Barriers to COVID-19 testing and testing hesitancy: A rapid scoping review

A rapid review updated as of January 8, 2021

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Abbreviations

BMJ   British Medical Journal

EXECUTIVE SUMMARY

Purpose

Testing is a foundational component of a comprehensive strategy aimed at mitigating the spread of COVID-19. However, emerging evidence suggests that there are barriers or hesitancy to the uptake of testing within populations and these barriers exist across multiple dimensions. This rapid scoping review was conducted by members of the SPOR Evidence Alliance in response to a request from Health Canada's COVID-19 Testing and Screening Expert Advisory Panel. This report will outline the review's objectives and methods, summarize the findings from the evidence identified and how it meets the review objectives, and discuss implications of the findings. Summary tables will be provided to aid in communicating the findings.

Objectives

To summarize the evidence on barriers or hesitation to COVID-19 testing. Specifically, interest is on identifying strategies that have been used to address known barriers and reduce hesitancy for COVID-19 testing.

Approach

A comprehensive literature search was conducted on **January 8, 2021** with the purpose of retrieving studies published from January 1, 2019 until the search date. The search was designed and executed by a library scientist in MEDLINE, Scopus, medRxiv, and the Cochrane Database of Systematic Reviews. A targeted grey literature search (OECD; WHO; CDC; ECDC; CADTH; National Public Health websites (e.g., Australia, New Zealand, UK, and others); Coronavirus resource centers (i.e., John Hopkins, COVID-END, CANCOVID, CORD19) and Google was also conducted to identify relevant media, technical and white paper reports related to the review area. Inclusion criteria was not limited to peer-reviewed publications and included letters of correspondence, commentaries and perspectives. Based on the rapid review approach, studies were screened independently for inclusion and data was extracted independently and reviewed by another team member for completeness.

Findings

We found 1294 unique published articles and 97 grey literature sources. After screening, 61 sources were included for data extraction (n=30 published articles, n=31 grey literature sources). We organized findings into a framework for health care seeking behaviour (planning, process and outcomes). Most sources described barriers to COVID-19 testing and frequently, how intersections in the social determinants of health created disparities and exacerbated barriers to testing. Several articles focused on the COVID-19 'infodemic' as a barrier. Additional barriers included: 1) social stigma and the consequences of a COVID-19 positive test; 2) access to testing; 3) acceptability of testing; 4) cost of testing; and 5) access to follow-up supports for those who test positive. Most articles also identified at least one strategy used to mitigate testing barriers or testing hesitancy; the most common strategies were related to addressing process barriers. Details on implementation and outcomes of suggested strategies were scarce. The use of implementation science frameworks may be helpful in the design, refinement and evaluation of COVID-19 testing strategies.

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Implications

The development of approaches for COVID-19 testing should consider multiple, intersecting factors. While there are strategies in development or underway to address barriers to COVID-19 testing and/or testing hesitancy, the impact or effectiveness of these strategies is largely unknown.

SUMMARY OF RAPID REVIEW

Rationale for review

Testing is a foundational component of any COVID-19 containment strategy. However, emerging evidence suggests that COVID-19 testing barriers and hesitancy for COVID-19 testing may affect uptake or participation; often these are multiple and intersecting factors that may vary across population groups. To this end, Health Canada's Testing and Screening Expert Advisory Panel commissioned this rapid review in January 2021 to explore the available evidence in this area. The aim of this review was to identify the evidence for COVID-19 testing barriers and testing hesitancy, as well as to identify evidence for strategies used to mitigate these factors and any frameworks for implementing strategies.

Review question(s)

The primary review question is what is the evidence on barriers to COVID-19 testing? A secondary question is what evidence exists for effective communication or testing strategies to aid in reducing barriers to COVID-19 testing or addressing COVID-19 testing hesitancy. The population, concept and context for this rapid scoping review is: 1) population – persons who are eligible to be tested for COVID-19; 2) concept – COVID-19 testing; and 3) context – testing in any setting.

RAPID REVIEW METHOD

Our approach was informed by the steps outlined in Tricco and Straus[i] and Peters, Godfrey and colleagues.[ii]

Search strategy

An experienced information specialist designed comprehensive search strategies in MEDLINE (Ovid MEDLINE All), Scopus (Elsevier), medRxiv, and the Cochrane Database of Systematic Reviews (CDSR) (Cochrane Library, Wiley). All database searches were executed on January 8, 2021, and results were limited to January 2019-current. The COVID-19 portion of the search was adapted for MEDLINE from the expert COVID-19 search strategy developed by expert searchers at Ovid for Ovid MEDLINE All[1] and subsequently translated to Scopus and CDSR. The medRxiv search was a simplified version of the other database searches due to limitations in database search functionality. Results from the database searches were exported to

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[i] Tricco AC, Straus SE. Rapid review methods more challenging during COVID-19: commentary with a focus on 8 knowledge synthesis steps. Journal of Clinical Epidemiology 2020, 126: 177-183.

[ii] Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil, H. Chapter 11: Scoping Reviews (2020 version). In: Aromataris E, Munn Z (Editors). *JBI Manual for Evidence Synthesis*, JBI, 2020. Available from https://synthesismanual.jbi.global. https://doi.org/10.46658/JBIMES-20-12

Covidence for de-duplication and screening. Grey literature was retrieved using a combination of targeted website searching and a series of Google queries. The full details of all searches are included in Appendix A.

Screening & Data extraction
Covidence was used to review the titles and abstracts for inclusion/exclusion based on the criteria described in Appendix B. Because of the rapid turnaround of this request, abstracts were reviewed by single reviewers. Next, articles were screened by two reviewers independently using the same inclusion/exclusion criteria found in the Appendix B. Conflicts were resolved by team consensus. Data extraction (abstracted by single reviewers and checked by another team member) was completed using the following end-points: (1) country; (2) purpose or aim; (3) study design (if applicable); (4) subgroups and populations of interest; (5) barriers to testing identified; (6) strategies to address barriers or testing hesitancy – either implemented or suggested; and (6) lessons learned, recommendations and outcomes of strategies implemented (if available).

FINDINGS

Overview of included studies
A total of 1294 unique published articles were identified from the database search. Another 97 grey literature sources were identified. After screening, 61 sources were included for data extraction (n=30 academic publications; n=31 grey literature sources) (see PRISMA – Appendix C). It should be noted that not all end-points were described/available for each extracted article. Upon secondary review of all extracted data, we removed one source that reported on COVID-19 vaccine testing hesitancy (not diagnostic testing hesitancy) and another source that was a merged reference (already represented within our findings) but improperly indexed. The removal of these articles had no bearing on our findings.

Findings are described and categorized in the following two sections: 1) barriers or factors that influence COVID-19 testing and/or testing hesitancy; and 2) strategies to mitigate COVID-19 testing barriers or hesitancy. A full annex with relevant data points and references for sources can be found in Appendix D.

Organizing Framework
Findings were organized using an adaptation of the *three delays model*[2] (figure 1). This model proposes that delays in health seeking behavior (for our purposes, COVID-19 testing) may be due to: 1) deciding to seek appropriate medical help for symptoms; 2) reaching an appropriate testing facility and getting tested; and 3) receiving adequate care and other actions taken when an outcome is determined. We adapted the model for our findings to outline barriers that influence seeking a COVID-19 test, including knowledge about access, symptoms, etc. (planning), the characteristics of the COVID-19 test itself (process) and consequence of the

COVID-19 testing results (outcomes) (table 1). Strategies to address these barriers were organized in the same manner.
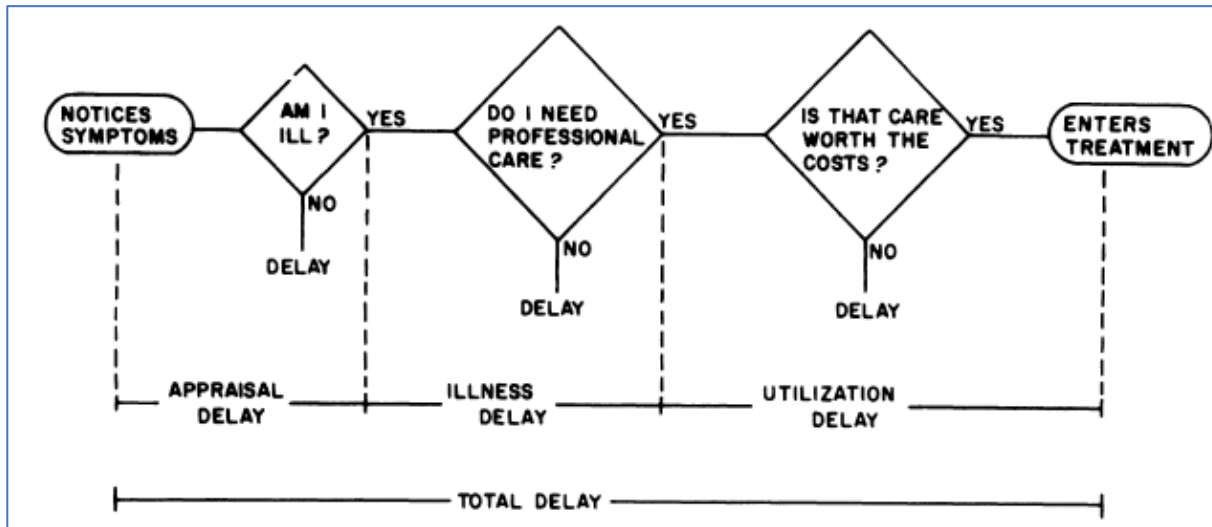
Figure 1. *Three delays model*

Planning	Process	Outcomes
• Testing criteria (changes in testing criteria) • Misinformation • Referral for testing • Health literacy, • Health status • Personal costs (cost of testing, going to test) • Trust in health system	• Availability of testing sites • Accessibility of testing sites • Waiting times (availability of human resources, testing supplies) • Time delay in results (including laboratory capacity) • Test properties (including pain, length of test) • Test accuracy/sensitivity (false positives) • Safety of test site (chance of infection) • Trust in the process	• Personal cost (cost of isolation, positive test results: work, cost related to care etc.) • Consequences on employment • Health consequences • Stigma

Table 1. Examples of barriers to COVID-19 testing organized by type of delay

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SECTION 1. Barriers to COVID-19 testing and/or factors that influence COVID-19 testing hesitancy

Planning barriers

Cost of testing

Cost was identified as a barrier to seeking COVID-19 testing by varied sources[3–10], that included media articles[6,7,9]; a hypothetical scenarios experiment (n=890 observations captured)[10], perspective and policy papers[3,4], a prevalence study[5], and a cross-sectional survey (n=979 participants). Lack of health insurance to cover the cost of testing was frequently cited as a barrier[3,4,6,11].

- Fernando (2020) described the prohibitive cost of testing and the cost of missing work as reasons why people did not seek testing, framing COVID-19 testing accessibility as a clear equity issue. Similarly, transportation costs associated with traveling to and from testing sites was also cited as a barrier to testing[12].

- Thunström (2020) found that personal financial situation did not affect an individual's willingness to take a free test. This suggests that the decision to not seek testing is determined more by prohibitive costs of testing rather than an individual's attitude about testing[10].

Health literacy

Health literacy was the most cited barrier to COVID-19 testing. Nine sources identified health literacy issues as a barrier[3,11–18]. These health literacy barriers refer to limited knowledge of testing, misinformation regarding testing and COVID-19, and poor recognition of symptoms.

According to the COVID-19 Unified Command report (2020), low health literacy is associated with risky health behaviours, lower likelihood of seeking treatments and care, and reduced compliance with health-related instructions/guidance, including seeking COVID-19 testing. Misinformation and mixed facts regarding protective measures, transmission, and testing protocols was cited by three sources as a reason people do not seek COVID-19 testing[14,17,18].

In a longitudinal survey of Australian citizens (n=1369 participants), Bonner (2020) found that not knowing when to get tested was a barrier to testing (n=98 respondents or 7.1% of the study participants).

Different social groups may be prone to low health literacy preventing testing for various reasons. Undocumented immigrants and foreign workers are often disconnected from the healthcare system and social services, resulting in this group not seeking testing or care when needed[11,15].

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Fear of deportation and language barriers also contributed to these groups not seeking COVID-19 tests was identified. A published perspective suggested that a lack of targeted information and limited access to social services were identified health literacy barriers to testing experienced by sex workers in Africa[3].

Trust in the health system

Low trust in the health system was cited as a barrier to seeking COVID-19 testing in six sources. Four of these sources were editorials or text and opinion pieces[19–22], one was a news articles[23], and one was a grey literature report[9]. Due to the nature of the sources, there is limited validated evidence that trust in the health system impacts the likelihood that an individual will or will not seek COVID-19 testing. Regardless, it is frequently described as a perceived barrier in the literature.

Trust in the health system combined with minority status results in decreased access to testing and overall disparities in access to COVID-19 care. Histories of systemic abuse and exploitation of minorities by the medical and research communities, such as the Tuskegee syphilis experiment, were cited by two sources[19,22] as a cause of distrust in the healthcare system.

Some COVID-19 procedures may not be effective when distrust of the healthcare system is present in the target population. In this media article, Ibarra (2020) reports on a telephone contact tracing program in which a test is offered to individuals on the call; anecdotal feedback suggests some people receiving the call may think it is fraudulent and lack trust in the process. Maxmen (2020) describes how misinformation regarding COVID-19 also contributes to community mistrust.

Health status

There were two sources that identified health status as a barrier to testing[24,25]. Both sources describe the challenges of encouraging individuals who feel healthy to take COVID-19 tests.

- Levitt (2020) indicates that people with self-perceived good health status who refuse to get tested (e.g., asymptomatic for COVID-19) is one of the greatest barriers to controlling COVID-19. This media article describes the societal costs of healthy individuals not getting tested and suggests ways to incentivize regular testing in this group, who may be reluctant to visit clinics for testing (fear of COVID-19 infection) or repeatedly experience negative tests.

- In this cross-sectional survey Kernberg (2020) determined that among individuals who declined COVID-19 testing (n=16 of n=289 eligible participants), the second most popular reason was confidence that they were not infected (n=2/16).

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Process barriers

Availability of testing sites

Fourteen sources described the availability of testing sites as a process barrier for testing, both in general[11,26–28] and more specifically in certain communities[5,12,18,21,29,30]. Transportation barriers play a role in accessing COVID-19 testing sites. Among adults surveyed in the United States (cross-sectional, n=3058 participants), 15% reported that they were not aware of where to get tested or did not have means to travel to get tested[18]. In New York City, clusters that were identified with lower rates of testing and positivity tended to have higher incomes and educational attainment and a larger white population, while clusters with higher rates of testing and positivity tended to have more individuals with no health insurance and a larger black population where rental income is greater or equal to 50 percent of income[29]; the authors further surmise from their findings that higher test rates and proportions testing positively suggest that testing occurred in more severe cases of COVID-19. Another pattern emerged where low testing and high proportions of testing positive, which was suggestive of both inadequate testing and more severe illness; this pattern emerged among non-citizens and with high use of public transportation. Two media sources and one study in Massachusetts also suggest disproportionate testing. The first media article reported that testing sites in Texas are in communities with "whiter" populations[21]. Similarly, in another news article, Konkol (2020) described that testing is limited in Black communities in Chicago due to inequitable distribution of resources[30]. In Dryden-Peterson and colleagues[5] prevalence study, they found that testing resources were allocated disproportionately where those communities experiencing vulnerabilities – socioeconomic, minority populations and language barriers, had the greatest gaps in testing relative to epidemic intensity.

Maxmen responded to readers' questions about testing availability and explained that access to testing is further exacerbated in rural and remote communities. He reported that testing is not always available in every community, and some people may not have access to a car or may be uncomfortable accessing testing in another community[22].

Rader et al. 2020 conducted a cross sectional analysis of 6,236 Covid-19 testing sites across the United States to determine distances of access between communities. Results indicated that distance to testing sites increases in rural areas, which resulted in a reduction of testing access[31]. Rader and colleagues conclude that geographic barriers to testing exacerbate health inequalities in rural counties. They recommend that geographic accessibility be considered when planning the location of testing sites.

A news article from Alberta, Canada reports on a pilot project underway focused on delivering supplies with drones and found that COVID-19 test kits were able to survive and return to the lab with no change or degradation to the sample[32].

In remote communities in Australia, testing availability and timeliness were identified as barriers to testing[33]. Adenjii (2020) undertook a review to assess the available means to increase wide-spread testing for COVID-19 and described that the current testing process in South Africa by healthcare professionals made testing limited[34].

Accessibility

Two articles described accessibility as a barrier to testing. Physical disability including limited mobility, blindness, low vision, difficulty hearing, communication or understanding information and sensory challenges have also been identified as barriers to testing[12,35] in addition to the accessibility and physical environment of testing sites.

Waiting times (availability of human resources, testing supplies, time delay in results)

Long testing wait times ang long waits for test results were identified as barriers to testing in 5 studies[18,36–39]. For example, Clipman et al. (2020) reported that 53% of survey respondents (n=3058) in the United Stated waiting eight or more days for test results. In addition, wait time for a drive-thru testing in Phoenix was anecdotally reported as up to 13 hours, highlighting that that the infrastructure to support testing was not adequate[37]. In their commentary, Thappa et al. (2020) also highlighted the discomfort and apprehension associated with waiting at a facility to receive testing results[38].

Test properties (including pain, length of test)

Test discomfort was identified as a testing barrier in two sources. Kernberg and colleagues (2020) conducted a cross sectional quality improvement initiative in a hospital by offering monosymptomatic pregnant patients a COVID-19 test. Of the 270 patients offered the test 83% (n=223) accepted. Of the 17% (n=47) who declined, concern for test discomfort was the highest cited reason (63%)[25]. In a Australian national survey of 1359 citizens, 'testing is painful' (11%) was the most common barrier[14]. In one additional study, the test type was identified as a barrier to testing[39].

Safety of test site (chance of infection)

Four sources reported that the safety of testing sites and worries about infection were barriers to seeking testing[27,40–42]. More specifically, the fears of the safety of test sites were related to physical distancing, isolation, and cleaning practices[42].

Mistrust

In their published perspective, Egelko and colleagues outline the historical and systemic challenges that have been experienced among racialized Americans, including an aversion to

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research, distrust of health systems, and mistrust of science. These were described as barriers to testing in racialized communities[43].

Outcome barriers

Stigma

Social stigma of testing positive for COVID-19 is a barrier to testing as it may reveal that people did not follow public health recommendations (use of personal protective equipment, physical distancing, etc.) and may be stigmatized a result[17,44,45]. Social stigma that inhibits people from getting testing may lead them to hide their illness, stop healthy behaviours or discourage them from seeking help[46].

Among racialized Americans, the fear of testing positive as a barrier to testing due to the possible repercussions, such as stigmatized healthcare[43]. In sex workers, social stigma, gender-based violence and discriminatory practices all inhibit access to testing, and hinders contact tracing[3].

Personal cost (cost of isolation, positive test results: work, cost related to care, etc.)

Several personal costs were identified as barriers to testing across populations. Loss of work was reported as a barrier in 5 sources, and specifically the cost of missing work[7,15,20,38,43]. The need to quarantine following a positive test is also a barrier to accessing testing[38,43]. Fears around immigration status are also a barrier to accessing testing among some Americans[15,43].

Health consequences

For racialized Americans, they may not know how or where to access healthcare. When they do access healthcare, they may be limited by language, not understanding medical instructions, or treatment options[15].

SECTION 2. Strategies to address COVID-19 testing barriers and/or COVID-19 testing hesitancy

Planning strategies

Eighteen sources describe strategies intended to address planning barriers. Seven articles described strategies to eliminate the cost of testing, although no evidence was provided that these strategies would be effective. Several authors[6,7,11,36] proposed improving uptake by eliminating the costs of COVID-19 tests, providing incentives to take tests, including cash benefits for those who take tests, especially for low income or undocumented citizens who may be afraid to take a test due to status. Page et al (2020) also suggests funding community and religious organizations to promote awareness around testing and testing sites. After drive thru testing sites failed to increase testing in Latino and Black communities in the US, Levitt et al (2020)[24] suggested providing free tests to anyone who wants to take one to incentivize.

A news article[47] also describes the failure of a drive thru test site to increase testing because of wait times. Therefore, they proposed eliminating the cost of testing as an alternative strategy.

Nine sources identified health literacy and the infodemic of misinformation as barriers to covid-19 testing and suggested various strategies to address them. Two sources suggest that scientists, academics and other experts are able to counteract misinformation about the pandemic, testing and consequences of a positive test with facts to help improve public trust [9,16]. Additionally, they suggest building a multi-disciplinary network of academic, community, public, and other partners to understand and address those most impacted by structural inequity, with a focus on testing and tracing.

In their reporting guidelines to reduce social stigma, UNICEF[46] recommended that governments do their part to influence positive behaviours by spreading facts, engaging influencers, amplifying voices of affects, portray different ethnic groups, and acting ethically to clear up misinformation as soon as it arises.

Khaldi[15] recommended a strategy that government bodies provide leadership through initiatives that address misconceptions about the pandemic, testing, outcomes, and other issues that inhibit individuals from testing. One approach to developing messages is to increase engagement with stakeholders including employers, embassies and NGOs to spread the messages on what individuals must do to protect themselves. Outreach through social media may also be supportive.

In a commentary, Thappa[38] suggested that the Indian government target specific information and education materials to address the "lax attitude" many India residents have toward testing. This will require regular updating of information and content. Similarly, in an editorial, Sotgiu[17] recommended that government provide a consistent stream of communication that addresses misinformation honest, direct, simple communication from leaders about testing.

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Earnshaw[45] conducted a cross-sectional survey of 845 adults in the US to examine individual characteristics such as COVID-19 stigma variables (i.e., anticipated stigma and stereotypes), COVID-19 control variables (i.e., knowledge and fear), and sociodemographic characteristics to determine behaviour towards testing. Although specifics are not provided, they imply that advertising, mass media, and educational interventions may reduce stigma, including stereotypes.

Several studies addressed providing public information campaigns to uninsured migrant workers in the US, who are afraid of being deported or arrested when seeking care. Doyle[20] proposed public information campaign to inform uninsured people that care is available at no charge. They suggest this will help address misconceptions about the consequences of testing. Capps et al (2020)[4] recommended the federal government provide funding to local testing sites in order to increase uptake of symptomatic individuals which will increase. They also suggest that a program, like Medicaid, be created specifically for lawful protected resident adults who are excluded from Medicaid.

Egelko[43] (2020) propose that unidirectional messaging will be ineffective and potentially turn individuals away. Instead, they suggest that community trust needs to be fostered with the aim of making testing an attractive option for all individuals through targeted approaches. Specifically, the authors suggest testing as a surveillance method which allows for anonymity instead of as a case-finding method which can be infringing.

Adebisi [3] proposed conducting more research aimed to better understand which groups are being excluded from testing and why. The research will examine the disadvantages people face, which will help empower these groups and to design inclusive policies and goals.

The community council of Tower Hamlet in the U.K. designed a protocol to address a local outbreak of Covid-19[48]. The protocol includes strategies for planning, process and outcomes. For planning, the designed a survey and community mapping exercise to gather in-depth insight on support needs. Additionally, a Community Engagement Sub-group was been established to plan supports for residents to take part in the national test and trace programme. Initial findings were that community members were more likely to engage in the plan if they were approached by trusted community faith leaders. Characteristics that addressed planning included messages co-produced with local communities and organizations, using community and faith groups/volunteers as messengers. This helped build trust to convey messages regarding benefits of testing and contact tracing and responding to data about hotspots or areas of low uptake.

Process strategies

Twenty-four articles described strategies to address process barriers. Eighteen articles described strategies for availability or accessibility of tests.

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A COVID-19 Testing and Contact Tracing Health Equity Guidebook[12] proposed offering bilingual, culturally-tailored testing and contact tracing services in communities most in need. By focusing on communities with elevated risk - selected using a data-driven approach, and tailoring testing events it will help outreach, approach and accommodations. Authors suggest considering processes to include individuals who lack permanent contact information or have unstable housing. To improve accessibility of test sites, they recommend providing several testing formats to be inclusive of barriers such as transportation. Furthermore, they suggest using a mixed approach to testing to meet as many needs as possible, for example drive-thru, walk-up site, mobile screening (service meets participants at a predetermined location but moves to another location), door-to-door (meeting participants in their homes). Choosing recognizable locations that are familiar to the community and large enough to accommodate the format, close to public transportation is recommended. As well, ensuring testing locations are accommodating for all abilities. It is also important that communities work in collaboration with a range of community groups that advocate and serve people from different cultures, races, ethnicities, across varying languages and abilities. Hours should be inclusive of those with non-traditional work schedules (outside of just 9-5pm). Seeking input from communities to ensure that tests are equitable is important.

Jacobson[49] also stated that to increase acceptability and feasibility of testing, trusted community leaders and community-based organizations must be involved in developing and coordinating testing strategies, including diversity of testing locations (at home testing, drive-thru/walk-thru testing, sending health workers to households lacking means of transportation).

Six articles suggest implementing decentralizing test sites by placing them in local settings to improve availability of tests[33,50–55].

- Murphy (2020) reported on the implementation of free testing initiative offered by the Black Doctors COVID-19 Consortium in which SEPTA employees are able to access a test whenever they want. The strategy was well received and increased the sense of safety within this population. At the time of publication, more than 5400 tests were completed within a time frame of 7 weeks.
- Three studies suggest targeting testing resources toward people with underlying medical conditions to make it safer to get tested as well as targeting testing resources toward people living in areas where physical distancing and other safe conditions[33,53,54].
- One news article proposes keeping the first two hours of the testing day for to first responders (police, firefighters, and emergency medical technicians), Oregon Health & Science University (OHSU) health patients and household members of OHSU health employees[56].
- Mukattash (2020) proposed increasing availability of testing sites by putting them into pharmacies[28].

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- Kissam (2020) argued that COVID testing in local areas should focus less on large-scale use of COVID testing and instead shift towards using testing as a component of a more comprehensive public health strategy that includes testing, contact tracing for those who test positive, and additional supports for those required to quarantine/self-isolate.

Mitchell and colleagues (2020) conducted an expert panel made up of public health experts and emergency care response team members to identify key themes and lessons from the COVID-19 response[57]. The expert panel identified accessibility and availability of testing as one of their success factors during the initial timeline of the pandemic. In the future the emphasized the need for collaboration between laboratories and academia to ensure surveillance and population wide testing. They also propose coalitions between public health and local healthcare systems make targeted efforts to communicate vulnerable populations to increase access to tests.

Maxmen (2020) described a multi-pronged approach being used to augment access to testing including testing at physical clinics, youth shelters and by deploying a street medicine team (using a mobile RV) - which is also useful for contact tracing for those individuals who are underhoused[22]. They also recommend having multiple options for testing facilities in the community acts like an "anchor" - residents are familiar with the health providers/clinics and "see people who look like them". They do not recommend drive thru testing as it will not work for people who don't have access to a vehicle. On the other hand, Siegler (2020) proposed making testing sites more convenient by providing home tests or drive through tests[58]. This strategy will also help address fear of infection.

The Minnesota Department of Health proposed improving access by and availability of testing sites for those with physical disabilities by providing signage that is clear, visible and easy to understand[35]. They also suggest providing transportation to and from testing sites may be needed for people with disabilities and unique health needs.

To address process barriers, the Tower Hamlet plan worked with support groups to address issues with access to testing or contact tracing in their communities[48].

Galavix (2020) describe testing and refinement of implementation strategies[21]. They propose that as interventions to improve testing roll out, it is important to document and evaluate their impact on access within minority populations. These interventions should consider factors such as culture, history, values and needs of minority communities. The authors suggest that testing should be deployed in places where minority communities both live and work. They suggest including the use of quasi-experimental research designs, pragmatic trials, adaptive study designs and hybrid effectiveness-implementation studies.

Babych (2020) describe an initiative that uses drones to deliver testing kits to remote communities in rural Alberta[32]. The drones are delivering COVID-19 test kits to Stoney Nakoda First Nations. Additional pilots were also planned for Eden Valley and Big Horn (satellite

reserves). The pilot found that samples were able to survive and return to the lab with no change or degradation to the sample. The research team is trying to determine how to enhance security of the package (on return back to the lab) in case any of the specimens are positive for COVID-19.

Adeniji (2020) suggested to increase safety and availability of tests by allowing self-administered tests and education on how to use them[34]. The author outlines some recommendations that may be implemented in South Africa to increase the testing rate in the country, including distributing self-administered COVID-19 tests, providing education to individuals on how the tests can be administered, and studying the effects of such interventions.

Two healthcare professionals in Saskatchewan agreed to take a COVID-19 test, despite being asymptomatic, so they could share their lived experience with their patients about what to expect. The intention was to decrease stigma and increase education about the discomfort of the test[59].

Other strategies

Zimba (2020) conducted a survey with 4,793 US citizens to consider different combinations of SARS-CoV-2 testing service features in a situation where the number of people hospitalized or dying from coronavirus in their community was increasing[39]. Each participant was asked to choose between two scenarios comprised of different combinations of the testing features. The results showed that most respondents preferred turnaround time for test results (30.4%), followed by test type (28.3%), specimen type (26.2%), and venue (15.0%). In a commentary, Mahase suggests that using saliva tests will increase uptake because of its convenience compared to PCR tests[27].

Ibarra (2020) reports on a contact tracing program in which a COVID-19 test is offered over the phone, in an effort to increase testing[23]. In discussion with experts, blanket testing is suggested as a way to control COVID-19. No specific outcomes, such as number of people contact/tested, are reported.

Fusco suggested that people living with HIV were not getting tested for COVID-19 because they voluntarily withdrew from therapeutic services during the pandemic[41]. Fusco suggests that HIV services could consider integrating COVID-19 testing within usual care for persons living with HIV.

Outcome Strategies

Two articles described strategies intended to address outcome barriers. Evans[54] propose various strategies to increase testing in minority populations such as improving availability of testing by increasing testing sites in minority neighborhoods, thus reducing wait-times for testing. Furthermore, they suggest increasing tracing of positive results by providing cost-free temporary housing that isolates non-critically ill and asymptomatic people with COVID living in densely

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crowded conditions where spread is likely. To address outcome barriers, the Tower Hamlet plan built on the foundation of the current response to pandemic, linking those isolating to existing support in the community, such as faith and Mutual Aid groups. They also used locally trained and embedded volunteers to support individual residents with every stage of the national test and trace process[48].

IMPLICATIONS OF REVIEW FINDINGS

This review identified a variety of barriers to testing as well as strategies to address them. The frequency of planning, process and outcome barriers found, are well aligned with the strategies. Process barriers, as well as strategies to address them, were most commonly reported in the included literature. Outcomes barriers and strategies to address them were least reported. The findings from this rapid review are supported by the *three delays model*[2] which suggests abstract barriers such as consequences of testing outcomes are less likely to inhibit health seeking behaviour than practical, directly experienced issues, like access and availability of testing (process) or the ability to self-appraise symptoms. This suggests prioritizing strategies that are tailored to address planning and process barriers over outcome barriers.

GAPS IN EVIDENCE

The majority of sources (39) were opinion pieces (i.e. commentaries, perspectives, media articles), two sources were a guideline to prevent stigma[46] and contact tracing[12], and twenty-one articles collected or analyzed primary or secondary data. This demonstrates a lack of experimental and observational designs to better understand causes of barriers to COVID-19 testing and direct impacts of strategies. There is a need for both experimental and observational studies to determine the extent to which a barrier inhibits COVID-19 test seeking behaviour and the effectiveness of strategies to improve uptake of COVID-19 testing or address testing hesitancy. Implementation science frameworks may also be helpful for understanding and addressing COVID-19 testing barriers and hesitancy. Many of the authors propose targeting underserved communities and increasing availability and accessibility of testing sites. Although results do suggest this is a promising approach, examining the implementation of these approaches is needed to assess the effectiveness of such initiatives. Since most of the sources are from the United States, there is also an opportunity to explore the applicability of strategies to address COVID-19 testing barriers and testing hesitancy to the Canadian context.

CONCLUSION

The impact or effectiveness of strategies to address COVID-19 testing barriers or testing hesitancy is largely unknown. However, sources included within this review do provide an evidentiary basis to suggest that multi-pronged approaches to addressing barriers are being

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both suggested and implemented. The use of implementation science frameworks may be a promising means of developing, evaluating and refining approaches to addressing COVID-19 testing barriers and hesitancy

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Search strategy details
database searches were executed on January 8, 2021.
Ovid MEDLINE
COVID-19 filter: adapted from Ovid filter (https://tools.ovid.com/coronavirus/Covid-19%20search%20notes.pdf   SARS/MERS & HIV literature not expressly excluded

#	Query
1	exp Coronavirus/
2	exp Coronavirus Infections/
3	(coronavirus* or corona virus* or oc43 or nl63 or 229e or hku1 or hcov* or ncov* or covid* or sarscov* or sarscov* or sars-coronavirus* or severe acute respiratory syndrome coronavirus*).mp.
4	(or/1-3) and ((20191* or 202*).dp. or 20190101:20301231.(ep).)
5	((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.
6	(2019-ncov or ncov19 or ncov-19 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or sarscoronavirus2 or sars-coronavirus-2 or coronavirus-19 or covid19 or covid-19 or covid 2019 or "2019-novel cov" or ((novel or new or nouveau) adj2 (cov or ncov or covid or coronavirus* or corona virus or pandemi*2)) or (coronavirus* and pneumonia)).mp.
7	covid-19.rx,px,ox. or severe acute respiratory syndrome coronavirus 2.os.
8	or/5-7
9	4 not (camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or bovine or calves or tgev or feline or porcine or erinaceus or bcov or ped or pedv or pdcov or fipv or fcov or canine or ccov or zoonotic or avian influenza or h1n1 or h5n1 or h5n6 or ibv or murine corona*).mp.
10	8 and (camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or bovine or calves or tgev or feline or porcine or erinaceus or bcov or ped or pedv or pdcov or fipv or fcov or canine or ccov or zoonotic or avian influenza or h1n1 or h5n1 or h5n6 or ibv or murine corona*).mp.
11	or/8-10
12	11 and 20191201:20301231.(dt).
13	((test* or screen* or pcr or rt-pcr or qt-pcr or lamp or contact tracing or contact investigation* or contact screening or contact epidemiology) adj5 (access* or attitud* or behavio?r* or aversion? or hesitanc* or objection? or oppos* or reluctan* or resist* or barrier* or deter or deters or deterred or difficult* or discourage* or hindrance* or hinder* or hurdle* or impediment* or obstacle* or (chang* adj2 mind?) or convinc* or galvani* or motivat* or persuad* or

#	
	persuas* or ease? or easing or expedit* or facilitat* or help? or helping or promot* or equality or equit* or inequality or inequit* or fair or fairly or fairness or shame* or stigma*)).ti,ab,kw,kf.
14	((test* or screen* or pcr or rt-pcr or qt-pcr or lamp or contact tracing or contact investigation* or contact screening or contact epidemiology) adj5 (population group* or ethnic group* or "sub group*" or ethnic population* or "sub population*" or ethnically diverse or poverty or impoverished or low income or low resource* or socioeconomic* or socio-economic* or ((rural* or remote* or isolated) adj2 (population* or area? or communit* or place?)) or "at risk" or minorit* or vulnerable or disparate* or disparit* or immigrant* or migrant* or foreign* or newcomer* or illegal alien* or expat* or ex-pat* or emigrant* or refugee* or indigenous or aboriginal* or first nations or native american* or maori? or african american* or black or bame or bme or "person* of colo?r" or "people of colo?r" or bipoc or latina? or latino? or latinx or latin american* or hispanic? or spanish speaking or lesbian* or gay* or bisexual* or homosexual* or queer* or same sex or same gender or sexual minorit* or trans or transgender* or transsexual* or lgbt* or glbt* or prison* or imprison* or incarcerate* or inmate* or convict* or jail* or correctional facilit* or detention facilit* or penitentiar*)).ti,ab,kw,kf.
15	13 or 14
16	12 and 15

#	Query
1	((TITLE-ABS-KEY (coronavirus* OR "corona virus*" OR oc43 OR nl63 OR 229e OR hku1 OR hcov* OR ncov* OR covid* OR sarscov* OR sarscov* OR "sars-coronavirus*" OR "severe acute respiratory syndrome coronavirus*")) AND NOT (TITLE-ABS-KEY (camel* OR dromedar* OR equine OR coronary OR coronal OR covidence* OR covidien OR "influenza virus" OR bovine OR calves OR tgev OR feline OR porcine OR erinaceus OR bcov OR ped OR pedv OR pdcov OR fipv OR fcov OR canine OR ccov OR zoonotic OR "avian influenza" OR h1n1 OR h5n1 OR h5n6 OR ibv OR "murine corona*"))) OR ((TITLE-ABS-KEY ("2019-ncov" OR ncov19 OR "ncov-19" OR "sars-cov2" OR "sars-cov-2" OR sarscov2 OR "sarscov-2" OR sarscoronavirus2 OR "sars-coronavirus-2" OR "coronavirus-19" OR covid19 OR "covid-19" OR "covid 2019" OR "2019-novel cov" OR ((novel OR new OR nouveau) W/2 (cov OR ncov OR covid OR coronavirus* OR "corona virus" OR pandemic*)) OR (coronavirus* AND pneumonia))

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	) AND (TITLE-ABS-KEY (camel* OR dromedar* OR equine OR coronary OR coronal OR covidence* OR covidien OR "influenza virus" OR bovine OR calves OR tgev OR feline OR porcine OR erinaceus OR bcov OR ped OR pedv OR pdcov OR fipv OR fcov OR canine OR ccov OR zoonotic OR "avian influenza" OR h1n1 OR h5n1 OR h5n6 OR ibv OR "murine corona*"))) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019))
2	TITLE-ABS-KEY ((test* OR screen* OR pcr OR "rt-pcr" OR "qt-pcr" OR lamp OR "contact tracing" OR "contact investigation*" OR "contact screening" OR "contact epidemiology") W/5 (access* OR attitud* OR behavior* OR behaviour* OR aversion* OR hesitanc* OR objection* OR oppos* OR reluctan* OR resist* OR barrier* OR deter OR deters OR deterred OR difficult* OR discourage* OR hindrance* OR hinder* OR hurdle* OR impediment* OR obstacle* OR (chang* W/2 mind*) OR convinc* OR galvani* OR motivat* OR persuad* OR persuas* OR ease* OR easing OR expedit* OR facilitat* OR help* OR promot* OR equality OR equit* OR inequality OR inequit* OR fair OR fairly OR fairness OR shame* OR stigma*))
3	TITLE-ABS-KEY ((test* OR screen* OR pcr OR "rt-pcr" OR "qt-pcr" OR lamp OR "contact tracing" OR "contact investigation*" OR "contact screening" OR "contact epidemiology") W/5 ("population group*" OR "ethnic group*" OR "sub group*" OR "ethnic population*" OR "sub population*" OR "ethnically diverse" OR poverty OR impoverished OR "low income" OR "low resource*" OR socioeconomic* OR "socio-economic*" OR ((rural* OR remote* OR isolated) W/2 (population* OR area* OR communit* OR place*)) OR "at risk" OR minorit* OR vulnerable OR disparate* OR disparit* OR immigrant* OR migrant* OR foreign* OR newcomer* OR "illegal alien*" OR expat* OR ex-pat* OR emigrant* OR refugee* OR indigenous OR aboriginal* OR "first nations" OR "native american*" OR maori? OR "african american*" OR black OR bame OR bme OR "person* of color" OR "person* or colour" OR "people of color" OR "people of colour" OR bipoc OR latina* OR latino* OR latinx OR "latin american*" OR hispanic* OR "spanish speaking" OR lesbian* OR gay* OR bisexual* OR homosexual* OR queer* OR "same sex" OR "same gender" OR "sexual minorit*" OR trans OR transgender* OR transsexual* OR lgbt* OR glbt* OR prison* OR imprison* OR incarcerate* OR inmate* OR convict* OR jail* OR "correctional facilit*" OR "detention facilit*" OR penitentiar*))

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4	#2 OR #3
5	(#1 AND #4) AND NOT INDEX(medline)

1	"covid-19" testing access
2	"covid-19" testing attitudes
3	"covid-19" testing behavior
4	"covid-19" testing hesitancy
5	"covid-19" testing equity
6	"covid-19" testing minority
7	"covid-19" testing vulnerable
8	"covid-19" testing disparity
9	"sars-cov-2" testing access
10	"sars-cov-2" testing attitudes
11	"sars-cov-2" testing behavior
12	"sars-cov-2" testing hesitancy
13	"sars-cov-2" testing equity
14	"sars-cov-2" testing minority
15	"sars-cov-2" testing vulnerable
16	"sars-cov-2" testing disparity

#	Query
1	("2019-ncov" OR ncov19 OR "ncov-19" OR "sars-cov2" OR "sars-cov-2" OR sarscov2 OR "sarscov-2" OR sarscoronavirus2 OR "sars-coronavirus-2" OR "coronavirus-19" OR covid19 OR "covid-19" OR "covid 2019" OR "2019-novel cov" OR ((novel OR new OR nouveau) near/2 (cov OR ncov OR covid OR coronavirus* OR "corona virus" OR pandemic*)) OR (coronavirus* AND pneumonia)):ti,ab
2	((test* OR screen* OR pcr OR "rt-pcr" OR "qt-pcr" OR lamp OR "contact tracing" OR "contact investigation*" OR "contact screening" OR "contact epidemiology") near/5 (access* OR attitud* OR behavior* OR behaviour* OR aversion* OR hesitanc* OR objection* OR oppos* OR reluctan* OR resist* OR barrier* OR deter OR deters OR deterred OR difficult* OR discourage* OR hindrance* OR hinder* OR hurdle* OR impediment* OR obstacle* OR (chang* near/2 mind*) OR convinc* OR galvani* OR motivat* OR persuad* OR persuas* OR ease* OR easing OR expedit* OR facilitat* OR help* OR promot* OR equality OR equit* OR inequality OR inequit* OR fair OR fairly OR fairness OR shame* OR stigma*)):ti,ab
3	((test* OR screen* OR pcr OR "rt-pcr" OR "qt-pcr" OR lamp OR "contact tracing" OR "contact investigation*" OR "contact screening" OR "contact epidemiology") near/5 ("population group*" OR "ethnic group*" OR "sub group*" OR "ethnic population*" OR "sub population*" OR "ethnically diverse" OR poverty OR

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	impoverished OR "low income" OR "low resource*" OR socioeconomic* OR "socio-economic*" OR ((rural* OR remote* OR isolated) near/2 (population* OR area* OR communit* OR place*)) OR "at risk" OR minorit* OR vulnerable OR disparate* OR disparit* OR immigrant* OR migrant* OR foreign* OR newcomer* OR "illegal alien*" OR expat* OR ex-pat* OR emigrant* OR refugee* OR indigenous OR aboriginal* OR "first nations" OR "native american*" OR maori* OR "african american*" OR black OR bame OR bme OR "person* of color" OR "person* or colour" OR "people of color" OR "people of colour" OR bipoc OR latina* OR latino* OR latinx OR "latin american*" OR hispanic* OR "spanish speaking" OR lesbian* OR gay* OR bisexual* OR homosexual* OR queer* OR "same sex" OR "same gender" OR "sexual minorit*" OR trans OR transgender* OR transsexual* OR lgbt* OR glbt* OR prison* OR imprison* OR incarcerate* OR inmate* OR convict* OR jail* OR "correctional facilit*" OR "detention facilit*" OR penitentiar*)):ti,ab
4	#2 or #3
5	#1 and #4

" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " attitude | behavior | aversion | hesitancy | objection | oppose | reluctance | resistance "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " barrier | deterred | difficulty | discouraged | hindered | hurdle | impediment | obstacle "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " change minds | convince | galvanize | motivate | persuade "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " ease | expedite | facilitate | help | promote "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " equality | inequality | equity | inequity | fairness | shame | stigma "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " "population group" | "ethnic group" | "sub group" | "ethnic population" | "sub population" | "ethnically diverse" "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " poverty | impoverished | "low income" | "low resource" | socioeconomic | rural | remote "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " "at risk" | minority | vulnerable | disparate | disparity | immigrant | migrant | foreign | newcomer | refugee "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " indigenous | aboriginal | "first nations" | "native american" | maori "

Barriers to COVID-19 testing and testing hesitancy: A rapid scoping review

Search terms
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " "african american" | black american | "african canadian" | black canadian | black people | bame | bme | "people of color" | "people of colour" | bipoc "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " latina | latino | latinx | "latin american" | hispanic | "spanish speaking" "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " lesbian | gay | bisexual | homosexual | queer | "same sex" | "same gender" | "sexual minority" | trans | transgender | transsexual | lgbt | glbt | lgbtq | lgbtq+ | lgbtq2+ "
" "covid-19" | coronavirus | "sars-cov-2" " " test | "contact tracing" " " prison | imprisoned | incarcerated | inmate | convict | jail | "correctional facility" | "detention facility" | penitentiary "

Other Grey Literature Sources

The following list of websites were searched for grey literature: OECD, WHO, CDC, ECDC, CADTH, National public health websites (e.g., Australia, UK, New Zealand, United States), Coronavirus resources (e.g., Johns Hopkins, COVID-END, CAN-COVID, CORD19).

Appendix B

Inclusion/exclusion criteria

Include/Exclude	Criteria
Include	COVID-19
Include	Population: All demographics and population subgroups eligible
Include	Setting: any setting related to COVID-19 testing OR any learnings from previous infectious disease-related epidemics or pandemics applied to the COVID-19 response.
Include	Study design: Published and pre-print pieces for academic journals (social science, science, and medicine); Research articles (multiple designs not just randomized control trails should be within scope); Letters; Commentary/perspectives/editorials; Grey literature (e.g. government, non-profits, etc.)
Include	Interventions: barriers to testing and strategies to address barriers to testing. Article should focus on individual behaviour/attitudes toward COVID-19 testing in any setting or population (ex. testing hesitancy, access to tests, access to information, economic impact of testing, the impact of repeat testing, and inequity) OR Article should focus on strategies to address individual behaviours toward barriers to testing
Exclude	non-COVID-19
Exclude	Purely technical papers; sources that only focus on technical aspect of testing (efficacy, protocols, procedures, etc.) Sources that only focus on testing outcomes Sources on general testing strategies that do not address barriers to testing

Appendix C

All academic databases searched
(January 8 2021):
MEDLINE (697), Scopus (343),
medRxiv/bioRxiv (252), Cochrane (2)

Identified through
database searching
n = 1294

Duplicates removed
n = 250

Screened by title &
abstract
n = 1044

Excluded
(irrelevant)
n = 940

Grey literature
identified
n = 97

Duplicates (grey)
removed
n = 7

Studies screened
by full text
n = 152

Excluded
(irrelevant)
n = 91

Included in
extraction
n = 61

Grey literature sources (all
searched January 10-12 2021):
- OECD
- WHO (World Health
  Organization)
- CDC
- ECDC
- CADTH
- National Public Health
  websites (e.g., Australia, New
  Zealand, UK, and others)
- Coronavirus resource
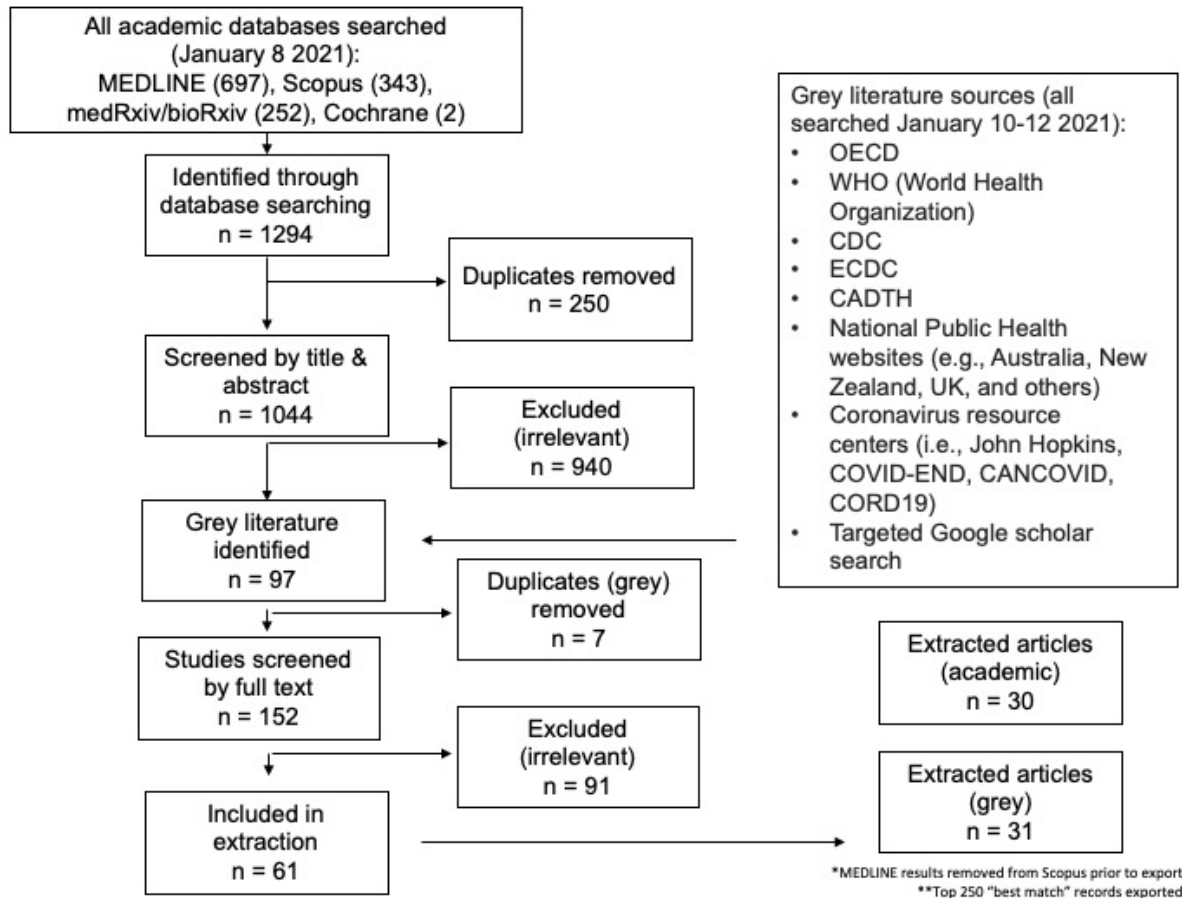 centers (i.e., John Hopkins,
  COVID-END, CANCOVID,
  CORD19)
- Targeted Google scholar
  search

Extracted articles
(academic)
n = 30

Extracted articles
(grey)
n = 31

*MEDLINE results removed from Scopus prior to export
**Top 250 "best match" records exported

Appendix D: Annex

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Adebisi 2020	American Journal of Tropical Medicine and Hygiene	Africa	Academic publication	Perspective on sex workers in Africa access to testing during COVID-19	Perspective	Social stigma, gender-based violence, and discriminatory policies inhibit access to care and treatment. This also hinders contract tracing. Reducing stigma will provide opportunities. to seek care and preventative measures. Sex workers are mobile and do not receive targeted information. Sex workers do not have access to many social services, such as health insurance.	"examine the disadvantages people face, to empower those who are left behind, and to enact inclusive far-sighted and progressive sustainable development goals." Involve communities in social protection schemes, health services.	None
Adeniji 2020	African Journal of Primary Health Care and Family Medicine	South Africa	Academic publication	A review of the literature to assess the available means of wide-scale testing for COVID-19 in order to positively affect the testing rate.	Narrative review	The author describes the rate of testing for COVID-19 in South Africa and overviews alternative testing methods, mostly self-administered, as a means of increasing testing availability.	The author outlines some recommendations that may be implemented in South Africa to increase the testing rate in the country, including distributing self-administered COVID-19 tests, providing education to individuals on how the tests can be administered, and studying the effects of such interventions.	None

Author-year and reference	Journal/source	Country	Source	Purpose	Type/design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Atchison 2020	Clinical Infectious Diseases	UK	Academic publication	To examine self-administered SARS-CoV-2 antibody testing in the home setting to determine its usability and acceptability. Lateral flow immunoassays were the tests used.	Cross sectional design (n= 315 in pilot; 8754 of 10600 who received LFIA1 kits; 2957 of 3800 who received LFIA2 kits)	Testing acceptability.	None.	The authors determined that the self-administered antibody kits had the potential to be effective in seroprevalence studies due to their significant usability and acceptability. The authors found high levels of self-test completion (98% for both tests).
Associated Press 2020	Media	United States	Media	Reports on test disparities in Phoenix, Arizona, specifically in Black and Latino neighbourhoods. Specifically, the article details barriers in opportunity for receiving a test surrounding racial disparities, and structural barriers.	Text and opinion	The barriers to testing reported surround racial disparities and inequities in the healthcare system. Specifically, there was an anecdotal report of hundreds of people lining up to receive a test and having to wait hours. Anecdotes from Pheonix describe nowhere to go and get tested, long wait times, and testing sites being set up in wealthy neighbourhoods. A free testing drive-thru event was scheduled and was not well received. This was because there was such high demand, the wait time was 13 hours, highlighting that people are willing to get tested, but the infrastructure is not there to support them.	Free testing and more testing for all.	
Babych 2020	Media	Canada	Media	Article describes a research project in Alberta that is piloting the delivery of medical supplies, including COVID-19 test kits, to remote, First Nations communities using drones.	Media article, research design unknown	Living in a remote community.	The pilot is being done to test the means of delivering medical supplies to remote communities during the COVID-19 pandemic. Currently many of these communities across Canada have limited access to testing centres and related medical supplies that can support rapid testing.	The drones are delivering COVID-19 test kits to Stoney Nakoda First Nations. Additional pilots were also planned for Eden Valley and Big Horn (satellite reserves). The pilot found that samples were able to survive and return to the lab with no change or degradation to the sample. The pilot was successful to maintain the integrity of the samples. The research team is trying to determine how to enhance security of the package (on return back to the lab) in case any of the specimens are positive for COVID-19.

Author-year and reference	Journal/source	Country	Source	Purpose	Type/design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Bartlett 2020	Media	United States	Media	Media article focusing on the cost of a COVID-19 test as a barrier for testing and travel. Article mostly describes the experience of a woman trying to get tested in order to travel, but vulnerable populations are briefly mentioned as not receiving adequate testing.	Media article	The majority of the article is not necessarily focused on vulnerable populations, however there is short mention of communities of color and low-income communities and that they should be given priority. The barriers to testing presented in the article are mainly to do with a lack of insurance to cover the cost of the test, in addition to wait time.	Federal funding to cover the costs of testing can reduce the cost of testing burden on insurers and control premiums for consumers.	At the time of publication, testing infrastructure was not adequate to support those needing to travel. Additionally, communities of color and low-income groups should be high priority populations for testing.
Bonner et al 2020	medRxiv	Australia	Preprint	The aim is to address a major gap in understanding how to improve COVID-19 testing behaviour, by: 1) reporting the prevalence of specific test barriers via survey; 2) identify additional test barriers through open responses; and 3) linking barriers to an overarching framework of behaviour change.	Longitudinal survey (n=4326 participants; testing barriers of interest were included in the Wave 3 study – n=1369 participants)	Testing is painful (n=153; 11.2% of respondents) I don't know when to get tested (n=98, 7.1% of respondents) Worried about getting infected at a testing clinic (n=81; 5.9% of respondents) I'll forget to get tested (n=33; 2.4% of respondents) Other: (organized in behaviour change theory) Worried about what others think (stigma) (n=33, 2.4%) Too difficult, too expensive (n=32, 2.3%) Testing doesn't work (n=17, 1.2%) No one else is getting tested (n=11, 0.8%)	None specifically provided	Bonner et al 2020

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Capps & Gelatt 2020	Think Tank	United States	White paper	The authors described barriers to COVID-19 testing for uninsured immigrants in different states. They undertook an analysis of the American Community Survey.	Policy analysis	Insurance inadequacy to cover the costs of testing. The authors mention that some steps have been taken to cover the cost of testing but that other options for covering the cost of tests exists. While this barrier is not described in depth and there is more investigation presented on understanding unemployment and un-insurance.	Federal government provide incentive for states to individually provide Medicare. Authors suggest that a program, similar to Medicaid, be created specifically for lawful protected resident adults who are excluded from Medicaid. Opportunity for public/private partnerships in order to get funding for community health centers to provide coverage for those in need.	The strategies presented by the authors are not aimed directly at increasing testing, however if Medicaid were available for this vulnerable population, testing may go up.
Clipman 2020	medRxiv	United States	Preprint	A survey of residents of Maryland, Florida, and Illinois to assess access to and barriers for testing.	Cross-sectional survey (n=3058 participants completed survey)	n=146 respondents wanted/needed a test, but did not get tested, main reasons were: 1) not knowing where to go (36%); 2) distance/waiting time (33%); and 3) 21% reported fear of being tested. A further n=177 respondents reported symptoms, exposure or both but did not want a test. Main reasons for this were: 1) belief that symptoms were due to other causes (42%); 2) no symptoms (18%); 3) not wanting to know one's status (18%); and 4) logistic issues, such as not knowing where to go or lack of transportation (15%).	Clear communication strategies and messaging. Access to rapid, POC, COVID-19 testing for results expediency.	
Cordes & Castro 2020	Spatial and Spatio-temporal epidemiology	USA	Academic publication	Spatial analysis of the rates of testing for COVID-19 and percent positivity through a spatial analysis of zip code data for the City of New York. The authors were interested in determining whether certain population characteristics were associated with low levels of testing and high positivity rates among areas of New York City.	Spatial analysis (n=177 zip codes)	The authors found that there were geographic clusters of areas that had lower rates of testing and positivity, as well as those areas with high rates of testing and positivity. The former areas tended to have higher income and educational attainment, as well as a larger White population. The latter areas tended to have more individuals with no health insurance and a larger Black population.	None provided	The covariates that were significantly associated with the test rate included: (positive correlation - rent => 50% of income), (negative correlation - Asian, public transportation, Bachelors or graduate, non-citizen, median income).

Author-year and reference	Journal/source	Country	Source	Purpose	Type/design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
COVID-19 Unified Command 2020	Government Website	United States	Grey literature	Guidance developed for testing and contact tracing using a health equity approach	Guidance document	Many barriers were identified and described including: 1) low health literacy; 2) testing site location or hours of operation; 3) physical, cognitive, developmental or functional limitations; 4) communication and transportation barriers also play a role in accessing COVID-19 testing services; 5) socioeconomic barriers affect post-COVID-19 testing supports, ability to self-isolate; access to paid leave and time spent away from work (if testing positive), paying for childcare to attend a testing event. Some people may be underhoused or fear immigration retribution and may not have permanent contact information or disclose this, which impacts on contact tracing efforts. There is a fear of the cost of the test, the need for medical insurance to get a test, and fear of medical costs if you become sick with COVID-19. Cultural and social barriers are also outlined.	Offer bilingual, culturally-tailored testing and contact tracing services in communities most in need. Focus on communities with elevated risk - select communities for testing using a data-driven approach and tailor testing events (outreach, approach and accommodations). Consider processes to include individuals who lack permanent contact information or have unstable housing.

Select testing format to be inclusive of barriers such as transportation. Suggest using a mixed approach to meet as many needs as possible. Testing formats include: drive-thru, walk-up site, mobile screening (service meets participants at a predetermined location but moves to another location), door-to-door - meeting participants in their homes. Consider testing hours and locations.

Recognizable location that is familiar to the community and large enough to accommodate the format, close to public transportation. Ensure testing locations are accommodating for all abilities. Work in collaboration with a range of community groups that advocate and serve people from different cultures, races, ethnicities, across varying languages and abilities. Hours should be inclusive of those with non-traditional work schedules (outside of just 9-5pm). Seeking input from communities to ensure that tests are equitable. | None of these strategies have been evaluated. This is a guidebook meant to draw attention to the various barriers for testing and to help design equitable testing strategies. |
| Staff DD 2020 | Media | Ireland | Media | Media article discusses COVID-19 testing stigma in Ireland from the perspective of GPs. | Text and opinion | People are not seeking testing because they are afraid of being judged. | None provided. | None provided. |
| Dodds & Fakoya 2020 | BMJ | UK | Academic publication | Editorial to advocate for the inclusion of ethnic minority groups in COVID-19 testing programs. | Editorial | Based on their previous research on other diseases, the authors outline the potential for mistrust between some ethnic minorities and the government when it comes to testing. | The needs of ethnic minority groups are required to be met to ensure the success and uptake of testing programs. This can be done through building trust by increasing access to testing options and providing equitable health care where needed.
They advocate for including community representatives in the planning of | None. |

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
							COVID-19 testing initiatives to build trust and strengthen the uptake of testing.	
Doyle 2020	CMAJ	Canada	Academic publication		Text and opinion	Various barriers for migrant workers in Canada are identified: 1) access to healthcare; 2) inability to work if testing positive for COVID-19.	Permanent and universal coverage for all medically necessary services regardless of immigration status.	None described.
Dryden-Peterson 2020	medRxiv	United States	Preprint	With improved testing infrastructure in Massachusetts, the study team sought to examine how SARS-CoV-2 testing aligned with the intensity of the epidemic.	Prevalence study 4,262,000 tests were reported in the time period under investigation.	Community socioeconomic vulnerability.	Strategies are not provided, other than to recognize that addressing structural inequities will help support alignment between epidemic intensity and resourcing of testing for future COVID-19 pandemic.	Communities with increased levels of vulnerabilities - socioeconomic, minority and language, were associated with greater gaps in testing relative to epidemic intensity. The findings from this study suggest that testing resources were allocated to the most privileged communities post-Wave 1 of COVID-19 in Massachusetts rather than communities where there might be greatest need.
Earnshaw 2020	Stigma and Health	United States	Academic publication	This study explored whether anticipated stigma and stereotypes are associated with the likelihood that one will get COVID-19 testing.	Cross-sectional study (n=845 participants that met inclusion criteria; 77.0% identified as White; 10.2% identified as Black, 3.6% identified as Asian; 3.0% identified as Latino(a) and 6.3% identified as "other"	The perception that one will experience discrimination based on a stigmatized status. Research from other infectious diseases suggest that people will avoid engaging in testing or treatment because of stigma associated with this. In this study, those persons with greater anticipated stigma and agreement with COVID-19 stereotypes were less likely to get a COVID-19 test. Study suggests that anticipated stigma may play a role in whether someone will get a COVID-19 test.	Authors suggest strategies to address stigma include mass media and educational interventions. Authors also suggest the expansion of non-discriminatory policies to include COVID-19.	No strategies were measured, just offered as suggestions by the authors. Further research is required to understand how stigma and stereotypes play a role as barriers to COVID-19 testing.

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Egelko 2020	American Journal of Public Health	United States	Academic publication	Commentary describes a number of barriers to mandatory testing in racialized communities and presents considerations for the ethical implementation and uptake of testing in this population.	Text and opinion	Multiple barriers described including: repercussions, research aversion and mistrust of science as contributing to testing hesitancy in racialized communities in the United States of America. In addition, financial barriers as testing can lead to mandatory quarantine of individuals with no sick leave or benefits. Immigration status is also highlighted as a barrier in the US as use of public resources can be counted against individuals throughout the immigration process. Stigma was also described a barrier to testing in these already marginalized communities. Other barriers include financial stressors; immigration status; and stigma/stereotype threat.	Community trust needs to be fostered with the aim of making testing an attractive option for all individuals. Specifically, the authors suggest testing as a surveillance method which allows for anonymity instead of as a case-finding method which can be infringing.	Outcome data was not presented given the nature of the article.
Evans 2020	New England Journal of Medicine	United States	Academic publication	Perspective article on how COVID-19 is disproportionately impacting African Americans, Latinx Americans, and Native Americans.	Perspective	Mistrust in the health care system: Health care providers, health care organizations, and academic medical centers should consider how their attitudes, actions, management, and ignorance of the realities that shape the lives of minority populations contribute to health disparities.	Several strategies are suggested to support populations with testing uptake including: free tests, contact tracing, shorter reporting time, and free temporary housing for folks who need to isolate.	
Feldman 2020	Media	United States	Media	This news media article to describe a free testing initiative in Philadelphia offered by the Black Doctors COVID-19 Consortium. The article goes in-depth into the barriers faced by Black people with respect to COVID-19.	Text and opinion	The following are a list of reasons (why COVID-19 prevalence is higher in Black communities) briefly mentioned in the news article (verbatim): a.) Black people are less likely to have primary care physicians b.) Black people are more likely to rely on public transportation c.) Black Philadelphians are more likely to work jobs that can't be performed at home, putting them at a greater risk of exposure d.) in jail's, sanitation, and transportation departments, workers are predominantly Black e.) the increased severity of illness among Black people may be due to underlying health conditions.	Free testing was set up in order to help curb the burden of COVID-19 on Black people in Philadelphia. It is briefly mentioned that lack of insurance may inhibit an opportunity for a test as the cost associated with a test may be too much.	This article describes the free testing program offered by Black Doctors COVID-19 Consortium. Philadelphians, who meet testing criteria, can receive a free COVID-19 test in hopes of increasing test uptake and decreasing the burden of COVID-19 in the Black community. No outcomes of the initiative are described in depth. Free testing is voluntary and that the program was advertised via social media. After only a few months of offering free testing, the program was able to test up to 350 people every day. When the article was published, more than 10,000 were tested (up to October 13 2020).

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Fernando 2020	Media	United States	Media	To describe the experiences of Americans in seeking COVID-19 testing.	Text and opinion	This article outlined several barriers to testing that Americans face, particularly: test shortages, cost of testing, cost of missing work and accessibility of testing sites.	They highlight the need for more rapid, affordable and accessible COVID-19 tests.	None provided.
Fleming 2020	Nature	Global	Academic publication	Article identifies ways that scientists and individuals can tackle misinformation about COVID-19. Some expert opinion is provided.	Text and opinion	Misinformation on the pandemic.	Scientists are in a place to tackle misinformation by countering it with facts. They can call out fake conspiracy theories and stories.\n\nVarious strategies for individuals to use when reading to spot misinformation: Source suspicion, bad language, emotional contagion, eureka news, false accounting, oversharing, money conflict, fact check.	
Fusco 2020	AIDS	Italy	Academic publication	Commentary focuses on the potential for underdiagnosis of COVID-19 among persons living with HIV (PLWH). Reports on the number of PLWH who completed COVID-19 nasopharyngeal swabs over the period of the time of the start of the epidemic to April 22, 2020.	Commentary (n=12,653 patients; n=16,382 NP swabs – of these only n=12 PLWH completed an NP swab)	Fear of COVID-19 transmission: Regularly, 2392 PLWH receive care from the hospital (routine blood work, therapy withdrawal) and only 0.5% of this population of patients referred for general COVID-19 testing. The authors speculate that since PLWH represent a high-risk group, there is a hesitancy to use community health services (for fear of COVID-19 transmission). 96% voluntarily withdrew from usual services but unsure what their motivations are. Persistent stigma within this population may also contribute.	Integrating COVID-19 services with usual HIV services. Suggested by authors as an approach that is familiar to PLWH.\n\nOngoing screening of PLWH for active/recent symptoms of COVID-19 with testing as appropriate.	

Author-year and reference	Journal/source	Country	Source	Purpose	Type/design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Galaviz 2020	Health Equity	United States	Academic publication	This commentary describes how implementation science can support the development of strategies aimed at mitigating health disparities experienced by African American, Hispanic and Native American populations during the COVID-19 pandemic and into recovery. These populations are overrepresented among both COVID-19 cases and COVID-19 deaths.	Perspective	Barriers described include: 1) language and health literacy; and 2) access to a testing site – gives the example from the state of Texas, where testing facilities are located predominantly in communities with "whiter" populations.	Designing equitable interventions. These interventions should consider factors such as culture, history, values and needs of minority communities. Suggests that testing should be deployed in places where minority communities both live and work.	Testing and refinement of implementation strategies. As interventions roll out, it is important to document and evaluate their impact within minority populations. A variety of implementation science approaches are suggested including the use of quasi-experimental research designs, pragmatic trials, adaptive study designs and hybrid effectiveness-implementation studies. Other strategies are identified not specific to COVID-19 testing, include ensuring minority populations are involved in testing vaccines and treatments for COVID-19, and the development of strategies to ensure that once approved, vaccines and treatments are deployed within minority communities.
Gillam 2020	Journal of Public Health	UK	Academic publication	Describes the pilot of a mass testing initiative at a university setting and assessed its acceptability, costs, and ability of being scaled up to serve the testing needs of students and staff on a wider basis. The authors evaluated a testing strategy in a setting with high-risk for infection and transmission (university) due to the possibility of asymptomatic cases.	Cross sectional study (n=1053 registered individuals of whom 798 provided one or more swabs while 687 provided four swabs; n=458 participated in the post-study survey) Copan Eswabs were used for all participants.	Testing acceptability. Overall acceptability was high 4.5/5 (5 being most favourable). 97% reported they would participate in repeat testing. 71% agreed or strongly agreed that taking the swab was easy to do.		The authors concluded that the testing strategy that was piloted was acceptable to the staff and students who participated, as well as feasible to be carried out. Further, the authors identified the need for a strong communication strategy and web-based system to convey the importance of testing and to describe its process.
Hengel 2020	The Lancet Infectious Diseases	Australia	Academic publication	In this descriptive paper, the authors described the enablers and challenges of setting up point-of-care testing in remote communities to increase access to testing among Indigenous peoples in Australia.	Viewpoint (n=86 communities)	Availability and timeliness of COVID-19 testing in remote Australian communities. In light of the COVID-19 pandemic, the original guidelines for remote communities specified that individuals suspected of being infected were to be airlifted while awaiting for their results. To increase the availability of testing, the authors describe a model of point-of-care testing that was rolled out and which was based on an existing framework of testing for sexually transmitted infections.	Decentralized POC PCR testing was implemented.	

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Huerto 2020	Health Affairs	United States	Grey literature online source	To describe how targeted strategies may help improve testing uptake.	Commentary		Targeted testing strategies include: -testing resources toward people. with underlying medical conditions to make it safer to get tested. -targeting people living in areas where there is physical distancing and other safe conditions. -targeting testing towards essential workers. Targeted messaging and clear, transparent criteria for testing (simple explicit instructions).	
Ibarra 2020	Media	United States	Media	Article describes the role that contact tracers have in offering COVID-19 tests to those who want one. Through discussing testing with experts in the field, this article reports on solutions to contain COVID-19 cases in California. Article is focused on the Black and Latino communities of Oakland, California.	Text and opinion	Describes a lack of trust in the system, highlighting racial disparities, accompanied by structural barriers inhibiting Black and Latino populations from accessing testing.	Blanket testing – specifically among essential workers and/or seniors.	Article reports on a contact tracing program in which a test is offered on the call. Some people receiving the call may think its fraudulent and lack trust in the process. While no particular outcomes are reported, the need for adequate testing in Black and Latino communities is highlighted.
Jacobson 2020	International Journal for Equity in Health	Global	Academic publication	This commentary specifically explores Covid-19 responses related to: 1) testing and surveillance; 2) contact and location tracing; 3) public mask use; and 4) social distancing, as well as unintended consequences of Covid-19 policies to ensure not only an equitable pandemic response but also a more equitable society in the post-pandemic era.	Commentary		The authors highlighted implementation strategies to be applied to testing, including: collecting disaggregated data to inform the need for adopting testing strategies, involving community leaders and community-based organizations to develop and coordinate testing strategies, and fostering engagement and public trust.	Applying rigorous implementation research frameworks and evaluation systems to the implementation of evidence-based interventions which are adapted to contextual factors can promote effective and equitable pandemic response and accelerate learning both among local stakeholders as well as between states to further inform their varied experiences and responses to the pandemic.

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Jegede 2020	Pan African Medical Journal	Nigeria	Academic publication	Commentary describes the ethical issues in providing adequate pandemic preparedness in locations that are resource limited, such as Nigeria.	Commentary	Stigma from COVID-19 positive test Testing inequity – focused on testing "elites" Lack of incentive for persons who test positive to identify contacts.	The authors describe the need for education and public awareness regarding prevention, the availability of free testing, and ensuring that isolation facilities, adequate amenities, and access to sanitization and disinfectants exists.	
Kelly 2020	Media	Canada	Media	The current piece is a news media article published on December 10, 2020. The aim of the piece is to describe the experiences of an Indigenous woman in Vancouver trying to seek testing for COVID-19.	Text and opinion	Clinic staff denied a test to an Indigenous woman meeting testing criteria (they suspected influenza). In addition, the article mentions that the family decided to travel to Tofino Hospital via water taxi in which case geographical barriers may also exist.	None	The family contacted Island Health where they were told the care they received had been inadequate.
Kernberg 2020	Obstetrics and Gynecology	United States	Academic publication	The goal was to determine COVID test uptake and reasoning for declining tests within the labour and delivery unit of a major hospital.	Cross sectional Study (n=289 eligible participants; n=270 accepted asymptomatic testing)	Testing discomfort. The authors identified discomfort as the main barrier to testing for of participants who declined a COVID-19 test across all phases of the study [63% (n=10/16) in phase 2; 75% (n=3/4) in phase 3; 66% (n=2/3) in phase 4] Belief that the participant does not have COVID-19. This was identified by 13% (n=2/16) of participants who declined. 3/16 (19%) of participants declined the study for unknown reasons.	No strategies identified.	Socio-demographic variables that *Increased* testing included being White, Hispanic, pregnant with first child, or having private insurance. Subgroup analysis identified that across study phases, White and Black patients and those with insurance (Medicaid or Private) were more likely to get tested.

Author-year and reference	Journal/ source	Country	Source	Purpose	Type/ design	Barriers identified	Strategies suggested or implemented	Additional notes, lessons learned and recommendations, including impact of strategies employed
Khalidi 2020	NGO website	Malaysia	Short report	Overview of why illegal citizens do not seek care during covid-19, including testing.	Research report	Illegal migrants fear of being charged if they are found. Language is also a barrier, as they may not understand medical instructions or treatment options. They may also not understand how or where to seek care. Fear of losing work if sick, as they rely on daily wages	Government initiatives that address misconceptions about what will happen when seeking COVID-19 testing. Increasing engagement with stakeholders including employers, embassies and NGOs to spread the message on what foreign workers must do to protect themselves. Outreach through social media may help.	
Kissam 2020	Statistical Journal of the IAOS	United States	Academic publication	Article addresses the challenges faced by local public health agencies in California to support their response to the COVID pandemic.	Case report		Argues that COVID-19 testing in local areas should focus less on large-scale use of COVID testing and instead shift towards using testing as a component of a more comprehensive public health strategy that includes testing, contact tracing for those who test positive, and additional supports for those required to quarantine/self-isolate.	
Konkol 2020	Media	United States	Media	Focuses on health system inequities for Black communities during the pandemic. Specifically, the article describes a situation in Chicago in which Governor Pritzker committed to providing tests and resources to Black communities, but fell short.	Media	Gap in testing of Black communities in the Chicago area (unclear if this is access to tests or other barriers).	Testing site focused on serving Black populations.	The article reported that the testing site failed because of a lack of available supplies.
Lan 2020	Frontiers in Public Health	China	Academic publication	Study was conducted to explore knowledge/attitudes/use of COVID-19 testing kits among those living in China (general public).	Cross sectional study (n=1167 participants)	Across participants, there was good/decent knowledge and good attitudes towards testing. However, there was overall limited knowledge of tests beyond the traditional PCR test, including antigen and antibody tests.		

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Levitt 2020	Media	United States	Media	Focus was on innovative ideas to persuade Americans to get tested for COVID-19.	Text and opinion	Cost of testing and testing positive for COVID-19 were identified as barriers.	Making testing free and readily accessible. Suggests using incentives such as weekly prizes and providing a COVID dividend to people who test positive.	
Li 2020	Journal of Medical Internet Research	United States	Academic publication	Study aims to identify potential associations between demographic variables, internet use and COVID risk awareness and engaging in preventative behaviours (e.g. mask wearing, hand washing) and COVID testing behaviours.	Cross sectional study (n=979 participants)	Authors identified that females were less likely to get a COVID test compared to male participants. The authors also identified that study participants without a partner or who were not married were less likely to get a COVID-19 test. Li et al., (2020) did not identify a significant association between viewing COVID health information online and improvements in COVID testing behaviours. (OR= 10.3)		1) Over a million kits distributed to care homes, secondary schools, and most universities. 2) Use in addition to PCR, PPE and infection control measures.
Loyola University 2020	University website	United States	Media	To review COVID Equity Response Collaborative's activities to address equity.	Media	Barriers identified included: 1) cost of testing; 2) understanding testing; and 3) knowing how to access testing.	Building a multi-disciplinary network of academic, community, public, and other partners to help understand and address those most impacted by structural inequity, with a focus on testing and tracing.	

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Mahase 2020	BMJ	UK	Media	News story of UK's Operation Moonshot, which proposed using general practices and pharmacies to make COVID-19 testing more available to the public.	Text and opinion	Testing is not available to the public.	Saliva tests would be a big step forward for patients.	The authors presented several perspectives on using general practices for COVID-19 testing in the UK, including support for them but also the risk of spreading COVID-19 within the clinics. The article highlights the need for mass testing across the UK.
Martin 2020	Media	Canada	Media	News article about stigma of COVID-19 testing	Text and opinion	Stigma of COVID-19 testing that testing is painful	Communication and outreach to decrease stigma and educate on the test: Health professional who received the PCR test had media availability to speak to their firsthand testing experiences.	No outcomes reported.
Maxmen 2020	Nature	United States	Media	Interview with Dr Noha Abolelata who works with the non-profit organization Roots Community Health Centre in Oakland, California on COVID-19 disparities in Black American communities. The interview summarizes the strategies employed in two regions of California experiencing disparities from COVID-19 and other health issues.	Text and opinion	Access to COVID-19 testing: People may not have access to a car. Also residents of the communities are not comfortable accessing health services outside of their communities. (1) Systemic and historical racism: Describes the experimentation of Black people (Tuskegee, syphilis study). Researchers that have historically come to the community for data collection but there is no further engagement. The idea of "insiders" taking information out. Identification cards and email address: Some people do not have access to these things for usual testing processes. Some do, but are mistrustful of the system so they don't want to provide them. Communications: There is conflicting COVID-19 information leading to mistrust within the community. There is	A multi-pronged approach is being used to augment access to testing. This includes testing at physical clinics, youth shelters and by deploying a street medicine team (using a mobile RV) - which is also useful for contact tracing for those individuals who are underhoused. Walk up testing sites have been set-up in both Oakland and San Jose. Test samples are being sent to six different testing labs to ensure results are received in a timely manner. Drive thru testing will not work for people who don't have access to a vehicle. Similar to the approach used for access to testing, having multiple options for testing facilities in the community acts like an "anchor" - residents are familiar with the health providers/clinics and "see people who look like them". Support network developed for those who test positive. This includes ensuring shelter so people	Designed own testing system separate from that of the mainstream model to improve access. Strategies are described as very labour intensive but critical to support care to these communities. At the time of the interview, the walk up site alone had a 14.4% positivity rate (based on 3200 COVID-19 tests completed).

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						the potential for information overload with a lack of clarity.	can self-isolate and quarantine, coordinating food delivery (food boxes) and providing cleaning supplies. Ensuring there is a support network who can take groceries to them when required.	
Minnesota Department of Health 2020	Government website	United States	Grey literature	Identifying barriers and strategies for disabled people to access testing.	Guidance	Physical disability including limited mobility; blindness; low vision; difficulty hearing, communicating, or understanding information; and in some cases sensory challenges.	Ease physical access, reduce physical barriers. More signage for those who may have visibility issues. Reduce sensitivity issues, such as lights, noises, smells, etc. Provide clear, easy to understand information. Allow them to get tested at their own pace. Suggests that at-home testing may be an option for those living with disabilities and sensitivities. May need additional support staff. Transportation to and from testing sites may be needed for people with disabilities and unique health needs.	
Mitchell et al 2020	Journal of the American College of Surgeons	United States	Academic publication	To describe the key contributors to the effective response to the COVID-19 pandemic in Western Washington.	Consensus statement from expert panel	The expert panel included accessibility and availability of testing as one of their success factors during the initial timeline of the pandemic.	In terms of lessons for the future, the authors emphasized the need for collaboration between laboratories and academia to ensure surveillance and population wide testing.	

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Mukattash 2020	International Journal of Clinical Practice	Jordan	Academic publication	The present study aims to exploring community pharmacists' willingness and readiness to test for COVID-19 in Jordan.	Qualitative interviews with 20 community pharmacists	Jordanian pharmacists are willing to test patients for COVID-19 in community pharmacies and in at-home testing. Pharmacies are an accessible testing site for the public. However, participants described they were not prepared/skilled administer tests and needed extra training and better safety precautions. Physical space in pharmacies in Jordan is also a barrier.	Certification guidelines and programmes and clear legislations to govern such services in community pharmacies.	
Murphy 2020	Media	United States	Media	To describe a testing program for SEPTA employees.	Media	Access to testing for essential workers.	Offering free tests to targeted populations.	5400 employees had been tested within 7 weeks of roll out.
News 2020	Media	United States	Media	Articles provide a description of the newly launched Black Doctors (COVID-19 Consortium whose initiative is to offer free mobile COVID-19 testing to at-risk and vulnerable communities.	Media	A lack of access to free testing is contributing to high rates of COVID-19 among Black communities.	Describes an initiative to offer free mobile testing to underserved/vulnerable communities. People who want a COVID-19 test, can sign up for an appointment online, as the group is testing anyone with symptoms or who has recently been in contact with a known positive. The consortium also has a GoFundMe page dedicated to generating money to continue providing the free testing, advocacy, and also a COVID-19 education component for Black persons.	Describes that the reason the consortium was created was to ensure access to testing and education for Black people in underserved communities. The writer did not provide any measurable outcomes or follow-ups on the program, but did mention that out of the 50,000$ goal on the GoFundMe, $25,000 had been attained.

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OHSU 2020	University website	United States	Media	Article outlines the novel strategies being used at Oregon Health & Science University to provide low-barrier testing, including reserving the first two hours for OHSU staff, their family members and first responders. In addition, if a patient does not have insurance, they can still have the test.	Media article	Not specific but talks about "low-barrier testing" strategy.	During high-volume periods, the first two hours of testing will be dedicated to first responders (police, firefighters, and emergency medical technicians), Oregon Health & Science University (OHSU) health patients and household members of OHSU health employees. Bill insurance for those who have it and free tests to uninsured patients. Expanded hours of testing and the introduction of pop-up mobile testing sites.	
Page 2020	New England Journal of Medicine	United States	Academic publication	Focuses on COVID-19 challenges experienced among the Latinx community.	Perspective	Demand for testing couldn't be met with available resources. The public questioning the benefit of testing as there's no treatment. Positive results could lead to job loss, isolation, stigmatization, and eviction.	Cash benefits should be extended to anyone who needs them, regardless of immigration status.	
Quest Diagnostics 2020	Media	United States	Media	Reports on the results of the Quest Diagnostics Health Trends Survey on Testing Hesitancy	Survey (n=2050 adults including n=337 identifying as Hispanic or Latinx; n=265 identifying as Black; and n=1278 identifying as White)	Multiple barriers were identified, including: 1) Fear of getting infected; 2) Not believing they may have the virus; 3) Fear of quarantine; 4) Cost. More Hispanic/Latinx adults (83%) than Whites(non-Hispanic (72%) and Blacks(72%) avoided or delayed a COVID-19 test when they believed they needed one.	The health system needs to design better communication strategies to promote testing.	The survey found that 3/4 Americans would not get a COVID-19 test, even if they had symptoms. The primary reason was fear of getting the virus (30%), did not think they had it (21%), fear of quarantine (15%), and cost (15%).

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Rader 2020	medRxiv	United States	Preprint	To assess the travel time to testing sites to determine their geographic accessibility in the United States, specifically focusing on travel time under and over 20 minutes.	Spatial analysis (n=6236 testing sites in 3108 counties)	Increased travel distance has the potential to decrease the geographic accessibility to testing.		The authors also included additional variables in their spatial model - population density, percent minority population, percent uninsured population - in additional to travel distance. The authors noted that counties which had a greater proportion of minority populations and those who were uninsured, as well as smaller population density, had the lowest accessibility to testing centres. Hence, the authors suggested that geographic accessibility be an integral part of planning. Just under a third of the population resided in counties where the testing sites were greater than 20 minutes away. They found that there were geographic differences in that a greater proportion of the population living in the Mountain division had to travel over 20 minutes compared to the Middle Atlantic at 86% versus 5%, respectively.
Siegler 2020	Open Forum Infectious Diseases	United States	Academic publication	To assess patient willingness to use various SARS-CoV-2 testing modalities for clinical care: home-based specimen collection, drive-through testing, and clinic-based testing.	Survey (n=4593 eligible participants; only n=1260 respondents)	Public preference for Covid-19 tests based on ease of use. Home testing was the most preferred type of test (92%), followed by drive-thru (71%), then lab or clinic-based tests. Preference differences were not affected by onset of symptoms, age, race or location.		Found that home tests are most likely to be used by individuals, followed by drive thru tests. Implied is the idea that the public do not want to seek tests in clinics where they may get sick. Instead, public prefers to maintain social isolation/physical distancing by taking at home tests.
Singh 2020	Medical Decision Making	United States	Academic publication	To examine whether providing COVID-19 testing at United States Postal Service locations would increase access by reducing the driving distances. The authors undertook a modeling exercise to evaluate the use of postal service locations as testing sites in order to increase the coverage and accessibility of COVID-19 testing, particularly for individuals residing remotely or within communities that are deemed to be at risk.	Modeling study	The authors evaluated an alternative testing location option (postal services) to address the issue of limited access to testing for a subset of the population.	The authors evaluated an alternative logistical network to administering COVID-19 testing, chiefly the possibility of utilizing the resources of the USPS. Through their modeling, they found that incorporating USPS services would allow for greater accessibility to testing of the population through on-site testing or the delivery of testing kits to homes.	If USPS locations were involved in COVID-19 testing, coverage would be over 88% in 49 of 50 states (all but Michigan). 90% of the population would be able to drive 7 miles or less to reach a postal service location. In three states (Minnesota, Illinois, Georgia), the use of USPS locations would provide 1.3-4.1 million residents with greater access and reduce their distance traveled by 0.8-3.0 miles.

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Sotgiu & Dobler 2020	European Respiratory Journal	Global	Academic publication	The describe the impact of social stigma on health-related behaviours related to the COVID-19 pandemic.	Commentary	Social stigma of being positive for corona virus inhibits people from getting tested because it may reveal they did not abide by social rules (PPE, isolation, etc.) and be shamed. This creates anxiety and uncertainty in people who don't want to be known for spreading the virus. Communication: The infodemic of misinformation, news, mixing facts, and rumours leads people to make poor health-related behaviours, including testing.	Education about symptoms, testing, outcomes, etc. Honest, direct, simple communication from leaders about testing.	Identifies the Trinità health educational model as a good example of using interactive education to inform people.
Thappa 2002	International Journal of Health Sciences and Research	India	Academic publication	This correspondence article aims to summarize the reasons for testing hesitancy in India.	Text and opinion	A variety of barriers are reported. (1) People with limited incomes are fearful of losing their jobs. (2) Waiting for test results (3) Living conditions for quarantine centre are suboptimal (consequences of testing positive): These centres are described as having poor lodging and food facilities, so people are reluctant to get tests. (4) Dilution of fear/threat of virus: testing hesitation turning into "ignorance". (5) COVID-19 fatigue: sense of fatigue among citizens of India owing to the fact there is an absence of any specific treatment for COVID-19 ("testing is done in vain"), that it is a disease that is much less harmful to young, healthy populations, and that there is a low frailty rate. (6) mental strain from lockdown and threat of being in quarantine; (7) history of hesitancy for new tests and vaccine amongst the population in India.	Targeted, specific information and education materials to address the lax attitude toward testing. Regular updating of information and content.	1) Prioritize high-risk and vulnerable groups for testing when supply is limited 2) Release inmates/detainees who are more susceptible to the virus based on age and underlying medical conditions.
The Unity Council 2020	NGO website	United States	Grey literature	Reporting on Community testing program in Fruitvale Sanado Juntos Community (California). This is a 2 page brief about the outcomes of the free testing event. It identifies three strategies that can improve testing in Latinx communities.	Brief report.	Access to testing	More COVID-19 testing and contact tracing to identify cases and provide resources to households. Targeted public health outreach to marginalized communities. Economic relief (food and housing assistance, income replacement for workers who need to quarantine). Strategies were suggested but not implemented.	Tested nearly 1200 citizens (the majority identifying as members of Latinx community) over a weekend in September 2020 using a "test and repond" model.

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Thunstrom 2020	Behavioural Public Policy	United States	Academic publication	To evaluate whether individuals are likely to test for COVID-19 infection, taking into account their financial abilities and willingness to pay, as well as their personality characteristics.

The authors used hypothetical scenarios to test the willingness of the participants to get tested. | Hypothetical field experiment (simulated RCT, between-subjects design)

(n=1000 total of whom n=890 observations were included due to not having already been tested for COVID-19 and having complete data) | | | The authors found that a majority of their respondents would be willing to get tested for COVID-19, even if they would have to financially cover it. Furthermore, the authors found that individuals who identified as extroverts and could in theory be more at risk for infection and its spread, had a high willingness to get tested. |
| Tower Hamlets Council | Government website | UK | Media | Community engagement for Test and Trace | Media | None specifically identified. | Strong network of community partners including community navigators who work one-to-one with residents to help them identify an access the support they need to enhance health and wellbeing. They gather insights on barriers to engagement, identifying support needs and then meeting these needs.

Working with other council services (eg sexual health commissioned services) and partners to strengthen the support offer within community, voluntary and faith sector groups, and enable identification of extra support the council may need to provide to increase uptake and engagement among these communities. This may include, for example, bespoke communications for specific communities, community champions, and proactive/reactive support for self-isolation. | Highlights the plan that is important for engagements: 1) co-produced with local communities and VCS organisations; 2) Using community and faith groups/volunteers as messengers; 3) Building trust and conveying messages regarding benefits of testing and contact tracing, and responding to data about hotspots or areas of low uptake. 4) Building on the foundation of the current response to pandemic, linking those isolating to existing support in the VCS, faith and Mutual Aid groups; 5) Working with and supporting groups with specific issues with access to testing or contact tracing in their communities; 6) Locally sourced, trained and embedded volunteers to support individual residents with every stage of the national test and trace process. |
| UNICEF 2020 | Government website | Global | White paper | To describe social stigma related to COVID-19, its negative effects and how to address it. | Guidance document | Social stigma can inhibit people from getting tested by having them hide their illness, stop healthy behaviour, and discourage them from seeking help. | Communication: words matter, become literate to effects of stigma.

Governments should do their part to influence positive behaviours by spreading facts, engaging influencers, amplifying voices of affects, portray different ethnic groups, and act ethically.

Address the infodemic by clearing up misinformation as soon as it arises, correct misconceptions, have one clear voice and spread facts. | |

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Zimba	medRxiv	United States	Preprint	To determine important drivers of decisions to obtain a SARS-CoV-2 test in the context of increasing community transmission. Survey to assess the relative importance of type of SARS-CoV-2 test, specimen type, testing venue, and results turnaround time.	Discrete choice experiment (n=5098 eligible from a current cohort study; n=4793 participated)	Findings suggest NP swabs may be a deterrent to testing.	Participants identified that rapid receipt of results, tests that detected current and past infections, cheek swabs and at-home self-collection were the most preferable testing service attributes. Simulating changes in attribute trade-offs individually, providing immediate or same day test results, providing both PCR and serology, or collecting oral specimens would increase testing uptake the most.	Results turnaround time had the highest relative importance (30.4%), followed by test type (28.3%), specimen type (26.2%), and venue (15.0%). Strategies were chosen based on survey results. Participants were asked to consider different combinations of SARS-CoV-2 testing service features in a situation where '...the number of people hospitalized or dying from coronavirus in your community was increasing.' Each participant was presented with five choice tasks, each containing two juxtaposed scenarios comprised of different combinations of the testing features (aka attribute levels), and a "None" option if neither testing scenario was appealing or desirable. Limitations of the study include the omission of other attributes which may influence testing preferences, such as frequency of testing, cost, facility wait times or distance