Review of Blood Donor Based SARS-CoV-2 Serosurveillance

Sheila O'Brien

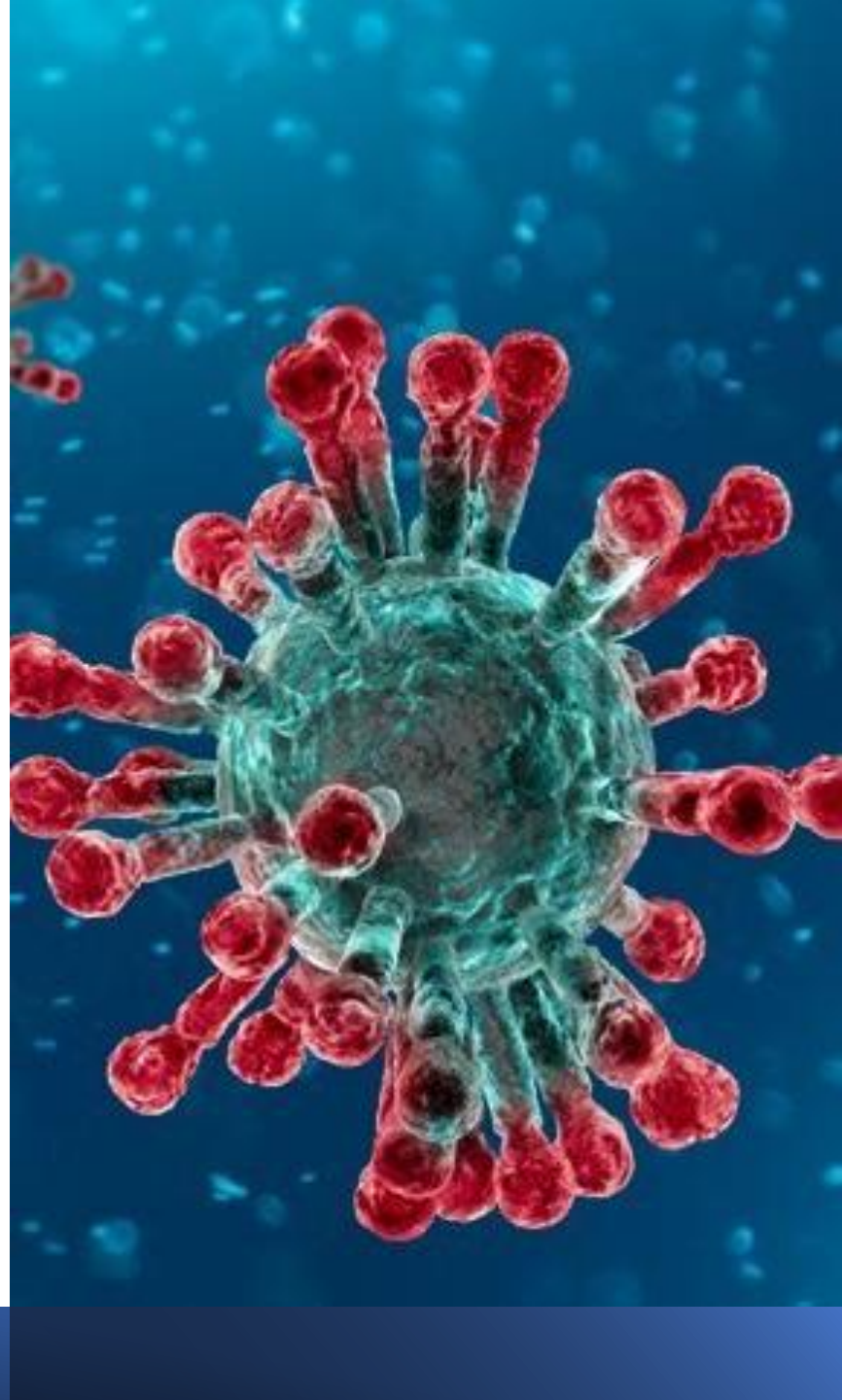
Associate Director, Epidemiology & Surveillance, Canadian Blood Services

Sahar Saeed

Epidemiologist, Epidemiology & Surveillance, Canadian Blood Services

International Plasma Fractionators Association

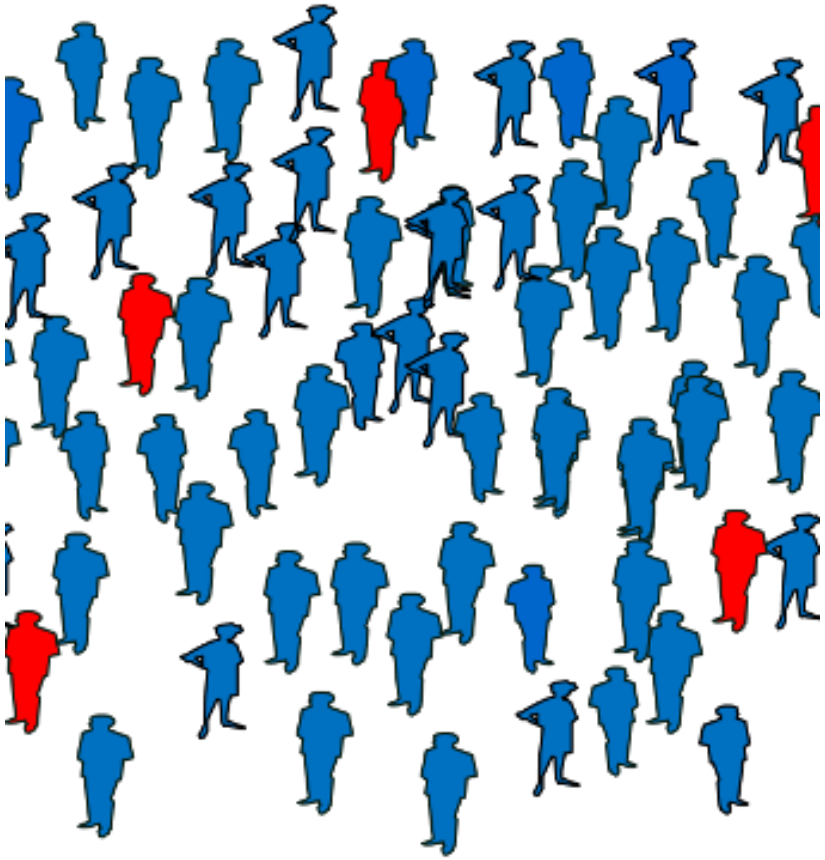
Tuesday May 4th, 2021



Objectives

- To describe international activity in SARS-CoV-2 seroprevalence studies
- To present results from Canadian Blood Services/Canadian Immunity Task Force seroprevalence study
- To discuss issues relating to analysis and interpretation
- To contemplate the future of surveillance to inform public health post-pandemic





Seroprevalence Studies

- As the pandemic continues, seroprevalence studies are playing a pivotal role in helping public health authorities:
    - assess policies
    - determine health capacity
    - monitor and coordinate vaccine coverage
    - monitor variants of concern

How to sample for seroprevalence surveys

- Samples needed to be collected quickly in early pandemic
- Serial cross-sectional sampling desirable
- Potential population sources
  - Random household survey
  - Mail out surveys/blood spot samples
  - Samples left-over from other testing (i.e. from public health laboratories)
  - Blood donations
- The WHO recommends blood donors for seroprevalence studies




Seroprevalence
International
Survey

International Society for Blood Transfusion
Working Party for Transfusion Transmitted Infectious Diseases, Surveillance Risk Assessment and Policy Sub-group

Research initiatives of blood services worldwide in response to the COVID-19 pandemic

Sheila O'Brien, Ryanne Lieshout-Krikke, Antoine Lewin, Christian Erikstrup, Whitney Steele, Samra Uzicanin, Brian Custer. Vox Sanguinis 2021:116;296-304

An international survey of anti-SARS-CoV-2 assays and seroprevalence estimates from blood component providers

Lewin A, Leishout-Krikke R, Erikstrup C, Steele WR, Fady H, Uzicanin S, Drews SJ, Saeed S, Custer B, O'Brien SF. 2021 Vox Sang *in press*

COVID-19: Blood centers rise to the occasion and lead seroprevalence studies

Sahar Saeed, Antoine Lewin, Ryanne Lieshout-Krikke, Sheila O'Brien. Transfusion Today *December, 2020*



The Survey (June, 2020)

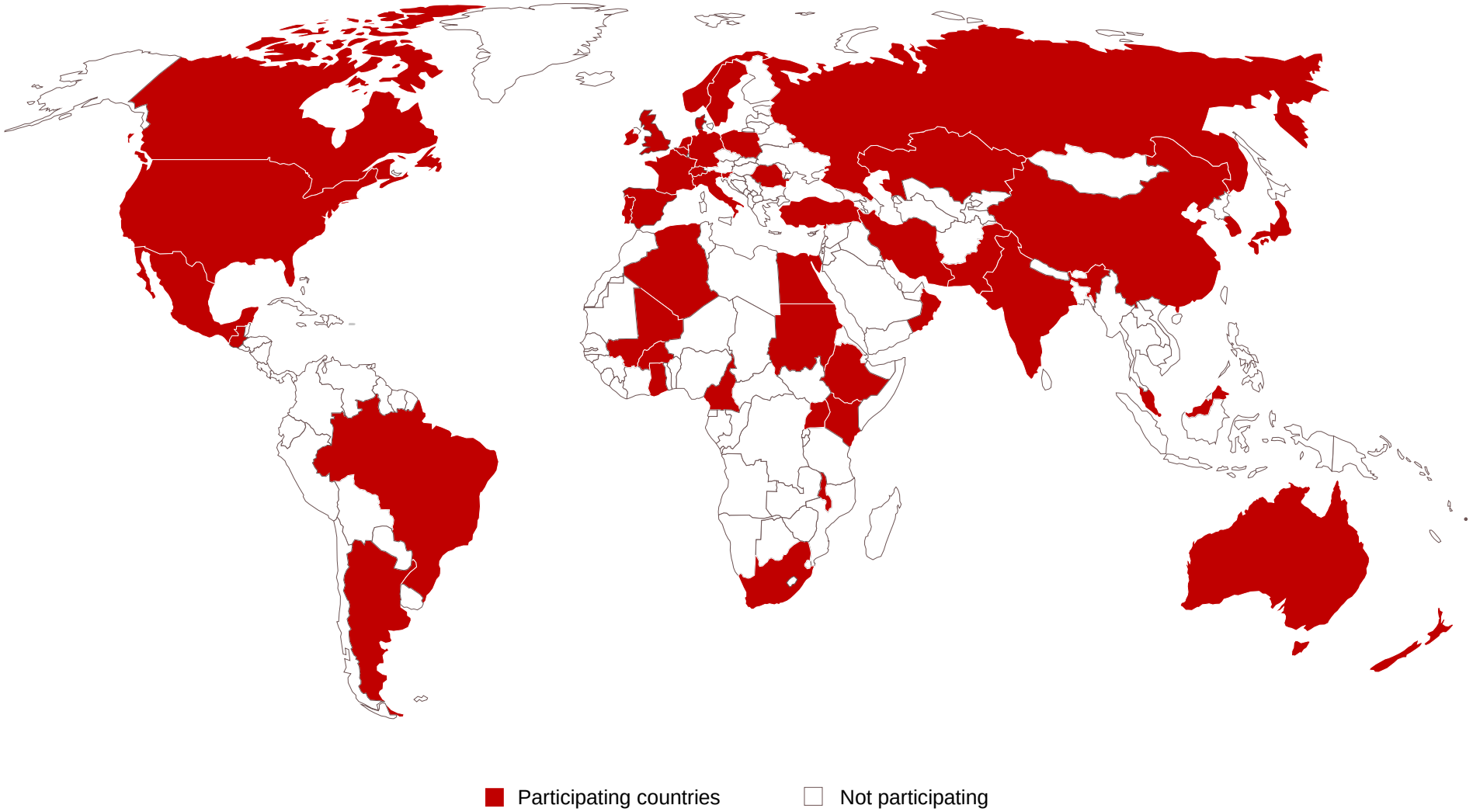
Participants

- Members of the International Society of Blood Transfusion (ISBT), Transfusion Transmitted Infectious Diseases Working Party
- The European Blood Alliance - Emerging Infectious Disease Monitoring Working Group
- Contacts of the investigators

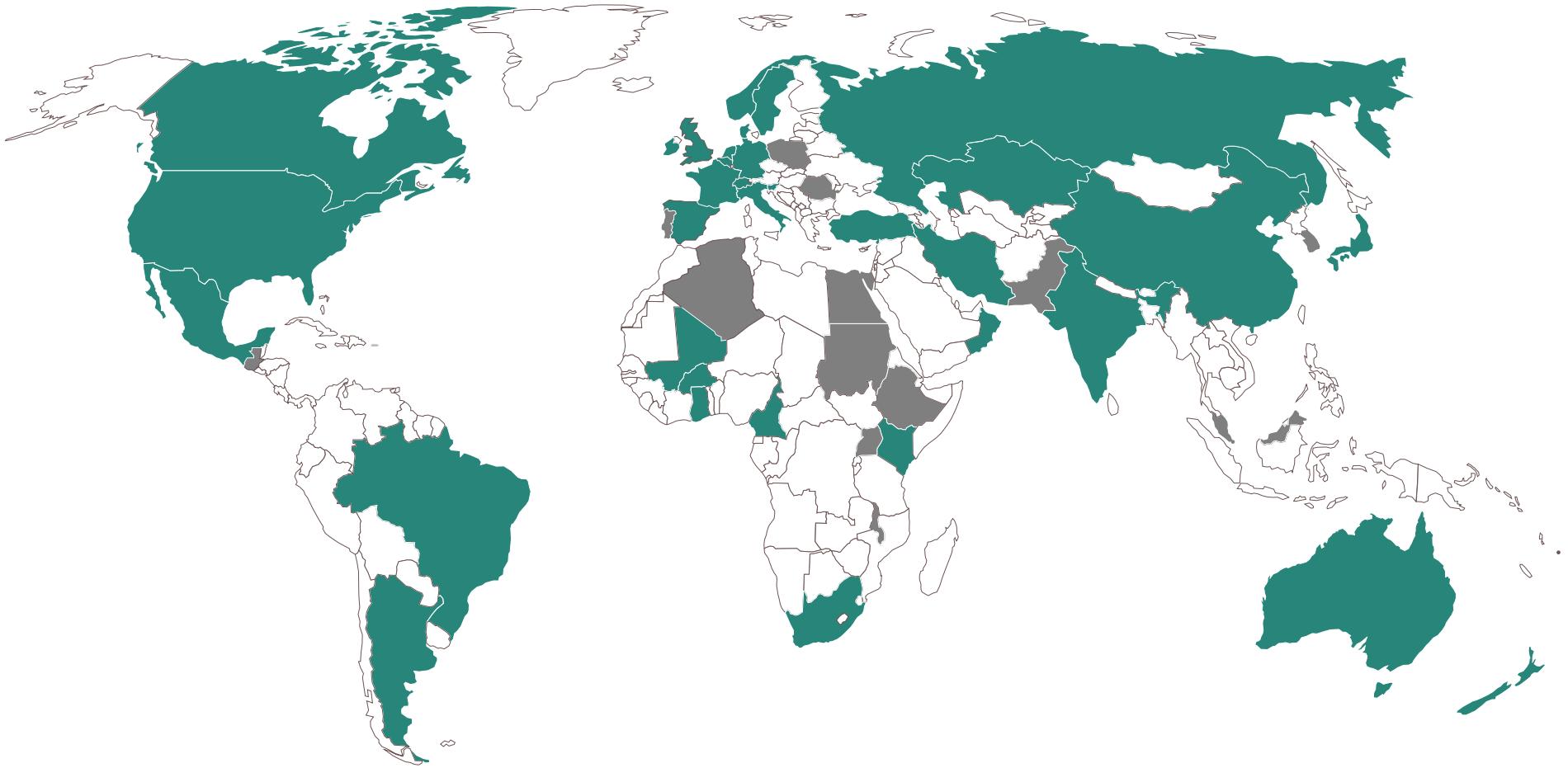
Information requested

- Region reporting for
- Donor seroprevalence studies planned or in progress
- Study design
- Convalescent plasma programs and clinical trials

Countries that participated in the survey



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



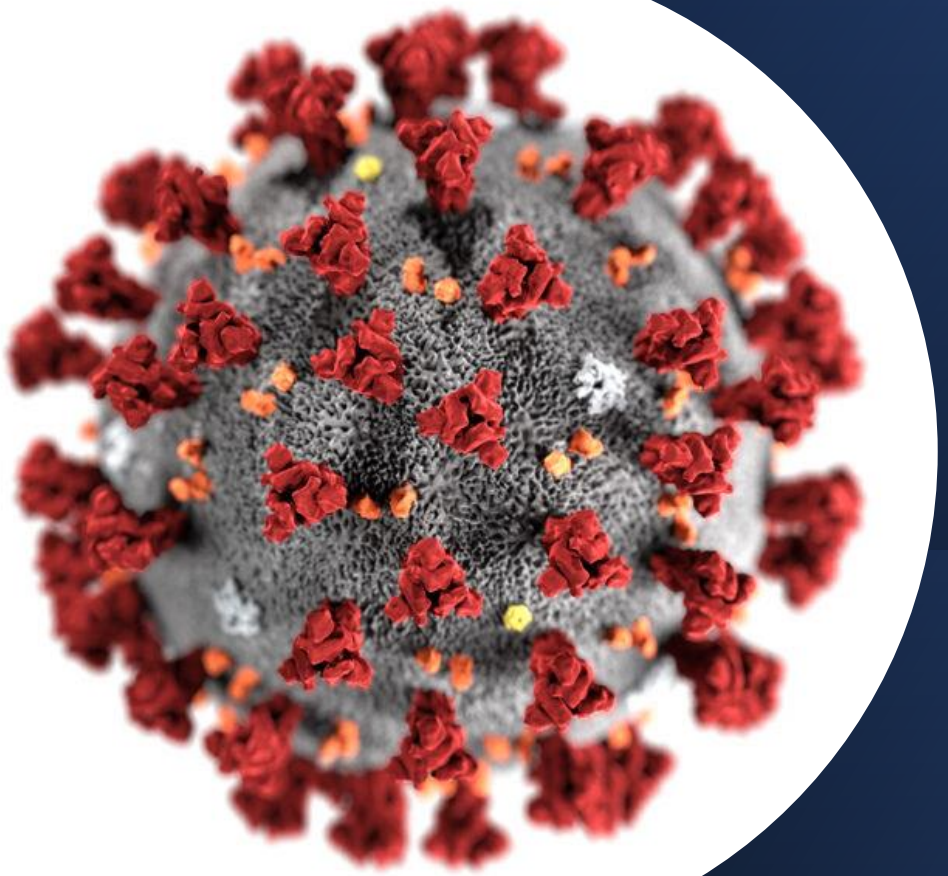
*as of June 2020

Study Design

- 13 (40%) single cross-sectional design
- 17 (53%) serial cross sectional design
- 8 (25%) longitudinal (some had serial cross-sectional as well)

Purpose of Study

- 27 (84%) inform public health
- 22 (69%) inform convalescent plasma programs (many both)



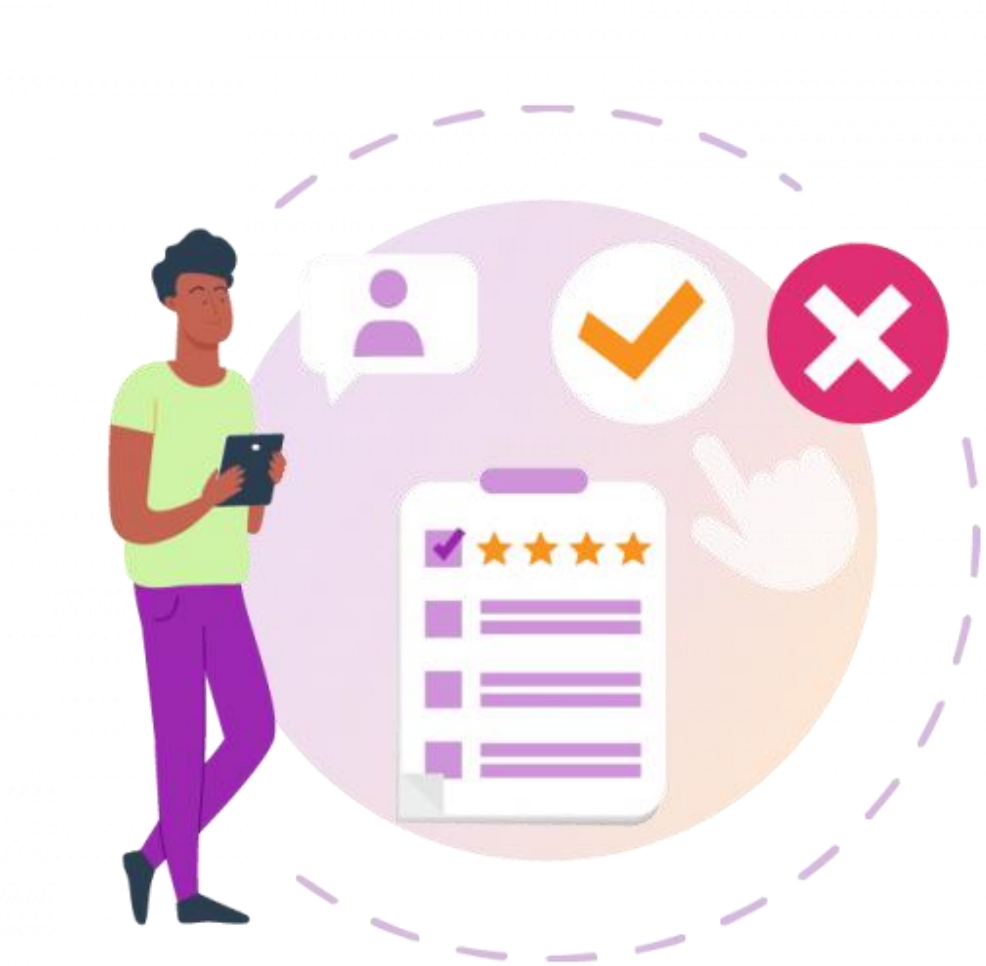
The Follow-up Survey-Assays (August, 2020)

Participants

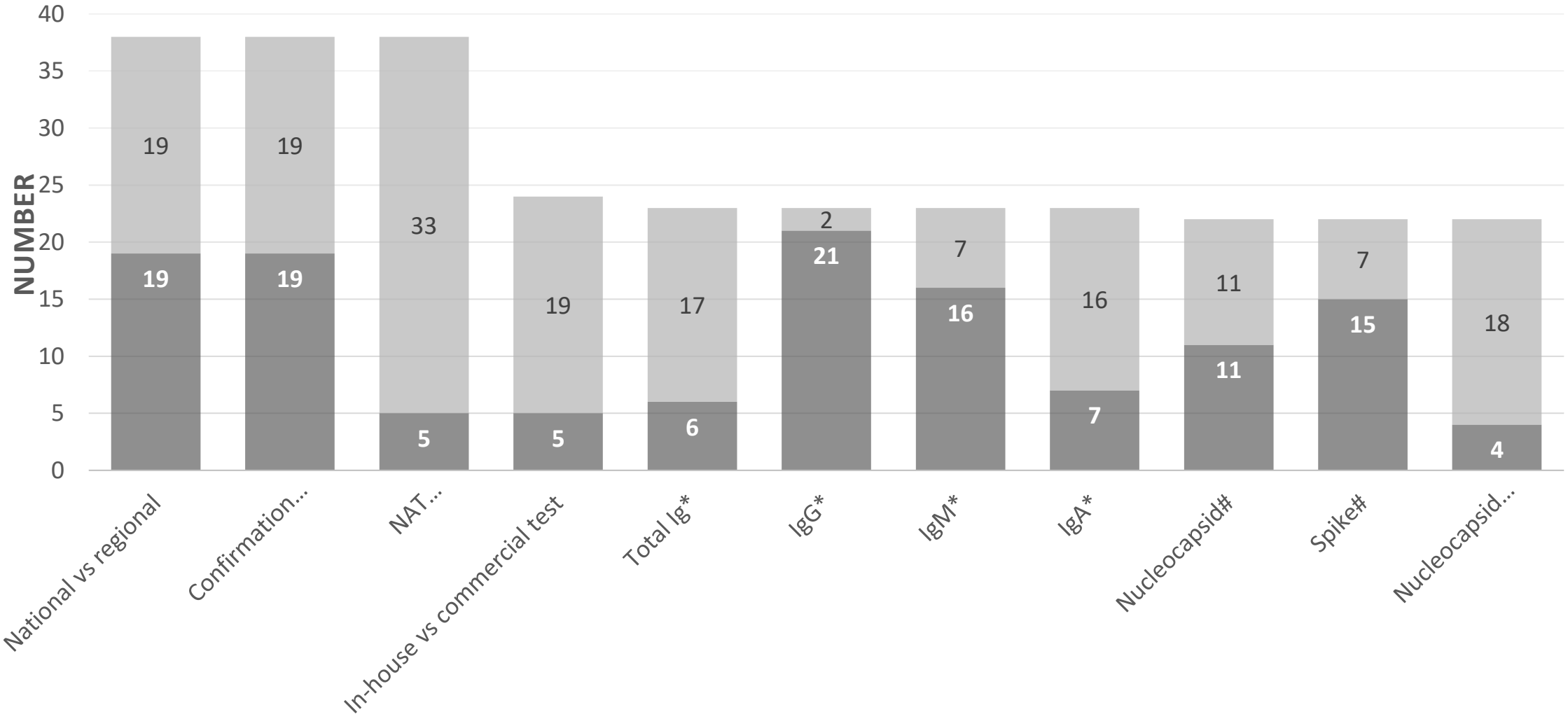
- All countries in the first survey who reported seroprevalence studies

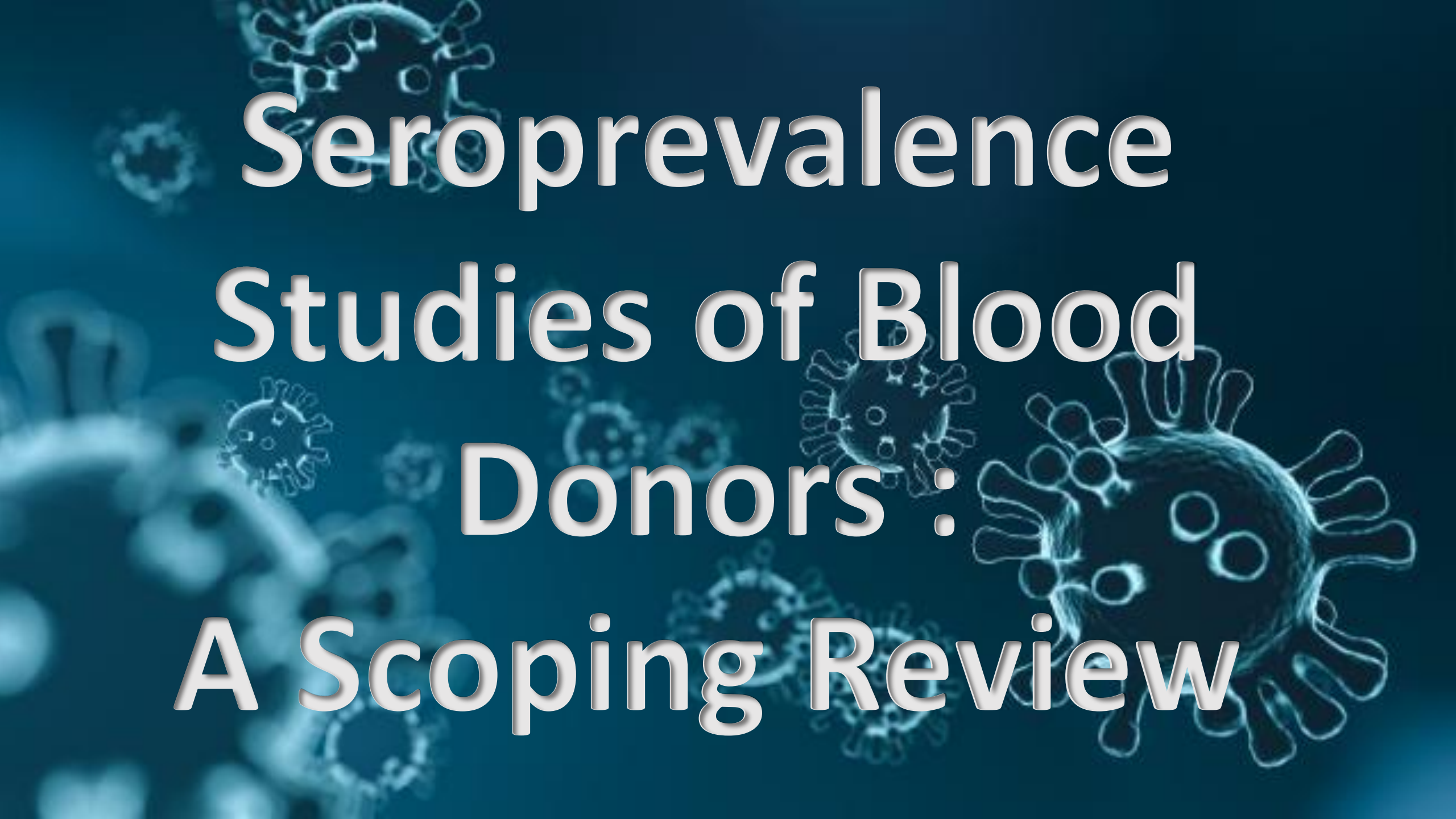
Information requested

- Assay
- Target Protein
- Isotype
- In-house/commercial



Summary of Assay Characteristics




Seroprevalence Studies of Blood Donors : A Scoping Review

AIMS

- As health authorities contend with the unrelenting COVID-19 pandemic, resources continue to be invested in serological studies to track the burden of disease.

- We conducted a scoping review to:
  - Characterize SARS-CoV-2 seroprevalence studies among blood donors
  - Evaluate the methodology used to address limitations associated with these studies

What is a scoping review?

- A **scoping review** is a relatively new **approach** to evidence synthesis and differs from systematic reviews in its purpose and aims.
- The purpose of a **scoping review** is to provide an overview of the available research evidence without producing a summary answer to a discrete research question



Examining the extent, range and nature of research activity



Determining the value of undertaking a full systematic review (e.g. Do any studies exist?)

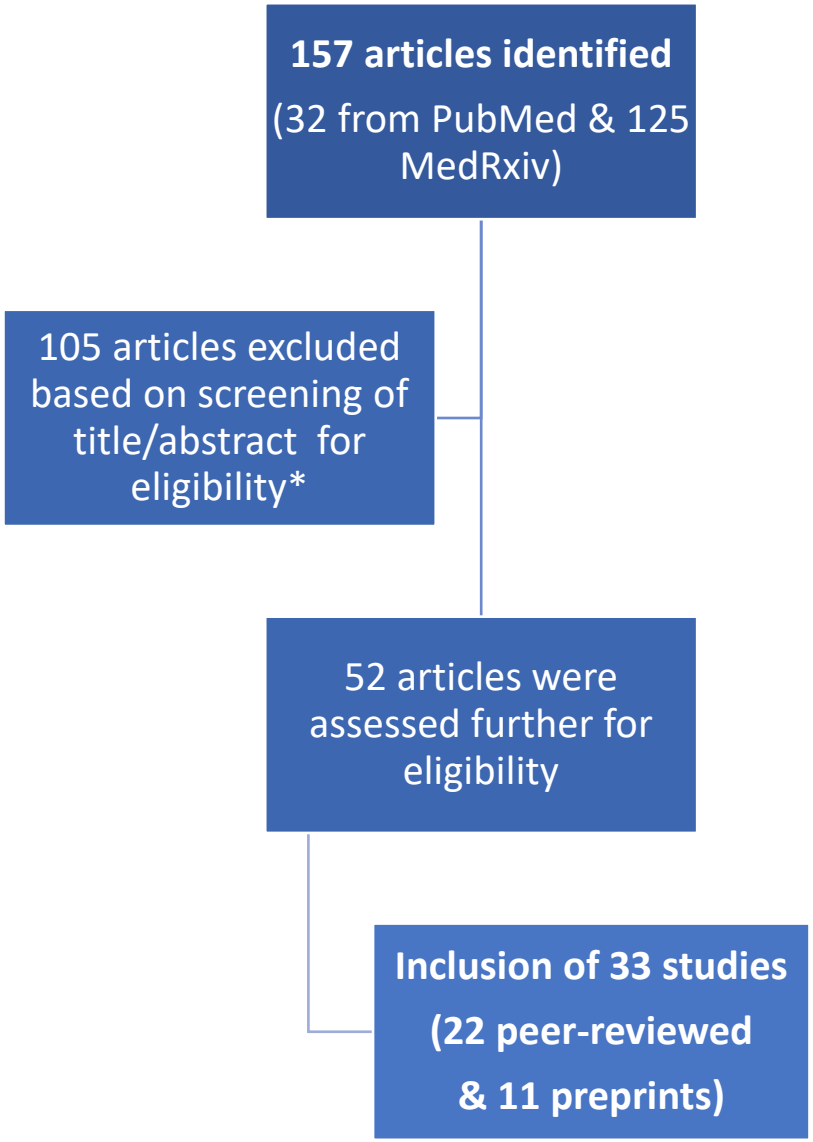


Summarizing and disseminating research findings



Identifying gaps in an existing body of literature

Studies Evaluated



*Eligibility: Only studies that reported the sample size, sampling dates and prevalence estimates (or the number of reactive samples) were included in this review.

Excluded studies that used residual blood:

(1) from convalescent plasma donors
(2) as negative controls
(3) to primarily evaluate assay performance

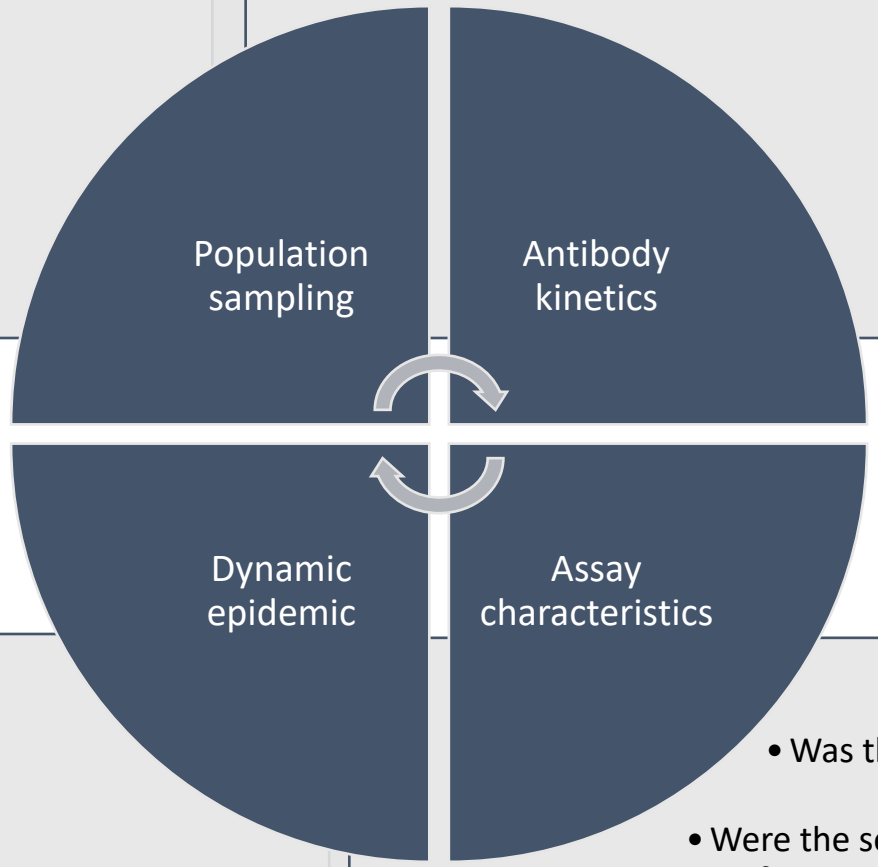
Seroprevalence estimates from the grey literature were not included in this review since methods are not routinely reported.

- Of the published studies the majority (91%; 20/22) were published in clinical or public health journals, two were published in transfusion medicine journals.

Methodological Assessment

- What was the scope of the study, national or regional?
- Were estimates stratified to evaluate variations by age, sex, socioeconomic status or specific regions?
- Was the seroprevalence estimate standardized to population level characteristics?

- When applicable were estimates adjusted for waning antibody titers?



- What was the type of study design (single or serial cross sectional)?
- Were temporal trends evaluated?

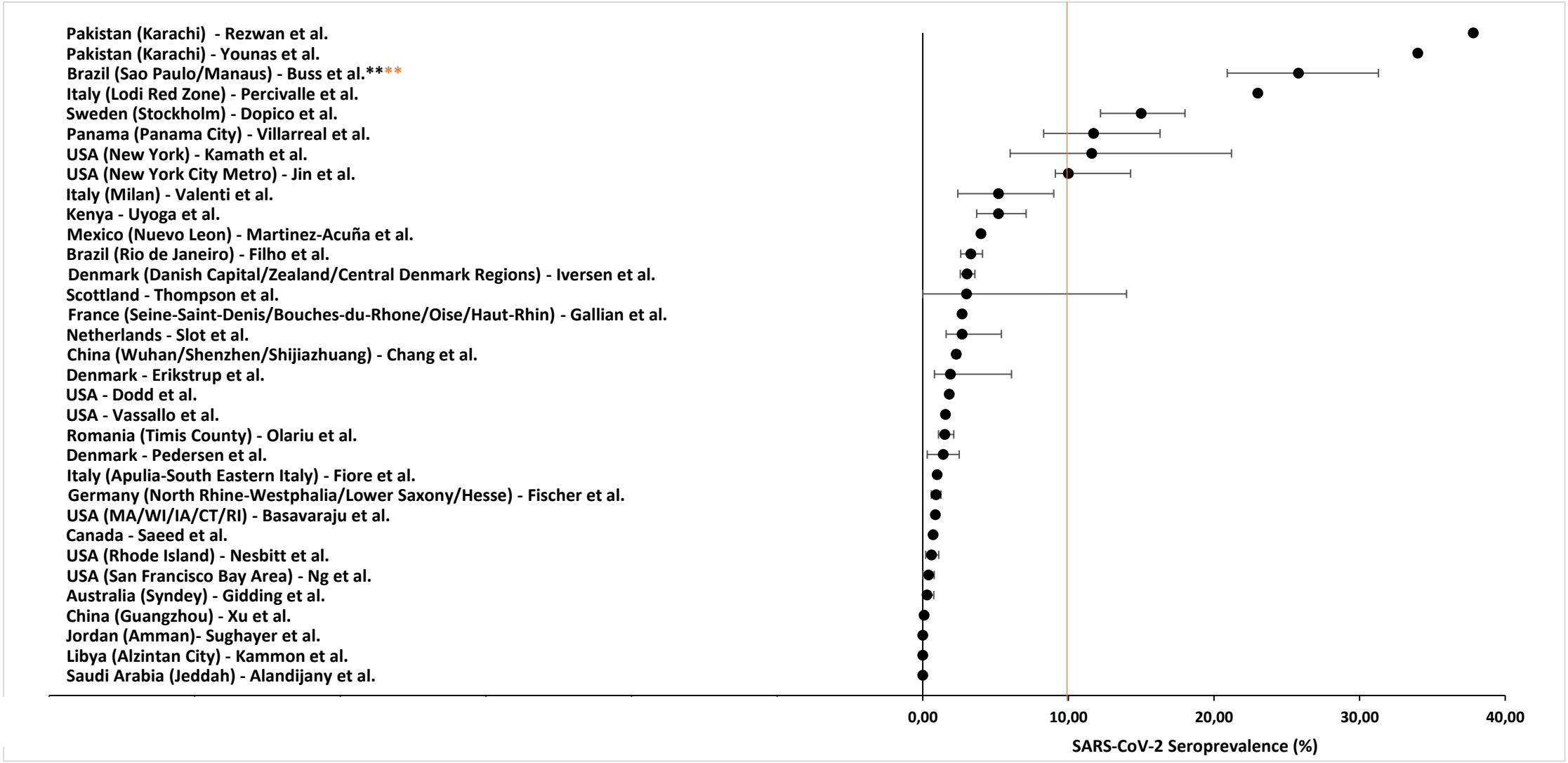
- Was the assay reported? Was the assay commercial or an inhouse assay?
- Were the seroprevalence estimates adjusted for imperfect assay characteristics? How?

Seroprevalence Studies represented 20 countries globally



- The median sample size was 1996 but ranged from as many as 953,926 in the USA to as few as 22 in Libya
- The majority (94%; 31/33) of the studies had initiated sero-surveys within three months of the WHO pandemic declaration on March 11, 2020

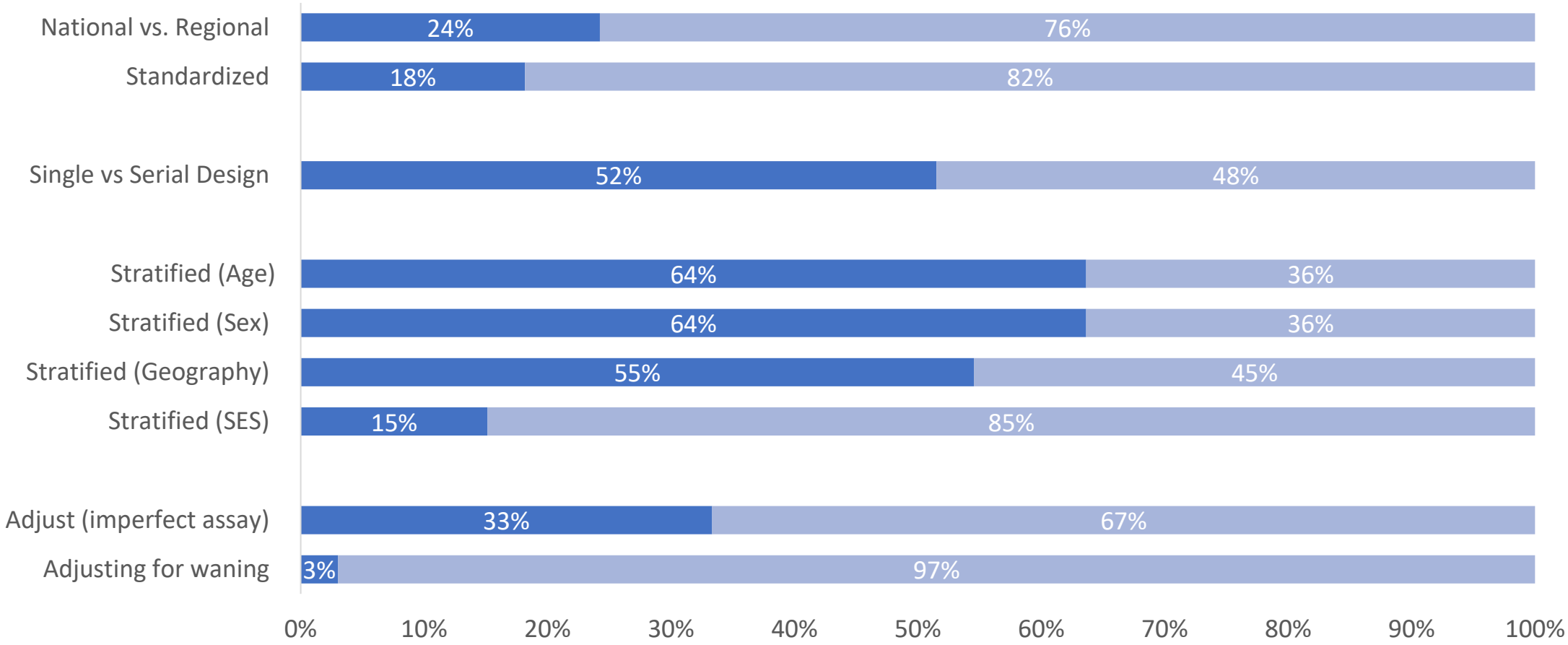
Seroprevalence among blood donors (0-38%)**



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

** Adjusted for waning antibodies as high as 76%

Methodology Assessment

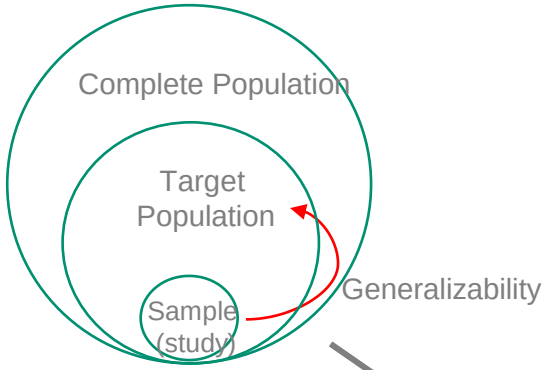


Diverse Assays

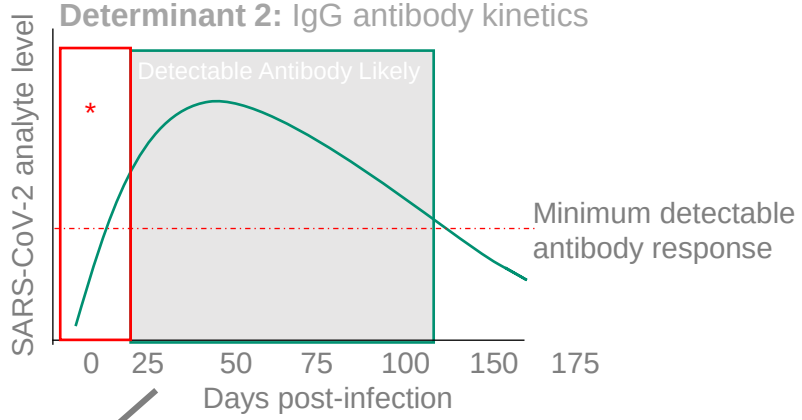
- There were almost as many unique assay combinations (n=27) as studies included in the review.
  - A single assay was used most often 19/33 (56%)
  - Other studies used two or more assays (maximum of 5)
- **Overall, 11/33 (33%) studies adjusted seroprevalence estimates by imperfect test characteristics.**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

Challenges to unbiased seroprevalence estimates

Determinant 1: Population sampling



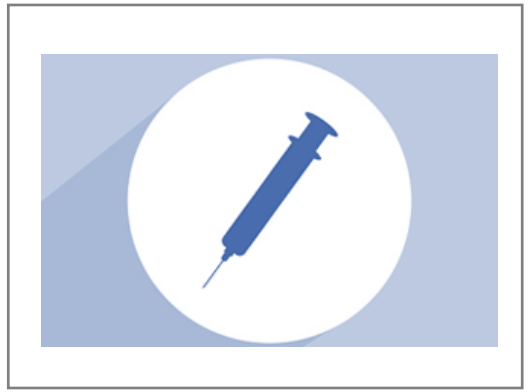
Determinant 2: IgG antibody kinetics



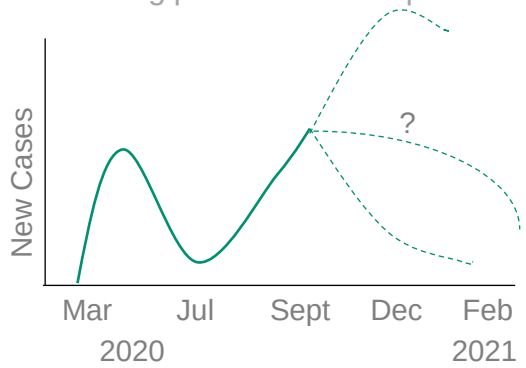
* *Symptoms would be likely be present*

Seroprevalence Estimate

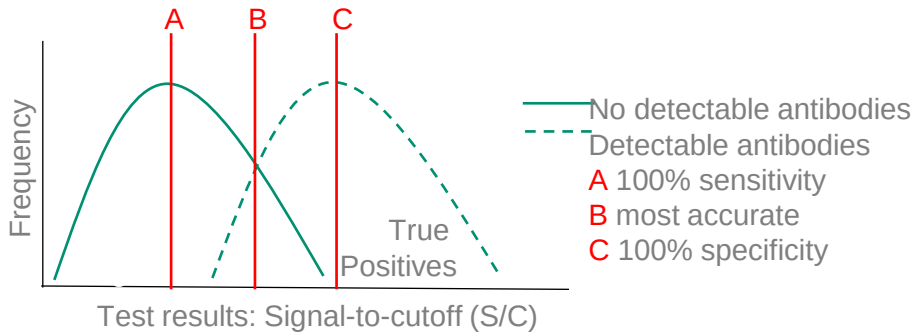
Vaccines



Determinant 3: Unknown dynamic epidemic and shifting public health response



Determinant 4: Imperfect assay



Saeed S, et al., Transfusion Today 2020

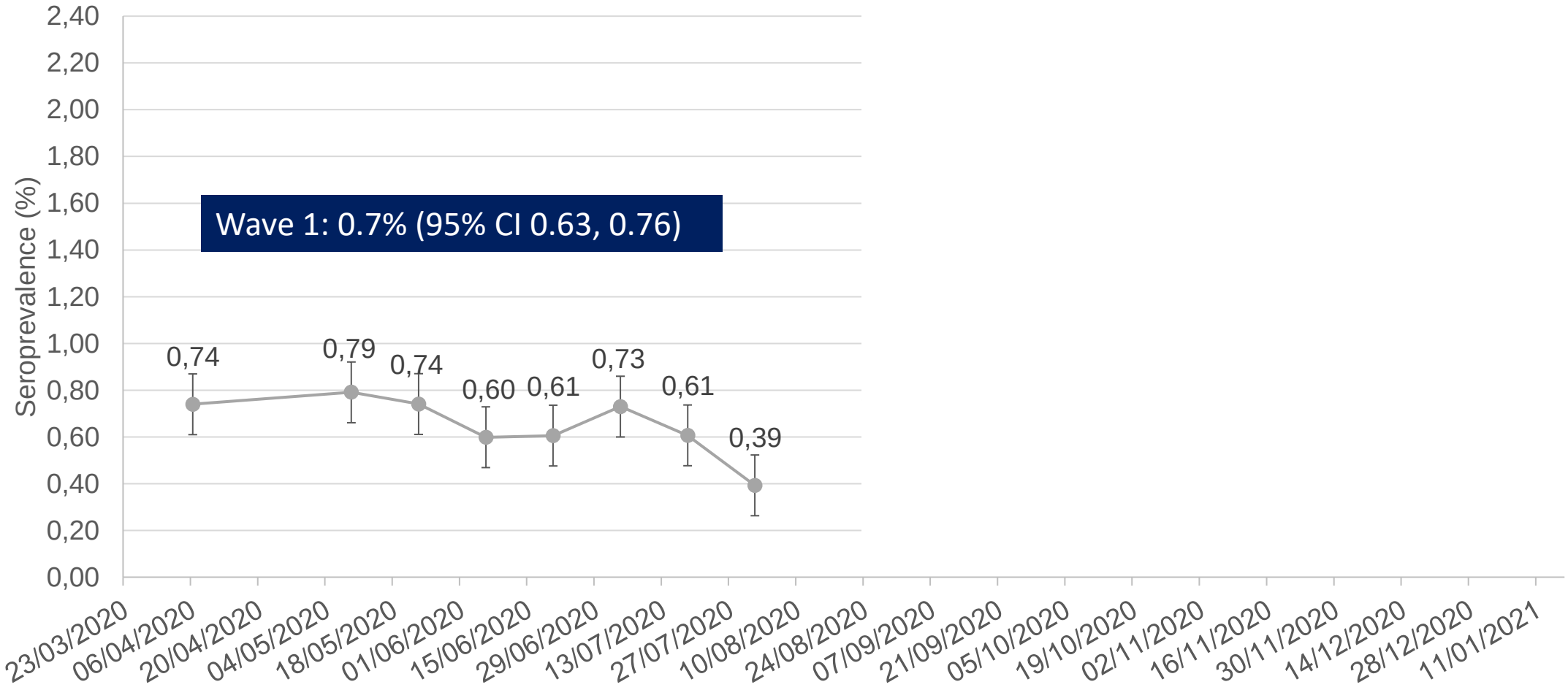

Seroprevalence
Canadian Blood
Services

Canadian Blood Services SARS-CoV-2 Seroprevalence

- 179,473 blood samples were tested between April 2020-January 2021
  - Includes all provinces except Quebec
- Tested with the Abbott Architect SARS-CoV-2 IgG Assay
- Results adjusted for age, sex and geographic location, sensitivity and specificity of the assay

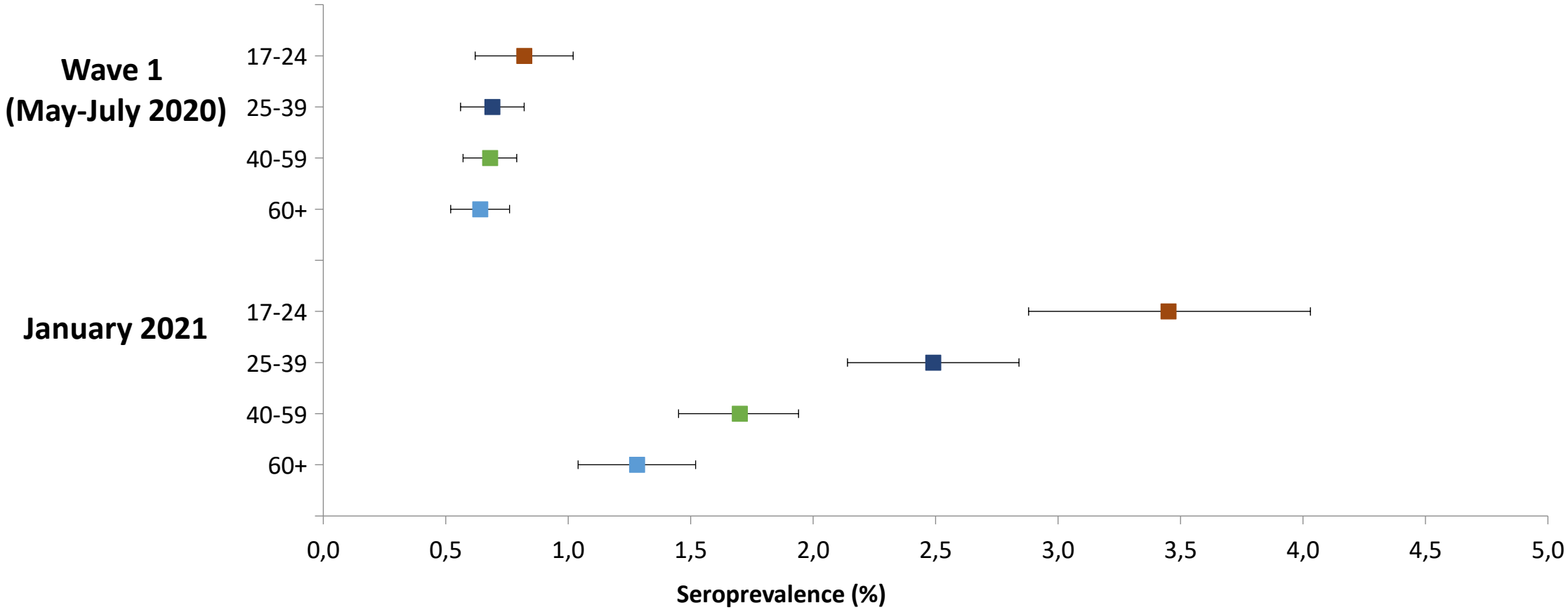
SARS-CoV-2 Seroprevalence across Canada

Adjusted for imperfect test characteristics and weighted to population level demographics



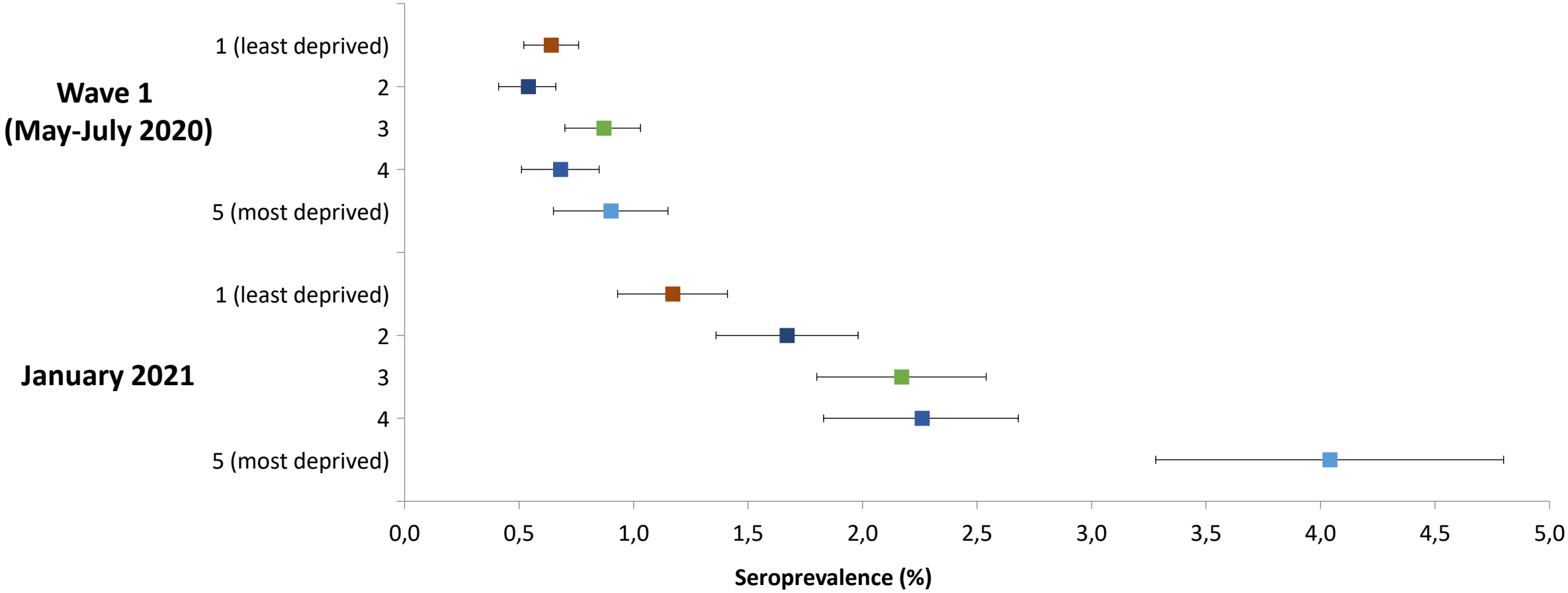
Saeed S, Drews SJ, Pambrun C, Qi-Long L, Osmond L, O'Brien SF. SARS-CoV-2 seroprevalence among blood donors after the first COVID-19 wave in Canada. Transfusion 2021

Seroprevalence Comparison between Wave 1 and January 2021 | Age Groups



- Squares represent adjusted estimates, whiskers are 95% CI.

Seroprevalence Comparison between Wave 1 and January 2021 | Quintiles of Material Deprivation



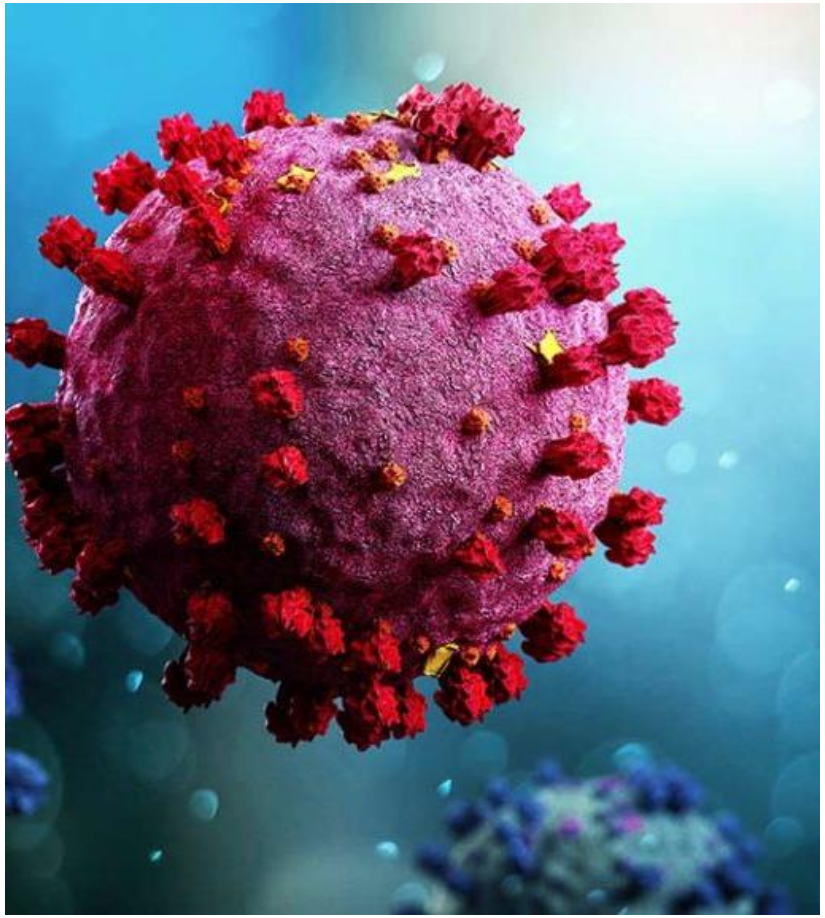
- Squares represent adjusted estimates, whiskers are 95% CI.

Surveillance to Inform Public Health



What can blood services offer public health surveillance?

- Awareness of the value of blood services in public health surveillance exemplified by SARS-CoV-2 seroprevalence studies around the world
- Blood donors are carefully screened and representative of the healthy adult population
- Data collected operationally and in studies could be analysed to make more relevant to public health policy
- The existing infrastructure offers a low cost option for large scale sample collection
- Blood services have a range of expertise that would be applicable to public health research



Summary & Conclusions

- Worldwide blood centers have leveraged the operational capacity to lead SARS-CoV-2 seroprevalence studies to inform public health policy
- In wave 1, most blood donors studies identified low seroprevalence, well below herd immunity
- Heterogeneous methodology and assays makes comparing country-level estimates difficult
- Post-pandemic surveillance using data from blood operators is likely to continue to play an important role in informing public health