Rapid Diagnostic Testing for COVID-19: social and economic impacts

Rapid systematic review

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Third-Party Materials

Not applicable.

General Disclaimer

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Abbreviations and Definitions

Abbreviations

CADTH = Canadian Agency for Drugs and Technology in Health

RDT = rapid diagnostic testing

Key Definitions:

Rapid diagnostic testing – refers to point of care testing. More fully, as defined by the US Food and Drug Administration: “Rapid, point-of-care diagnostic tests use a mucus sample from the nose or throat but can be analyzed at the doctor’s office or clinic where the sample is collected and results may be available in minutes. These may be molecular or antigen tests.”[1] For the purpose of this review, pooled testing (i.e., where samples are analyzed as a batch, and if a batch tests positive, then individuals in that pool are retested) is excluded from the definition unless explicitly defined as rapid in nature.

[1] US FDA. Coronavirus Disease Testing Basics. Nov 8, 2021. https://www.fda.gov/media/140161/download.

EXECUTIVE SUMMARY

Introduction

The purpose of this study was to provide evidence on the social and economic impacts of rapid diagnostic testing (RDT) for COVID-19. This project sought to identify emerging evidence on social and economic considerations of RDT and serves as an update to a related project conducted in June 2021. This work was commissioned by Health Canada through the SPOR Evidence Alliance.

Research question

What evidence exists on the social and economic considerations for rapid diagnostic testing for COVID-19?

Design

A rapid systematic review was conducted.

Methods

MEDLINE, EMBASE and the Web of Science were searched. We performed all searches between Nov 1-3, 2021. Both empirical and modeling studies were included from 2020-2021. No language restrictions were applied. Two team members carried out the initial title and abstract screen following a calibration exercise (single reviewer screening) and then one team member undertook the full study data extraction. In addition, grey literature was searched through McMaster Plus, Google and the CADTH COVID-19 Evidence platform. Finally, key country websites were searched. Two public members were engaged in the project and provided comments on the draft report.

Summary of key findings

WHAT EVIDENCE EXISTS ON SOCIAL CONSIDERATIONS FOR RDT FOR COVID-19?	• Published papers suggest that RDT leads to reduced COVID transmission and enables continued opening of schools, workplaces and other settings, though they do not separate the effects of screening from other public health measures • For the most part, mass screening programs in schools, workplaces or other community settings appear to be acceptable to the relevant publics
WHAT EVIDENCE EXISTS ON ECONOMIC CONSIDERATIONS FOR RDT FOR COVID-19?	• Economic modeling of large-scale testing programs suggests that these are cost-effective from the societal perspective although the realism of assumptions upon which such models have been based may be questionable

Conclusion

Where RDT has been reported in specific settings, such as schools or workplaces, it appears to have been largely accepted by the affected audiences, judging by rates of participation. This holds even for one instance of nation-wide mass testing, in Slovakia. Studies are also optimistic that testing will have high, even very high, cost-effectiveness. The literature here suggests that such programs are also feasible to implement, although marshalling the necessary resources is a very real challenge and potentially could be quite burdensome to organizations without some form of external government support. Overall, these findings suggest that for the duration of the pandemic, exploration of RDT programs holds promise as an additional strategy for protecting the public's health from COVID-19.

Introduction

It is increasingly important to consider emerging evidence on how rapid diagnostic testing (RDT) policies for COVID-19 might be applied to different segments of the population. Other recent reviews have examined the effectiveness of point-of-care testing and RDT.[2,3] The intention here was not to duplicate these efforts but rather to look specifically at RDT and the relevant social and economic considerations. This work builds on a previous project carried out by the authors in June of 2021.

Research question:

What evidence exists on the social and economic considerations for rapid diagnostic testing for COVID-19?

Methods

Search strategy and screening

An experienced medical information specialist developed and tested the search strategies through an iterative process in consultation with the review team. We searched Medline, EMBASE and Web of Science Core Collection. We performed all searches between Nov 1-3, 2021. The full searches are found in Appendix A. No language restrictions were applied but results were limited to the publication years 2020 to the present. Results were downloaded and deduplicated and then uploaded to Excel.

Two team members carried out the initial title and abstract screen following a calibration exercise (single reviewer screening) and then one team member undertook the full study data extraction using a data extraction form modified for this study.

In addition, grey literature was searched through McMaster Plus, Google and the CADTH COVID-19 Evidence platform using a combination of the following keywords: *COVID-19*, *rapid test*, *economic impact*, *social impact*. The second component of the grey literature search involved going through the webpages for the national government, national ministry/department of health, and/or any national COVID-19 response department for the following nations: Canada, Australia, Austria, Belgium, France, Germany, Israel, Italy, Spain, Sweden, Switzerland, and the Netherlands, USA, and UK.

Population/ problem:

1. We included studies on empirical findings or modeling results, or other evidence, about **social impacts** of SARS-CoV-2.

[2] Kelly S, Wells G. Rapid and point-of-care diagnostic tests for SARS-CoV-2 (COVID-19). SPOR Evidence Alliance, June 2021.
[3] Mitton C, Smith N, Lakzadeh P, Kim D. Rapid Diagnostic Testing for COVID-19 in a fully vaccinated population. SPOR Evidence Alliance, June 2021.

Interpretation:

- empirical designs can be either qualitative or quantitative
- include ethical or policy analyses
- exclude opinion pieces, commentary or editorials

2. We included studies on empirical findings or modeling results, or other evidence, about **economic impacts** of SARS-CoV-2 testing.

   Interpretation:

   - economic impacts can be at the societal level, the health system level, the insurer or the individual
   - empirical designs can be either qualitative or quantitative
   - exclude opinion pieces, commentary or editorials

Both 'social impacts' and 'economic impacts' were left open in their respective interpretation so as to not artificially limit capture *a priori*. In practice, this meant that any study using these terms, however self-defined, could be selected into our review.

Synthesis approach

Studies included upon abstract screening were summarized in a table with a decision for final inclusion. Results from full data extraction were discussed by the research team and were summarized in text. Information from the grey literature searches were also synthesized and integrated in summary form with the full text reviews.

Public member input

Two public members who were part of the original study were re-engaged and asked to provide feedback on the draft report. Their comments were incorporated into the final report.

Results

Study selection

The number of studies by source found through our search are outlined in Table 1.

Table 1: studies by source from abstract screening to full paper review

Search	Total Title/Abstract screened (after duplicates removed)	Initially screened as, Yes	Yes -retained after full text review	Initially screened as, Maybe	Maybe - retained after full text review	Total retained
Medline Social a	576	1	1	3	1	2
Medline Social b	283	1	1	7	2	3
Medline Econ	424	1	1	7*	2	3
Embase Social	526	3	2	0	--	2
Embase Econ	570	0	--	0	--	--
Web of science	383	0	--	0	--	--
SUB-TOTAL	2,762		5		5	10
Additional Sources	n/a	3**	3	0	0	3
TOTAL			8		5	13

*One of these was a Cochrane rapid review of screening (Viswanathan et al, 2020); only 2 studies used rapid testing as defined here—the two original studies were included instead (see line 9)
** Two items identified within Cochrane review as above, plus one additional grey lit source identified from expert recommendation

Summary of findings

The following summary is based upon analysis of 13 academic research studies retained for this review (12 peer-reviewed publications and one Working Paper from the grey literature). Where appropriate, links are made to the government websites identified in the grey literature search and which are described more fully elsewhere in this review. All papers were in the English language, and published in 2020 or 2021. Key themes are summarized in tabular format in Appendix B.

Of the 13 papers, seven studies were conducted in the US or modeled using US-data; one study came from each of Australia, Germany, Italy, Slovakia, Spain and the UK. The most common design (n=6) was observational, reporting upon results of COVID-19 tests conducted. Four studies developed economic or epidemiological models as the sole output. One study was a validation of a new type of

diagnostic test, one was primarily a qualitative reporting of parent opinions around screening, and one study offered a narrative description of the development of a rapid testing program.

Eleven of the 13 included studies address what is best described as universal screening; that is, the testing regime involves the entire population of a setting, or in some cases a random sample of that population. Five studies were set in schools or universities, two in health care facilities, and one in a large industrial workplace; three studies considered population-wide screening of the entire country. Two studies reported on targeted testing; that is, tests were employed for diagnosis of suspected cases only – asymptomatic persons were not eligible. Both studies looked at the introduction of rapid testing across large, remote and largely Indigenous areas, in Australia and Alaska.

If we assume that December 2020 represents the beginning of large-scale vaccination, then 6/10 empirical articles (60%) had completed data collection prior to that time, and so represent RDT in a largely unvaccinated population; the remaining papers carried through some data collection into the first quarter or half of 2021. Studies took place across a range of background conditions in community spread. Pavelka et al, for instance, note that nation-wide testing in Slovakia was implemented as rates of prevalence in most counties had been rapidly increasing, and two of three rounds of tests were specifically targeted to the highest-rate regions. Rennert et al estimate that the rate of Covid-19 in the community surrounding Clemson University was stable at approximately 0.6-1.7% over the duration of their study, while the rates among students fell from 8.7% to 0.8% over the course of the research. By contrast, Segui et al state that rates in Catalonia were substantially lower than those of Spain overall, leading to lower cost-effectiveness estimates in their work. Wachinger et al describe rates of Covid-19 in the area around their school project as fluctuating – rising to 50% above baseline by mid-study, and then falling to 50% below baseline by the study's end.

Based on awareness of issues reported in the popular media, and careful reading of the articles, seven themes were inductively identified in order to answer the given research question – five social and two economic. These can be labelled in shorthand as (1) Intended Impacts, (2) Unintended Impacts, (3) Acceptability, (4) Withdrawal, (5) Legal Factors, (6) Costs and Benefits, and (7) Feasibility. These themes are synthesized here, noting a data extraction matrix is included in Appendix C.

SOCIAL CONSIDERATIONS

Intended Impacts. Overall, the authors of the non-modeling papers, which considered the implementation of real-world RDT programs, believed that these had achieved positive results. This included things such as reduced numbers of reported cases (Hodges), reduced case prevalence (Pavelka), and limiting disease transmission in-schools to allow continued educational and extra-curricular activities (Lanier, Volpp). However, none of these papers separated the impacts of rapid diagnostic testing from the entire package of preventive measures (e.g., masking, social distancing, hand hygiene, improved ventilation etc.) put in place within these settings, which limits the strength of the conclusion. "The extent to which other factors, such as enhanced community mitigation efforts, might have contributed to the steep decline in case counts … is unclear" (Hodges et al, p. 1122).

"Associations between the implementation of testing strategies and outcomes are not causal; other factors might have contributed to the drop-in disease prevalence" (Rennert et al, p. 435). Hodges et al note that case incidence in their study area fell dramatically in conjunction with the achievement of substantial rates of vaccination in the population (p. 1122, see Figure). Three papers had primary outcomes which might be considered quality measures (i.e., case detection (Rennert), test effectiveness (Osterdahl), error rates (Hengel)). Some papers (e.g., Vilani, Hengel) provided only preliminary results while further data collection and analysis were on-going.

Unintended outcomes. The literature has expressed potential concerns about the unintended impacts of mass screening, largely based on the rates of false negatives and false positives which might occur (false negatives being people who have the illness but are not identified, and so continue to be active in the community when they ought to self-isolate, and false positives being people who do not have the illness but are nonetheless required to self-isolate because of an erroneous test result). According to Pavelka, false negatives were not a problem with the mass testing employed in Slovakia. However, Hodges et al report that "one of the unanticipated challenges of relying on rapid point-of-care antigen testing was that persons frequently mistook a negative antigen test result as an indication that they no longer needed to isolate until serial repeat testing was completed" (p. 1122). Several other papers note the existence of this concern, but have no direct data regarding it (Lanier, Osterdahl, Pahltiel, Wachinger). Atkeson et al contend that use of confirmatory tests for initial positives is likely necessary in order to prevent unnecessary self-isolation and its economic impacts, which is current practice in many jurisdictions where positive rapid antigen tests trigger a second PCR test—advice on all three of the government websites identified in the grey literature search (Govt of Canada, Govt of UK, Public Health Agency of Sweden).

An additional concern is that testing might lead people to feel less need to comply with other public health measures (mis-incentive). This acknowledged by Atkeson et al, who explicitly note that is something their economic model does not include. Qualitative evidence gathered by Wachinger et al, finds the concern unwarranted in their case: "Negative consequences (eg, more risk-taking behaviour) were not observed" (p. 7). Alternatively, Lanier et all suggest that in their study "linking serial testing results to socially desirable activities, such as participation in extracurricular activities, might have incentivized masking and other preventive behaviors," though this is speculative and not something which they can demonstrate with direct data.

Acceptability. This refers to the extent to which a rapid diagnostic testing program is acceptable to the public which is expected to participate in it. Overall the authors of these studies appear to believe that this condition is fulfilled. This is explicit in Osterdahl's small scale study (within a 24-bed care home), where "All [patients] were enthusiastic to be involved and could see the value of rapid testing" (pp. 3-4). Support can be built through meaningful engagement of stakeholders. Wachinger et al note the extensive role played by parents in developing their school-based study. Both the articles focused upon rapid screening in rural Indigenous areas emphasize the importance of consultation and engagement.

In other articles, the finding of acceptability seems to be a judgment based upon high rates of uptake. For instance, per Rennert et al, "The high rate of compliance with mandatory testing among the student population, despite few consequences for noncompliance, indicates that such testing on a public university campus is feasible and acceptable to the student population" (p. 434; see also Pavelka, Vilani, Volpp and Wachinger). The qualitative data in Wachinger et al do also report instances of parent frustration in encounters with the testing-hesitant however, and similarly qualitative data from Lanier et al find that perceived lack of community support is a barrier to the school-based rapid testing. Paltiel et al include this as a factor in their model, while the three other models address only non-compliance with isolation after a positive test.

Withdrawal and Legalities. Withdrawal refers to the prospect that people opposed to testing will remove themselves from participation, for instance by taking their children from school or quitting their jobs if testing is mandated; this could lead to disruptive impacts upon the economy and public institutions. The included papers do not address this social consideration, with the exception of a brief mention by Wachinger et al that some German families (not at the study site) express opposition to testing mandates by turning to home-schooling. Another relevant factor is the legal environment allowing for and structuring the use of rapid testing programs in different settings. Again this is relatively neglected by the included papers. Wachinger et al refer to lawsuits initiated by parents opposed to testing, though again not directly observed in their study site. Paltiel et al note that requirements for physician authorization in some US jurisdictions may be a barrier to the use of certain testing modalities[4]. The website of the Public Health Agency of Sweden makes several references to legal obligations associated with rapid diagnostic testing in workplace settings, indicating this is a practical concern.

ECONOMIC CONSIDERATIONS

Cost/Benefit. Cost and benefit considerations relate to how expensive it is to put a testing program in place, who bears those costs, and to what extent the benefits obtained (outcomes) are worth that cost. For the most part, authors of the included studies endorse such programs. Two economic models address a theoretical plan for population-wide screening (Atkeson, Paltiel). While both present a variety of scenarios, they encourage readers to look beyond any specific set of numbers to bottom line conclusions. "Our qualitative policy finding… a nationwide rollout of frequent, home-based testing and self-isolation is justified on both epidemiologic and economic grounds" (Paltiel et al, p. 807); it would be "exceptionally good value" (p. 806). "Even with partial compliance, screening testing induces large net economic benefits" (Atkeson et al, p.4) where "benefits exceed costs by a factor of 5-10 for weekly testing" (p.4). (Pavelka et al report an actual case example of nation-wide screening, but do not assess costs explicitly.) Both US modeling studies find this benefit in terms of cost recouped or avoided, with even greater dollar values attributable if reductions in morbidity and mortality are included. This is the societal perspective on benefit, also taken by Segui et al based on Spanish data from a large automotive sector employer. "The set of avoided cases [based on successful screening] represents

[4] As another example, Pollack et al note that in Massachusetts, in order to participate in a pooled rapid testing program, schools sites had to receive a Certificate of Waiver under public health law in the state.

744,488 Euros of saving in the use of health resources" (p. 4) over a 1-year period. Avoided mortality and morbidity provide an additional benefit of 1,223,661 Euros in health gain. This is equivalent in the end to savings of 10.44 Euro per test performed.

Rennert et al provide cost/benefit numbers in the context of a university as payor:

> "Effective surveillance testing strategies are economical when the alternative is university closure…. we estimate that testing an on-campus population of 6000 students would cost a university $22 000–255 000 per week with SBIT and $44 000–510 000 per week with weekly testing. On the other, we estimate that Clemson University generated approximately $1·65 million per week in housing and dining costs that would have been lost if the university was forced to shut down" (p. 434).

More modest economic claims made by Rennert and by Osterdahl are that a certain type of testing is more resource-efficient (in detecting more cases for the same number of tests, or in requiring less expensive analytic equipment) and thus presumably would save money for the users. To the extent that it is addressed by the included studies, the government is expected to be the funder of testing done in public institutions or at-large. Segui argues that due to the public benefits obtained, workplace testing ought to be publicly subsidized, which is indeed the approach which is being taken at least in part by the Canadian federal government (GoC website).

Some of the cost comparisons (explicit or implicit) may be based on assumptions which are unrealistic or out-of-date, particularly in situations where COVID may be highly prevalent. For instance, the agreed-upon Australian guideline, in the absence of rapid testing, was that all suspected cases in remote Indigenous communities would be airlifted out until test results were available, a large expense which might be prohibitive if required frequently[5].

Feasibility. Feasibility refers to whether or not an organization or entity is able to bear the costs and effects of implementing a rapid diagnostic testing program. The biggest practical issue appears to be staffing capacity. At the national-level in Slovakia, Pavelka et al state that mobilizing sufficient medical personnel, supportive army personnel, test materials and PPE were challenging to implementation. At the school or college level, Rennert et al's exploration of a particular model of testing was based on the premise that few colleges have sufficient infrastructure to deliver a gold-standard of universal testing on a weekly or more frequent basis. Other school studies included here concur: "Setting up an extensive logistical operation to conduct twice weekly sample collection on campus of all students, faculty, and

[5] As another example, Currie et al use cost minimization to find the economic impact of a Welsh program in which all suspect Covid cases are tested in their homes by a two-person Health Board team. The comparator, or usual care, presumes that each suspect case would be transported by ambulance to hospital to be tested, accompanied by a back-up ambulance in case the first one failed. In retrospect, this seems more reflective of Ebola-virus levels of risk and not the way in which Canada or most other countries have actually handled case testing.

staff members with relatively fast turn-around-times was required, which also involved considerable expense" (Volpp et al, p. 381; see also Lanier, Wachinger).

Limitations

We were unable, due to time constraints, to do appropriate formal quality assessment of the included studies. We note, however, that the two papers obtained from the Cochrane rapid review of screening programs (Osterdahl; Zhang) were assessed by those authors. The Zhang paper was deemed to offer very low-certainty evidence, with its weighting downgraded due to concerns about a high risk of bias and the use of unrealistic assumptions in its epidemiological modeling (for instance, assuming 100% test sensitivity). The Osterdahl paper was assessed to have an unclear risk of bias, and to include reporting flaws such as not indicating if all participants were included in final analysis and lack of blinding when comparing their test results to the reference standard. There may be methodological flaws in the remaining included papers as well, and so some caution should be exercised when evaluating the strength of the evidence identified in this review.

Grey literature

The grey literature identified websites (in English) from three governments – Canada, Sweden, and the UK – addressing the use of rapid tests for COVID-19 screening in either school or workplace settings. These are outlined in Table 2.

Table 2: grey literature identified websites from three countries

Schools	United Kingdom: ***https://www.gov.uk/government/news/students-urged-to-take-a-rapid-covid-19-test-before-end-of-half-term*** Updated: October 29, 2021	Sweden: ***https://www.folkhalsomyndigheten.se/the-public-health-agency-of-sweden/communicable-disease-control/covid-19/covid-19-testing/screening-at-workplaces-and-schools/*** Updated: November 1, 2021
Workplaces	Canada: ***https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/testing-screening-contact-tracing/workplace.html*** and ***https://www.canada.ca/en/public-health/services/publications/diseases-***	

	conditions/covid-19-rapid-testing-workplace-infographic-employees.html Updated: August 11, 2021	

The UK and Canadian sites are subsections of the main government page, while the Swedish site is from the website of the Public Health Agency. The audience for the workplace websites is both employers and employees. As for schools, the Swedish site is directed primarily to school administration or leadership, while the UK piece speaks to students directly. All of the websites state very clearly that screening is only one of a larger suite of preventative measures that will contribute to the control of COVID-19, e.g., vaccination, social distancing, proper hand hygiene, adequate ventilation, wearing masks, etc.

The Swedish site describes antigen tests, with links to more detailed information, as a means of rapid testing, though emphasizing in several places that these are less sensitive than PCR molecular tests. Any positive test in a screening program MUST (emphasis in original) be confirmed with a PCR test. The UK sites states that screens involve “lateral flow tests” (another term for antigen testing), and the nature of screening tests in Canada is not explicitly identified, but both countries also tell those who receive positive tests to get a confirmation PCR.

School Specific Assessment

In the UK, “the government recommends that schools ask pupils and staff to test twice a week, and that families continue this during the holidays” – testing in other words remains voluntary. The website depicts tests as being conducted at home, with kits which families already possess or can obtain (whether at a cost or not is unclear) from pharmacies. By contrast, the Swedish government is **not** recommending school-based testing at present: “The Public Health Agency of Sweden currently considers that the risks and uncertainties surrounding the use of regular screening among pupils outweigh the possible benefits. This is particularly true of the screening of younger pupils. There is still a lack of knowledge regarding whether screening schoolchildren can be an important tool in preventing the spread of infection and reducing sickness absences at school.” This is consistent with current advice in some Canadian provincial jurisdictions as well, such as Ontario: “Routine rapid antigen screening of fully vaccinated individuals and children is not currently recommended given the effectiveness of the COVID-19 vaccines as well as the risks posed to the disruption of learning as a result of false positive.” (https://news.ontario.ca/en/release/1000924/targeted-covid-19-rapid-antigen-screening-to-keep-students-safe).

Workplace Specific Assessment

The Canadian government encourages workplaces to set up testing programs, including through the provision of free testing kits to employers, and workers are encouraged to participate, even after they

are vaccinated. In Sweden, workplace testing is presented as a voluntary arrangement between employers and their workers; the website stresses employer responsibility to "regularly carry out risk assessments and introduce protective measures to reduce the risk of spreading COVID-19 at the workplace," while also emphasizing medical and legal requirements under which programs must operate. Workers are informed about what they should expect from employers when it comes to testing programs, and in contrast to the Canadian stance, states that "Some groups do not need to be included in screenings. This generally applies to people who have had COVID-19 within the last six months and people who have been vaccinated." The Canadian governments website implies that workplace testing programs will be on-site; Sweden suggests that programs may be on-site or conducted with home testing kits which "are not covered by the Health and Medical Services Act" and so don't require a doctor to prescribe and administer.

Overall, the tone of the UK information is very positive and encouraging, including several quotes from senior bureaucrats and Ministers lauding students for proactively being tested. It is presented in the form of a supposed news article, and is the only one to include statistical information. The tone of the Canadian website is also quite positive, while the Swedish site strikes a much more cautious tone, emphasizes limits to current knowledge, obligations related to the implementation of testing processes, as well as the specific recommendation not to test widely in school settings.

Discussion

COVID-19 has been a global pandemic leading to mortality and illness, and threatening hospital capacity, in several waves in countries around the world. International public health consensus has coalesced behind the advocacy of several preventive or mitigative measures, such as hand hygiene, physical distancing, masking and vaccination. The development of RDTs enabling site-specific or widespread community screening can be another potential measure for COVID control. This review summarizes recent international experience, with research evidence from seven countries –and government information from two additional ones -- in this regard.

While COVID-19 research continues to be prolific, social and economic considerations remain relatively sparsely addressed relative to clinical questions. The studies identified here provide some suggestions as to the impacts of one particular public health intervention, the implementation of RDT programs. Generally, they find positive impacts although these are measured in terms of cases identified or prevented, rather than connected to measures of health system usage, or morbidity and mortality. There is some indication that the studies do build upon one another; for instance, both Lanier et al and Wachinger et al note consistency of their findings with those published by Volpp et al. This consistency should strengthen the overall conclusion at least in regard to school-based testing regimes. The studies also find relatively little evidence of unanticipated or undesirable impacts. Together, this suggests that screening programs are likely to produce some benefit. Modeling studies, along with an empirical example from Spanish industry, suggest that the benefits are obtained in a cost-effective manner.

Testing programs are implemented with considerable variation in design, even within the studies reviewed here; for instance, they vary in the frequency of testing and measures used to monitor compliance. Further research is needed to determine what specific design features are most effective in which settings. This might involve alternative review methodologies, such as realist review. The studies generally collected data prior to widespread vaccination, which would be expected to lower community prevalence and might have some effect on interpretation of the conclusions; that said, the studies here do represent a range of background conditions, including high, low and fluctuating rates of disease prevalence in the community relative to the RDT sites.

Conclusion

Where RDT has been reported in specific settings, such as schools or workplaces, it appears to have been largely accepted by the affected audiences, judging by rates of participation. This holds even for one instance of nation-wide mass testing, in Slovakia. Studies are also optimistic that testing will have high, even very high, cost-effectiveness. The literature here suggests that such programs are also feasible to implement, although marshalling the necessary resources is a very real challenge and potentially could be quite burdensome to organizations without some form of external government support. Little has been reported as to how such programs might disrupt the day-to-day business of their settings, though we might presume they have lesser impacts than would full scale closures or lock-downs. Overall, these findings suggest that for the duration of the pandemic, exploration of RDT programs holds promise as an additional strategy for protecting the public's health from COVID-19.

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Appendix A: Search strategies

Research Question

What are the social and economic impacts of rapid diagnostic testing for COVID-19?

6. Web of Science Search –COVID2 (Economic Aspects)

UBC Database: Web of Science Core Collection (Clarivate Analytics)

UBC access: ***https://resources.library.ubc.ca/page.php?details=web-of-science-core-collection&id=138***

WOS Account: ***mimi.doyle-waters@ubc.ca***

Search Name: COVID2

Date: Nov. 3, 2021

Results:

269 References

207 Duplicates (52 with the other databases, 155 with the WOS Social Impact Search)

62 Records for Review

Set	Results	Search Terms
# 21	269	#20 AND #5 AND DOCUMENT TYPES: (Article) Indexes=SCI-EXPANDED, SSCI Timespan=2020-2021

20 ***418,321*** (#19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #6) **[Economic Aspects]**

19 ***59,872*** (TS=(fiscal or funding or financial or financ*))

18 ***25,718*** (TS= (government* and (financ* or expenditure* or support* or assistance or manag* or control*)))

17 ***20,096*** (TS= governance)

16 ***156,747*** (TS=econom*)

15 ***13,082*** (TS=budget*)

14 ***1,432*** (TS="Public-Private")

13 ***8,113*** (TS=Partnership*)

12 ***397*** (TS= ("public assistance" or "workers* compensation"))

11 ***1,685*** (TS=public expenditures)

10 ***28,354*** (TS=health benefit*)

9 ***1,116*** (TS=salaries)

8 ***197,059*** (TS=costs)

7 ***1,002*** (TS="industr* development")

6 ***6,766*** (TS="resource allocation")

5 ***1,572*** #4 OR #3 OR #2 OR #1 **[COVID-19 Testing]**

4 ***24*** (TS=("covid-19 nucleic acid test*" or "covid19 nucleic acid test*"))

3 ***23*** (TS=("covid-19 serological test*" or "COVID19 serological test*"))

2 ***696*** (TS=("SARS-CoV-2 test*" or "SARS-CoV2 test*" or "SARSCoV-2 test*" or "SARSCoV2 test*" or "SARS2 test*" or "SARS-2 test*" or "severe acute respiratory syndrome coronavirus 2 test*"))

1 ***867*** (TS=("COVID19 test*" or "COVID-19 test*"))

5. Web of Science Search –COVID (Social Aspects)

UBC Database: Web of Science Core Collection (Clarivate Analytics)

UBC access: ***https://resources.library.ubc.ca/page.php?details=web-of-science-core-collection&id=138***

WOS Account: ***mimi.doyle-waters@ubc.ca***

Search Name: COVID

Date: Nov. 3, 2021

Results:

631 References

248 Duplicates with the other databases

383 Records for review

# 33	*631*	#32 AND #5 **[Social Aspects]** *AND* DOCUMENT TYPES: (Article) Indexes=SCI-EXPANDED, SSCI Timespan=2020-2021
# 32	***1,169,470***	(#31 OR #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6)

# 31	***8,390***	(TS= (personal and (interaction* or relationship*)))
# 30	***15,119***	(TS=Masks)
# 29	***330,088***	(TS=strateg*)
# 28	***377***	(TS="Mass Screening")
# 27	***1,877***	(TS="Disease Outbreak*")
# 26	***22,561***	(TS= (Prevention and Control))
# 25	***73,962***	(TS=(organization or organisation))
# 24	***22,730***	(TS=Distress*)
# 23	***815***	(TS="physical distancing")
# 22	***12,660***	(TS=psychosocial)
# 21	***42,052***	(TS=Anxiety)

# 20	***4,106***	(TS="Health Promotion")	
# 19	***1,334***	(TS=Altruism)	
# 18	***2,996***	(TS="public policy")	
# 17	***5,462***	(TS=(Manage* and (crisis or crises)))	
# 16	***55,478***	(TS=(societ* and (impact* or adjust* or norm* or behavi?or* or chang* or factor* or interact*)))	
# 15	***24,431***	(TS="physical activit*")	
# 14	***44,349***	(TS=attitude*)	
# 13	***399,896***	(TS=(behavior or behaviour))	
# 12	***21,130***	(TS=coping)	
# 11	***21,585***	(TS="well being")	
# 10	***38,276***	(TS="Mental Health")	

9 230,865 (TS=stress)

8 47,233 (TS="Quality of Life")

7 168,074 (TS=social)

6 827 (ts="social aspect*")

5 1,572 #4 OR #3 OR #2 OR #1 **[COVID-19 TESTING]**

4 24 (TS=("covid-19 nucleic acid test*" or "covid19 nucleic acid test*"))

3 23 (TS=("covid-19 serological test*" or "COVID19 serological test*"))

2 696 (TS=("SARS-CoV-2 test*" or "SARS-CoV2 test*" or "SARSCoV-2 test*" or "SARSCoV2 test*" or "SARS2 test*" or "SARS-2 test*" or "severe acute respiratory syndrome coronavirus 2 test*"))

1 867 (TS=("COVID19 test*" or "COVID-19 test*"))

4. EMBASE Search – COVID E4 (Economic Aspects)

Database: EMBASE (OVID)

UBC access: ***http://resources.library.ubc.ca/129***

OVID Account: COVID19

Search Name: COVID E4

Results:

64 62 not 63 (857) E4 Economic Search

Minus 157 duplicates from the social search leaves 700 records

130 duplicates with other databases

570 records for review

Search was executed on: Nov. 2, 2021

Database: Embase <1974 to 2021 November 01>

Search Strategy:

E4 Economic Aspects Search

1 coronavirus disease 2019/ and screening test/ (932)

2 covid-19 testing/ or covid-19 nucleic acid testing/ or covid-19 serological testing/ (3773)

3 ((COVID or COVID-19 or COVID19) and (assay? or immunoassay? or immuno-assay?)).ti,ab,kw. (4656)

4 (COVID test* or COVID-19 test* or COVID19 test*).ti,ab,kw. (1974)

5 ((SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2) and (assay? or immunoassay? or immuno-assay?)).ti,ab,kw. (4834)

6 ((SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2) adj1 (screen* or test*)).ti,ab,kw. (1783)

7 or/1-6 [COVID-19] (11568)

8 economic aspect/ (116638)

9 economic decision making/ (46)

10 financial management/ or public expenditure/ (116455)

11 resource management/ or resource allocation/ (33019)

12 collective action problem/ or "diffusion of responsibility"/ or public goods dilemma/ (41)

13 economic crisis/ or financial crisis/ (587)

14 economic development/ (14347)

15 economic efficiency/ or allocative efficiency/ or pareto optimality/ or production efficiency/ (266)

16 economic incentive/ or loyalty program/ or monetary reward/ or remuneration/ or exp "salary and fringe benefit"/ or exp tax incentive/ or token economy/ or voucher program/ (36249)

17 "inflation (economics)"/ or "cost inflation"/ (30)

18 performance indicator/ or balanced scorecard/ or key performance indicator/ (893)

19 resource shortage/ or food shortage/ or exp medical resource shortage/ or exp personnel shortage/ (3984)

20 socioeconomics/ or consumer protection/ or customer satisfaction/ (149035)

21 exp socioeconomics/ (434266)

```
22      economic well-being/ (99)
23      economics/ (242973)
24      health economics/ or exp economic evaluation/ or exp "health care
cost"/ or exp health care need/ or exp pharmacoeconomics/ (715675)
25      exp "cost"/ (369623)
26      ((financ* or economic) adj3 (policy or policies)).ti,ab,kw. (3920)
27      public-private partnership/ (6361)
28      public finance/ (27)
29      personal finance/ (24)
30      economic*.ti,ab,kw. (388980)
31      economy.mp. (36521)
32      "cost benefit analysis"/ (88463)
33      "cost control"/ (71592)
34      workplace/ (47113)
35      de.fs. [Device economics] (4981)
36      or/8-35 [Economic impact] (1748135)

37      7 and 36 (926)

38      Socioeconomics/ (148817)
39      Cost benefit analysis/ (88463)
40      Cost effectiveness analysis/ (162798)
41      Cost of illness/ (20246)
42      Cost control/ (71592)
43      Economic aspect/ (116638)
```

```
44      financial management/ (116230)
45      Health care cost/ (202780)
46      Health care financing/ (13548)
47      Health economics/ (33770)
48      Hospital cost/ (23013)
49      (fiscal or financial or finance or funding).tw. (236512)
50      Cost minimization analysis/ (3704)
51      (cost adj estimate$).mp. (3773)
52      (cost adj variable$).mp. (288)
53      (unit adj cost$).mp. (4952)
54      or/38-53 [SIGN Economic Filter Embase] (1002402)
55      7 and 54 (554)

56      7 and (36 or 54) [COVID Testing and Economic aspects] (1134)

57      exp animal/ not human/ (4998805)
58      56 not 57 (1129)
59      editorial/ or letter/ or note/ (2621983)
60      58 not 59 (1002)
61      limit 60 to yr="2020 -Current" (1002)
62      remove duplicates from 61 (997)
63      limit 62 to medline (140)
64      62 not 63 (857)
```

3. EMBASE Search – COVID E3 (Social Aspects)

Database: EMBASE (OVID)

UBC access: ***http://resources.library.ubc.ca/129***

OVID Account: COVID19

Search Name: COVID E3

Results:

59 57 not 58 (617)

91 duplicates with other databases

526 records for review

Search was executed on: Nov. 2, 2021

Database: Embase <1974 to 2021 November 01>

Search Strategy:

---

1 coronavirus disease 2019/ and screening test/ (932)

2 covid-19 testing/ or covid-19 nucleic acid testing/ or covid-19 serological testing/ (3773)

3 ((COVID or COVID-19 or COVID19) and (assay? or immunoassay? or immuno-assay?)).ti,ab,kw. (4656)

4 (COVID test* or COVID-19 test* or COVID19 test*).ti,ab,kw. (1974)

5 ((SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2) and (assay? or immunoassay? or immuno-assay?)).ti,ab,kw. (4834)

6 ((SARS-CoV-2 or SARS-CoV2 or SARSCoV-2 or SARSCoV2 or SARS2 or SARS-2 or severe acute respiratory syndrome coronavirus 2) adj1 (screen* or test*)).ti,ab,kw. (1783)

7 or/1-6 [COVID-19] (11568)

8 "organization and management"/ (424303)

9 "prevention and control"/ (32917)

10 communicable disease control/ (2627)

11 preventive measure*.ti,ab,kw. (34201)

12 sporting event/ (1336)

13 *behavior/ (62852)

14 "quality of life"/ (528678)

15 social anxiety/ (2806)

16 social interaction/ (61689)

17 behavior change/ (41428)

18 *social structure/ (2021)

19 social participation/ (7707)

20 *physical activity/ (44849)

21 psychological resilience/ (6050)

22 mental stress/ (89508)

23 mental health/ (160634)

24 *mental health/ (45204)

25 social distance/ (4370)

26 lifestyle/ (121969)

27 *lockdown/ (2291)

28 Disease Outbreaks/pc [Prevention & Control] (3405)

29 Psychological well being.ti,ab,kw. (13382)

30 social environment/ (34915)

31 community care/ (56797)

32 socialization/ (11226)

33 social aspect/ (79943)

34 human relation/ (90299)

35 social norm/ (4098)

36 life event/ (30327)

37 health promotion/ (103098)

38 community/ (84001)

39 social impact*.ti,ab,kw. (4454)

40 Neighb?orhood*.ti,ab,kw. (30654)

41 prosocial behavior/ (418)

42 social control/ (14552)

43 (social adj3 (impact* or adjust* or norm* or behavi?or* or chang* or factor* or interact* or policy or policies)).ti,ab,kw. (129569)

44 (societ* adj3 (impact* or adjust* or norm* or behavi?or* or chang* or factor* or interact*)).ti,ab,kw. (12530)

45 mask/ (6898)

46 (mitigat* adj3 strateg*).ti,ab,kw. (10255)

47 social behavior/ or altruism/ or community participation/ or cooperation/ or social adaptation/ or social inclusion/ or social responsibility/ (162817)

48 Collectivism.mp. (776)

49 social isolation/ (27136)

50 or/8-49 [social impact] (2112410)

51 7 and 50 (930)

52 exp animal/ not human/ (4998805)

53 51 not 52 (927)

54 editorial/ or letter/ or note/ (2621983)

55 53 not 54 (821)

56 limit 55 to yr="2020 -Current" (820)

57 remove duplicates from 56 (815)

58 limit 57 to medline (198)

59 57 not 58 (617)

Search Concepts

2. MEDLINE Search – COVID-M9 (Economic Aspects)

Database: MEDLINE (OVID)

UBC access: ***http://resources.library.ubc.ca/139***

OVID Account: COVID19

Search Name: COVID M9; (M9 minus M7)

Results:

```
57      limit 56 to yr="2020 -Current" (530)
```

Minus 86 duplicates with M7 Social

444 records for review

Search was executed on: Nov. 1, 2021

```
Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-
Review & Other Non-Indexed Citations, Daily and Versions(R) <1946 to October
29, 2021>

Search Strategy:

--------------------------------------------------------------------
```

1 covid-19 testing/ or covid-19 serological testing/ or covid-19 nucleic acid testing/ [COVID-19 Testing] (7265)

2 socioeconomic factors/ or economic factors/ (166580)

3 economics/ or economic development/ or industrial development/ or economic recession/ or resource allocation/ (41505)

4 ((financ* or economic) adj3 (policy or policies)).ti,ab,kf. (3651)

5 exp "Costs and Cost Analysis"/ (251079)

6 "salaries and fringe benefits"/ or health benefit plans, employee/ or sick leave/ (31476)

7 ec.fs. [Economics] (438784)

8 Public-Private Sector Partnerships/og [Organization & Administration] (512)

9 inflation, economic/ or public expenditures/ (1391)

10 financing, government/ or public assistance/ or workers' compensation/ (31643)

11 financing, organized/ (6940)

12 financial management/ or financial support/ (20598)

13 financing, personal/ (5764)

14 economic*.ti,ab,kf. (329761)

15 economy.mp. (31840)

16 or/2-15 [Economic impact] (961665)

17 1 and 16 (403)

18 Economics/ (27381)

19 "costs and cost analysis"/ (50141)

```
20      Cost allocation/ (2010)
21      Cost-benefit analysis/ (87106)
22      Cost control/ (21618)
23      Cost savings/ (12418)
24      Cost of illness/ (29841)
25      Cost sharing/ (2632)
26      "Deductibles and Coinsurance"/ (1795)
27      Medical savings accounts/ (543)
28      Health care costs/ (42353)
29      Direct service costs/ (1209)
30      Drug costs/ (16869)
31      Employer health costs/ (1096)
32      Hospital costs/ (11667)
33      Health expenditures/ (22176)
34      Capital expenditures/ (1998)
35      Value of life/ (5768)
36      exp economics, hospital/ (25375)
37      exp economics, medical/ (14302)
38      Economics, nursing/ (4008)
39      Economics, pharmaceutical/ (3033)
40      exp "fees and charges"/ (30940)
41      exp budgets/ (13912)
42      (low adj cost).mp. (69726)
43      (high adj cost).mp. (16698)
```

44 (health?care adj cost$).mp. (13785)

45 (fiscal or funding or financial or finance).tw. (167706)

46 (cost adj estimate$).mp. (2499)

47 (cost adj variable).mp. (47)

48 (unit adj cost$).mp. (2790)

49 (economic$ or pharmacoeconomic$ or price$ or pricing).tw. (345627)

50 or/18-49 [SIGN Economic Filter] (815656)

51 1 and 50 (375)

52 1 and (16 or 50) (562)

53 exp animals/ not humans/ (4908071)

54 52 not 53 (561)

55 comment/ or letter/ or news/ (1801283)

56 54 not 55 (530)

57 limit 56 to yr="2020 -Current" (530)

Search Concepts

1. MEDLINE Search – COVID-M7 (Social)

Database: MEDLINE (OVID)

UBC access: ***http://resources.library.ubc.ca/139***

OVID Account: COVID19

Search Name: COVID M7 Final (includes M7 and M7b)

Results:

```
79      remove duplicates from 78 (904)
```

844 records to review

Search was executed on: Nov. 1, 2021

```
Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-
Review & Other Non-Indexed Citations, Daily and Versions(R) <1946 to October
29, 2021>

Search Strategy:

--------------------------------------------------------------------

1      covid-19 testing/ or covid-19 serological testing/ or covid-19 nucleic
acid testing/ [COVID-19 Testing] (7265)
```

Rapid Diagnostic Testing for COVID-19: social and economic impacts

2 "Quality of Life"/ (225464)

3 Social Welfare/ (9520)

4 Adaptation, Psychological/ (99638)

5 Psychological well being.ti,ab. (10549)

6 Mental Health/ (48338)

7 exp Stress, Psychological/ (142834)

8 coping.ti,ab. (60664)

9 Consumer Behavior/ (22906)

10 social behavior/ or cooperative behavior/ or empowerment/ or help-seeking behavior/ or helping behavior/ or mass behavior/ or social adjustment/ or social conformity/ or social desirability/ or psychological distance/ or social inclusion/ or social isolation/ or social marginalization/ (149013)

11 social norms/ or social values/ or psychosocial functioning/ (21935)

12 Collectivism.ti,ab. (692)

13 Individualism.ti,ab. (1227)

14 physical distancing/ (1726)

15 Social distancing.ti,ab,kf. (6020)

16 Social Networking/ (4478)

17 social network*.ti,ab,kf. (21237)

18 Anxiety/ (92591)

19 "Activities of Daily Living"/ (68644)

20 Everyday life.ti,ab,kf. (10848)

21 Emotions/ (74306)

22 Psychological Distress/ (2536)

23 attitude/ or optimism/ (50951)

24 social support/ or psychosocial support systems/ (76121)

25 social environment/ or community networks/ (50896)

26 social isolation/ or loneliness/ (18919)

27 social norms/ or socialization/ (9139)

28 work-life balance/ (908)

29 sociological factors/ or social change/ or social conditions/ (26741)

30 social factors/ (144)

31 social integration/ or social interaction/ (984)

32 interpersonal relations/ (75187)

33 social norms/ (1690)

34 life style/ or life change events/ (82929)

35 risk reduction behavior/ or risk-taking/ (41985)

36 (risk adj3 (taking or behavio?r)).ti,ab,kf. (26441)

37 social inclusion/ (110)

38 Health Promotion/ (78058)

39 Community resources.ti,ab,kf. (2689)

40 adjust*.ti,ab. (692842)

41 Social Participation/ (2975)

42 Exercise/ (125067)

43 physical activit*.ti,ab,kf. (130503)

44 social life.ti,ab,kf. (5311)

45 Well being.ti,ab,kf. (91657)

46 community services.ti,ab,kf. (2942)

47 social impact*.ti,ab,kf. (3223)

48 Residence Characteristics/ (36437)

49 Neighb?orhood*.ti,ab,kf. (27474)

50 Altruism/ (7221)

51 Prosocial behaviour.mp. (448)

52 Prosocial behavio?r.ti,ab,kf. (2517)

53 (Manage* adj3 (crisis or crises)).ti,ab,kf. (2437)

54 social control policies/ or public policy/ (33374)

55 (social adj3 (impact* or adjust* or norm* or behavi?or* or chang* or factor* or interact* or policy or policies)).ti,ab,kf. (115508)

56 (societ* adj3 (impact* or adjust* or norm* or behavi?or* or chang* or factor* or interact*)).ti,ab,kf. (9074)

57 Communicable Disease Control/ (26411)

58 Masks/ (6106)

59 (mitigat* adj3 strateg*).ti,ab,kf. (8798)

60 og.fs. [Organization & Administration] (501431)

61 pc.fs. [Prevention & Control] (1372695)

62 60 and 61 (57937)

63 or/2-59,62 [Social Impacts] (2201063)

64 1 and 63 [COVID-19 Screening & Social Impact] (983)

65 exp animals/ not humans/ (4908071)

66 64 not 65 (983)

67 comment/ or letter/ or news/ (1801283)

68 66 not 67 (908)

69 limit 68 to yr="2020 -Current" (908)

70 remove duplicates from 69 (904)

Appendix B: Key themes from 13 retained papers

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
Hengel et al*	Program evaluation pending. 5342 tests across six Jurisdictions completed in approx. 6 mo. No data on pos/neg results; 1.8% error rate		Extensive work done with Indigenous community representatives to ensure acceptability. Policies, implementation and governance discussed in depth.			Guidelines require suspect cases to be airlifted from communities while awaiting test results. Program funded by Australian federal govt. System will be usable in future for other communicable diseases.	Enables testing at POC community clinics rather than central labs.
Hodges et al*	"Introduction of rapid, point-of-care testing was followed by a more than threefold reduction in daily SARS-CoV-2 case rates"	"one of the unanticipated challenges of relying on rapid point-of-care antigen testing was that persons frequently mistook a negative antigen test result as an	"As cases were identified, local tribal councils and governments were notified to provide situational awareness and prompt appropriate				Reduces turnaround time by removing need to ship samples to centralized labs

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
		indication that they no longer needed to isolate until serial repeat testing was completed."	mitigation measures, including scheduled visitation with selected family members for funerals or religious ceremonies"				
Lanier et al	"facilitated completion of approximately 95% of scheduled high school extracurricular winter athletics" events; and saved " an estimated 109,752 in-person instruction student-days" "Utah's testing programs likely helped reduce	"linking serial testing results to socially desirable activities, such as participation in extracurricular activities, might have incentivized masking and other preventive behaviors" [speculative, not measured.] False positives from regular testing might be an issue where	Only 13/29 eligible schools opted to take part in Test to Stay; reasons are not reported. Qualitative data reports that a barrier to testing was "lack of perceived community support." Teachers worry about creation of 'dual mode' schooling			Training and test kits provided by state govt.	Qualitative data report staffing capacity as a barrier. Design of program stated as a balance of feasibility and resources with impacts.

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
	SARS-CoV-2 transmission in schools and communities"	community prevalence is low (<1%) [from cited literature]					
Osterdahl et al		" "clinically workable" [if] safeguards are put in place to guard against overconfidence in negative individuals"	No formal patient/public engagement or ethics approval, due to speed or response, but discussed with staff and care home residents of sufficient capacity. Individual consents given. "All [patients] were enthusiastic to be involved and could see the value of rapid testing"			The LAMP testing has similar materials cost to PCR, but less expensive (2-3x) equipment.	Rapid POC test. "We feel that this level of sensitivity is "clinically workable" in a time of crisis, particularly if repeated testing is utilized" .
Paltiel et al	"the intervention would be exceptionally good value"	Acknowledges the concern that false negatives may lead	Models cases with 50-75% non-uptake, and 50-75% failure to		"obstacles to broader use of these tests in the United	VSL assumed at 5.3M, test sensitivity at 80%, and weekly	

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	based on assumptions of infections and deaths prevented. “our qualitative policy finding—… a nationwide rollout of frequent, home-based testing and self-isolation is justified on both epidemiologic and economic grounds.”	people to be in public when they ought not be, and false positives leading to unnecessary isoltation	comply with isolation following a positive test.		States include the requirement for a physician's order for certain tests”	testing in base case model. Tests would be shipped direct to households, so presumably government pays. Base case results: Program costs, $12.5B. Reduced hospital costs, 5.9B. Increased lost work days over no intervention of $14B	
Pavelka et al	“each round of mass Testing was estimated to have reduced observed infection prevalence by 56%	“From the low test-positive rates in some counties, we estimate with 95% certainty that	Three rounds of testing in some or all counties, each reaching 83-87% of age-eligible population			“national mass testing campaigns are likely to have a major disruptive effect on routine passive syndromic	Mobilizing sufficient medical personnel, supportive army personnel, test materials and PPE were challenging

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	(95% CI: 52 to 59%)"—with considerable variation county-to-county "data on hospital bed occupancy shows a sudden flattening from mid-November, indicating a sharp decrease in new admissions that is consistent with a sizable reduction in new infections when the mass testing campaigns occurred".	the specificity of the SD Biosensor Standard Q antigen test exceeded 99.85%, and the occurrence false positives was therefore not of major concern in this study."				surveillance"	
Rennert et al	"Compared with random tests,		7-day compliance with testing			"SBIT detected more SARS-COV-2	Starts with premise that many colleges lack infrastructur

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
	targeted tests were 2·03 times more likely to detect a SARS-COV-2 positive case (95% CI 1·67–2·46)”		requirements was 96.2% “The high rate of compliance with mandatory testing among the student population, despite few consequences for noncompliance, indicates that such testing on a public university campus is feasible and acceptable to the student population”.			positive cases among the student population than random surveillance testing alone, despite using the same number of daily tests”. Thus “an SBIT approach is more resource efficient”. “Effective surveillance testing strategies are economical when the alternative is university closure…. we estimate that testing an on-campus population of 6000 students	e for regular universal screening. Authors suggest that the 25% of schools currently doing random surveillance would have capacity for SBIT.

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
						would cost a university $22 000–255 000 per week with SBIT and $44 000–510 000 per week with weekly testing. On the other, we estimate that Clemson University generated approximately $1·65 million per week in housing and dining costs that would have been lost if the university was forced to shut down".	
Segui et al			Company-initiated policy. Cost model uses a 75% compliance with self-isolation			"The set of avoided cases represents 744,488 of saving in the use of health resources" over a 1-year period.	

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
						Avoided mortality and morbidity provide an additional benefit of 1,223,661 Euros in health gain. Savings equal to 10.44 Euro per test performed. Authors suggest that governments should subsidize company testing.	
Villani et al	Results still preliminary		98.9% of school population consented				
Volpp	Concludes that the whole package of mitigation measures was effective in preventing in-school transmission.		All students, faculty and staff asked to sign an agreement which included participating in the testing program, with a 'three strikes' clause for students.				"Setting up an extensive logistical operation to conduct twice weekly sample collection on campus of all students, faculty, and staff

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
			(1.3% of students sent home for violations over the semester). All people on campus required to wear a personal tracking device.				members with relatively fast turn-around-times was required, which also involved considerable expense".
Wachinger et al	Only 1 case reported in the school during the study period.	Some participants had concerns about the burden on children. "Negative consequences (eg, more risk-taking behaviour) were not observed." Suggests false positives might decrease acceptability, so research	The school and parents reached out to researchers to do the study.—"high level of stakeholder ownership" "Pupils, parents and school staff perceive home-based RDT screening as feasible **and less disrupting than other protective measures (eg, mask mandates)".**	-refers to home-schooling initiated by parents against screening of children (not at the study site)	-refers to lawsuits initiated by parents against screening of children (not at the study site)	Tests provided to students and staff for home administration (doesn't say who paid)	"School stakeholders and staff predominantly highlighted organisational and infrastructural barriers to school-based screening, including the strain on already limited teaching time, concerns regarding the psychological consequences of a pupil

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		on that is needed	Initially voluntary, with 62% of staff and 59% of students; once made mandatory by the state, 14% of participating students withdrew. Some qual themes: Screening not a dominant topic in intraschool interactions 'Almost noone cares about that'. General perception of high screening acceptance within the school but debates outlining overarching disagreemen				testing positive in school (including potential stigmatisation by peers), and questions regarding teacher accountability". Qual theme: "Gradual integration of testing into daily routines: from 'annoyed' and 'scared' to 'like brushing teeth'"

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
			ts regarding the pandemic—some participants frustrated by encounters with the testing-hesitant				
Zhang et al	Model predicts weekly testing of ED workers would lead to 3.1% at 5.9% reduction in new infections, at 2 hospital sites (over a 180 day period)		No data given about whether compliance rates were modeled			[avoided cases not monetized]	Criticized by Cochrane review for the unrealistic assumption of 100% test sensitivity
Govt of Canada website						Notes that the government will supply tests to (at least some) businesses at no charge, so long as they adhere to certain	

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
						requirements	
Govt of UK website						Tests available at pharmacies; implies cost is voluntarily taken on by the public?	
Public Health Agency of Sweden website					Notes that, "Within the framework of their work environment responsibility, employers must regularly carry out risk assessments and introduce protective measures to reduce the risk of spreading COVID-19 at the workplace." Workplace screening must be medically supervised		

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
					but home tests "are not covered by the Health and Medical Services Act." Provides a link to documents that outline specific legal obligations related to workplace testing		
Atkeson et al	"even with partial compliance, screening testing induces large net economic benefits" based on 3 different models considered	Use of confirmatory tests for initial positives is likely necessary in order to prevent unnecessary self-isolation and its economic impacts. Notes that their model does not	The models incorporate different degrees of adherence to post-test self-isolation, but do not seem to include rates of initial participation.			All "incremental testing" to be federal govt funded. "economic benefits exceed costs by a factor of 5-10 for weekly testing. If all the tests were paid for by the federal	The authors claim the model parameters are meant to be reflective of programs that could feasibly be implemented.

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
		address the issue of possibly incentivizing risky behaviour				government, the additional tax revenues generated by the induced GDP growth would more than pay for the testing costs. Net benefits rise if one additionally monetizes deaths averted using a statistical value of life." [which they estimate at 9.3M]	

Appendix C: Data Extraction: Social and Economic Considerations

Paper	Intended Impacts	Unintended Impacts	Acceptability	Withdrawal	Legalities	Costs/Benefits	Feasibility
Hengel et al*	*X*		*X*			X	*X*
Hodges et al*	X	X	X				X
Lanier et al	X	X	X			X	X
Osterdahl et al		X	X			X	X
Paltiel et al	X	X	X		X	X	
Pavelka et al	X	X	X			X	X
Rennert et al	X		X			X	X
Segui et al			X			X	
Villani et al	X		X				
Volpp	X		X				X
Wachinger et al	X	X	X	X	X	X	X
Zhang et al	X		X			X	X
Govt of Canada website						X	
Govt of UK website						X	
Public Health Agency of Sweden website					X		
Atkeson et al	X	X	X			X	X

*Targeted rather than universal screening