General pop.: random	551	33% (28-39%)	1,024	High
Padova, Italy	Chemiluminescence (91.2%, 97.3%)	Healthcare workers: unclear	133	4.5%	3,398	High
Kobe, Japan	Immunochromatography	Outpatients: random	1,000	2.7% (1.8-3.9%)	15	High
Scotland	ELISA, Microneutralization	Blood donors: unclear	1,000	1.2%	23	High
Singapore, Singapore	NR	General pop.: cluster-based	NR	5.2%	2,556	Unclear
Geneva, Switzerland	NR	Annual survey participants: random	343	3.5% (1.6-5.4%)	2,438	Moderate
	NR	Annual survey participants: random	417	5.5% (3.3-7.7%)	2,968	Moderate
Santa Clara County, US	LFIA (80.3%, 99.5%)	Targeted Facebook users: stratified	3,330	2.8% (2-3.5%)	274	Moderate
Los Angeles County, US	LFIA (80.3%, 99.5%)	General pop.: random	863	4.1% (2.8-5.6%)	503	Moderate
Baton Rouge, US	NR	General pop.: unclear	432	4.4%	1,560	Unclear
Seattle, US	NR	Stored sera samples: unclear	221	0.4%	1,964	Unclear

*For populations with multiple prevalence estimates, only the most recent fully-adjusted estimate was included; 95% confidence intervals were included in parentheses if they were reported. *Overall risk of bias (high, medium, low, unclear) was determined by considering all Joanna Briggs Institute criteria for prevalence estimates (5), and using these criteria to guide an assessment of the extent, nature, and magnitude of systemic bias, and reflects the extent to which the estimated prevalence may deviate from the true prevalence value. **High:** Limited certainty in the prevalence: the true prevalence may be substantially different from the estimated prevalence. **Moderate:** Moderate certainty in the prevalence: the true prevalence is likely to be close to the estimate, but there is a possibility that it is substantially different. **Low:** High certainty in the prevalence estimate: true prevalence is likely close to the estimate. **Unclear:** There was insufficient information to assess risk of bias.

Abbreviations: 1M pop = one million population; LFIA = Lateral flow immunoassay; ELISA = Enzyme-linked immunosorbent assay; S-FLOW = a type of lateral flow immunoassay; US = United States; N = sample size; NR = not reported