Current challenges for SARS-CoV-2 seroprevalence studies among blood donors

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PLASMA
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ORGANS
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Research initiatives of blood services worldwide in response to the covid-19 pandemic

O'Brien et al Vox Sang 2020

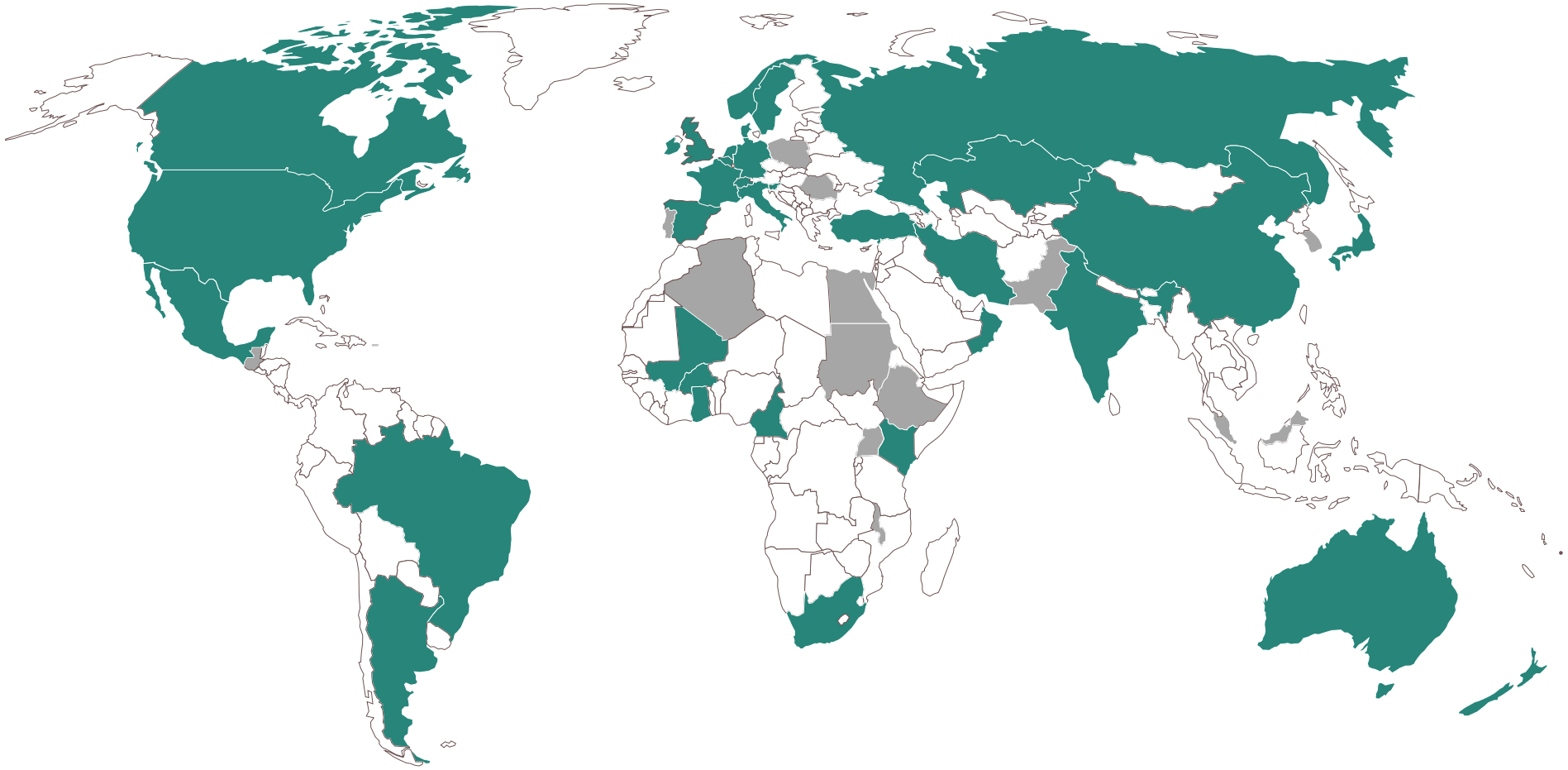
An International Comparison of Anti-SARS-CoV-2 Assays

Lewin et al Vox Sang 2021

Scoping Review of SARS-CoV-2 seroprevalence studies among blood donors

Saeed et al (in prep)

32 of 48 countries (73%) surveyed had a seroprevalence study (June 2020)



Seroprevalence studies No seroprevalence studies

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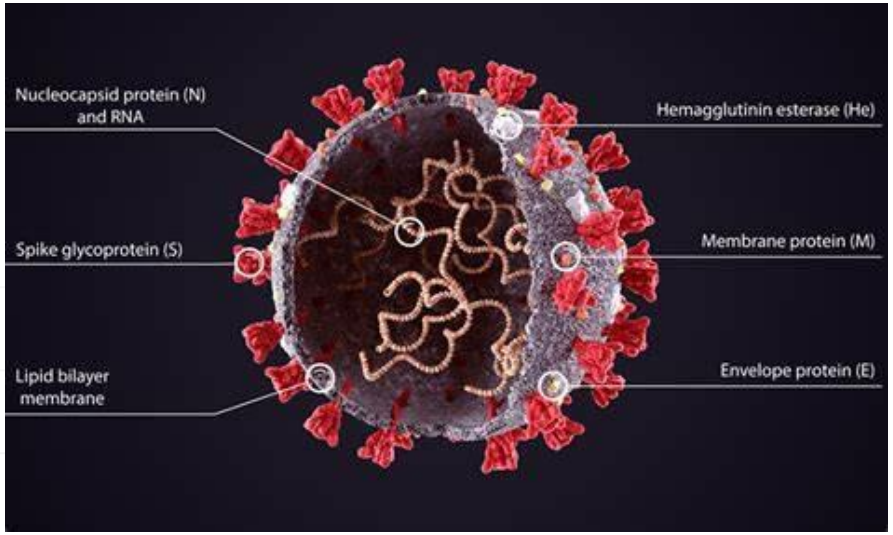
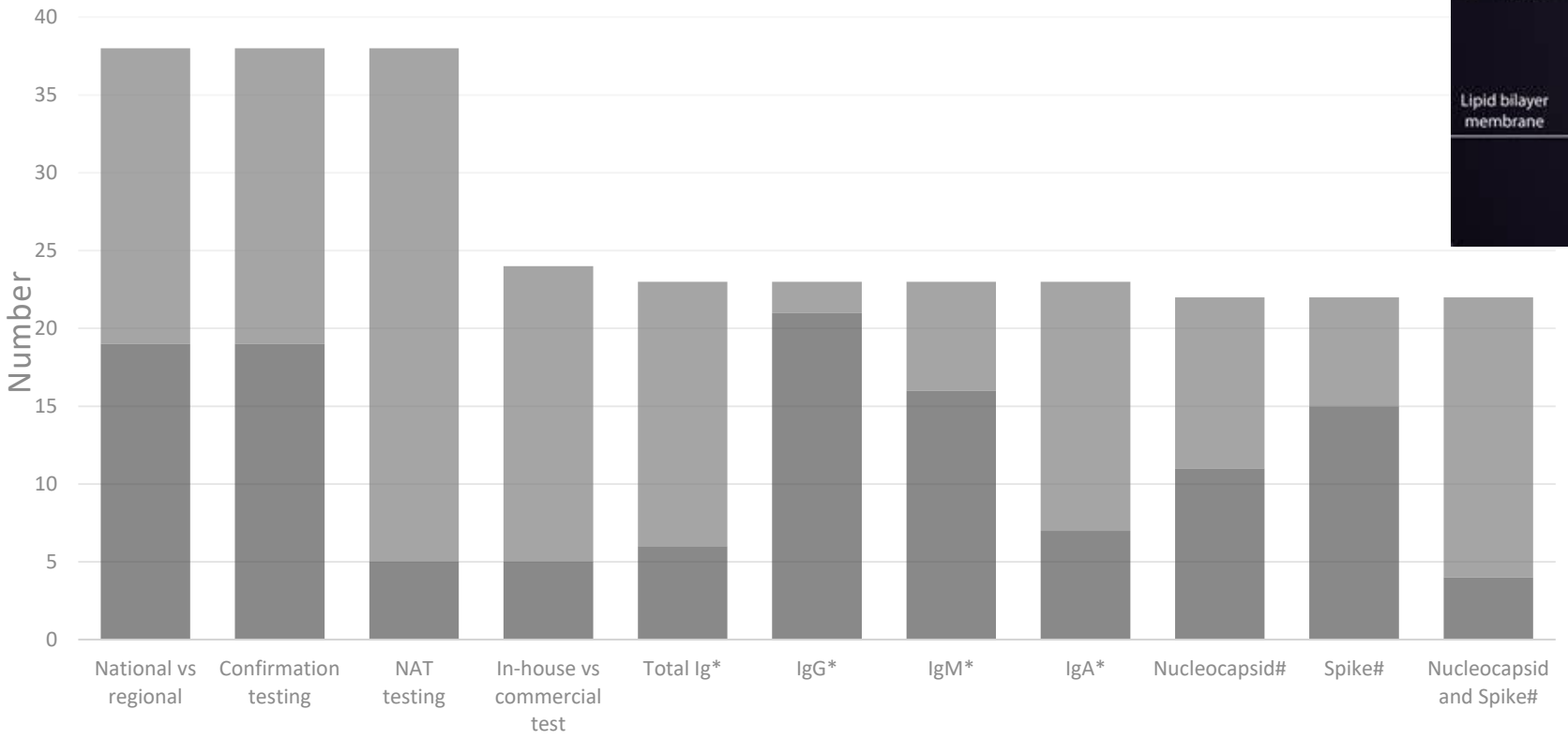
Variability of assay characteristics





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Aim of the Scoping Review

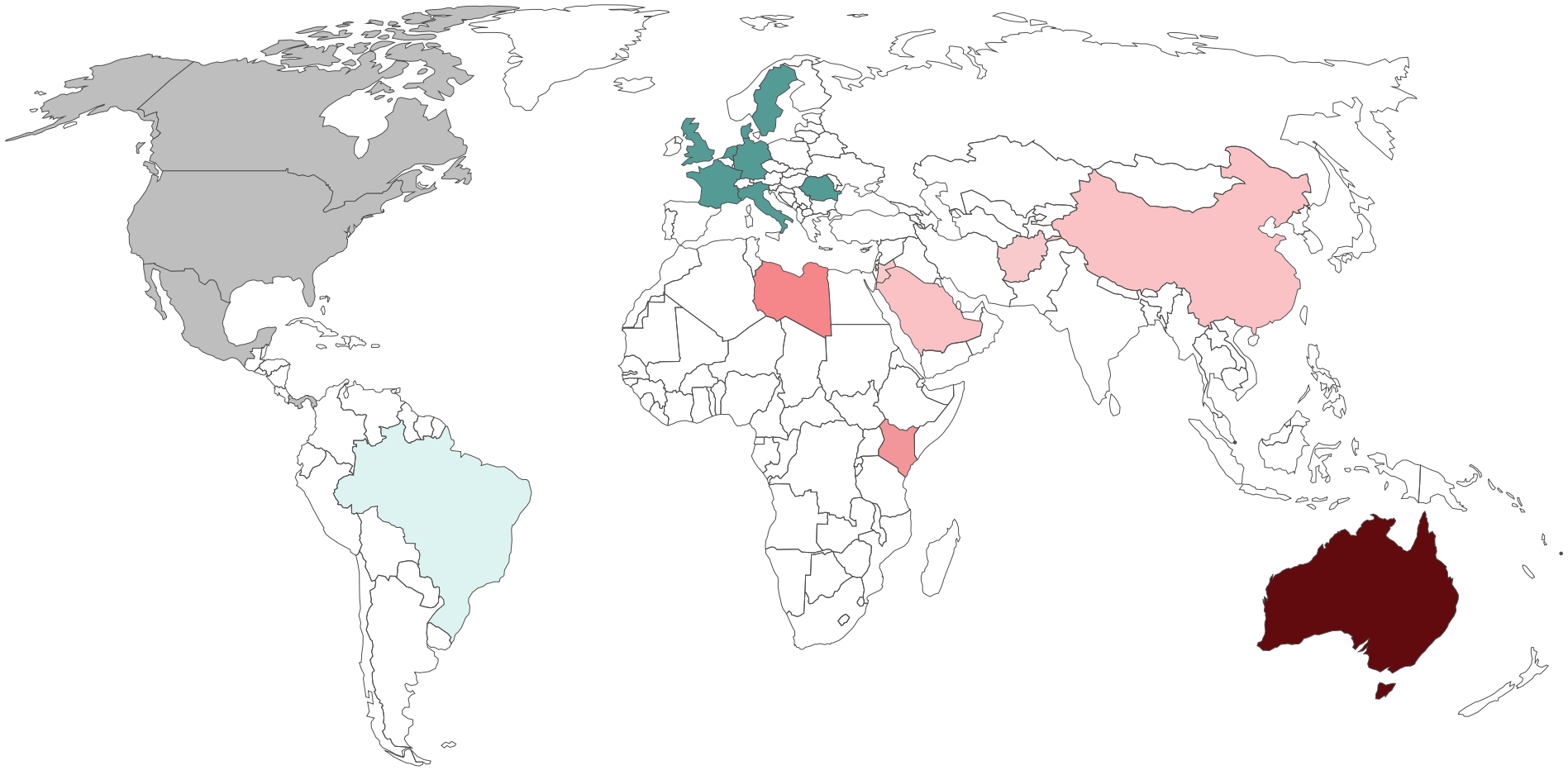
- Characterize SARS-CoV-2 seroprevalence specifically among blood donors
- Evaluate how well subpopulations and geographic areas have been represented
- Determine the diversity of methodology used to address limitations associated with these studies.

Studies Evaluated

- We identified 33 seroprevalence studies among blood donors; 22 were published peer-reviewed and 11 were preprints.
- Representing 1,323,307 blood donors from surveys conducted between January 2020 until December 2020

The search identified a total of 157 articles (32 from PubMed and 125 articles not peer reviewed from MedRxiv). Based on the screening of title and abstract, 105 articles were excluded. The full text of the remaining 52 articles were assessed for eligibility, which resulted in the inclusion of 33 studies

Seroprevalence Studies represented 20 countries globally



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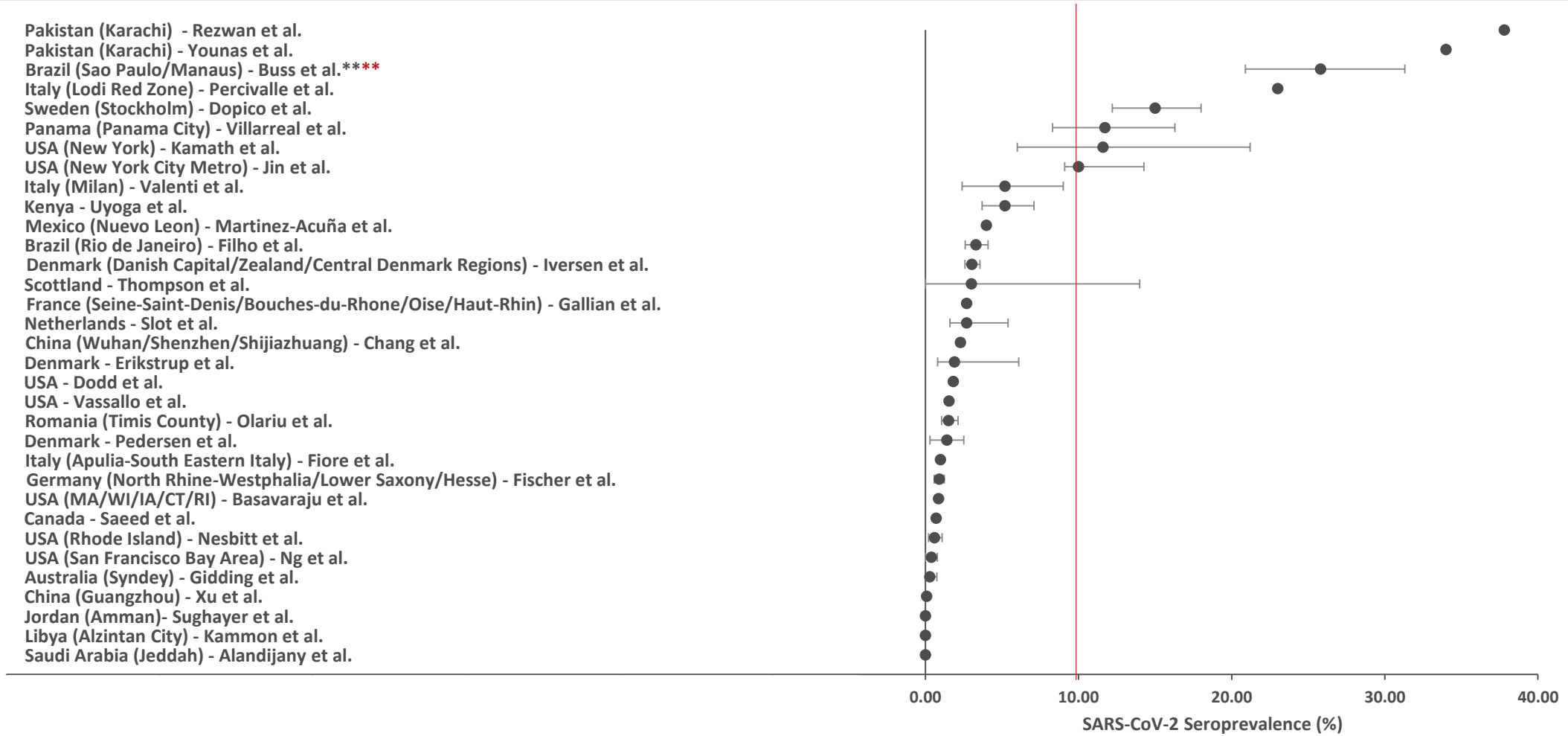
The median sample size was 1996 but ranged from as many as 953,926 in the USA to as few as 22 in Libya

Seroprevalence among blood donors (0-38%)**



** Adjusted for waning antibodies as high as 76%

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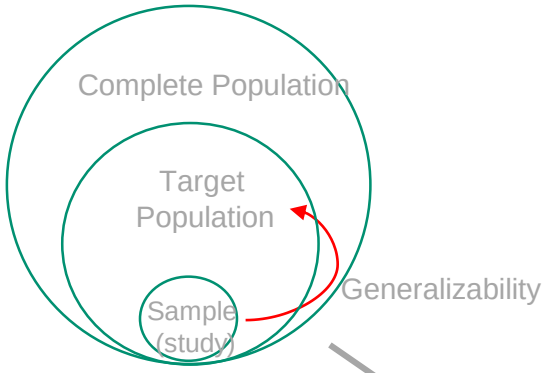
Approximately a third (12/33) did not provided a 95% confidence interval or a range of estimates.

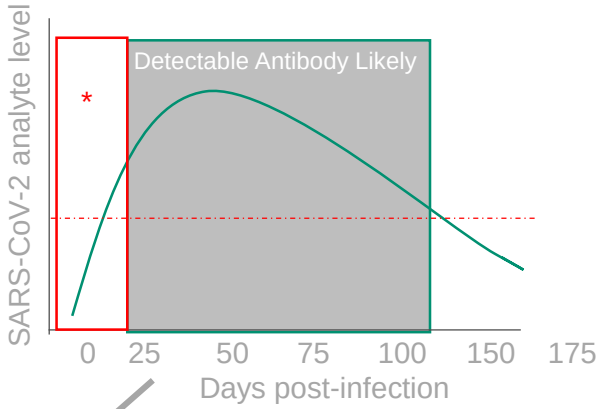
Heterogeneity

- In addition to variations in community transmission and the diverse public health response to the COVID-19 pandemic, study designs and methodology were contributing factors to this heterogeneity.

Concern 1: Population sampling/selection bias



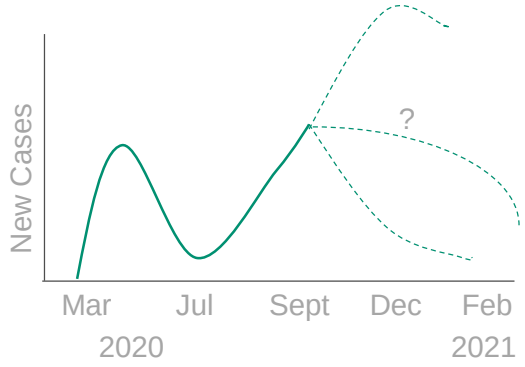
Concern 3: IgG antibody kinetics



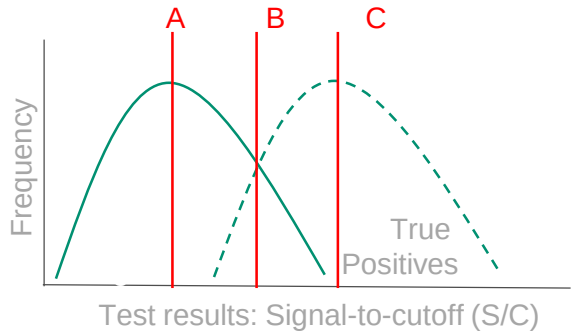
* *Symptoms would be likely be present*

Seroprevalence Estimate

Concern 2: Timing of study and shifting public health response



Concern 4: Imperfect assay



Population-level characteristics

	Number of studies (n=33)	Challenge
National vs Regional	24 (78%)	Significant regional variation of estimates
Age	21 (62%)	Inconsistent groupings
Sex	21 (62%)	
Geography	18 (53%)	Inconsistent • As granular as dissemination areas to country estimates
Socioeconomic Status	5 (15%)	Limited/ inconsistent • 1 study by occupation, 1 neighbourhood-level SES; 1 education

Overall less than 1 in 5 studies, adjust seroprevalence rates to reflect the demographics of the general population.

Periodicity

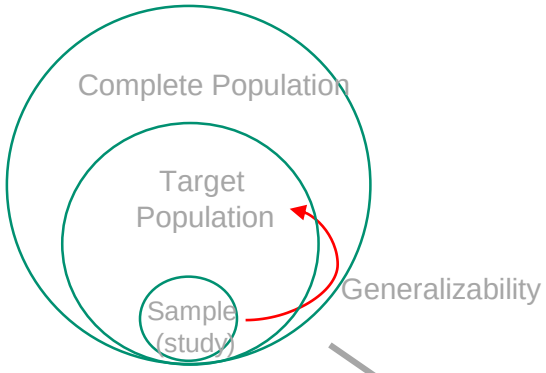
Approximately half of the studies (52%; 17/33) provided a single seroprevalence estimate.

Diverse Assays

- There were almost as many unique assay combinations (n=27) as studies included in the review.
  - A single assay was used most often 19/33 (56%)
  - Other studies used two or more assays (maximum of 5)
- Overall 12/33 studies adjusted seroprevalence estimates by imperfect test characteristics.
  - 5/11 used the Rogan-Gladen equation
  - 5/11 used Bayesian methods

Possible solutions

Challenge 1: Population sampling/selection bias



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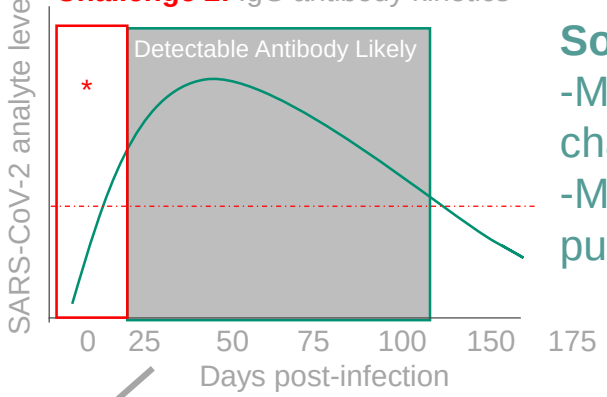

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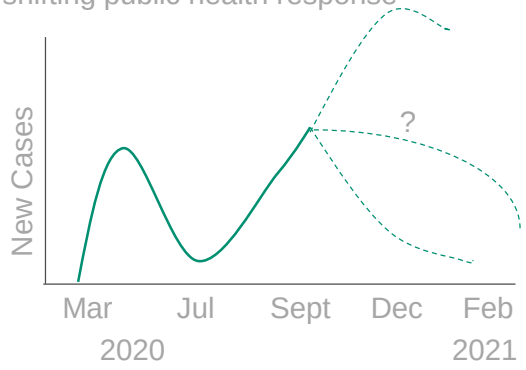
Solution 1:
-Stratify
-Adjust for population weights
-Inverse probability of selection weights (IPSW)

Solution 2:
-Modify thresholds for test characteristics
-Modelling approaches using public health data

Seroprevalence Estimate

Challenge 3: Unknown dynamic epidemic and shifting public health response



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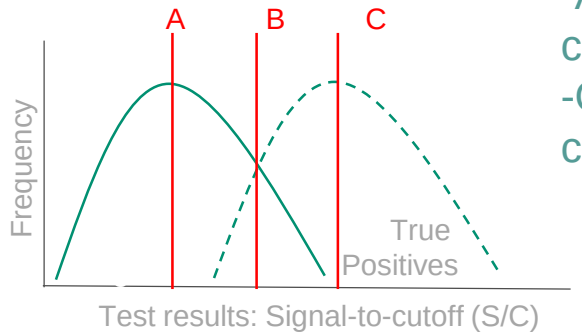


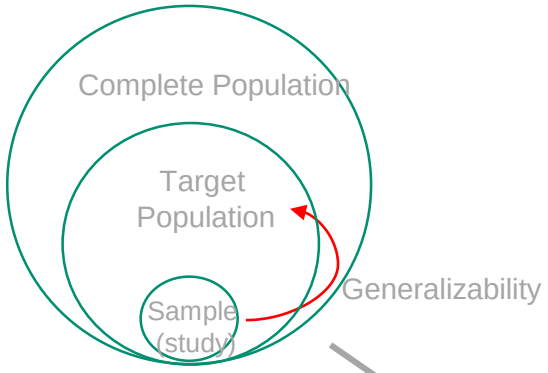
Solution 3:
-Serial cross-sectional studies
-describe non-pharmaceutical interventions

Solution 4:
-Adjust estimates for test characteristics
-Orthogonal testing/Latent class analysis

Now another consideration…

Determinants of Seroprevalence by Natural Infections

Determinant 1: Population sampling



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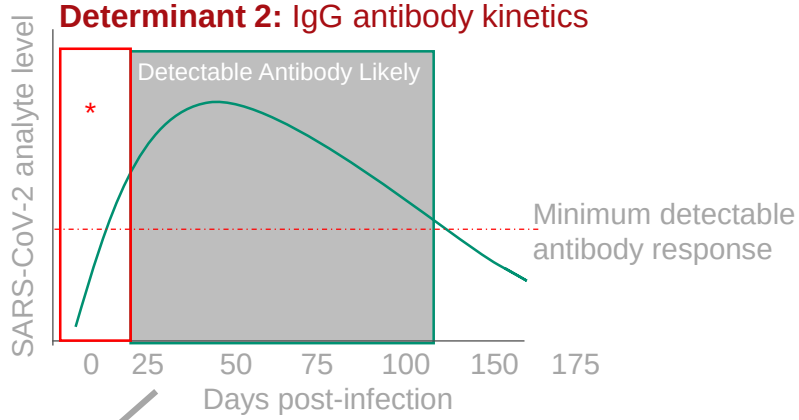

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Seroprevalence Estimate

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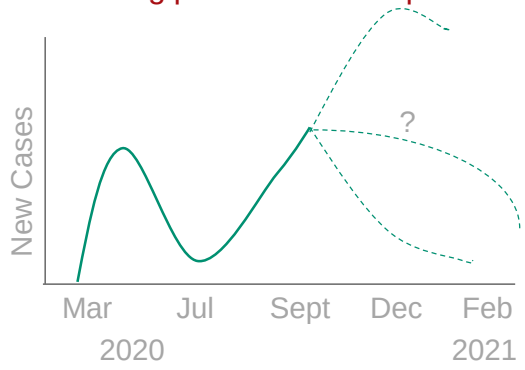

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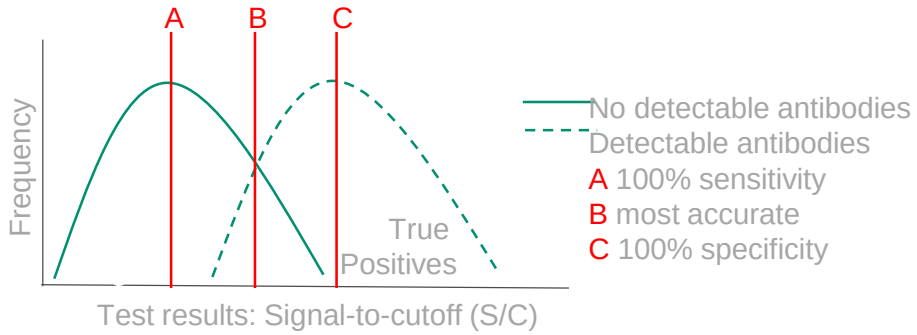

Vaccines

Conclusions

- This review highlights limitations of seroprevalence studies, however it is important to note the world has not experienced a widescale pandemic since 1918.
- Public health authorities had to mobilized resources quickly
- Despite the limitations of study designs and methodology, new research is quickly accumulating, and blood donors can continue to play a vital role in facilitating seroprevalence of natural infections to assess and monitor disease burden and population level immunity through vaccination

Acknowledgments

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Europe

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