

Use cases for COVID-19 screening and surveillance with rapid antigen-detecting tests: A systematic review

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Background

- Antigen-detecting rapid diagnostic tests (Ag-RDTs) improve access to timely testing for COVID-19 and are being deployed in a variety of settings globally.
- As compared to NAATs, Ag-RDTs have advantages such as simplicity, low cost, and rapid results.^{1,2}
- They are the most accurate when viral loads are highest, i.e., shortly before and in the first week of symptom onset.^{2,3}
- Priority uses of Ag-RDTs include community testing of symptomatic individuals, to detect and respond to suspected COVID-19 outbreaks and for screening of high-risk asymptomatic individuals.⁴



Objective

- To assess the different settings in which Ag-RDTs were used and their performance during the first half of the pandemic.

Methods

- Inclusion criteria: Studies assessing COVID-19 screening and surveillance efforts utilizing Ag-RDTs were included.
- Reasons for exclusion are listed in Figure 1.
- PRISMA guidelines were used.

Databases

- Pubmed, Embase, MedRxiv
- Searches conducted on: 14 December 2020, 22 February 2021 and 12 April 2021

Record screening

- 3 independent reviewers (AA, EM, JB)
- Titles, abstracts and full-texts screened

Quality assessment

- 4 independent reviewers (AA, EM, JB, TU)
- Diagnostic accuracy studies: QUADAS-2 tool
- Observational studies: Tool by Munn et al.

Data abstraction

- Double data abstraction by 4 independent reviewers (AA, EM, JB, TU)

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Results

STUDY CHARACTERISTICS



- Of 4313 identified studies, 39 were included (Figure 1).
- Of 39 studies, 35 were published and 4 were pre-prints.
- Populations tested included symptomatic and asymptomatic close contacts of COVID-19 cases, hospital patients and healthcare workers, travel passengers, students and teachers of schools and universities, sports clubs, and hot-spot general population.
- Sample sizes ranged from 40 to > 5 million.

QUALITY ASSESSMENT



- Risk of bias was in general low or unclear across all domains for all studies.
- Of 22 diagnostic accuracy studies, 2 had a high risk of bias due to sampling.
- For studies reporting other outcomes, risk of bias was high for two studies in relation to sampling scheme.

STUDY RESULTS



- Of 39 studies, 37 (94.9%) investigated lateral flow Ag-RDTs and two (5.1%) investigated multiplex sandwich chemiluminescent enzyme immunoassay Ag-RDTs.
- Six broad types of screening initiatives were identified: mass screening, targeted screening, healthcare entry testing, at-home testing, surveillance and prevalence surveys (Table 1).
- Across studies, Ag-RDT sensitivity varied from 40% to 100%, and specificity from 92.1% to 100% (Table 1).

Table 1. Types of screening initiatives and diagnostic accuracy

Type of testing	Description	Countries of study conduct	Sensitivity range	Specificity range
Mass screening (n=13)	Broad, community-based screening (e.g. mass surge testing, drive-through testing) or general population screening	The Netherlands, USA, Austria, Spain, UK, Italy, Slovakia	44.4% to 89.0%	99.0% to 100%
Targeted screening (n=11)	Screening conducted in specific settings/venues e.g. small set of hospitals, schools, airports	USA, Cameroon, Japan, Italy, UK	40% to 100%	92.1% to 100%
Healthcare entry testing (n=6)	Testing conducted before admission to hospital, outpatient attendance, before operation	Israel, India, Italy, Belgium	54.2% to 80.3%	99.1% to 100%
At-home testing (n=4)	Testing administered in an individual's home	UK, Germany	85.7% to ~90%	Not provided
Surveillance (n=4)	Testing to monitor COVID-19 in a defined setting/region	USA, Greece, The Netherlands, Switzerland	Not provided	99.4% to 100%
Prevalence study (n=1)	Testing to monitor COVID-19 prevalence across a country	India	68.0%(symptomatic) 46.9%(asymptomatic)	Not provided

Noted Advantages: Easy to use, low cost, rapid turnaround time to test results, enables timely identification of cases and subsequent interventions to prevent onward transmission of COVID-19.

Applications: Large-scale screening of asymptomatic and symptomatic populations, asymptomatic individuals in high-prevalence settings and in settings with limited resources, mandatory screening in health-care settings, airports, schools etc.

Operational Findings

Test Results: Minimal user errors when tests were conducted by trained personnel or healthcare workers, but training and clear instructions needed for accurate results; serial testing can compensate for comparatively low sensitivity.

Self-testing or at-home testing: High acceptability and compliance, usually performed to a satisfactory standard, regular at-home or self-testing was reassuring and allowed regular activities.

Conclusion

- This review demonstrated that Ag-RDTs were rapid, low-cost and easy to use tools for mass and targeted screening, healthcare entry testing, at-home testing, surveillance and prevalence studies during the first year of the pandemic.

References

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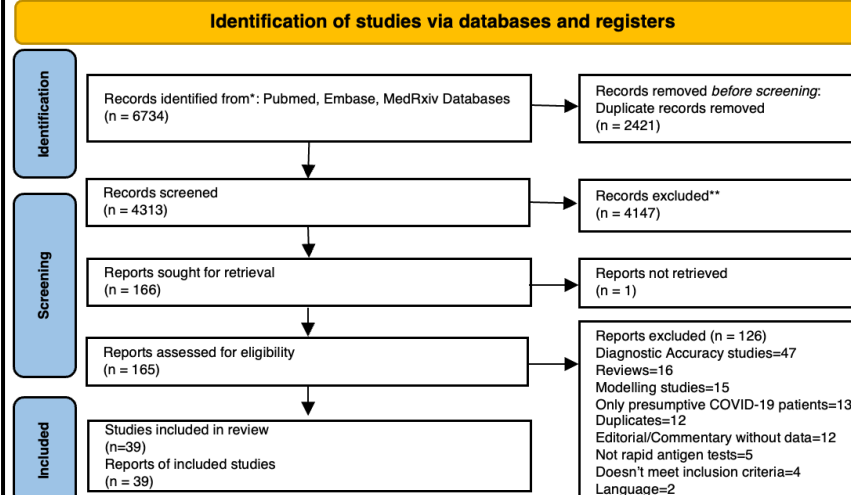


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow chart of included studies.

