McMaster University | HEALTH FORUM

Rapid Evidence Profile

Examining the use of serosurveillance approaches to monitor diseases and conditions and inform policy decisions

6 December 2023

[MHF product code: REP 58]

Appendix 1: Methodological details

We use a standard protocol for preparing rapid evidence profiles to ensure that our approach to identifying research evidence is as systematic and transparent as possible in the time we were given to prepare the profile.

Engaging subject matter experts

At the beginning of each rapid evidence profile and throughout its development, we engage a subject matter expert, who help us to scope the question and ensure relevant context is taken into account in the summary of the evidence.

Identifying research evidence

For this REP, we searched Health Evidence, Health Systems Evidence, and PubMed for:
1) evidence syntheses
2) single studies
3) commentaries that provided thoughtful historical review and/or insight about key priorities for serosurveillance

We searched Health Evidence using the search terms: "Serosurveillance" OR "Seroprevalence" OR "seroepidemiology" OR "antibody surveillance" OR "population immunity". We conducted an open search on Health Systems Evidence using the term “serosurveillance. We did not identify any evidence documents in Health Evidence and Health Systems Evidence. In PubMed, we conducted a search using the following strategy: ("Serosurveillance" OR "Seroprevalence" OR "seroepidemiology" OR "antibody surveillance" OR "population immunity") AND ("public health" OR "public health actions" OR "pandemic preparedness" OR vaccination strategy OR immunization strategy OR biobank*) AND (chronic disease OR vector-borne disease OR infectious disease OR emerging disease OR COVID-19) AND ("action" OR "strategy" OR "decision-making" OR "learn" OR "lesson").

Each source for these documents is assigned to one team member who conducts hand searches (when a source contains a smaller number of documents) or keyword searches to identify potentially relevant documents. A final inclusion assessment is performed both by the person who did the initial screening and the lead author of the rapid evidence profile, with disagreements resolved by consensus or with the input of a third reviewer on the team. The team uses a dedicated virtual channel to discuss and iteratively refine inclusion/exclusion criteria throughout the process, which provides a running list of considerations that all members can consult during the first stages of assessment.

During this process we include published, pre-print and grey literature. We do not exclude documents based on the language of a document. However, we are not able to extract key findings from documents that are written in languages other than Chinese, English, French or Spanish. We provide any documents that do not have content available in these languages in an appendix containing documents excluded at the final stages of reviewing. We excluded documents that did not directly address the research questions and the relevant organizing framework.

Assessing relevance and quality of evidence

We assess the relevance of each included evidence document as being of high, moderate or low relevance to the question.

Two reviewers independently appraised the quality of the guidelines we identified as being highly relevant using AGREE II. We used three domains in the tool (stakeholder involvement, rigour of development and editorial independence) and classified guidelines as high quality if they were scored as 60% or higher across each of these domains.

Two reviewers independently appraise the methodological quality of evidence syntheses that are deemed to be highly relevant. Disagreements are resolved by consensus with a third reviewer if needed. AMSTAR rates overall methodological quality on a scale of 0 to 11, where 11/11 represents an evidence synthesis of the highest quality. High-quality evidence syntheses are those with scores of eight or higher out of a possible 11, medium-quality evidence syntheses are those with scores between four and seven, and low-quality evidence syntheses are those with scores less than four. It is important to note that the AMSTAR tool was developed to assess evidence syntheses focused on clinical interventions, so not all criteria apply to those pertaining to health-system arrangements or to economic and social responses. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, an evidence synthesis that scores 8/8 is generally of comparable quality to another scoring 11/11; both ratings are considered 'high scores.' A high score signals that readers of the evidence synthesis can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the evidence synthesis should be discarded, merely that less confidence can be placed in its findings and that the evidence synthesis needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8.

Identifying experiences from other countries and from Canadian provinces and territories

For each REP, we work with the requestors and a subject matter expert to collectively decide on what countries (and/or states or provinces) to examine based on the question posed. For other countries, we search relevant government and stakeholder websites including World Health Organization, Eurosurveillance, national governmental pages on serosurveillance, and governmental agencies (e.g., Centers for Disease Control in the U.S. and South Korea). In Canada, a similar approach was used, searching the website of federal and provincial government pages on serosurveillance, Canadian Blood Services, Héma-Québec, and the COVID19 Immunity Task Force. While we do not exclude content based on language. Where information is not available in English, Chinese, French or Spanish, we attempt to use site-specific translation functions or Google translate. A full lit of websites and organizations searched is available upon request.

Preparing the profile

Each included document is cited in the reference list at the end of the REP. For all included guidelines, evidence syntheses and single studies (when included), we prepare a small number of bullet points that provide a summary of the key findings, which are used to summarize key messages in the text. Protocols and titles/questions have their titles hyperlinked, given that findings are not yet available. For this profile, we prepared bulleted summaries of key findings for all evidence documents identified.

We then draft a summary that highlights the key findings from all highly relevant documents (alongside their date of last search and methodological quality) as well as key findings from the jurisdictional scan.

Upon completion, the REP is sent to the subject matter expert for their review.

Framework to organize what we looked for

- Category of disease or condition
  - Emerging diseases
  - Infectious diseases
  - Chronic diseases
  - Vector-borne diseases
  - COVID-19
- What is collected
  - Patient-level information
    - Demographic variables (e.g., age, sex, place of residence, ethnic group)
    - Socioeconomic variables (e.g., occupation, educational level, income level)
    - Household conditions
    - Vaccination history (e.g., doses administered)
    - Travel history
    - History of illness or related symptoms
  - Biological specimens collected
    - Residual blood from donation
    - Residual blood from clinical sample
    - Antenatal blood
    - Oral fluid
    - Other
- Who conducts and analyzes the surveillance
  - Internal to a public health agency which oversees a national or sub-national population
  - External to a public health agency (i.e., contracted out)
- How data is collected and linked
  - Surveys
  - Administrative databases
  - Other
- Types of analyses to inform public-health actions
  - Estimating past/accumulated burden of an infectious disease or health condition in a population
  - Identifying groups at increased risk of acquiring the disease (e.g., age, gender, geographic location, etc.)
  - Identifying population trends in past accumulative exposure to an infection over time
  - Monitoring and evaluating the impact of vaccination programs and informing immunization policy
  - Conducting disease modelling (e.g., for the prediction of potential outbreak, projections of illness or hospitalization)
  - Examining trends in immunity over time
  - Monitoring emerging diseases (e.g., in relation to climate change)
- How is serosurveillance shared
  - Not disseminated publicly (i.e., internal-use only)
  - Summary of key indicators provided publicly
  - Summary of all indicators provided publicly
- Adaptations to serosurveillance systems following the COVID-19 pandemic
  - Bio-banking samples
  - Adapting assays for different (or greater specificity for) antigens
  - Creating integrated serosurveillance for multiple conditions
- Equity considerations (derived from PROGRESS-Plus)
- Ethics considerations (e.g., when is individual patient consent required, when REB is sought, and whether requirements differ for anonymous samples vs. linked to administrative/survey data)

Appendix 2: Key findings from evidence syntheses organized by relevance

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Living status	Quality (AMSTAR)	Last year literature searched	Availability of GRADE profile	Equity considerations

• Category of disease or condition
  ○ Vector-borne disease
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ○ Biological specimens collected
  ▪ Residual blood from donation
• Who conducts and analyses the surveillance
  ○ Internal to a public health agency which oversees a nation or sub-national population
• How is data collected and linked
  ○ Administrative databases
• Types of analyses to inform public health decisions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying population trends in past accumulative exposure over time
	Seroprevalence of internally collected blood donations may support typical surveillance to estimate the disease burden and identify population trends of the Zika and dengue viruses, given its limitations are considered(1)
	• The purpose of this systematic review was to estimate the population prevalence of the Zika and dengue virus, using information from seroprevalence through blood donations conducted by internal public health agencies.
	• The authors concluded that the seroprevalence of Zika and dengue virus through blood donations was higher than other surveillance tools. This may be because blood donations are able to capture incidence rates of asymptomatic people. Therefore, seroprevalence of blood donations may be used to support surveillance systems to identify trends in exposure and inform policy decisions.
	• Seroprevalence of blood donations should be interpreted considering its limitations. First, blood donations may not be representative of the entire population. For example, persons with a high school degree or who live in urban areas may be more likely to donate blood than others. Additionally, blood donations do not always show current indication of disease, but rather previous infection.
		High	No	6/10 (AMSTAR rating from McMaster Health Forum)	2017	Not available	• Place of residence
							• Education

• Category of disease or condition
  ○ COVID-19
• How data is collected and linked
  ○ Administrative databases
  ○ Other
• How is serosurveillance shared
	The slower release of peer-reviewed and preprint articles when compared to the release of studies on other publication platforms made academic SARS-CoV2 seroprevalence literature less useful for public health decision-making during the COVID-19 pandemic; Government or institutional reports were found to be more timely, representative, and had better data validity(2)	High	No	7/11 (AMSTAR rating from McMaster Health Forum)	31 December 2021	No	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Living status	Quality (AMSTAR)	Last year literature searched	Availability of GRADE profile	Equity considerations
○ Summary of key indicators provided publicly	• In this global analysis of SARS-CoV2 surveillance publications, studies of special populations such as healthcare workers were found to take longer to publish compared to studies of the general population. More timely reporting of seroprevalence data from publications with low or moderate risk of bias can improve their usefulness for surveillance.						

Appendix 3: Key findings from single studies organized by relevance

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations

• Category of disease or condition
  ○ COVID-19
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ○ Biological specimens collected
  ▪ Residual blood from clinical sample
• Who conducts and analyses the surveillance
  ○ Internal to a public health agency which oversees a national or sub-national population
• How is data collected and linked
  ○ Administrative databases
• Types of analyses to inform public health decisions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying population trends in past accumulative exposure to an infection over time
• Adaptations to serosurveillance systems following the COVID-19 pandemic
  ○ Creating integrated serosurveillance for multiple conditions
	Seroprevalence studies require access to data collection materials and populations for recruitment to adequately answer public health questions related to monitoring disease, estimating prevalence, and identifying population trends(3)
	• The purpose of this study was to understand and explore the challenges of seroprevalence studies of COVID-19 in Africa.
	• Challenges with seroprevalence included difficulty recruiting participants, obtaining sufficient sample sizes, and managing and storing serological and demographic data.
	• Factors that may facilitate challenges with seroprevalence studies include: 1) sufficient planning and preparation, 2) using validated and accessible serological tools (e.g., blood samples), 3) partnering with local clinics.
		High	*Publication date:* 28 April 2023
			
			Jurisdiction studied: Africa
			
			Methods used: Qualitative
				• Place of residence

• Category of disease or condition
  ○ COVID-19
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ▪ History of illness or related symptoms
  ○ Biological specimens collected
  ▪ Residual blood from donation
• Who conducts and analyses the surveillance
  ○ Internal to a public health agency which oversees a national or sub-national population
	Blood donations are important to estimate seroprevalence of COVID-19 cases and identify trends in exposure across regions and demographic subgroups to establish mitigation measures(4)
	• The purpose of this study was to explore trends in seroprevalence data collected from blood donors from internal public health agencies and external organizations.
	• The authors found increases in seroprevalence across numerous jurisdictions in the United States during March to August 2020. The average increase in seroprevalence was 1-2%, with New York State having the highest increase of 15.8%. They were also able to report differences in
		High	*Publication date:* 10 June 2021
			
			Jurisdiction studied: United States
			
			Methods used: Cross-sectional
				• Place of residence
				• Race/ethnicity/culture/language

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples ○ Adapting assays for different (or greater specificity for) antigens	demographics, as seroprevalence was higher in young Hispanic donors. • Blood donations may be biased as donors tend to be primarily white, healthy, and in better financial standing, in comparison to non-donors. One potential method of reducing bias of seroprevalence using blood donors is to adapt assays to have sufficient sensitivity to detect asymptomatic or mild symptoms.			
• Category of disease or condition ○ Emerging diseases ○ Infectious diseases ○ Chronic diseases ○ Vector-borne diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ○ Biological specimens collected ▪ Residual blood from donation • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously	Blood donations can capture the seroprevalence of conditions in which people present as asymptomatic or with subtle symptoms to increase the accuracy of surveillance strategies and predict future outbreaks of various conditions(5) • The purpose of this study was to demonstrate how blood centres can determine how representative their samples are of the general population. • Given that blood donations are from typically healthy persons, the authors suggest that blood centres collect demographic information (e.g., blood pressure, age, location) that can be compared against normative population statistics to help their interpretation of serological data.	High	*Publication date:* 4 October 2022 *Jurisdiction studied:* Canada *Methods used:* Cross-sectional	• Place of residence

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ Identifying population trends in past accumulative exposure to an infection over time				
• Category of disease or condition ○ COVID-19 • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying population trends in past accumulative exposure to an infection over time	During the COVID-19 pandemic, the Democratic Republic of Congo, Senegal, Nigeria, and Uganda all leveraged their previous experiences with epidemics by rapidly training health workers, increasing resources for national laboratories, building COVID-19 indicators into their existing data management systems, and adopting electronic systems to improve the timeliness of reporting; however, inadequate surveillance staffing, low case detection rates, and community stigma and misinformation created challenges at the national and sub-national levels(6)	High	*Publication date:* May 2023 *Jurisdiction studied:* Democratic Republic of Congo, Senegal, Uganda, Nigeria *Methods used:* Mixed-methods observational	• Language – Francophone/Anglophone countries
• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ○ Biological specimens collected ▪ Residual blood from donor • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How data is collected and linked ○ Surveys • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously	Stratified sampling of residual blood donor specimens was used to estimate SARS-CoV-2 antibody prevalence among the population of Melbourne, Australia during the second COVID-19 epidemic wave in 2020; results suggested a lack of extensive community transmission of SARS-CoV-2 and good ascertainment of cases based on routine testing(7) • The study sample included blood donors between June and September 2020 aged 20-69 years in three areas of Melbourne with low, medium and high COVID-19 incidence based on case notification data. All blood donations were processed by the Australian Red Cross Lifeblood through one processing centre in Melbourne and specimens were tested at the Victorian Infectious Disease Reference Laboratory. Demographic information was recorded.	High	*Publication date:* July 2022 *Jurisdiction studied:* Melbourne, Australia *Methods used:* Population surveys	None identified
• Category of disease or condition	Serosurveillance of SARS-CoV-2 in Canada through the use of collecting bio-banking blood samples and adapting assays of	High	*Publication date:* 14 August 2023	Place of residence

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ▪ History of illness or related symptoms ○ Biological specimens collected ▪ Residual blood from clinical sample • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Examining trends in immunity over time • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples • Adapting assays for different (or greater specificity for) antigens	different variants in internal public health agencies and external organizations can help monitor population trends to inform public health decisions(8) • The purpose of this study was to understand the progression of serosurveillance of SARS-CoV-2 in Canada. • Study results up to March 2023 indicated that most people had acquired SARS-CoV-2 antibodies through natural infection or vaccination.		*Jurisdiction studied:* Canada *Methods used:* Time-series approach	
• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ▪ History of illness or related symptoms	Seroprevalence of antibodies in blood samples can support disease modelling to predict trends in COVID-19 outbreaks and outcomes(9) • The purpose of this study was to design a model that can predict trends in COVID-19 outbreaks and outcomes. • The researchers used data from regular surveillance techniques as well as reported seroprevalence measured by antibodies in the blood.	Medium	*Publication date:* 25 April 2023 *Jurisdiction studied:* United States	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ Biological specimens collected ▪ Residual blood from clinical sample • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-nation population ○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Conducting disease modelling			*Methods used:* Disease modelling	
• Category of disease or condition ○ Infectious diseases ○ Chronic diseases • What is collected ○ Patient-level information ▪ Demographic variables ○ Biological specimens collected ▪ Residual or antenatal blood • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease in a population	Nucleic acid tests (NAT) involving dual reactivity for seroreactive donations and NAT yielded for seronegative donations can reliably identify an infection; this information can be used to monitor trends in disease and the quality of blood donations(10) • Researchers of this study collected blood donations in the U.S. from 2011 to 2012 and determined surveillance-positive rates for hepatitis B virus (HBV), hepatitis C virus (HCV), human T-cell lymphotropic virus (HTLV), and human immunodeficiency virus (HIV). • All rates were higher among first-time donations and rates of all viruses, with the exception of HTLV, were higher among males. • Results of this study demonstrated that standardized surveillance data from multiple U.S. donor blood systems can be combined and analyzed for changes to policies affecting donor suitability.	Medium	*Publication date:* 25 August 2016 *Jurisdiction studied:* United States *Methods used:* Cross-sectional	None identified
• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ History of illness or related symptoms	Seroprevalence, estimated using blood samples, is a systematic process that provides reliable estimates of COVID-19 transmission that can inform decision making to prepare for future cases and support vulnerable groups(11) • The purpose of this study was to analyse seroprevalence data acquired from blood samples to identify trends in COVID-19 exposure in Africa.	Medium	*Publication date:* 27 May 2023 *Jurisdiction studied:* Africa	• Place of residence

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ Biological specimens collected ▪ Residual blood from clinical sample • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously	• This study found that seroprevalence was 33% higher than the official PCR test data and revealed a higher prevalence of youth with COVID-19 antibodies.		*Methods used:* Cross-sectional	
• Category of disease or condition ○ Emerging diseases • What is collected ○ Biological specimens collected ▪ Residual blood from clinical sample • Types of analyses to inform public-health actions • Estimating past/accumulated burden of an infectious disease or health condition in a population	There are potential limitations to the use of residual samples for diseases influenced by environmental determinants (e.g., tick-borne disease)(12) • Residual blood was collected through participating diagnostic laboratories within the Belgian sentinel laboratory network. • There was limited added value for the surveillance of Lyme borreliosis given that the low prevalence made it difficult to detect regional differences. • A population-based sampling could allow for a better representative sample or seroprevalence studies in risk groups or risk areas.	Medium	*Publication date:* 17 May 2019 *Jurisdiction studied:* Belgium *Methods used:* Cross-sectional	None identified
• Category of disease or condition ○ Infectious diseases • What is collected ○ Biological specimens collected ▪ Residual blood from donor • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population	Authors suggested that small-scale serosurveillance could improve the efficacy of vaccination policies from low- to high-incidence settings(13) • In this study, an age-stratified serum bank collected over the year before a measles outbreak in northern Vietnam in 2014 was used to assess the population-level seroprevalence of protection against measles. • Results revealed a significant discrepancy between levels of protection from serology and vaccine coverage estimates of UNICEF's Multiple Indicator Clustered Surveys.	Medium	*Publication date:* 24 January 2019 *Jurisdiction studied:* Vietnam *Methods used:* Cross-sectional	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations

• Category of disease or condition
  ○ COVID-19
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ▪ Vaccination history
  ▪ History of illness or related symptoms
  ○ Biological specimens collected
  ▪ Residual blood from clinical sample
• How is data collected and linked
  ○ Administrative databases
• Types of analyses to inform public health decisions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
• Adaptations to serosurveillance systems following the COVID-19 pandemic
  ○ Bio-banking samples
  ○ Adapting assays for different (or greater specificity for) antigens
	Point of care assessment of serology samples are effective at detecting anti-SARS-CoV-2 antibodies and can be used to help inform pandemic preparation decisions(14)
	• This study used serosurveillance to assess the effectiveness of rapid anti-SARS-CoV-2 antibody testing, in comparison to standard laboratory tests.
	• A phlebotomy was performed to collect participants' serology samples. Samples either went through a point of care lateral flow immunoassay or a point of care test assessment.
	• The results of this study showed high sensitivity, specificity, and predicative value for the point of care test assessment, suggesting that it can be used as a tool for serosurveillance to estimate the prevalence of COVID-19 infections. This information can assist policy makers when making preparation decisions.
		Medium	*Publication date:* 28 September 2023
			
			Jurisdiction studied: Ireland
			
			Methods used: Cross-sectional study
				None identified

• Category of disease or condition
  ○ COVID-19
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ○ Biological specimens collected
  ▪ Residual blood from clinical sample
• Who conducts and analyzes the surveillance
  ○ External to a public health agency
• How data is collected and linked
  ○ Administrative databases
  ○ Other
• Types of analyses to inform public-health actions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
	Based on range distributions for known bat SARSr-CoV hosts and data on human-bat contact, human viral seroprevalence and antibody duration, it was estimated that a median of 66,280 in Southeast Asia are infected with SARSr-CoVs annually; spillover data such as this can be used to guide surveillance to identify new CoV infection earlier and prevent spread(15)	Medium	*Publication date:* 9 August 2022
			
			Jurisdiction studied: China, South and Southeast Asia
			
			Methods used: Quantitative evaluation and risk assessment
				None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
○ Identifying groups at increased risk of acquiring the disease previously ○ Identifying population trends in past accumulative exposure to an infection over time ○ Conducting disease modelling				
• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Socioeconomic variables ○ Biological specimens collected ▪ Residual blood from clinical sample • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How data is collected and linked ○ Surveys • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously • How is serosurveillance shared ○ Summary of all indicators provided publicly	Results of a national COVID-19 surveillance survey in Denmark in October 2020 showed that seropositivity increased with age and that there was no clear difference in compliance between seropositive and seronegative participants; however, the seroprevalence results were somewhat hampered by the performance of the point-of-care rapid tests (POCT) used that was lower than expected(16) • This study was performed under the authority of the national infectious disease control institute, Statens Serum Institut (SSI). • The rapid test used (POCT) detected antibodies in whole blood, and case samples were obtained from individuals within two months of disease onset.	Medium	*Publication date:* December 2021 *Jurisdiction studied:* Denmark *Methods used:* Epidemiological survey	None identified
• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ○ Biological specimens collected ▪ Residual blood from clinical sample • How data is collected and linked ○ Surveys	The most commonly implemented investigation within this study was the population seroprevalence protocols, which were adopted by a total of 73% of participating countries(17) • This study featured a total of ten protocols, coined as the 'UNITY' protocols – of which, population seroprevalence was found to be the most frequently implemented. These population seroprevalence protocols were population-based, age-stratified when examining for COVID-19 infection. • The implementation of these protocols were supported by the World Health Organization, and through their support,	Low	*Publication date:* October 2021 *Jurisdiction studied:* 71 countries *Methods used:* Cross-sectional and longitudinal cohort designs	• Place of residence • Gender/sex

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations

• Types of analyses to inform public-health actions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying groups at increased risk of acquiring the disease previously
  ○ Identifying population trends in past accumulative exposure to an infection over time
• Adaptations to serosurveillance systems following the COVID-19 pandemic
  ○ Bio-banking samples
  ○ Adapting assays for different (or greater specificity for) antigens
  ○ Creating integrated serosurveillance for multiple conditions
	population seroprevalence was adopted by 50 low- and middle-income countries and 21 high-income countries.
	• It was found that seroprevalence investigations were particularly critical in rapid policy decision making for many of the participating countries.			

• Category of disease or condition
  ○ COVID-19
• What is collected
  ○ Biological specimens collected
  ▪ Other
• Who conducts and analyzes the surveillance
  ○ Internal to a public health agency which oversees a national or sub-national population
  ○ External to a public health agency
• How data is collected and linked
  ○ Surveys
• Types of analyses to inform public-health actions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying groups at increased risk of acquiring the disease previously
  ○ Identifying population trends in past accumulative exposure to an infection over time
  ○ Examining trends in immunity over time
	A novel seroprevalence test examining dried blood spots has been found to have a high degree of sensitivity and specificity, thus serving as a potential source for enhanced public health monitoring and surveillance(18)
	• The primary objective of this research study was to examine the sensitivity and specificity of a seroprevalence test that detects antibodies to COVID-19 proteins using dried blood spots.
	• This study tested 56,000+ dried blood samples from 2020 in New York, USA, and found that the specificity ranged between 90-96% for symptomatic and 77-91% for asymptomatic individuals.
	• The authors concluded from the findings of this study that this test is effective for large-scale, populated-based serosurveys.
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		Low	*Publication date:* 28 July 2021
			
			Jurisdiction studied: New York, USA
			
			Methods used: Validation Study
				None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Study characteristics	Equity considerations
• Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Adapting assays for different (or greater specificity for) antigens				

• Category of disease or condition
  ○ COVID-19
• How data is collected and linked
  ○ Surveys
• Types of analyses to inform public-health actions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying groups at increased risk of acquiring the disease previously
  ○ Identifying population trends in past accumulative exposure to an infection over time
  ○ Examining trends in immunity over time
• Adaptations to serosurveillance systems following the COVID-19 pandemic
  ○ Adapting assays for different (or greater specificity for) antigens
	The current understanding of serological test accuracy is limited, and positive results present little practical value as the probability of infection by COVID-19 remains low(19)
	• The primary objective of this study was to further examine serological testing accuracy in order to better understand how test results can help guide individual actions and policy decisions.
	• Given the likelihood of COVID-19 infection remaining low after a positive result, this can only be confirmed if the serological test is followed by a viral RNA test.
		Low	*Publication date:* 2020
			
			Jurisdiction studied: Italy
			
			Methods used: Qualitative Study
				None identified

Appendix 4: Key findings from commentaries organized by relevance

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Equity considerations

• Category of disease or condition
  ○ Emerging diseases
  ○ Infectious diseases
  ○ Chronic diseases
  ○ Vector-borne diseases
  ○ COVID-19
• Who conducts and analyzes the surveillance
  ○ Internal to a public health agency which oversees a national or sub-national population
• Types of analyses to inform public-health actions
  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
  ○ Identifying groups at increased risk of acquiring the disease previously
  ○ Identifying population trends in past accumulative exposure to an infection over time
  ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy
  ○ Conducting disease modelling
  ○ Examining trends in immunity over time
  ○ Monitoring emerging diseases in relation to climate change
• Adaptations to serosurveillance systems following the COVID-19 pandemic
  ○ Bio-banking samples
  ○ Creating integrated serosurveillance for multiple conditions
	The Public Health Collaborator on Serosurveillance for Pandemic Preparedness and Response recommended three next steps including: use serological studies to guide vaccination strategies (including tailored approaches for priority populations) and shift toward multi-pathogen monitoring, build a repository of serosurveillance studies, and strengthen national and regional biobanks for baseline immunity and development of tests for novel pathogens and biomarkers(20)
	• The Robert Koch Institute in Germany convened an online symposium with research organisations, national public health agencies, institutes, and regional public health agencies from low- and middle-income countries to draw on lessons learned, conclusions, and next steps for the use of serosurveillance.
	• Serosurveillance was useful during the early phase of COVID-19 to track national and regional outbreak dynamics; however, serosurveillance in the later phases of the pandemic need to be tailored to focus on priority populations (e.g., those who are immunocompromised and older adults) and guide vaccination strategies.
	• Serological research should also focus on antibody measurements, correlates of protection (e.g., seroconversion and waning of antibodies), and multi-pathogen serosurveillance to test different pathogens or biomarkers.
	• Strengthening biobank infrastructures could support retaining samples for baseline measurements or as negative controls for a novel pathogen and biomarker testing for chronic disease.
		High	None identified

• Category of disease or condition
  ○ Emerging diseases
  ○ Chronic diseases
• What is collected
  ○ Patient-level information
  ▪ History of illness or related symptoms
  ○ Biological specimens collected
	The investigators of the Danish Blood Donor Study biobank indicated that they leveraged existing infrastructure for data collection and handling and storage of plasma samples and developed a baseline questionnaire and related consent forms to blood donors for future research on risk factors and biomarkers(21)
	• The Danish Blood Donor Study biobank uses existing infrastructure for data collection and handling and storage of plasma samples, in addition to collecting baseline questionnaire data on all donors for future research on biomarkers.
		High	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Equity considerations
▪ Residual blood from donor • How data is collected and linked o Surveys o Administrative databases • Types of analyses to inform public-health actions o Identifying groups at increased risk of acquiring the disease previously • Adaptations to serosurveillance systems following the COVID-19 pandemic o Bio-banking samples	• Blood donors are informed during their blood donation if they want to participate in the studies (e.g., completion of consent form, four-page health questionnaire, contact information for further follow-up, look-back blood samples). • Less than 5% of the invited blood donors declined to participate, with 40,000 donors part of the prospective cohort.		
• Category of disease or condition o Emerging diseases o Infectious diseases o Chronic diseases o Vector-borne diseases o COVID-19 • What is collected o Patient-level information ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group) ▪ Vaccination history (e.g., doses administered) ▪ Travel history o Biological specimens collected ▪ Residual or antenatal blood • Who conducts and analyzes the surveillance o Internal to a public health agency which oversees a national or sub-national population o External to a public health agency (i.e., contracted out) • Types of analyses to inform public-health actions o Estimating past/accumulated burden of an infectious disease in a population o Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.) o Identifying population trends in past accumulative exposure to an infection over time	Some investigators from the Canadian Blood Services, research institutions, and the Public Health Agency of Canada concluded that the near-national reach of blood services' daily collections (including demographic variables, recent vaccinations, recent travel history, medications) and laboratory capacity can be leveraged to survey pathogens; however, future work is needed to collect data from underrepresented populations and enhance methods to collect and link health and lifestyle data(22) • Hemoglobin levels are measured before each donation in addition to a questionnaire including demographic variables (e.g., age, sex, postal code, and ethnicity), current medications, recent vaccinations and recent travel history. • Infections routinely tested in Canada include HIV, Hepatitis B, Hepatitis C, West Nile virus, Human T-lymphotropic virus, Chagas disease, *Treponema pallidum* in addition to the ability to undertake lookback processes, traceback processes, and a biobank for COVID-19 • Canadian Blood Services and Héma-Québec worked with the Government of Canada COVID-19 Immunity Task Force to conduct serosurveillance, in addition to collaborating with universities, industry research groups, public health organizations and provincial/national public health laboratories. • The data collected during COVID-19 informed public health policy and guided laboratory practices in provincial and clinical laboratories, in addition to current vaccine rollout and antibody concentrations. • Collection and linkages of health and lifestyle data through questionnaires are being explored	High	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Equity considerations
○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy • How data is collected and linked ○ Surveys • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples			
• Category of disease or condition ○ Emerging diseases ○ Infectious diseases ○ Chronic diseases ○ Vector-borne diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ○ Biological specimens collected ▪ Residual blood from clinical sample ▪ Other • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a nation or sub-national population • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease ○ Identifying population trends in past accumulative exposure over time • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples ○ Adapting assays for different antigens ○ Creating integrated serosurveillance for multiple conditions	Establishing a serosurveillance platform requires consideration of biomarkers, data collection strategies, ethical considerations, and dissemination techniques; this platform should be continuously monitored and evaluated to determine its utility in monitoring infection and informing public health decisions(23) • The purpose of this paper was to propose a plan for implementing a serosurveillance platform using biomarkers to inform policy decisions for infection control and prevention. • There are several steps to developing aserosurveillance platform. The first step is to identify the desired biomarkers and keep a repository for future reference. Next, it is important to establish immunological assays and set up a protocol for data collection. The type of data to be collected (e.g., blood sample or saliva-based test), as well as how and where it will be collected should be pre-established. Demographic data is also needed to contextualize the results. Next, it is important to understand the logistics including how data will be transported (e.g., drones or commercial cars), as well as the ethical considerations of data storage and ownership. Finally, it is important to establish an analytical framework to 1) integrate serological and surveyed data and 2) disseminate findings. Knowledge mobilization plans can be facilitated through partnerships with community members. • As the serosurveillance platform is developed, continuous monitoring and evaluation is needed to ensure reliability, efficacy, cost efficiency, and feasibility. Evaluation can be completed through pilot studies or analysis of disease pattern identification.	High	None identified

Dimension of organizing framework	Declarative title and key findings	Relevance rating	Equity considerations

• Category of disease or condition
  ○ Emerging diseases
  ○ Infectious diseases
  ○ COVID-19
• What is collected
  ○ Patient-level information
  ▪ Demographic variables
  ○ Biological specimens collected
  ▪ Residual blood from clinical sample
  ▪ Other
• Who conducts and analyses the surveillance
  ○ Internal to a public health agency which oversees a nation or sub-national population
• How is data collected and linked
  ○ Administrative databases
• Types of analyses to inform public health decisions
  ○ Identifying population trends in past accumulative exposure over time
  ○ Conducting disease modelling
	Creating instruments with high sensitivity and specificity to extract serological data from wildlife reservoirs and domestic farms can be used to support traditional surveillance methods and promote pandemic preparedness(24)
	• The purpose of this commentary was to provide an overview of strategies for pandemic prevention from viruses with animal ancestral originals.
		Medium	None identified

Appendix 5: Detailed jurisdictional scan of other countries about the use of serosurveillance to monitor diseases and conditions and inform policy decisions

Jurisdiction	Key findings	Dimension of the organizing framework

Australia	• The National Centre for Immunisation Research and Surveillance (NCIRS) provides technical expertise to inform policy and planning for vaccine preventable diseases, including surveillance, monitoring of vaccination coverage, vaccination program evaluations, and vaccine safety monitoring
	  ○ Core funding is provided by the Federal government and New South Wales government
	• The NCIRS co-leads the Australian COVID-19 Serosurveillance Network to measure prevalence of SARS-CoV-2-specific antibodies and conduct serosurveys among Australian blood donor population
	• The NCIRS also leads the national Japanese encephalitis virus serosurveillance program, where they work with state and territory governments, the Australian Red Cross Lifeblood, and public laboratories to conduct seroprevalence studies (e.g., using consent-based surveys using blood collections and residual sera)
	• Every five years, the NCIRS and the Centre for Infectious Diseases and Microbiology Laboratory Services (CIDMLS) conduct national serosurveys from diagnostic laboratories that receive residual samples from hospitalized people to examine trends of immunity over time, impact of vaccination programs, identify groups at risk, inform policies and disease modelling, estimate the burden of specific vaccine-preventable diseases, predict potential outbreaks, and identify new or emerging pathogens
	  ○ The program provides useful data for age groups and baseline measures of immunity
		• Category of disease or condition
		  ○ Emerging diseases
		  ○ Infectious diseases
		  ○ Chronic diseases
		  ○ Vector-borne diseases
		  ○ COVID-19
		• What is collected
		  ○ Biological specimens collected
		  ▪ Residual blood from donation
		  ▪ Residual blood from clinical sample
		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population
		• Types of analyses to inform public-health actions
		  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
		  ○ Identifying groups at increased risk of acquiring the disease (e.g., age, gender, geographic location, etc.)
		  ○ Identifying population trends in past accumulative exposure to an infection over time
		  ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy
		  ○ Conducting disease modelling (e.g., for the prediction of potential outbreak, projections of illness or hospitalization)
		  ○ Examining trends in immunity over time
		  ○ Monitoring emerging diseases (e.g., in relation to climate change)
		• How is serosurveillance shared
		  ○ Summary of key indicators provided publicly
		• Ethics considerations (e.g., when is individual patient consent required, requirements for anonymous samples vs. linked to administrative data)

Denmark	• Denmark's infectious disease surveillance system includes analysis of outbreaks and microorganisms
	• The Danish National Biobank provides researchers access to more than 30.6 million biological samples from 6.2 million people
		• Category of disease or condition
		  ○ Emerging diseases
		  ○ Infectious diseases
		  ○ Chronic diseases
		  ○ Vector-borne diseases
		  ○ COVID-19

Jurisdiction	Key findings	Dimension of the organizing framework
	○ The Novo Nordisk Foundation and the Ministry of Science, Technology and Innovation supported the Statens Serum Institut (a national research institute) to establish the national biobank ○ Registries with information about all residents in Denmark are linked with biological samples ○ The Danish National Biobank collaborates with hospitals, universities, and other public research institutions to collect and use the biological samples ○ The Biobank includes samples from the Danish National Birth Cohort, biobanks in hospitals, research projects, disease-specific biobanks (e.g., Danish Cancer Biobank) and is linked with the Danish Civil Registration System, the Danish National Patient Register, the Danish Pathology Register, and the Copenhagen Primary Care Laboratory Database	• Who conducts and analyzes the surveillance ○ External to a public health agency (i.e., contracted out) • What is collected ○ Biological specimens collected ▪ Residual blood from donation ▪ Residual blood from clinical sample ▪ Antenatal blood • How data is collected and linked ○ Administrative databases • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease (e.g., age, gender, geographic location, etc.) ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Conducting disease modelling (e.g., for the prediction of potential outbreak, projections of illness or hospitalization) ○ Examining trends in immunity over time
Germany	• The Robert Koch Institute provides information on serosurveillance initiatives in Germany. • Nationwide COVID-19 monitoring was conducted in 2020 and 2021/2022 ○ Participants removed a blood sample from their finger to detect COVID-19 antibodies • COALA study investigated COVID-19 in daycares ○ Blood was taken from the children's' fingertips to check for antibodies • Info is collected from blood donations under the Transfusion Act ○ Donation institutions must report number of samples tested and those confirmed positive for an infection marker ○ For those who test positive demographic info is recorded, mode of infection. ○ Reports of positive infections are analyzed and published in the federal health gazette	• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group) • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.) • How is serosurveillance shared ○ Summary of key indicators provided publicly
Israel	• In the early weeks of the COVID-19 pandemic, all COVID-19 tests were sent to one laboratory in the centre of the city; however, as the pandemic progressed more laboratories were certified to provide testing using Polymerase Chain Reaction (PCR) instruments and increased testing capacity	• Category of disease or condition ○ COVID-19 • What is collected ○ Biological specimens collected

Jurisdiction	Key findings	Dimension of the organizing framework
	○ Public health laboratories in Israel were among the first to develop a testing kit for COVID-19 • In November 2021, serological tests were used to confirm whether recovered COVID-19 patients had coronavirus antibodies; if so, the patient had to receive a single vaccine dose in order to be issued a Green Pass from the Ministry of Health that allowed them to enter certain businesses and events ○ The anti-N serological test had to be performed in Israel	▪ Residual blood from clinical sample • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency • How data is collected and linked ○ Administrative databases ○ Other • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Examining trends in immunity over time
Netherlands	• A national seroepidemiology program was first launched in the Netherlands in 1995/1996, which utilized a population-based random sampling strategy and the use of questionnaires, to study the prevalence of vaccine-preventable diseases in the country, including: 1) measles, 2) mumps, 3) rubella, 4) varicella, 5) hepatitis A, B, and C, 6) diphtheria, 7) tetanus, 8) polio, 9) pertussis, 10) streptococcus pneumoniae, and 11) human papillomavirus ○ The implementation of this program influenced the creation of multiplexing techniques for testing population-based serum banks • The Ministry of Health, Welfare, and Sport's National Institute for Public Health and the Environment published a document on their National Immunisation Programme in the Netherlands, which spoke to high seroprevalence reports of : ○ HPV among individuals aged 15 years of age and older in the Caribbean Netherlands (e.g., 51% of women and 18% of men); ○ Measles (97% of the general population); and ○ Rubella (95% of the general population has anti-rubella antibodies) • *Pienter3* population-based studies are conducted every decade in the Netherlands to test vaccine-preventable disease immunity in the general population (the first of which was completed in 1995/1996, later in 2006/2007, and more recently in 2016/2017) • The Ministry of Health, Welfare, and Sport's National Institute for Public Health and the Environment has published interim findings from their *PIENTER Corona Study*, which was launched in April 2020, with key features noted below: ○ A total of 56,600 blood samples were examined over the course of nine research rounds in two years ○ Women constituted of the majority of the blood samples, with 50 years being the average age of participants ○ The age range with the most participants was 70-74 years and 75-79 years old	• Category of disease or condition ○ Emerging diseases ○ Infectious diseases ○ Chronic diseases ○ Vector-borne diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group) ▪ Vaccination history (e.g., doses administered) ○ Biological specimens collected ▪ Residual blood from donation ▪ Oral fluid • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How data is collected and linked ○ Surveys ○ Administrative databases • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease in a population ○ Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.)

Jurisdiction	Key findings	Dimension of the organizing framework
	○ Testing was conducted to identify the IgG type of antibodies in the blood and IgA type in the nose ○ The seroprevalence found through these analyses reported figures as low as three percent in the spring of 2020, increasing to 65% in the summer of 2021 (of which, 20% were from previous infection), and the highest rate at 95% in the spring of 2022 (60% of which came from previous infection) ○ By the end of 2022, it was reported that at least 85% of the general population had antibodies from previous COVID-19 infection ○ Differences in COVID-19 infection by region, ethnic background, and sex seemed to have disappeared following the emergence of the Omicron variant • The 11th research round was conducted in October/November 2023	○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Conducting disease modelling (e.g., for the prediction of potential outbreak) ○ Examining trends in immunity over time • How is serosurveillance shared ○ Summary of key indicators provided publicly • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples ○ Adapting assays for different (or greater specificity for) antigens • Creating integrated serosurveillance for multiple conditions
South Korea	None identified	
United Kingdom	• Public Health England (PHE) leveraged the use of the UK Health Security Agency (UKHSA) serosurveillance program during the COVID-19 pandemic to report on the burden of this infectious disease, identify behaviour and mixing patterns of different age groups, and identify trends over time ○ In the early stages of the pandemic, the reports were published on a weekly basis, later converting to monthly reports, and now, are released on a quarterly basis • Serosurveillance was discussed in PHE's COVID-19 Vaccine Surveillance Strategy, with specific information on serological sample collection: ○ Serological samples were obtained from healthy adult blood donors supplied by the National Health Service (NHS) from varying age, demographic, and geographic locations; the Roche S assay was used for serological surveillance ○ Seroprevalence surveys using blood samples were collected from pediatric populations of 10 years of age or older ▪ This includes the collection of residual serum samples from general practitioner clinics, with further patient-level information collected, such as vaccine status and demographic/clinical information ○ The seroepidemiology unit collects residual sera from all age groups that is provided by laboratories across England ○ UKHSA has undertaken many serosurveillance studies over the past few years on COVID-19 to better understand disease transmission, including the *Schoolkid Surveillance* and *SIREN* studies (which included blood samples, and nose and throat swabs) ○ UKHSA expanded their serological testing to further examine the surveillance of pertussis and influenza • The seroepidemiology network established within the United Kingdom has influenced policy decisions, including the addition of a meningococcal conjugate booster dose for infants at 12 months of age	• Category of disease or condition ○ Emerging diseases ○ Infectious diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group) ▪ Vaccination history (e.g., doses administered) ○ Biological specimens collected ▪ Residual blood from donation ▪ Residual blood from clinical sample ▪ Oral fluid • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population ○ External to a public health agency (i.e., contracted out) • How data is collected and linked ○ Surveys ○ Administrative databases • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease in a population ○ Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.) ○ Identifying population trends in past accumulative exposure to an infection over time

Jurisdiction	Key findings	Dimension of the organizing framework
		○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Conducting disease modelling (e.g., for the prediction of potential outbreak) ○ Examining trends in immunity over time • How is serosurveillance shared ○ Summary of key indicators provided publicly • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Adapting assays for different (or greater specificity for) antigens
United States	• From July 2020 to December 2022, the US Centres for Disease Control (CDC) maintained a nationwide COVID-19 antibody seroprevalence survey that provided estimates of the percentage of people in the U.S. with at least one resolving or past infection with SARS-CoV-2 ○ This survey did not capture reinfections or people who had been vaccinated against COVID-19 and had no history of infection ○ Serum specimens were obtained from commercial laboratories ○ The U.S. CDC was able to estimate the infection-inducted antibody seroprevelance of adults and pediatric age groups (ages six months to 17 years). ○ The U.S. CDC collected and analyzed the data from nationwide commercial laboratories about vaccination-induced antibodies among pediatric age groups • The U.S. CDC also maintained a nationwide blood donor seroprevalence survey (up until December 2022) which provided estimates of the percentage of people in the U.S. ages 16 years and above that had antibodies (from infection or vaccination) against COVID-19 ○ The U.S. CDC worked with the National Heart, Lung, and Blood Institute Recipient Epidemiology and Donor Evaluation Study-IV-Pediatric (REDS-IV-P) program to use monthly blood donation specimens from 17 metropolitan regions to estimate both infection- and vaccination-induced antibody seroprevelance from 2020 to 2021 ○ In 2022, the U.S. CDC collaborated with Vitalant Research Institute, American Red Cross, and Westat to conduct antibody seroprevelance from de-identified blood samples.	• Category of disease or condition ○ Infectious diseases ○ Chronic diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ○ Biological specimens collected ▪ Residual blood from clinical sample ▪ Oral fluid ▪ Other • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How data is collected and linked ○ Surveys ○ Administrative databases • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease in a population ○ Identifying groups at increased risk of acquiring the disease previously ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Conducting disease modelling ○ Examining trends in immunity over time • How is serosurveillance shared ○ Not disseminated publicly Summary of key indicators provided publicly

Appendix 6: Detailed jurisdictional scan of Canadian provinces and territories about the use of serosurveillance to monitor diseases and conditions and inform policy decisions

Jurisdiction	Key findings	Dimension of the organizing framework
Pan-Canadian	• The Canadian COVID-19 Antibody and Health Survey (CCAHS), a national survey evaluating active COVID-19 infections and COVID-19 antibody prevalence within the Canadian population, provides real-world data **from self-reported information and dried blood spot (DBS) testing to detect COVID-19 antibodies** and to inform decision-making during Canada's pandemic recovery ○ **These surveys evaluated active COVID-19 infections and COVID-19 antibody prevalence using self-reported data from a representative population survey and dried blood spot (DBS) testing, producing national seroprevalence estimates for two time periods: November 2020-April 2021 and April 2021-August 2022.** ○ **The most recent update of the seroprevalence part of the survey that was based on DBS samples collected between April and August 2022 concluded that nearly all Canadian adults (98%) had SARS-CoV2 during that period of time** ○ A third cycle of survey questionnaire data was collected between May to June 2023 that focused on participants' changes in vaccination status, COVID-19 reinfection and symptoms, and the impact on the participants' daily lives, health conditions, and use of health care services ○ This CCAHS is produced by Statistics Canada, the COVID-19 Immunity Task Force (CITF) and the Public Health Agency of Canada, and targets adults 18 years and older living in 10 Canadian provinces; excluded population include people living in the three territories, people living on reserves and other Indigenous communities, people living in certain remote regions, and members of the Canadian forces living on base • Seroprevalence studies funded by the COVID-19 Immunity Task Force (CITF) were used to provide estimates of the prevalence and trends in COVID-19 infection in Canada and included blood donors from Canadian Blood Services and Héma-Québec, anonymized discarded, or residual blood samples from provincial laboratories, or participants from research cohorts ○ **Over 120 individual studies related to seroprevalence, immunity science, optimization of immunologic testing, vaccine surveillance, pediatric vaccination, boosters, and population immunity modelling were produced from the coordinated effort of external researchers, national blood donor agencies and Statistics Canada** ○ Study results from 30 November 2023 found that infection-acquired serosurveillance increased between September and November by 4% from 79.1% to 82.9%	• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group) ▪ Vaccination history (e.g., doses administered) ▪ History of illness or related symptoms ○ Biological specimens collected ▪ Residual blood from donation ▪ Residual blood from clinical sample ▪ Antenatal blood • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How data is collected and linked ○ Surveys • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Conducting disease modelling ○ Examining trends in immunity over time • How is serosurveillance shared ○ Summary of key indicators provided publicly

Jurisdiction	Key findings	Dimension of the organizing framework

British Columbia	• BC Centre for Disease Control contributed to the seroprevalence studies by the COVID-19 Immunity Task Force
	• For COVID-19, Influenza A and other emerging pathogens, the BC Centre for Disease Control monitors seroprevalence changes with support from LifeLabs for residual serological surveillance, blood donor screening with Canadian Blood Services, and antenatal serological surveillance
		• Category of disease or condition
		  ○ Emerging diseases
		  ○ Infectious diseases
		  ○ COVID-19
		• What is collected
		  ○ Biological specimens collected
		  ▪ Residual blood from donation
		  ▪ Residual blood from clinical sample
		  ▪ Antenatal blood
		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population
		• Types of analyses to inform public-health actions
		  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
		  ○ Identifying population trends in past accumulative exposure to an infection over time
		  ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy

Alberta	• Serosurveillance systems have been utilized by the Alberta government to monitor emerging and infectious diseases, including COVID-19 and the West Nile virus
	  ○ The report on the West Nile virus indicated that Alberta Health and Wellness conducted seroprevalence testing from March 2007 to June 2007
	  ▪ Participant recruitment was conducted in the Palliser Health region by telephone
	  ▪ Sampling of participants was conducted through place of residence to identify variations between those living in urban and rural settings
	  ▪ Participants aged 18 years or older were asked to complete a telephone survey (n=3747) and provide a sample of blood (n=1960)
	  ○ The COVID-19 Immunity Task Force provides estimates of COVID-19 seroprevalence in Canada based on 20+ studies; these include blood samples from the Canadian Blood Services and anonymized discarded, or residual blood samples from provincial laboratories
	  ▪ As of 30 September 2023, infection-induced seroprevalence in Alberta is estimated to be 81.7% (which is the second highest province in the country)
		• Category of disease or condition
		  ○ Emerging diseases
		  ○ Infectious diseases
		  ○ COVID-19
		• What is collected
		  ○ Patient-level information
		  ▪ Demographic variables (e.g., age, sex, place of residence, ethnic group)
		  ▪ Vaccination history (e.g., doses administered)
		  ○ Biological specimens collected
		  ▪ Residual blood from donation
		  ▪ Residual blood from clinical sample
		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population
		  ○ External to a public health agency (i.e., contracted out)
		• How data is collected and linked
		  ○ Surveys
		• Types of analyses to inform public-health actions
		  ○ Estimating past/accumulated burden of an infectious disease in a population

Jurisdiction	Key findings	Dimension of the organizing framework
		○ Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.) ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy • How is serosurveillance shared ○ Summary of key indicators provided publicly
Saskatchewan	• Seroprevalence of Canadian provinces and bio-banked blood samples were conducted by the COVID-19 Immunity Task Force to monitor infection and vaccinates rates and identify population trends. • Canadian Blood Services have reported an increase in seroprevalence of blood samples in Saskatchewan. From 1.69 to 8.71%	• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ▪ History of illness or related symptoms ○ Biological specimens collected ▪ Residual blood from donation • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Examining trends in immunity over time • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples
Manitoba	• The Government of Manitoba possesses an Epidemiology and Surveillance Unit within the Department of Health, and their primary aim is to support the health system by monitoring, analyzing, and reporting on communicable and non-communicable diseases in the province; however, there is limited publicly available knowledge and information on their serosurveillance efforts • The COVID-19 Immunity Task Force provides estimates of COVID-19 seroprevalence in Canada based on 20+ studies; these include blood samples from the Canadian Blood Services, and anonymized discarded, or residual blood samples from provincial laboratories	• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Vaccination history (e.g., doses administered) ○ Biological specimens collected ▪ Residual blood from donation • Who conducts and analyzes the surveillance ○ External to a public health agency (i.e., contracted out) • Types of analyses to inform public-health actions

Jurisdiction	Key findings	Dimension of the organizing framework
	○ As of 30 September 2023, infection-induced seroprevalence in Manitoba is estimated to be 81.18% (which is the third highest province in the country)	○ Estimating past/accumulated burden of an infectious disease in a population ○ Identifying groups at increased risk of acquiring the disease previously (e.g., age, gender, geographic location, etc.) ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy • How is serosurveillance shared ○ Summary of key indicators provided publicly
Ontario	• Early in the COVID-19 pandemic, Public Health Ontario (PHO) began a COVID-10 serosurveillance initiative that used anonymized blood specimens to understand the proportion of Ontario's population that had COVID-19 antibodies and support the government in evaluating the effectiveness of its pandemic response ○ The COVID-19 surveillance program used residual specimens (i.e. blood, serum or plasma) to test for antibodies against COVID-19 ○ Specimens were proportionately selected based on the distribution of age groups, sex, and residence in each of Ontario's health regions • For the time being, PHO is shifting focus from serosurveillance to focus on validating new methods for measuring antibody response to COVID-19 and investigating vaccine protection from COVID-19	• Category of disease or condition ○ Infectious diseases ○ Chronic diseases ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ○ Biological specimens collected ▪ Residual blood from donation • Who conducts and analyzes the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How data is collected and linked ○ Surveys ○ Administrative databases • Types of analyses to inform public-health actions ○ Estimating past/accumulated burden of an infectious disease in a population ○ Identifying groups at increased risk of acquiring the disease previously ○ Identifying population trends in past accumulative exposure to an infection over time ○ immunization policy ○ Conducting disease modelling ○ Examining trends in immunity over time • How is serosurveillance shared ○ Summary of key indicators provided publicly
Québec	• Héma-Québec in collaboration with Institut national de santé publique (INSPQ), and in partnership with the COVID-19 Immunity Task Force (CITF) conducted seroprevelance studies of COVID-19 in the province ○ Residual samples from donations were used to conduct the studies ○ Donors agree to participate in the studies and analyses their blood in the laboratories at the organization	• Category of disease or condition ○ COVID-19 • Who conducts and analyzes the surveillance ○ External to a public health agency (i.e., contracted out) • Types of analyses to inform public-health actions

Jurisdiction	Key findings	Dimension of the organizing framework
	○ They developed a biobank of samples from frequent plasma donors to monitor immune responses over time ○ Individuals who have been excluded from donating blood can register for the Research Blood Donor Registry for research and development projects ○ Individual risk-based questionnaires are given to new donors which is more inclusive for the LGBTQ+ communities than a population-based questionnaire	○ Estimating past/accumulated burden of an infectious disease or health condition in a population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Examining trends in immunity over time • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples • Equity considerations (derived from PROGRESS-Plus)
New Brunswick	• Seroprevalence of Canadian provinces and bio-banked blood samples were conducted by the COVID-19 Immunity Task Force to monitor infection and vaccinates rates and identify population trends.	• Category of disease or condition ○ COVID-19 • What is collected ○ Patient-level information ▪ Demographic variables ▪ Vaccination history ▪ History of illness or related symptoms ○ Biological specimens collected ▪ Residual blood from donation • Who conducts and analyses the surveillance ○ Internal to a public health agency which oversees a national or sub-national population • How is data collected and linked ○ Administrative databases • Types of analyses to inform public health decisions ○ Estimating past/accumulated burden of an infectious disease population ○ Identifying population trends in past accumulative exposure to an infection over time ○ Monitoring and evaluating the impact of vaccination programs and informing immunization policy ○ Examining trends in immunity over time • Adaptations to serosurveillance systems following the COVID-19 pandemic ○ Bio-banking samples
Nova Scotia	• Nova Scotia is part of the Canadian HIV Strain and Drug Resistance Surveillance Program, where they send archived diagnostic sera samples of those newly diagnosed with HIV for subtype analysis, genotyping, and testing for recency of infection ○ This information is sent to Public Health Agency of Canada	• Category of disease or condition ○ Infectious diseases • What is collected ○ Biological specimens collected ▪ Residual blood from clinical sample

Jurisdiction	Key findings	Dimension of the organizing framework

		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population
		• Types of analyses to inform public-health actions
		  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population
		  ○ Identifying population trends in past accumulative exposure to an infection over time

Newfoundland and Labrador	None identified	

Northwest Territories	• The Government of the Northwest Territories announced a plan to test blood samples of residents for antibodies to COVID-19
	  ○ Public health and community health authorities collected residents' discarded samples from routine health tests dating back to 1 April 2022
	  ○ Testing for antibodies and whether the antibodies resulted from immunization or infection
		• Category of disease or condition
		  ○ COVID-19
		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population
		• Types of analyses to inform public-health actions
		• Estimating past/accumulated burden of an infectious disease or health condition in a population

Yukon	• A report from Yukon Communicable Disease Control on Hepatitis B (2019) recommends serological testing for HBV markers in specific groups:
	  ○ Pregnant women
	  ○ Immigrants from HBV Endemic Countries
	  ○ Post-vaccination for certain groups (high risk infants, high risk pregnant individuals, immunocompromised, chronic liver disease, post-exposure, high risk health care workers)
		• Category of disease or condition
		  ○ Infectious diseases
		• Who conducts and analyzes the surveillance
		  ○ Internal to a public health agency which oversees a national or sub-national population

Nunavut	• Nunavut Communicable Disease Manual from September 2015 mentions a serologic study conducted in 1983-1985 to screen for Hepatitis B antigens and antibodies in the Inuit population, in addition to a seroprevalence study in 2006 for Human T-cell Lymphotropic Virus, Type 1	• Category of disease or condition
		  ○ Infectious diseases
		• Types of analyses to inform public-health actions
		  ○ Estimating past/accumulated burden of an infectious disease or health condition in a population

Appendix 7: Documents excluded at the final stages of reviewing

Document type	Hyperlinked title
Commentary	Global SARS-CoV-2 genomic surveillance: What we have learned (so far)

Single study	SARS-CoV-2 Surveillance System in Canada: Longitudinal trend analysis
	SARS-CoV-2 seroprevalence and implications for population immunity: Evidence from two health and demographic surveillance system sites in Kenya, February-December 2022
	Prediction of the next major outbreak of COVID-19 in Mainland China and a vaccination strategy for it
	The role of serological testing in the SARS-CoV-2 outbreak
	SeroTracker: a global SARS-CoV-2 seroprevalence dashboard
	Nationwide seroprevalence of antibodies against SARS-CoV-2 in Israel

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