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RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS- COV-2 (COVID-19)

A RAPID SUMMARY OF TESTS AVAILABLE IN CANADA

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DISCLAIMER

This Rapid Response Report summarizes data available on or before June 1, 2020. Given the rapidly changing nature of the coronavirus pandemic, the status of the diagnostics tests and/or some of the references included in this report may quickly become out-of-date.



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EXECUTIVE SUMMARY

Research questions

1. What point-of-care diagnostic tests for SARS-COV-2 (COVID-19) are available in Canada?
2. How accurate are the point-of-care diagnostic tests authorized in Canada at identifying individuals with SARS-COV-2 (COVID-19)?
3. What recommendations and guidelines are there for the use of point-of-care diagnostic tests to identify individuals with SARS-COV-2 (COVID-19)?
4. What are the key benefits and limitations of the point-of-care diagnostic tests for SARS-COV-2 (COVID-19) authorized in Canada?

Summary of key findings

<p>WHAT POINT-OF-CARE DIAGNOSTIC (PCR) TESTS FOR COVID-19 ARE AVAILABLE IN CANADA?</p>	<p>There are 3 point-of-care- (POC) polymerase chain reaction (PCR) diagnostic tests authorized or in the application phase in Canada as of June 1, 2020:</p> <ul style="list-style-type: none"> • Two POC tests for SARS-COV-2 (COVID-19) are currently authorized for use by Health Canada – the Cepheid Xpert Xpress platform system, and the Spartan Bioscience Cube mobile system. <ul style="list-style-type: none"> ○ One POC PCR mobile test system (Biomeme Go-Strips) has been submitted for authorization to Health Canada. • All other applications in the Health Canada database for POC tests were serological tests, which are out of scope in this review. • The Spartan Cube is currently authorized only for research use and cannot be used for diagnosis of COVID-19 until fully authorized. • A number of other mobile or platform-based POC PCR tests have been authorized for use in the United States, Europe, Australia and other jurisdictions.
<p>HOW ACCURATE ARE THE POINT-OF-CARE DIAGNOSTIC TESTS AUTHORIZED IN CANADA AT IDENTIFYING INDIVIDUALS WITH SARS-COV-2 (COVID-19)?</p>	<p>Our searches identified 1 rapid health technology assessment and 2 rapid reviews from a number of international sources.</p> <ul style="list-style-type: none"> • A protocol for a rapid review in-progress was also located in the Cochrane Library. • No reviews reported performance data for the Spartan Cube or Biomeme Go-strips tests. • Two reviews synthesized laboratory performance data for the Cepheid Xpert Xpress system based on information supplied by the manufacturer.



	<ul style="list-style-type: none">○ Although the tests are reported to be accurate (sensitive and specific) and have good agreement compared to the reference RT-PCR test, there may be limitations associated with the quantity and quality of evidence available (Although individual study quality was not assessed as part of this rapid review).○ Manufacturer-reported sensitivity ranges from 86% to 100% and specificity from 88% to 100%○ Current data are for a small number of samples under optimal laboratory conditions and their validity and reliability in the real-world is currently unknown (Spartan Cube, Biomeme go-strips).● Citation tracking located 7 reports of additional laboratory or real-world clinical use and evaluation of the Cepheid Xpert Xpress test.<ul style="list-style-type: none">○ None of the studies were conducted in Canada, and some are pre-print studies which are not peer-reviewed or formally published in a journal. Studies showed that the Xpert Xpress test was accurate and in agreement with the reference test.● Test characteristics show that POC PCR tests can deliver results in 45 mins, compared to 6-8 hours or 1-2 days for the reference test, but throughput¹ may be limited to single test at a time.● Reporting of review methods in all included reports were insufficient to assess methodological quality using the AMSTAR2 tool.
<p>WHAT RECOMMENDATIONS AND GUIDELINES ARE THERE FOR THE USE OF POINT-OF-CARE DIAGNOSTIC TESTS TO IDENTIFY INDIVIDUALS WITH CURRENT COVID-19?</p>	<p>No formal guidelines were located relevant to the use or implementation of POC PCR tests for SARS-COV-2 (COVID-19).</p> <p>Guidance for diagnostic tests for SARS-COV-2 (COVID-19) during the pandemic often do not specifically address POC tests, rather, they recommend continued use of RT-PCR laboratory tests as best practice, while acknowledging logistical and supply issues.</p> <ul style="list-style-type: none">● Scientific advice from the World Health Organization (WHO) in April 2020 recommends use of these new POC immunodiagnostic tests only in research settings and not for any other setting, including for clinical decision-making, until evidence supporting use for specific indications is available.● The United States Centers for Disease Control proposed POC rapid tests to supplement laboratory testing, enabling testing to be available for communities and populations that cannot readily access laboratory testing or need to quickly address emerging outbreaks.

¹ i.e., the volume of tests that can be processed through the system.



	<ul style="list-style-type: none">○ <i>“Laboratory testing remains the primary testing mechanism for the nation because of the ability to perform a high volume of tests at one time.”</i>
WHAT ARE THE KEY BENEFITS OF THE POINT-OF-CARE DIAGNOSTIC TESTS AUTHORIZED IN CANADA?	<ul style="list-style-type: none">• Faster than the current reference standard RT-PCR tests – results to patient < 1 hour• Simple, no expertise required to run or interpret the test• “Hands-off” test processing• Test are portable and no laboratory required• May ease pressure for certain swabs or reagents in shortage situations• Allows healthcare resources to focus where needed (versus on testing)• Can be used anywhere – hospital, clinic, cruise ship, remote or rural locations without access to lab, drive through clinic, workplace
WHAT ARE THE KEY LIMITATIONS OF THE POINT-OF-CARE DIAGNOSTIC TESTS AUTHORIZED IN CANADA?	<ul style="list-style-type: none">• Tests are likely run one at a time, which could limit throughput¹ and use in environments where volume of testing is high unless multiple testing platforms are purchased.• Tests may require supplies (i.e., swabs) that are in limited supply at times, and kits for POC tests may still be subject to order backlogs• While adequate test accuracy and precision may be achieved under ideal circumstances in the laboratory, these may be negatively impacted when used at the point-of-care.• Appropriate staff training and use of robust standardized operating procedures may be required to moderate any sources of error.• There is limited evidence of use in real world settings, especially in Canadian settings.



CONTEXT

The World Health Organization (WHO) has stated that “diagnostic testing for COVID-19 is critical to tracking the virus, understanding epidemiology, informing case management, and to suppressing transmission” and this has been supported by governments and public health authorities at all levels in Canada. Current Ontario guidance for COVID-19 testing can be found [here](#).

Since the declaration of the global pandemic and the identification of the SARS-CoV-2 virus, development and deployment of tests to detect SARS-CoV-2 (COVID-19) has been relatively rapid. Given the essential role for diagnostic testing in pandemic response, regulatory agencies worldwide have been granting temporary or special use authorization to devices used for testing. Canada began accepting applications in March of 2020 and to date a total of 21 tests have been granted authorization for use in Canada. Many others have submitted applications and are under review.

According to Health Canada, nucleic acid-based testing (also called PCR (polymerase chain reaction), antigen, or molecular testing) is the reference standard (or ‘best practice’) used in Canada and abroad. PCR testing is used for the diagnosis of active COVID-19 infection in patients with symptoms. Details about COVID-19 tests in general are available from the Province of Ontario [here](#). The reference test requires samples to be sent to a laboratory environment for processing so that they detect even tiny amounts of the virus. The PCR test is able to find small amounts of the COVID-19 virus by amplifying the virus’ genetic material to a level where it can be detected. The test requires a sample from a person and that sample is collected by a health care provider, typically using a swab inserted into a person’s nose or throat. Although they are generally considered to be accurate (specific and sensitive) tests, there are a number of constraints associated with PCR tests, including logistics (availability of health care personnel, time required for laboratory analysis and the availability of certain swabs or reagent materials required to run the tests).

Point-of-care (POC) molecular PCR tests are lauded for a number of potential benefits, including the mitigation of some of the constraints associated with lab-based PCR testing. Accurate and scalable POC tests for the diagnosis of COVID-19 have the potential to increase the scope for diagnosis to be made in the community (including rural or remote areas) and outside the laboratory setting. Reducing the time to receipt of an actionable result would benefit public health objectives and may have additional applications to support appropriate use of resources, infection control, and recruitment into research studies.

There are different types of mobile or facility-based PCR test platforms that can be used at the POC. *Mobile platforms* are portable, small in size, and may be suitable for small volume or offsite testing as they typically handle a single sample at a time, while *facility-based platforms* are larger and may be located within a hospital or medical centre. These POC platforms may be able to process multiple samples at once and have a larger throughput of test volume. Both types of POC platforms can deliver test results in one hour or less.

METHODS OVERVIEW

Objective

The objective of this report is to provide a summary of the molecular POC diagnostic tests authorized for use in Canada, the characteristics of tests available, the evidence of diagnostic test accuracy, and available guidelines specific to the diagnosis of patients with suspected COVID-19. In this report, we consider only molecular PCR-type POC tests and exclude POC tests based on serological assays, which detect the presence of antibodies in a blood sample. Although considered out-of-scope for the current review, relevant evidence and Canadian context related to POC serological tests has been collected and summarized in a horizon scan by the Canadian Agency for Drugs and Technologies in Health (CADTH) which was last updated May 28, 2020². A systematic review and meta-analysis of real-world data for antigen POC tests was also published May 18, 2020³.

For the purposes of this review, we applied the CADTH definition for POC tests as “any testing conducted outside a lab, in a hospital, in a clinic or by a health care organization providing ambulatory care.” which includes tests defined as point-of-care by the College of Medical Laboratory Technologists of Ontario (CMLTO) which is “medical diagnostic testing performed outside the clinical laboratory, at or near, where a patient is receiving care”.

Research questions

1. What point-of-care diagnostic tests for SARS-COV-2 (COVID-19) are available in Canada?
2. How accurate are the point-of-care diagnostic tests authorized in Canada at identifying individuals with SARS-COV-2 (COVID-19)?
3. What recommendations and guidelines are there for the use of point-of-care diagnostic tests to identify individuals with SARS-COV-2 (COVID-19)?
4. What are the key benefits and limitations of the point-of-care diagnostic tests for SARS-COV-2 (COVID-19) authorized in Canada?

Summary of research methods

We followed a staged approach to answer each research question of interest. Table 1 provides a summary of the target condition, index and reference tests, and the general outcomes of interest for this review. A detailed summary of methods by research question is reported in Appendix 1.

² CADTH Horizon Scan: Serological Tests for COVID-19. CADTH. Ottawa, Canada. Last accessed June 1, 2020. Report Published May 28, 2020. Accessible at: <https://cadth.ca/sites/default/files/covid-19/eh0085-serology-for-covid-tests-final.pdf>

³ <https://www.mdpi.com/2077-0383/9/5/1515/htm>



Table 1: Scope of current rapid review.

TARGET CONDITION	Current SARS-COV-2 virus/COVID-19 infection
INDEX TEST	<p>Molecular (nucleic acid technology, or PCR) point-of-care (POC) tests designed to test individuals for current infection.</p> <p>For the purposes of this review, we applied the CADTH definition for point-of-care tests: Point-of-care tests or testing is defined as “<i>any testing conducted outside a lab, in a hospital, in a clinic or by a health care organization providing ambulatory care.</i>” which includes tests defined as point-of-care by the College of Medical Laboratory Technologists of Ontario (CMLTO) which is “<i>medical diagnostic testing performed outside the clinical laboratory, at or near, where a patient is receiving care</i>”.</p>
REFERENCE TEST	Conventional (or real-time) RT-PCR laboratory tests
OUTCOME	Ability of the test to distinguish who does and does not have SARS-COV-2/COVID-19 [Test characteristics, diagnostic test accuracy/performance characteristics (e.g., sensitivity, specificity)]
OTHER	<p>Benefits, limitations or implementation considerations</p> <p>Guideline recommended use.</p>

RESULTS

What point-of-care diagnostic tests for SARS-COV-2 (COVID-19) are available in Canada?

Authorized molecular POC diagnostic tests in Canada

A search of the COVID-19 Testing Device Applications Authorized by Health Canada found that there are 21 tests in total in the database as of June 1, 2020. Of these, two nucleic acid technology POC PCR tests are authorized for use in Canada: the *Xpert Xpress SARS-CoV-2 system* (Cepheid, United States) and the *Spartan Cube COVID-19 System* (Spartan Bioscience, Canada). Information available for these tests from the database is presented in Table 2.

Table 2: Approved molecular point-of-care diagnostic tests for COVID-19 available in Canada (Current to June 1, 2020)

Device Name	Manufacturer	Device Type	Test Type	Approval conditions	Date Authorized
Xpert Xpress SARS-CoV-2	Cepheid (United States)	Nucleic acid technology	Lab-based test, Point-of-care test	Medical Devices Special Access Program	2020-03-24
Spartan Cube COVID-19 System	Spartan Bioscience (Canada)	Nucleic acid technology	Point-of-care test	Medical Devices Special Access Program, As of May 5 for Research Use Only ^a	2020-05-02

EUA-emergency use authorization; FDA=United States Food and Drug Administration; EU=European Union

^aOn May 5, 2020, Health Canada issued a safety notice which stated that the Spartan Covid-19 System does not perform as claimed for its intended use in a clinical setting. There is a risk of false negative test results. The Spartan Covid-19 System is no longer intended for use in diagnosis and should be for research use only.

Xpert Xpress SARS-CoV-2 System

The Xpert Xpress SARS-CoV-2 system was authorized for use on March 24, 2020 and there have been no regulatory status updates since approval.

Spartan Cube COVID-19 System

The Spartan Cube COVID-19 system was developed by Spartan Bioscience headquartered in Ottawa, Ontario and originally authorized for use by Health Canada on April 13, 2020. On May 1, 2020, Canada's National Microbiology Laboratory contacted Health Canada to flag concerns over efficacy of the tests. On May 5, 2020, Health Canada issued a safety notice,⁴ which stated that the Spartan Cube COVID-19 System does not perform as claimed for its intended use in a clinical setting with specific mention of a risk of false negative test results and amended the initial approval to limit the use of the Spartan COVID-19 System to research use only.

⁴ <https://healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2020/72971r-eng.php#reason-motif>

Media reports indicate that Spartan Bioscience is currently performing additional validation studies. No additional regulatory information is available. Media reports also note that the issue was not with the technology or testing platform itself, but rather with the swabs used to collect biologic samples from individuals. Original testing by Spartan was based on synthetic, not human, samples which may also have been a contributing factor. Company representatives state that a resolution in the form of a new proprietary swab is expected 'by the summer'⁵.

COVID-19 Diagnostic Device Applications Received by Health Canada

Review of the Health Canada diagnostic device application database for COVID-19 located a single POC PCR diagnostic test, the *Biomeme SARS-COV-2 go-strips* (Table 3).

Table 3: COVID-19 Diagnostic Device Applications Received by Health Canada (As of June 1, 2020)

Device Name	Manufacturer	Device Type	Test Type	Current Status
Biomeme SARS-COV-2 go-strips	Biomeme Inc. (United States)	Nucleic acid technology	Point-of-care test	Under Review

Subtext if needed

The application date for this test is not provided, and no other updates are available from Health Canada other than the test is currently under review as of June 1, 2020.

Table 4 provides a summary of regulatory authorizations outside of Canada for the three molecular POC diagnostic tests authorized for use or under review in Canada. These data were collected from industry websites and the currency or completeness of the data could not be verified within the timelines of this rapid review.

Table 4: International Regulatory Status as of May 26, 2020

Device Name	Manufacturer	FDA Regulatory Status	EU Regulatory Status	Other Regulatory Approvals
Spartan Cube COVID-19 System	Spartan Bioscience (Canada)	NO	NO	NO
Xpert Xpress SARS-CoV-2	Cepheid (United States)	YES 3/20/2020	NO	YES: Australia, Singapore
Biomeme SARS-COV-2 go-strips	Biomeme Inc. (United States)	UNCLEAR	UNCLEAR	UNCLEAR

⁵ <https://www.cbc.ca/news/politics/spartan-bioscience-testing-device-back-out-summer-1.5555226>

How accurate are the molecular POC tests authorized in Canada for diagnosis of individuals with current COVID-19?

Our search identified two rapid reviews (Oxford University Centre for Evidence based Medicine (CEBM), United Kingdom and National University of Singapore), one rapid health technology assessment (HTA) (HIQA, Ireland) and one rapid review in-progress (Cochrane). Table 5 provides a summary of the review titles, approach, currency of evidence, and links to the document sources which are all open source. No further assessment of the Cochrane review in-progress by Deeks et al. was conducted as there was limited information available on the scope or methods for the rapid review outside of the research questions being considered. One industry report was located but was not formally included in this review as it was behind a paywall⁶.

Table 5: Rapid or systematic reviews identified

Review Title	Produced by	Approach used	Date of last update	Link
Molecular and antibody point-of-care tests to support the screening, diagnosis and monitoring of COVID-19.	Oxford COVID-19 Evidence Service Team Centre for Evidence-Based Medicine, Nuffield Department of Primary Care Health Sciences, University of Oxford. April 2020.	Rapid review	Report posted April 8, 2020 Evidence current to March 23, 2020	https://www.cebm.net/wp-content/uploads/2020/04/POCT-Covid19.pdf
COVID-19 Science Report: Diagnostics	Saw Swee Hock School of Public, National University of Singapore	Rapid review	Updated daily. Evidence current to June 1, 2020	https://sph.nus.edu.sg/wp-content/uploads/2020/06/COVID-19-Science-Report-Diagnostics-1-Jun.pdf
Rapid HTA of alternative diagnostic testing for coronavirus 2 (SARS-CoV-2).	Health Information and Quality Authority (HIQA), Ireland	Rapid Health Technology Assessment	Report posted May 8, 2020	https://www.hiqa.ie/sites/default/files/2020-05/Rapid_HTA_COVID-19_tests.pdf
Diagnosis of SARS-CoV-2 infection and COVID-19: accuracy of signs and symptoms; molecular, antigen, and antibody tests; and routine laboratory markers.	Deeks JJ, Dinnes J, Takwoingi Y, Davenport C, Leeflang MMG, Spijker R, Hooft L, Van den Bruel A, Emperador D, Dittrich S. Cochrane Database of Systematic Reviews 2020, Issue 4	Protocol record for a rapid review in-progress	No evidence available and no methods or scope outside the research questions posted.	https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013596/abstract

⁶ <https://www.idtechex.com/en/research-report/covid-19-diagnostics/736>

No single technology reviews were located for the individual tests. All reviews considered POC tests in addition to those approved in Canada. The rapid HTA by HIQA in Ireland mentions the Cepheid Xpert Xpress and Spartan Cube systems in their scan of tests available internationally but did not search for or summarize any test characteristics or performance data for the tests. The rapid review by the National University in Singapore sought test characteristic and performance data for the Biomeme Go-strips POC test, but only cost data were identified. The Cepheid Xpert Xpress test was considered in two reviews and test characteristics and performance data were summarized. Table 6 reports the sources of evidence considered in each review and indicates which of the tests are included in the evidence summaries reported.

Table 6: Summary of evidence for POC PCR tests approved in Canada

Review Title	Evidence sources used in review	POC PCR Tests approved or under consideration in Canada		
		Cepheid XPERT XPRESS	Spartan Cube System	Biomeme Go-Strips
Molecular and antibody point-of-care tests to support the screening, diagnosis and monitoring of COVID-19. Oxford University	Manufacturers' websites and assay package inserts. "at time of writing we could not find clinical evaluations of these assays in the literature"	YES	NO	NO
COVID-19 Science Report: Diagnostics, National University of Singapore	Comprehensive: PubMed, Google, webpages of government and international bodies with official information and guidelines (WHO, Europe CDC, US CDC, US FDA), diagnostic protocols, scientific commentaries, market news, and press releases, manufacturer data	YES	NO	PARTIAL ^a
Rapid HTA of alternative diagnostic testing for coronavirus 2 (SARS-CoV-2). HIQA Ireland	Tests located using review of data from a variety of government organizations and grey literature sources including online repositories (such as the non-governmental organization, FIND). Manufacturer data for test characteristics and performance.	NO	NO	NO

^a only cost data available as of May 29, 2020



Summary of rapid or systematic reviews for POC PCR diagnostic tests for SARS-COV-2 (COVID-19)

1. Kile Green, Sara Graziadio, Philip Turner, Thomas Fanshawe, Joy Allen. ***Molecular and antibody point-of-care tests to support the screening, diagnosis and monitoring of COVID-19.*** Oxford COVID-19 Evidence Service Team Centre for Evidence-Based Medicine, Nuffield Department of Primary Care Health Sciences, University of Oxford. April 2020. Available From: <https://www.cebm.net/wp-content/uploads/2020/04/POCT-Covid19.pdf>. Accessed May 25, 2020.

This rapid review was conducted in the United Kingdom by the Oxford COVID-19 Evidence Service Team at the Centre for Evidence-Based Medicine located in the University of Oxford in April 2020. As the rapid review was completed in early April, authors noted that there were no clinical evaluations for any of the POC PCR tests included in the literature, and the report were synthesized from evidence from manufacturers' websites and assay package inserts. The report presented tests characteristics and performance data for only the Cepheid Xpert Xpress SARS-COV-2 System, with laboratory-based RT-PCR tests as the reference standard for SARS-COV-2 (COVID-19) diagnosis. There was no mention of the Spartan Cube or Biomeme Go-strips tests in the report. Evidence from this report specific to the Xpert Xpress SARS-COV-2 system was used to inform Tables 8 and 9. Suggested advantages and disadvantages relevant to the use of the POC diagnostic tests were also collected from this report. As this rapid review was published on the website on April 8, 2020, and no updates are indicated, evidence may be out-of-of date. No methods were published beyond the scope of the search, and therefore, no AMSTAR evaluation could be completed to assess the methodological quality of the review.

The conclusions of this report presented as a 'verdict' statement are that *"moving diagnostic testing for COVID-19 from laboratory settings to the point of care is potentially transformative in the rate and quantity of testing that could be performed. Eleven diagnostic tests that are potentially suitable for testing for COVID-19 at the point-of-care are described: six molecular tests, and five antibody-based tests. Some devices show high diagnostic accuracy during controlled testing, but performance data from clinical settings, and a clear understanding of the optimal population and role for these tests in the care pathway, are currently lacking"*.

2. ***COVID-19 Science Report: Diagnostics.*** Saw Swee Hock School of Public Health. National University of Singapore. 1 June 2020. Available at: <https://sph.nus.edu.sg/wp-content/uploads/2020/06/COVID-19-Science-Report-Diagnostics-1-Jun.pdf>

This rapid review is updated daily and presents evidence for SARS-COV-2 (COVID-19) diagnostic tests located using a comprehensive search of PubMed, Google and gray (unpublished) sources, including webpages of government and international bodies with official information and guidelines (WHO, Europe CDC, US CDC, US FDA), diagnostic protocols, scientific commentaries, press releases and biomedical news sites (Bioworld, Genetic Engineering & Biotechnology News, GenomeWeb/360Dx, Verdict Medical Devices). The report summarizes issues associated with POC tests for diagnosis that were used to inform Table 10 and the summary of suggested advantages and disadvantages for POC RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)



diagnostic tests. No conclusions regarding the use of tests are presented, rather, test characteristics and available evidence for test performance are presented in tables. Data are presented for the Cepheid Xpert Xpress SARS-COV-2 System and the BioMeme Go-strips (cost only, and in what jurisdiction the costs are based is unclear). The Spartan Cube System is not mentioned in the report. References indicate the evidence tables for the Cepheid system are based on manufacturer data from clinical laboratory testing done to inform their FDA approval. No methods were published beyond the scope of the search, and therefore, no AMSTAR evaluation could be completed to assess the methodological quality of the review. Descriptions in the text indicate that a single author is screening all test data included in the rapid review.

3. **Rapid HTA of alternative diagnostic testing for coronavirus 2 (SARS-CoV-2).** Health Information and Quality Authority (HIQA), Ireland. 05 May 2020. <https://www.hiqa.ie/reports-and-publications/health-technology-assessment/rapid-hta-alternative-diagnostic-testing>

This rapid health technology assessment from Ireland was conducted to inform their strategy for diagnostic testing and to make sure that Ireland is ready to make the best use of emerging developments in this area. The report assessed the available evidence for the alternative diagnostic tests, whether any of these tests are being used internationally, and when the tests could be deployed in the clinical pathway. The assessment identified a wide range of diagnostic tests, both in development and already commercialised. No data on test characteristics or performance were included in the report, but we did utilize the information presented to inform the suggested advantages and disadvantages summary for research question 4 (Table 10).

HIQA concluded that before these tests can be adopted as part of a national testing strategy, they should be evaluated thoroughly as with all other POC tests in the country *“they will need to be independently clinically validated, locally verified, with ongoing review as part of a comprehensive quality assurance program. The current test, real-time RT-PCR, remains the ‘gold standard’ test for detecting and confirming COVID-19 cases.”*

International regulatory status of POC PCR diagnostic tests for SARS-COV-2 (COVID-19) available in Canada

An ever increasing number of diagnostic tests have been approved or authorized under accelerated regulatory pathways internationally. One website⁷ and the rapid HTA from HIQA in Ireland reported on the regulatory status of the tests included. A summary is provided in Table 7 for the three POC PCR diagnostic tests authorized for use or under review in Canada. No data on the regulatory status of the Biomeme SARS-COV-2 go-strips was located. The currency or completeness of the data could not be verified within the timelines of this rapid review.

Table 7: International Regulatory Status as of May 26, 2020

⁷ https://www.finddx.org/covid-19/pipeline/?section=molecular-assays#diag_tab



Device Name	Manufacturer	Unites States	Europe	Australia	Other Regulatory Approvals
Spartan Cube COVID-19 System^a	Spartan Bioscience (Canada)	No approval listed	No application made	No application made	No other applications or approvals noted
Xpert Xpress SARS-CoV-2	Cepheid (United States)	Emergency use authorization granted 3/20/2020	No information available	Approved 22/03/2020	Singapore Provisional authorization 26/03/2020
Biomeme SARS-COV-2 go-strips	Biomeme Inc. (United States)	Not reported	Not reported	Not reported.	Not reported

^a Media reports indicate that Spartan is prioritizing the provision of tests to Canada, in the volume required by public health authorities, before they consider other jurisdictional applications.

A summary of the characteristics of the tests available in Canada is provided in Table 8. This information was identified through technical documents from the manufacturer and the rapid reviews included. No product monograph or technical documents were located for the Spartan Cube System and so summaries are based on information presented on the Spartan Bioscience website only.

Descriptions of test characteristics

Xpert Xpress SARS-CoV-2 System

The Xpert Xpress SARS-CoV-2 test is a molecular in vitro diagnostic test that aids in the detection and diagnosis SARS-CoV-2 and is based on widely used nucleic acid amplification technology. The Xpert Xpress SARS-CoV-2 test contains primers and probes and internal controls used in RTPCR for the in vitro qualitative detection of SARS-CoV-2 RNA in upper respiratory specimens. The Xpert Xpress SARS-CoV-2 test can be used to test nasopharyngeal, nasal, or mid-turbinate swab specimens using the GeneXpert Xpress System platform in patient care settings outside of the clinical laboratory environment. The test can produce results in 45 minutes and each machine can only run one sample at a time, this poses a limitation in true volume throughput of diagnostic tests run. The system requires the use of single-use disposable cartridges that hold the RT-PCR reagents and host the RT-PCR process. The test cartridge is a complete solution containing all the necessary reagents. A patient sample is loaded into the cartridge and a GeneXpert System is required to run the test. This is different from some other test kits on the market which may require additional reagents such as extraction materials. Because the cartridges are self-contained, cross-contamination between samples is minimized.

Table 8: Manufacturer-quoted test characteristics for POC PCR diagnostic tests available in Canada

Device Name	Device Type	Sample Type	Gene Targets	Hands-on Prep Time	Time to result	Throughput	Storage Temperature
Spartan Cube COVID-19 System <i>Spartan Bioscience (Canada)</i>	Cartridge-based nucleic acid amplification mobile test.	Upper respiratory swab	unclear	<5 mins	45 min-1 hr	1 test cartridge per cube	No information available
Xpert Xpress SARS-CoV-2 <i>Cepheid (Unites States)</i>	Cartridge-based nucleic acid amplification test. The Xpert Xpress SARS-CoV-2 cartridge test is performed on the required GeneXpert Xpress System Platform	Specimen Collection: Nasopharyngeal, nasal, mid-turbinate, or oropharyngeal swabs and nasal wash/aspirates *Transport Media: UTM/VTM or Saline	Tests for two gene targets: N2 – nucleocapsid gene E – envelope protein gene	5 mins	As soon as 30 minutes for positives^ and approximately 45 minutes for negatives	1 test cartridge at a time.	2-28 degrees C
Biomeme SARS-COV-2 go-strips <i>Biomeme Inc. (United States)</i>	Nucleic acid amplification technology Go-Strips are designed for the Biomeme Franklin™ mobile handheld qPCR device Related app and data cloud for results.	nasopharyngeal and oropharyngeal (throat) swab	SARS-CoV-2-Orf1ab gene •SARS-CoV-2-Spike gene	unclear	1 hour	1 test at a time.	15-30 degrees C

min = minutes; hr=hour;*=degrees

Spartan Cube COVID-19 System

The Spartan Cube System is described on the manufacturer website as a mobile, rapid, sample-to-result DNA testing platform that can be used to detect the COVID-19 virus in under an hour using nucleic acid amplification technology⁸. The diagnostic platform is a DNA analyzer (the cube) used in combination with a COVID-19-specific cartridge insert. Once a cartridge is inserted, a button is pressed and the test runs ‘hands-off’ until results are available. No other technical or scientific documents are available on the website. The cube can test one sample at a time and takes approximately 45 mins to produce a result.

The test was developed based on the reference standard COVID-19 test (RT-PCR) developed by the United States Centres for Disease Control (CDC). The Cube has a single button and a small visual display screen used to communicate instructions. Once a cartridge is inserted, the top of the cube is closed, and the device runs automatically and generates results. The test is likened to a “coffee-pod brewing system” where the cartridge is replaced for each test run. There are other non-COVID-19 investigational uses for the Spartan Cube system listed by the company, including for genetic pre-screening of Alzheimer’s disease and identification of a known liver enzyme mutation used for genotype-guided antiplatelet drug therapy strategies after percutaneous coronary intervention in cardiology.

Biomeme SARS-CoV-2 Starter Kit

The Biomeme SARS-CoV-2 Starter Kit is an all-inclusive solution that can be used to detect the RNA that causes coronavirus disease 2019 (COVID-19), also known as “2019-nCoV” or “Wuhan coronavirus.” Two RNA targets for the novel coronavirus are multiplexed together with Biomeme’s process control assay for RNA extraction and RT-PCR (MS2). Assay targets include: Biomeme’s SARS-CoV-2 Test is a multiplex assay intended for qualitative detection of RNA from SARS-CoV-2 in nasopharyngeal and oropharyngeal (throat) swab samples. The test utilizes proprietary prep cartridges for RNA extraction, Biomeme’s SARS-CoV-2 Go-Strips assay, and Biomeme’s portable Franklin™ Real-Time qPCR Thermocycler. There is also a companion mobile app, Biomeme Go, which is utilized to scan tests, run PCR experiments online or offline, and to quickly interpret test results while syncing data to the Biomeme Cloud. This is a mobile system which Biomeme’s website reports as having a weight of 1.2 kg and is battery-operated,

Evidence for Test Performance

Test characteristics and diagnostic test accuracy statistics as outlined in Appendix 4 were sought. Evidence for test performance from the included reviews is presented in Table 9. Data are extremely limited and based almost entirely on laboratory validation data released through the manufacturers.

⁸ <https://www.spartanbio.com/products/medical/covid-19/>
RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)

Xpert Xpress SARS-CoV-2 System

The CEBM and National University of Singapore both reported test performance data for the Cepheid Xpert Xpress Sars-CoV-2 system. Based on laboratory samples, sensitivity is 100% (95% confidence interval 86%, 100%) and specificity is 100% (95% confidence interval 86%, 100%). Agreement with true positive and negative samples is reported to be 100%.

Table 9: Comparative diagnostic accuracy information for PoC tests available (or pending) in Canada.

Device Name	True Positive	Total Positive	% Sensitivity (95% CI)	True Negative	Total Negative	% Specificity (95% CI)	Validation data reported
Data from clinical samples							
Xpert Xpress SARS-CoV-2	Real world test performance data located See summary of additional primary studies located on page 17						
Spartan Cube COVID-19 System	No real world test performance data located.						
Biomeme SARS-COV-2 go-strips	No real world test performance data located.						
Data from laboratory samples							
Xpert Xpress SARS-CoV-2^a	30	30	100% (86%, 100%)	35	35	100% (88%, 100%)	Contrived nasopharyngeal spiked swab samples. 2xLoD 20/20 agreement. 3xLoD 5/5, 5xLoD 5/5. Negative 35/35 agreement. ⁹
Spartan Cube COVID-19 System	No laboratory test performance data located.						
Biomeme SARS-COV-2 go-strips	No laboratory test performance data located in the rapid reviews. The product monograph provides an estimate of analytical sensitivity (95% and 95.7%). Regarding specificity, the product monograph states that the test “ <i>showed no significant combined homologies with human genome, other coronaviruses, or human microflora that would predict potential false positive rRT-PCR results</i> ”						

^a As reported in the product monograph, the E primers and probes are cross-reactive and are not specific for SARS-COV-2. They will detect human and bat SARS coronavirus.

⁹ Source identified in the review by National University of Singapore and CEBM: <https://www.fda.gov/media/136315/download> RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)

Citation tracking of the included reviews did not result in any additional rapid or systematic reviews reporting test performance data. Through citation tracking in Google Scholar, a number of relevant primary studies reporting the Cepheid Xpert Xpress system were located. The studies below report some real-world use of the Xpert Xpress test, and include approaches using different respiratory sample locations (upper and lower respiratory tract) and different types of samples (e.g., saliva). Methods and results are summarized below each citation, and important findings highlighted. The Abbott ID NOW test is compared to Xpert Xpress in two studies but is not available for use in Canada and is not currently in the list of applications received by Health Canada.

1. Femke Wolters, Jeroen van de Bovenkamp, Bart van den Bosch, Sharon van den Brink, Maaïke Broeders, Ngoc Hoa Chung, Barbara Favié, Gabriel Goderski, Judith Kuijpers, Ilse Overdeest, Janette Rahamat-Langedoen, Lisa Wijsman, Willem JG Melchers, Adam Meijer. **Multi-center evaluation of cepheid xpert® xpress SARS-CoV-2 point-of-care test during the SARS-CoV-2 pandemic.** Journal of Clinical Virology, Volume 128, 2020. <https://doi.org/10.1016/j.jcv.2020.104426>

In this multicentre (multi-laboratory) study, the Xpert Xpress SARS-CoV-2 assay was evaluated against the routine in-house real-time RT-PCR assays in three medical microbiology laboratories in The Netherlands. A sensitivity and specificity panel was tested consisting of a dilution series of SARS-CoV-2 and ten samples containing SARS-CoV-2 and a range of other seasonal respiratory viruses. Additionally, 58 samples of patients positive for SARS-CoV-2 with different viral loads and 30 tested negative samples in all three Dutch laboratories using an in-house RT-PCR, were evaluated using Cepheids Xpert Xpress SARS-CoV-2 cartridges. No information was provided as to whether the samples were taken from symptomatic individuals. Results showed that the Xpert Xpress SARS-CoV-2 point-of-care test showed equal performance compared to routine in-house testing with a limit of detection (LOD) of 8.26 copies/mL. Other seasonal respiratory viruses were not detected. In clinical samples Xpert Xpress SARS-CoV-2 reaches an agreement of 100 % compared to all in-house RT-PCRs. Authors concluded that the test is a valuable addition for laboratories in situations where rapid and accurate diagnostics are of the essence. This is a published, peer-reviewed manuscript.

2. Angelica Moran, Kathleen G. Beavis, Scott Matushek, Carol Ciaglia, et. al. **The Detection of SARS-CoV-2 using the Cepheid Xpert Xpress SARS-CoV-2 and Roche cobas SARS-CoV-2 Assays.** Journal of Clinical Microbiology Apr 2020, JCM.00772-20; DOI: 10.1128/JCM.00772-20
<https://jcm.asm.org/content/early/2020/04/17/JCM.00772-20.abstract>

This is an accepted manuscript, published online. No details on peer review were available. This report compares results from specimens tested with both the Cepheid Xpert Xpress SARS-CoV-2 assay and the Roche cobas SARS-CoV-2 40 assay. Eight nasal and 95 nasopharyngeal specimens were collected from inpatients and ambulatory 39 patients at the University of

Chicago. Of these 103 specimens, 42 tested positive and 60 tested negative with both systems for agreement of 99%. Testing was repeated on the single specimen with discrepant results. For this specimen, the Roche assay was repeatedly negative for SARS-CoV-2. The initial Cepheid assay result was positive for SARS-CoV-2. Repeat Cepheid testing was negative for both targets. These results suggest that SARS-CoV-2 was present at a very low concentration, near the detection limit of the Cepheid assay. Limitations of this study include small sample size and testing limited to patients in a single institution. The assays also detect different SARS-CoV-2-specific genes, which could lead to false-negative results if a mutation prevents primer binding. The Roche platform is batch-based, accommodating 90 samples/run every 90 minutes. As each run requires up to three hours and 45 minutes, throughput is approximately 1 result/minute. Overall, the Cepheid Xpert Xpress SARS-CoV-2 and Roche cobas SARS-CoV-2 assays show excellent agreement (>99%), and their combined usage can be tailored to maximize SARS-CoV-2 testing.

3. Michael J. Loeffelholz, David Alland, Susan M. Butler-Wu, Utsav Pandey, Carlo Frederico Perno, et al. **Multicenter Evaluation of the Cepheid Xpert Xpress SARS-CoV-2 Test**. *Journal of Clinical Microbiology*. May 2020, JCM.00926-20; DOI: 10.1128/JCM.00926-20.
<https://jcm.asm.org/content/early/2020/04/30/JCM.00926-20.abstract>

This study evaluated the analytical and clinical performance characteristics of the Xpert Xpress SARS-CoV-2 (Xpert) test. Analytical sensitivity and specificity/interference were assessed with infectious SARS-CoV-2, other infectious coronavirus species including SARS-CoV, and 85 nasopharyngeal swab specimens positive for other respiratory viruses including endemic human coronaviruses (hCoVs). Samples from a study population of patients who were referred for COVID-19 testing at seven sites (in USA, United Kingdom, Italy and France) according to the local criteria at each testing site (not reported). No other details about the study population were provided, including whether they were symptomatic. Clinical performance was assessed using 483 remnant upper and lower respiratory specimens previously analyzed by standard of care tests. Results the limit of detection of the Xpert test was 0.01 plaque forming units (PFU)/mL. Other hCoVs, including Middle East Respiratory Syndrome coronavirus, were not detected by the Xpert test. SARS-CoV, a closely related species in the *Sarbecovirus* subgenus, was detected by a broad-range target (E) but was distinguished from SARS-CoV-2 (SARS-CoV-2-specific N2 target). Compared to the reference standard (RT-PCR), the positive agreement of the Xpert test was 219/220 (99.5%) and the negative agreement was 250/261 (95.8%). A third tie-breaker RT-PCR tests resolved all but three of the discordant results in favor the Xpert test. Authors concluded that the The Xpert test provided sensitive and accurate detection of SARS-CoV-2 in a variety of upper and lower respiratory tract specimens. The high sensitivity and fast time to results of approximately 45 minutes may impact patient management. This finding may be of interest as the current laboratory-based RT-PCR tests are reported to have different accuracy depending on upper or lower respiratory tract samples. This is a published, peer-reviewed manuscript.

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4. Clare McCormick-Baw, Kristi Morgan, Donna Gaffney, Yareli Cazares, et al. Saliva as an Alternate Specimen Source for Detection of SARS-CoV-2 in Symptomatic Patients Using Cepheid Xpert Xpress SARS-CoV-2. *Journal of Clinical Microbiology* May 2020, JCM.01109-20; DOI: 10.1128/JCM.01109-20.
<https://jcm.asm.org/content/early/2020/05/14/JCM.01109-20.abstract>

This is an accepted, online version of a study submitted as a letter to the editor regarding the use of saliva samples instead of respiratory samples in the Cepheid Xpert Xpress System. Authors point out the increasing need for alternative specimen sources due to the nasopharyngeal swab shortages. This study was performed at a single institution and sought to validate saliva specimens for diagnosis of COVID -19 using the Cepheid Xpert Xpress SARS-CoV-2 PCR test. They compared nasopharyngeal swab (NPS) using 3 mL universal transport media (UTM) (Becton, 32 Dickinson and Company, Franklin Lakes, NJ) with unpreserved saliva samples collected 33 in the Emergency Department and from in-patients in a COVID positive hospital unit. The specimens were collected prospectively in the ED, when a patient with suspected COVID-19 was being investigated following institutional and national guidelines for testing or randomly in the hospital COVID unit from patients not requiring mechanical ventilation. Education to the ED nursing staff and the nurses on the COVID 38 unit was disseminated to encourage saliva, not sputum collection. Also, it was highly recommended that patients did not have any food, drink, tobacco or gum for 30 minutes prior to collection. A total of 156 paired NPS and saliva specimens were tested. The overall positivity was 50/156 (32.1%). 153/156 (98% [95% Confidence Interval (CI) 94.48 to 99.60%,]) samples were in overall agreement. 47/49 samples were positive in saliva when compared to the NPS resulting in a positive percent agreement of 96% (95% CI 86.02 to 99.5%). 105/106 samples had a negative saliva and NPS. We conclude that saliva is an acceptable alternative source for detecting SARS-CoV-2 nucleic acid. Another advantage to saliva versus NPS is that the process to collect saliva is non -invasive and a patient, with education and coaching, could self-collect the specimen. These differences could reduce the risk to healthcare workers, decrease personal protective equipment usage, and provide less discomfort to patients during collection. Furthermore, an important pre -analytical variable for SARS -CoV -2 testing is proper nasopharyngeal collection which may have been a contributing factor for the discrepant saliva positive/nasopharyngeal swab negative sample. Because saliva has excellent agreement as compared to NPS in UTM, saliva could potentially be used for diagnosis of COVI-19 in symptomatic patients using the Cepheid Xpert Xpress PCR test. This research did not receive financial support from any funding agency or commercial vendor.

5. Marie C. Smithgall, Ioana Scherberkova, Susan Whittier, Daniel A. Green, **Comparison of Cepheid Xpert Xpress and Abbott ID Now to Roche cobas for the Rapid Detection of SARS-CoV-2.** *Journal of Clinical Virology*, Volume 128, 2020, <http://www.sciencedirect.com/science/article/pii/S1386653220301700>

Citing the lack of robust data on the relative performance of available rapid molecular tests across a full range of viral concentrations, this study aimed to compare two recently-authorized (USA) rapid tests, Cepheid Xpert Xpress SARS-CoV-2 and Abbott ID Now SARS-CoV-2, to the Roche cobas SARS-CoV-2 assay for samples with low, medium, and high viral concentrations. A total of 113 nasopharyngeal swabs from remnant patient samples were tested, including 88 positives spanning the full range of observed Ct values on the cobas assay. Compared to cobas, the overall positive agreement was 73.9% with ID Now and 98.9% with Xpert. Negative agreement was 100% and 92.0% for ID Now and Xpert, respectively. Both ID Now and Xpert showed 100% positive agreement for medium and high viral concentrations (Ct value <30). However, for Ct values >30, positive agreement was 34.3% for ID Now and 97.1% for Xpert. While Xpert showed high agreement with cobas across a wide range of viral concentrations, this study highlights an important limitation of ID Now for specimens collected in viral or universal transport media with low viral concentrations. Limitations of this study include the relatively few number of samples from pediatric patients, as only two samples from patients aged 1 day and 5 days were included, and both of these were negative on all three testing methods. No other patient data were reported, including symptom status. The performance of this assay with direct nasal swabs requires further evaluation in subsequent studies. Another limitation is the use of the cobas assay as the comparator assay. Two samples that were identified as positive only by Xpert on the basis of N2 nucleocapsid gene detection were negative for both targets on cobas. Whether these samples were truly positive or truly negative could not be determined.

6. Atreyee Basu, Tatyana Zinger, Kenneth Inghima, Kar-mun Woo, Onome Atie, Lauren Yurasits, Benjamin See, Maria E. Aguero-Rosenfeld. **Performance of Abbott ID NOW COVID-19 rapid nucleic acid amplification test in nasopharyngeal swabs transported in viral media and dry nasal swabs, in a New York City academic institution.** bioRxiv 2020.05.11.089896; doi: <https://doi.org/10.1101/2020.05.11.089896>

Our laboratory currently uses two real time RT-PCR platforms, the Roche Cobas SARS-CoV2 and the Cepheid Xpert Xpress SARS-CoV-2. Both platforms demonstrate comparable performance; however, the run times for each assay are 3.5 hours and 45 minutes, respectively. In search for a platform with shorter turnaround time, we sought to evaluate the recently released Abbott ID NOW COVID-19 assay which is capable of producing positive results in as little as 5 minutes. We present here the results of comparisons between Abbott ID NOW COVID-19 and Cepheid Xpert Xpress SARS-CoV-2 using nasopharyngeal swabs transported in viral transport media and comparisons between Abbott ID NOW COVID-19 and Cepheid Xpert Xpress SARS-CoV-2 using nasopharyngeal swabs transported in viral transport media for Cepheid and dry nasal swabs for Abbott ID NOW. Regardless of method of collection and sample type, Abbott ID NOW COVID-19 had negative results in a third of the samples that tested positive by Cepheid Xpert Xpress when using nasopharyngeal swabs in viral transport media and 45% when using dry nasal swabs. This article has not been peer-reviewed and is published on a pre-print server.

7. Wei Zhen¹, Elizabeth Smith, Ryhana Manji, Deborah Schron, Gregory J. Berry. **Clinical Evaluation of Three Sample-To-Answer Platforms for the Detection of SARS-CoV-2.** 24 April 2020 J. Clin. Microbiol. doi:10.1128/JCM.00783-20 Available from: <https://jcm.asm.org/content/jcm/early/2020/04/23/JCM.00783-20.full.pdf>

This is an accepted manuscript posted online. The objective was to evaluate three sample-to-answer molecular diagnostic platforms (Cepheid Xpert® Xpress SARS-CoV-2 [Xpert Xpress], Abbott ID NOW™ COVID-19 [ID NOW], GenMark 23 ePlex® SARS-CoV-2 Test [ePlex]) to determine analytical sensitivity, clinical performance, and workflow for the detection of SARS-CoV-2 in nasopharyngeal swabs from 108 symptomatic patients (all ages, all genders, 50 negative and 58 positive specimens). The study found that the Xpert Xpress had the lowest limit of detection (100% detection at 100 copies/mL) and the highest positive percent agreement (PPA) when compared to our reference standard (98.3%) (Hologic Panther Fusion® SARS-CoV-2 assay). All three assays showed 100% negative percent agreement (NPA). In the workflow analysis, the time to result for Xpert Xpress was approximately 46 minutes. What the ID NOW gained in rapid results (19 minutes), it lost in analytical and clinical performance. This study provides real-world information about the clinical and analytical performance of these assays, as well as workflow. The Hologic Panther Fusion SARS-CoV-2 assay (RT-PCR) used as the reference test in this study is approved by Health Canada for use in Canada.

Spartan Cube COVID-19 System

No test performance evidence was located for the Spartan Cube System in the included reviews, and through detailed searching of bibliographic manufacturer, online and regulatory sources. The only sources of accuracy data were in the Health Canada safety alert which indicated preliminary testing by the National Laboratory in Winnipeg showed a 35% False Negative rate in their testing.

Biomeme go-strips

No test performance evidence was located for the Spartan Cube System in the included reviews, and through detailed searching of bibliographic manufacturer, online and regulatory sources.



What formal guidelines or recommendations are available relevant to POC diagnostic tests for SARS-COV-2 (COVID-19)?

As of June 1 2020, laboratory-based RT-PCR testing is considered the reference standard for the detection of the SARS-COV-2 virus (COVID-19 infection) in Ontario.

Available guidelines

No formal guidelines specific to molecular POC diagnostics tests (or point-of-care tests for COVID-19 in general) were located.

Available recommendations or policy documents

A number of jurisdictions have policy documents that are pertinent to diagnostic testing during the pandemic, but most mention the availability of rapid, near-patient or nucleic acid amplification/POC tests and note that laboratory testing with RT-PCR nucleic acid technology is standard for diagnosis of SARS-COV-2 (COVID-19).

A scan of scientific advice and policy statements internationally returned relevant recommendations or guidance from the World Health Organization (WHO), the United States Centres for Disease Control (CDC) specific to POC tests for diagnosis of COVID-19. A number of media reports were located indicating use in several Canadian Provinces or Territories, but our brief scan did not return any use case or formal policy documents to inform this report.

Advice from the World Health Organization (WHO)

A WHO Scientific Brief posted on April 8, 2020¹⁰ with advice on the use of point-of-care tests for COVID-19. The advice provided was that *“At present, based on current evidence, WHO recommends the use of these new point-of-care immunodiagnostic tests only in research settings. They should not be used in any other setting, including for clinical decision-making, until evidence supporting use for specific indications is available”*. As of June 1 2020, there has been no update to this advice since and the website says that the WHO will consider revising as needed.

Proposed Use Statement from the United States Centres for Disease Control

CDC proposed uses for SARS-COV-2 (COVID-19) diagnostic tests are *“POC rapid tests are envisioned to supplement laboratory testing, enabling testing to be available for communities and populations that cannot readily access laboratory testing or need to quickly address emerging outbreaks. Laboratory testing remains the primary testing mechanism for the nation because of the ability to perform a high volume of tests at one time.”*¹¹ This guidance is not dated, but the CDC website where the document is posted notes the content was last updated May 11, 2020.

¹⁰ World Health Organization, Advice on the use of point-of-care immunodiagnostic tests for COVID-19: Scientific Brief <https://www.who.int/news-room/commentaries/detail/advice-on-the-use-of-point-of-care-immunodiagnostic-tests-for-covid-19>

¹¹ <https://www.cdc.gov/coronavirus/2019-ncov/downloads/OASH-COVID-19-guidance-testing-platforms.pdf>



What are the key benefits and limitations of the POC diagnostic tests for SARS-COV-2 authorized in Canada?

After this rapid review of the literature a number of benefits and limitations were observed that should be noted. These are summarized in Table 10.

Table 10: Summary of suggested key benefits and limitations of the POC diagnostic tests for SARS-COV-2 authorized in Canada

Suggested benefits	Suggested limitations
<ul style="list-style-type: none"> • Faster than the current reference standard RT-PCR tests – results to patient < 1 hour according to manufacturers’ claims • Manufacturers’ claims of accuracy equivalent to the current reference standard RT-PCR tests • Portable • May ease pressure for certain swabs or reagents in shortage situations • Simple, no expertise required to run or interpret • No laboratory required • Allows healthcare resources to focus where needed (versus on testing) • Can be used anywhere – hospital, clinic, cruise ship, remote or rural locations without access to lab, drive through clinic, workplace • In settings with the installed base systems already in use (Cube, GeneExpress, Franklin) for other indications 	<ul style="list-style-type: none"> • It is unclear if stated accuracy data from product monographs can be replicated in clinical use settings <ul style="list-style-type: none"> ○ Data used to obtain regulatory approvals may have been based on synthetic, rather than human, samples • May still be subject to materials shortages or kit order backlogs • Throughput is limited for cartridge systems and dependent on number of available slots in the system • For the tests available in Canada, single tests can be run at once which is a substantial limitation when a higher volume of tests is required <ul style="list-style-type: none"> ○ Higher volume testing would require multiple platforms to be run at once • May still be influenced by sample preparation • Associated privacy and security for apps and cloud data (Biomeme) are not addressed in current reviews • There are some suggestions that negative POC tests should be confirmed with RT-PCR tests • Real world studies to-date for Xpert Xpress appear to have tested on different types of specimens (e.g., lower respiratory, saliva)



RELEVANT MEDIA IN CANADA

- Rollout of Xpert Xpress Tests in British Columbia: <http://www.phsa.ca/about/news-stories/stories/partners-in-protection>
- Test validation/use underway in Northwest Territories: <https://cabinradio.ca/35962/news/economy/nwt-unveils-emerge-stronger-plan-for-economic-recovery/>
- Original Industry Canada Call for POC or rapid tests: COVID-19 Challenge — Point-of-care and Home Diagnostic Kit for COVID-19 (<https://www.ic.gc.ca/eic/site/101.nsf/eng/00100.html>)
- The trouble with COVID-19 swabs: The case of Ottawa's Spartan Bioscience. James Bagnall, Ottawa Citizen, Publishing date: May 5, 2020:
- <https://www.ascp.org/content/news-archive/news-detail/2020/04/24/point-of-care-are-rapid-immunodiagnostic-tests-for-covid-19-ready-for-prime-time>
- *Ontario-funded Spartan Research Project Announced May 21, 2020: <https://news.ontario.ca/opo/en/2020/05/ontario-announces-first-phase-of-research-projects-to-fight-covid-19.html>
- <https://ottawacitizen.com/news/local-news/the-trouble-with-covid-19-swabs-the-case-of-ottawas-spartan-bioscience/>
- <https://globalnews.ca/news/6919378/peterborough-law-firm-drops-spartan-bioscience-from-lawsuit-coronavirus/>
 - Related to: <https://www.newswire.ca/news-releases/miskin-law-bringing-class-action-over-false-positive-covid-19-test-results-822352085.html>
- <https://www.cbc.ca/news/canada/saskatoon/coronavirus-saskatchewan-government-1.5567922>
- (NWT use of test) <https://cabinradio.ca/36427/news/health/coronavirus/nwt-says-spartan-test-issues-are-not-significant-setback/>
- *Ontario initial contract for Spartan tests: <https://www.thestar.com/news/canada/2020/04/13/ontario-orders-close-to-one-million-spartan-bioscience-portable-covid-19-test-kits.html>
- Quebec, Ontario, Alberta, and the Federal Government negotiated contracts with Spartan for tests in April 2020 <https://www.canadianmanufacturing.com/manufacturing/health-canada-approves-spartan-biosciences-portable-covid-19-test-251049/>

APPENDIX 1: DETAILED METHODS

Approach by research questions

What molecular POC tests are currently available in Canada for diagnosis of COVID-19?

For this report, available tests are either authorized by Health Canada or formally in the application phase. We searched the Health Canada COVID-19 Diagnostic Device Authorization database¹². Health Canada provides a disclaimer on the website which states “only testing devices authorized by Health Canada can be imported or sold in Canada. Unauthorized tests may not produce accurate results, leading to potential misdiagnosis. Health Canada has confirmed that authorized COVID-19 tests are well supported by evidence indicating they will provide accurate and reliable results.” This list is updated daily and our search is current to June 1, 2020. We considered both mobile and facility-based POC PCR platforms.

The public list of Health Canada applications under consideration was also reviewed to identify point-of-care diagnostic tests that may be approved in the future¹³. This list contains all applications for diagnostic devices that are complete, ready for scientific review and permitted by the applicant to be made public. This list is updated daily and our search is current to June 1, 2020. There are disclaimers listed on the site stating that “Diagnostic devices on this list have not been authorized by Health Canada and the sale or import of these devices in Canada is prohibited under the Food and Drugs Act until an authorization or license has been issued. Being on the list of applications does not guarantee that a product will be authorized by Health Canada”, and it is noted on the website that diagnostic tests using nucleic acid technology (the current reference test being used in laboratories across Canada for COVID-19) are being prioritized for review. It is unclear if point-of-care tests using nucleic acid technology fall within this priority group.

The Health Canada COVID-19 Diagnostic Device Authorization and Applications databases provide the device name, manufacturer name and country, device type, and the date the device was approved or the application was received, along with relevant regulatory or application status indicators. In this review we selected tests identified in the Health Canada authorization or application databases as point-of-care tests using nucleic acid technology (Table 1).

A single reviewer accessed the Health Canada databases, extracted relevant test information, and checked for daily updates until June 1, 2020.

How accurate are the molecular POC tests authorized in Canada for diagnosis of individuals with current COVID-19?

To find test characteristics and existing evidence for the molecular POC diagnostic tests available in Canada, search strategies were developed and tested through an iterative process by an experienced medical information specialist in consultation with the review team. Using the OVID platform, we

¹² <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/covid-19/diagnostic-devices-authorized.html>

¹³ <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/covid-19/diagnostic-devices-applications.html>



searched Ovid MEDLINE® ALL, including Epub Ahead of Print and In-Process & Other Non-Indexed Citations, Embase Classic+Embase, and EBM Reviews Cochrane Central Register of Controlled Trials and Cochrane Database of Systematic Reviews. We also searched Web of Science. All searches were performed on May 25, 2020.

Strategies utilized a combination of controlled vocabulary (e.g., “Coronavirus Infections”, “Point-of-Care Testing”, “Nucleic Acid Amplification Techniques”) and keywords (e.g., “covid-19”, “rapid test”, “nucleic acid technology”). We searched the Health Canada COVID-19 Diagnostic Device Authorization database and the related database of applications received to identify tests authorized (or in the application pipeline) in Canada and added relevant names to the search strategy. Vocabulary and syntax were adjusted across databases. Results were limited to the publication years 2019 to 2020 or records added to the databases since November 1, 2019.

Each database was searched using an individualized search strategy; Specific details regarding the strategies appear in Appendix 1.

We also search the websites of test manufacturers, regulatory and public health agencies, online diagnostic test databases specific to COVID-19, and media reports related to approvals of point-of-care tests. We accessed the following websites on 26/03/2020 and extracted the information or data relevant to the molecular POC tests available (or pending) in Canada, in particular, to supplement data reported in rapid or systematic reviews (if necessary):

- <https://www.360dx.com/coronavirus-test-tracker-launched-covid-19-tests>
- <https://www.bioworld.com/COVID19diagnostics>
- <https://www.finddx.org/covid-19-backup/>
- <https://www.finddx.org/covid-19/pipeline/>
- <https://www.fda.gov/medical-devices/emergency-situations-medical-devices/emergency-useauthorizations>
- [Check for website Ahmed gave us](#)
- [EPPI evidence map websites](#)

We searched known evidence repositories for rapid or systematic reviews published or in progress, and the websites of health technology assessment organizations (utilizing the CADTH Grey Matters checklist). Lastly, we conducted searches in general purpose databases (e.g. Google) on June 1, 2020 and citation tracking was conducted to identify citing records from included rapid and systematic reviews. We performed reference management in the Mendeley reference management software.

A single reviewer screened the search results to identify relevant rapid or systematic reviews, test characteristics and diagnostic test accuracy statistics as outlined in Appendix D (all available data were collected and charted). Test characteristics of interest were charted including platform type, time to result, materials and system components required. Where there were identified gaps in test characteristics, evidence, or other essential data, media reports were reviewed to locate colloquial reports of POC test use, uptake and efficacy.



Where possible, evidence was flagged to note whether data were collected for accuracy in an optimal testing environment, or as part of monitored real-world clinical diagnostic assessment.

All evidence types are reported in the results and are appraised by a single reviewer where possible.

What recommendations and guidelines are there for the use of point-of-care diagnostic tests to identify individuals with current COVID-19?

A scan of jurisdictional websites internationally using CADTH Grey matters¹⁴. Details in Appendix 3.

Formal guidelines were going to be assessed by a single reviewer with the AGREE tool (Note: none were located, no assessments completed)

What are the key benefits and limitations of the point-of-care diagnostic tests authorized in Canada?

A single reviewer collected and charted descriptive text relevant to the benefits and limitations of the molecular POC tests available in Canada. Benefits and harms were summarized by test and more broadly by test platform. Potential contextual or implementation issues, if reported, were also captured.

¹⁴ <https://www.cadth.ca/resources/finding-evidence/grey-matters>

APPENDIX 2: SEARCH STRATEGY

Covid-19 – Rapid/POC Testing

Final Strategies

2020 May 25

Ovid Multifile

Database: Embase Classic+Embase <1947 to 2020 May 22>, Ovid MEDLINE(R) ALL <1946 to May 22, 2020>, EBM Reviews - Cochrane Central Register of Controlled Trials <April 2020>, EBM Reviews - Cochrane Database of Systematic Reviews <2005 to May 21, 2020>

Search Strategy:

-
- 1 Coronavirus/ (9201)
 - 2 Coronavirus Infections/ (11078)
 - 3 (COVID-19 or COVID19).mp. (26403)
 - 4 ((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)).mp. (2865)
 - 5 Wuhan virus*.mp. (12)
 - 6 2019-nCoV.mp. (1427)
 - 7 (nCoV or n-CoV).mp. (1504)
 - 8 HCoV-19.mp. (15)
 - 9 (SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2).mp. (8252)
 - 10 (novel coronavirus* or novel corona virus*).mp. (4835)
 - 11 ((coronavirus* or corona virus*) adj2 "2019").mp. (13114)
 - 12 ((coronavirus* or corona virus*) adj2 "19").mp. (1354)
 - 13 (coronavirus 2 or corona virus 2).mp. (7495)
 - 14 (coronavirus* or corona virus*).ti. (19347)
 - 15 or/1-14 (50702)
 - 16 Coronavirus Infections/di [diagnosis] (1868)
 - 17 Diagnosis/ (1519452)
 - 18 "Diagnostic Techniques and Procedures"/ (90342)
 - 19 Molecular Diagnostic Techniques/ (25713)
 - 20 (diagnos* adj3 (assay? or detect* or kit or kits or procedur* or technic? or technique? or technolog* or test*)).tw,kf. (441054)
 - 21 exp Nucleic Acid Amplification Techniques/ (466148)
 - 22 ((DNA or RNA or nucleic acid? or gene or genes or genetic*) adj3 (amplif* or assay? or detect* or procedur* or kit or kits or technic? or technique? or technolog*)).tw,kf. (536078)
 - 23 exp Reagent Kits, Diagnostic/ (58110)
 - 24 ((COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2) adj3 (assay? or test*)).tw,kf. (963)
 - 25 ((coronavirus* or corona virus*) adj2 "2019" adj3 (assay? or test*)).tw,kf. (25)
 - 26 ((coronavirus* or corona virus*) adj2 "19" adj3 (assay? or test*)).tw,kf. (5)
 - 27 (("coronavirus 2" or "corona virus 2") adj3 (assay? or test*)).tw,kf. (0)
 - 28 ((coronavirus* or corona virus*) adj3 (assay? or test*)).ti. (115)
 - 29 (test* kit? or test* device?).tw,kf. (16901)

RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)



30 Point-of-Care Systems/ (15125)
31 Point-of-Care Testing/ (15086)
32 ((POC or point-of-care or bedside* or bed side* or portabl* or portabilit* or rapid*) adj3 (assay? or detect*
or kit or kits or procedur* or test* or technolog*)).tw,kf. (177297)
33 exp "Sensitivity and Specificity"/ (953998)
34 "sensitivity and specificity".tw,kf. (309356)
35 or/16-34 [DIAGNOSTIC/RAPID TESTING] (3976575)
36 (biomeme\$2 adj3 corona*).mp. (0)
37 (biomeme\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or
SARS-CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
38 (biomeme\$2 adj3 "go strip*").mp. (0)
39 (spartan\$2 adj3 corona*).mp. (3)
40 (spartan\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-
CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
41 (spartan\$2 adj3 cube?).mp. (6)
42 Xpert Xpress*.mp. (53)
43 or/36-42 [TESTS OF INTEREST] (62)
44 15 and 35 [COVID-19 - DIAGNOSTIC/RAPID TESTS] (6167)
45 43 or 44 [COVID-19 - DIAGNOSTIC/RAPID TESTS, INCL TESTS OF INTEREST] (6213)
46 exp Animals/ not Humans/ (17176673)
47 45 not 46 [ANIMAL-ONLY REMOVED] (3551)
48 limit 47 to yr="2019-current" (1784)
49 (201911* or 201912* or 2020*).dt. (769375)
50 47 and 49 (1518)
51 48 or 50 (1789)
52 51 use medall [MEDLINE RECORDS] (1568)
53 Coronavirinae/ (3816)
54 Coronavirus infection/ (12047)
55 (COVID-19 or COVID19).mp. (26403)
56 ((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)).mp. (2865)
57 Wuhan virus*.mp. (12)
58 2019-nCoV.mp. (1427)
59 (nCoV or n-CoV).mp. (1504)
60 HCoV-19.mp. (15)
61 (SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2).mp. (8252)
62 (novel coronavirus* or novel corona virus*).mp. (4835)
63 ((coronavirus* or corona virus*) adj2 "2019").mp. (13114)
64 ((coronavirus* or corona virus*) adj2 "19").mp. (1354)
65 (coronavirus 2 or corona virus 2).mp. (7495)
66 (coronavirus* or corona virus*).ti. (19347)
67 or/53-66 (48543)
68 Coronavirus infection/di [Diagnosis] (1986)
69 diagnosis/ (1519452)
70 diagnostic procedure/ (90067)
71 molecular diagnosis/ (18783)



- 72 (diagnos* adj3 (assay? or detect* or kit or kits or procedur* or technic? or technique? or technolog* or test*)).tw,kw. (451268)
- 73 nucleic acid amplification/ (9192)
- 74 ((DNA or RNA or nucleic acid? or gene or genes or genetic*) adj3 (amplif* or assay? or detect* or procedur* or kit or kits or technic? or technique? or technolog*)).tw,kw. (539348)
- 75 diagnostic kit/ (6104)
- 76 viral disease test kit/ (120)
- 77 influenza virus test kit/ (17)
- 78 sars coronavirus test kit/ (13)
- 79 ((COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2) adj3 (assay? or test*)).tw,kw. (974)
- 80 ((coronavirus* or corona virus*) adj2 "2019" adj3 (assay? or test*)).tw,kw. (25)
- 81 ((coronavirus* or corona virus*) adj2 "19" adj3 (assay? or test*)).tw,kw. (5)
- 82 (("coronavirus 2" or "corona virus 2") adj3 (assay? or test*)).tw,kw. (0)
- 83 ((coronavirus* or corona virus*) adj3 (assay? or test*)).ti. (115)
- 84 (test* kit? or test* device?).tw,kw. (17111)
- 85 point of care system/ (15164)
- 86 point of care testing/ (15086)
- 87 ((POC or point-of-care or bedside* or bed side* or portabl* or portabilit* or rapid*) adj3 (assay? or detect* or kit or kits or procedur* or test* or technolog*)).tw,kw. (178107)
- 88 virus detection/ (38356)
- 89 exp "sensitivity and specificity"/ (953998)
- 90 "sensitivity and specificity".tw,kw. (312531)
- 91 or/68-90 [DIAGNOSTIC/RAPID TESTING] (3617732)
- 92 (biomeme\$2 adj3 corona*).mp. (0)
- 93 (biomeme\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
- 94 (biomeme\$2 adj3 "go strip").mp. (0)
- 95 (spartan\$2 adj3 corona*).mp. (3)
- 96 (spartan\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
- 97 (spartan\$2 adj3 cube?).mp. (6)
- 98 Xpert Xpress*.mp. (53)
- 99 or/92-98 [TESTS OF INTEREST] (62)
- 100 67 and 91 [COVID-19 - DIAGNOSTIC/RAPID TESTS] (5564)
- 101 99 or 100 [COVID-19 - DIAGNOSTIC/RAPID TESTS, INCL TESTS OF INTEREST] (5610)
- 102 exp animal/ or exp animal experimentation/ or exp animal model/ or exp animal experiment/ or nonhuman/ or exp vertebrate/ (53267759)
- 103 exp human/ or exp human experimentation/ or exp human experiment/ (41306588)
- 104 102 not 103 (11962909)
- 105 101 not 104 [ANIMAL-ONLY REMOVED] (4312)
- 106 limit 105 to yr="2019-current" (2833)
- 107 (201911* or 201912* or 2020*).dc. (1225909)
- 108 105 and 107 (1216)
- 109 106 or 108 (2840)

RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)



- 110 109 use emczd [EMBASE RECORDS] (1278)
- 111 Coronavirus/ (9201)
- 112 Coronavirus Infections/ (11078)
- 113 (COVID-19 or COVID19).mp. (26403)
- 114 ((coronavirus* or corona virus*) and (hubei or wuhan or beijing or shanghai)).mp. (2865)
- 115 Wuhan virus*.mp. (12)
- 116 2019-nCoV.mp. (1427)
- 117 (nCoV or n-CoV).mp. (1504)
- 118 HCoV-19.mp. (15)
- 119 (SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2).mp. (8252)
- 120 (novel coronavirus* or novel corona virus*).mp. (4835)
- 121 ((coronavirus* or corona virus*) adj2 "2019").mp. (13114)
- 122 ((coronavirus* or corona virus*) adj2 "19").mp. (1354)
- 123 (coronavirus 2 or corona virus 2).mp. (7495)
- 124 (coronavirus* or corona virus*).ti. (19347)
- 125 or/111-124 (50702)
- 126 Coronavirus Infections/di [diagnosis] (1868)
- 127 Diagnosis/ (1519452)
- 128 "Diagnostic Techniques and Procedures"/ (90342)
- 129 Molecular Diagnostic Techniques/ (25713)
- 130 (diagnos* adj3 (assay? or detect* or kit or kits or procedur* or technic? or technique? or technolog* or test*)).ti,ab,kw. (450492)
- 131 exp Nucleic Acid Amplification Techniques/ (466148)
- 132 ((DNA or RNA or nucleic acid? or gene or genes or genetic*) adj3 (amplif* or assay? or detect* or procedur* or kit or kits or technic? or technique? or technolog*)).ti,ab,kw. (539130)
- 133 exp Reagent Kits, Diagnostic/ (58110)
- 134 ((COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2) adj3 (assay? or test*)).ti,ab,kw. (972)
- 135 ((coronavirus* or corona virus*) adj2 "2019" adj3 (assay? or test*)).ti,ab,kw. (25)
- 136 ((coronavirus* or corona virus*) adj2 "19" adj3 (assay? or test*)).ti,ab,kw. (5)
- 137 (("coronavirus 2" or "corona virus 2") adj3 (assay? or test*)).ti,ab,kw. (0)
- 138 ((coronavirus* or corona virus*) adj3 (assay? or test*)).ti. (115)
- 139 (test* kit? or test* device?).ti,ab,kw. (17080)
- 140 Point-of-Care Systems/ (15125)
- 141 Point-of-Care Testing/ (15086)
- 142 ((POC or point-of-care or bedside* or bed side* or portabl* or portabilit* or rapid*) adj3 (assay? or detect* or kit or kits or procedur* or test* or technolog*)).ti,ab,kw. (177917)
- 143 exp "Sensitivity and Specificity"/ (953998)
- 144 "sensitivity and specificity".ti,ab,kw. (312269)
- 145 or/126-144 [DIAGNOSTIC/RAPID TESTING] (3988025)
- 146 (biomeme\$2 adj3 corona*).mp. (0)
- 147 (biomeme\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
- 148 (biomeme\$2 adj3 "go strip*").mp. (0)
- 149 (spartan\$2 adj3 corona*).mp. (3)

RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)



- 150 (spartan\$2 adj3 (COVID-19 or COVID19 or 2019-nCoV or nCoV or n-CoV or HCoV-19 or SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2)).mp. (0)
- 151 (spartan\$2 adj3 cube?).mp. (6)
- 152 Xpert Xpress*.mp. (53)
- 153 or/146-152 [TESTS OF INTEREST] (62)
- 154 125 and 145 [COVID-19 - DIAGNOSTIC/RAPID TESTS] (6175)
- 155 153 or 154 [COVID-19 - DIAGNOSTIC/RAPID TESTS, INCL TESTS OF INTEREST] (6221)
- 156 limit 155 to yr="2019-current" (2926)
- 157 (201911* or 201912* or 2020*).up. (32858195)
- 158 155 and 157 (4732)
- 159 156 or 158 (4792)
- 160 159 use coch,cctr [COCHRANE RECORDS] (33)
- 161 52 or 110 or 160 [ALL DATABASES] (2879)
- 162 remove duplicates from 161 (1967) [TOTAL UNIQUE RECORDS]
- 163 162 use medall [MEDLINE UNIQUE RECORDS] (1528)
- 164 162 use emczd [EMBASE UNIQUE RECORDS] (406)
- 165 162 use coch [COCHRANE DSR UNIQUE RECORDS] (1)
- 166 162 use cctr [CENTRAL DSR UNIQUE RECORDS] (32)

Web of Science

- # [293](#) #18 OR #17
- 20 Refined by: PUBLICATION YEARS: (2020 OR 2019)
Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [864](#) #18 OR #17
- 19 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [813](#) #12 AND #4
- 18 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [51](#) #16 OR #15 OR #14 OR #13
- 17 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # 0 TOPIC: (spartan* NEAR/3 (cube or cubes))
- 16 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # 0 TOPIC: (spartan*) AND TOPIC: ("COVID-19" or COVID19 or "2019-nCoV" or nCoV or "n-CoV" or "HCoV-19" or "SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2)
- 15 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [14](#) TOPIC: (spartan* NEAR/3 corona*)
- 14 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [37](#) TOPIC: (biomeme*)
- 13 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [755,738](#) #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5
- 12 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years

RAPID and POINT-OF-CARE DIAGNOSTIC TESTS FOR SARS-COV-2 (COVID-19)

- # [75,224](#) TOPIC: ("sensitivity and specificity")
11 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [130,948](#) TOPIC: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 assay*) OR TOPIC: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 detect*) OR TITLE: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 kit) OR TITLE: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 kits) OR TOPIC: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 procedur*) OR TOPIC: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 test*) OR TOPIC: ((POC or "point-of-care" or bedside* or "bed side" or "bed sides" or portabl* or portabilit* or rapid*) NEAR/3 technolog*)
10 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [11,711](#) TOPIC: ("test kit" or "test kits" or "testing kit" or "testing kits") OR TOPIC: ("test device" or "test devices" or "testing device" or "testing devices")
9 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [60](#) TOPIC: (("coronavirus 2" or "corona virus 2") NEAR/3 assay*) OR TOPIC: (("coronavirus 2" or "corona virus 2") NEAR/3 test*) OR TITLE: ((coronavirus or "corona virus") NEAR/3 assay*) OR TITLE: ((coronavirus or "corona virus") NEAR/3 test*)
8 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [146](#) TOPIC: (("COVID-19" or COVID19 or "2019-nCoV" or nCoV or "n-CoV" or "HCoV-19" or "SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2) NEAR/3 assay*) OR TOPIC: (("COVID-19" or COVID19 or "2019-nCoV" or nCoV or "n-CoV" or "HCoV-19" or "SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or SARSCoV2) NEAR/3 test*)
7 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [382,588](#) TOPIC: (DNA NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: (RNA NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: ("nucleic acid" NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: ("nucleic acids" NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: (gene NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: (genes NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*)) OR TOPIC: (genetic* NEAR/3 (amplif* or assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*))
6 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [212,438](#) TOPIC: (diagnos* NEAR/3 (assay or assays or detect* or kit or kits or procedur* or technic or technics or technique* or technolog* or test*))
5 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [11,694](#) #3 OR #2 OR #1
4 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years

- # [7,852](#) TITLE: (coronavirus*) OR TITLE: (corona W/0 virus*)
3 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [1,556](#) TOPIC: (coronavirus* NEAR/2 "2019") OR TOPIC: ((corona W/0
2 virus*) NEAR/2 "2019") OR TOPIC: (coronavirus* NEAR/2 "19") OR TOPIC: ((corona W/0
virus*) NEAR/2 "19") OR TOPIC: (novel W/0 coronavirus*) OR TOPIC: ("novel corona" W/0
virus*) OR TOPIC: ("coronavirus 2" or "corona virus 2")
Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years
- # [4,785](#) TOPIC: ("COVID-19" or COVID19) OR TOPIC: (coronavirus* and (hubei or wuhan or beijing or
1 shanghai)) OR TOPIC: (Wuhan W/0 virus*) OR TOPIC: ("2019-nCoV") OR TOPIC: (nCoV or "n-
CoV") OR TOPIC: ("HCoV-19") OR TOPIC: ("SARS-CoV-2" or "SARS-CoV2" or "SARSCoV-2" or
SARSCoV2)
Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years

APPENDIX 3: UNPUBLISHED LITERATURE SOURCES

- Canada – CADTH, HQO, INESSS
- International: INAHTA, WHO
- Australia: MSAC, JBI (I can search for you if desired), Monash CCE, COAG Health Council
- Belgium: KCE
- France: HAS
- Germany: DIMDI
- Ireland: Health Information and Quality Authority
- Norway: Norwegian Institute of Public Health
- Sweden: SBU
- UK: All (some overlap, some discontinued)
- US: All (AHRQ not as active as previously)

(All searched May 26)

Centers for Disease Control & Prevention

<https://www.cdc.gov/coronavirus/2019-ncov/index.html>
2020 May 26 – nothing found

European Centre for Disease Prevention and Control
<https://www.ecdc.europa.eu/en/covid-19-pandemic>
2020 May 26 – results found

LitCovid

<https://www.ncbi.nlm.nih.gov/research/coronavirus/>
2020 May 26

Boimeme*, Spartan, xpert* - results found (nothing unique from bibliographic search)
"rapid test" or "rapid tests" or "rapid testing" – results found

MedRxiv – Preprints

<https://connect.medrxiv.org/relate/content/181>
2020 May 26 – Advanced searching – Biomeme, spartan, xpert

Abstract & title: 19 Results

for abstract or title "covid 19 xpert" (match all words)

No Results

for abstract or title "covid 19 biomeme" (match all words)

2 Results

for abstract or title "covid 19 spartan" (match all words)

18 Results

for full text or abstract or title "xpert xpress" (match whole phrase)

No Results

for full text or abstract or title "spartan cube" (match whole phrase)

No Results

for full text or abstract or title "spartan cube" (match whole all)

No Results

for full text or abstract or title "biomeme go strip" (match whole all)

No Results

for full text or abstract or title "biomeme go strips" (match whole all)

No Results

for full text or abstract or title "biomeme covid-19" (match whole all)

No Results

for full text or abstract or title "biomeme coronavirus" (match whole all)

COVID-19 Evidence Alerts from McMaster PLUS™

<https://plus.mcmaster.ca/COVID-19/Home>

2020 May 26 – Results found (nothing unique)

CADTH

<https://covid.cadth.ca>

2020 May 26 – browsed Covid-related pubs, including work in progress; results found

Canadian Foundation for Healthcare Improvement

<https://www.cfhi-fcass.ca/WhatWeDo/covid-19-response>

ECRI

<https://www.ecri.org/coronavirus-covid-19-outbreak-preparedness-center/>

(Coronavirus resources free during pandemic)

2020 May 26 – Results found

2020 May 26 – Nothing relevant

Centre for Evidence-Based Medicine (CEBM)

<https://www.cebm.net/covid-19/>

2020 May 26 – Results found

Public Health England

<https://www.gov.uk/coronavirus>

2020 May 26 - Results found

COVID-19 content from HIS journals (Healthcare Infection Society)

<https://www.his.org.uk/journals/journal-of-hospital-infection/covid-19-content-from-his-journals/>

2020 May 26 – Browsed content – Results found

APPENDIX 4: TEST PERFORMANCE DEFINITIONS AND STATISTICS OVERVIEW

		Condition		
		+	-	
Rapid test result	+	TP	FP	TP+FP
	-	FN	TN	FN+TN
		P=TP+FN N=FP+TN		

Condition positive (P) = number of condition positive cases

Condition negative (N) = number of condition negative cases

True positive (TP) = number of rapid test positive when condition positive

True negative (TN) = number of rapid test negative when condition negative

False positive (FP) = number of rapid test positive when condition negative

False negative (FN) = number of rapid test negative when condition positive

Accuracy = (true positive + true negative) / (condition positive + condition negative)

$$= (TP+TN) / (P+N) = (TP+TN) / (TP+TN+FP+FN)$$

Sensitivity = (true positive) / (condition positive) = TP/P

Specificity = (true negative) / (condition negative) = TN/N

Positive predictive Value (PPV) = (true positive) / (prediction positive) = TP / (TP+FP)

Negative predictive Value (NPV) = (true negative) / (prediction negative) = TN / (TN+FN)

Positive likelihood ratio (LR+) = (true positive rate) / (false positive rate) = (TP/P) / (FP/N)

Negative likelihood ratio (LR-) = (false negative rate) / (true negative rate) = (FN/P) / (TN/N)