RESEARCH ARTICLE

Diagnostic accuracy of the Cepheid Xpert Xpress and the Abbott ID NOW assay for rapid detection of SARS-CoV-2: A systematic review and meta-analysis

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Abstract

Rapid and accurate diagnosis of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is essential to prevent the spread of the virus. We investigated the diagnostic accuracy of the Xpert Xpress and the ID NOW assays for rapid detection of SARS-CoV-2 using a systemic review and meta-analysis approach. A systematic literature search was performed using PubMed, Embase, and the Cochrane COVID-19 Study Register. The sensitivity and specificity of these tests for detecting viruses in patients with suspected SARS-CoV-2 infection were pooled. We used commercial and laboratory-developed reverse transcription-polymerase chain reactions as reference standards. The Quality Assessment of Diagnostic Accuracy Studies-2 tool was used to assess the risk of bias. We identified 11 studies involving 1734 subjects for the Xpert Xpress assay and 10 studies involving 1778 subjects for the ID NOW assay. The pooled sensitivity and specificity of the Xpert Xpress assay for detection of SARS-CoV-2 were 0.99 (95% confidence interval [CI], 0.97 to 0.99) and 0.97 (95% CI, 0.95 to 0.98), respectively. The pooled sensitivity and specificity of the ID NOW assay were 0.79 (95% CI, 0.69 to 0.86) and 1.00 (95% CI, 0.98 to 1.00), respectively. The studies included in our analysis seemed to have low methodological quality. The Xpert Xpress assay showed excellent diagnostic accuracy for rapid detection of SARS-CoV-2. However, as the ID NOW assay showed relatively low sensitivity, this test might miss several positive samples.

KEYWORDS

COVID-19 testing, diagnosis, point-of-care testing, reverse transcription polymerase chain reaction, SARS-CoV-2

Jonghoo Lee and Jae-Uk Song contributed equally to this study.

1 | INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has generated global health concerns since December 2019.[1,2] Rapid and accurate diagnosis of SARS-CoV-2 infection can reduce the risk of virus transmission through early patient isolation and rapid institution of appropriate personal protective equipment use.[3] Nucleic acid amplification tests (NAATs) are considered the gold standard diagnostic method for detection of SARS-CoV-2.[4] Available NAATs commonly require batch testing, are time-consuming, and require a high degree of technical expertise. There also are commercially available rapid diagnostic NAATs that can be performed on demand, providing test results in <1 h.

The following rapid molecular tests have been currently approved for use under Emergency Use Authorization (EUA) from the US Food and Drug Administration (FDA): Xpert Xpress SARS-CoV-2 (Cepheid), ID NOW COVID-19 (Abbott), Accula SARS-CoV-2 (Mesa Biotech), and Cue COVID-19 (Cue Health Inc.).[5] Among commercially available rapid molecular tests, the Xpert Xpress and the ID NOW assays have principally been studied. The Xpert Xpress SARS-CoV-2 assay is a commercially available molecular test that detects the viral envelope E gene and the nucleocapsid N2 gene as its SARS-CoV-2-specific targets.[6] This platform integrates specimen processing, nucleic acid extraction, reverse transcription-polymerase chain reaction (RT-PCR) amplification of RNA, and amplicon detection using a single cartridge.[6] This assay has a short turnaround time of approximately 45 min.[6] The ID NOW COVID-19 assay is a rapid diagnostic test that utilizes isothermal amplification and can report results in <15 min.[7]

Currently, the clinical utility of the two assays remains unclear. Our objective was to evaluate the diagnostic performances of the Xpert Xpress and the ID NOW assays in rapid diagnosis of the SARS-CoV-2 virus from respiratory tract specimens. This evaluation was conducted through a systematic review and meta-analysis of clinical trial data.

2 | MATERIALS AND METHODS

2.1 | Data sources and search strategy

This meta-analysis is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses of Diagnostic Test Accuracy Studies statement.[8] We performed a comprehensive search of three electronic databases (PubMed, Embase, and the Cochrane Central Register) ending in January, 2021. Search terms were "COVID-19 diagnostic testing" [MeSh] OR "Xpert" OR "Gene Xpert" OR "Xpert Xpress" OR "Cepheid" OR "ID NOW" OR "Abbott ID NOW" AND "COVID-19" OR "SARS-CoV-2" OR "2019-nCoV." The full search strategy for each database is provided in the Supporting Information. As this study was a systematic review of published articles, neither informed consent nor ethics approval was required. We also conducted a manual search of the references listed in relevant review articles.

2.2 | Study selection

We included studies that met the following inclusion criteria: (1) full-length reports published in peer-reviewed English language journals; (2) evaluations of the performance of the Xpert Xpress assay or the ID NOW assay compared with a reference standard; (3) inclusion of patients with SARS-CoV-2 infection; and (4) provision of sufficient data to calculate absolute numbers of true-positive, false-positive, false-negative, and true-negative results. Review articles, case reports, commentaries, and studies reporting outcomes without raw data or peer review were excluded. We also excluded preprint papers that did not receive the corresponding peer review. Participant demographics and underlying diseases were not restricted.

Respiratory specimens comprised nasopharyngeal (NP) aspirates, swabs, or washes; nasal aspirates, swabs, or washes; and throat swabs. The reference standard was either a commercial or laboratory-developed RT-PCR.

2.3 | Data extraction and quality assessment

The two authors independently performed extractions of potentially relevant studies and reviewed each study according to predefined eligibility criteria, after which data were extracted. Any disagreements that arose during study selection or data extraction were resolved by discussion. A predefined form was used to extract data from each study. The extracted data from each study included in the meta-analysis were author, study design, place of study, number of samples, age of subjects, sex of subjects, index test, comparison test, and type of specimens. As recommended by the Cochrane Collaboration, we used the Quality Assessment of Diagnostic Accuracy Studies (QUADAS)-2 tool to assess the risk of bias in diagnostic test accuracy.[9] The studies were considered to have a "low" risk of bias if the risk assessment was scored as "low" for patient selection, index test, reference standard, and flow and timing. If any domain was scored as a "high" risk of bias, or if two or more domains were assessed to have "unclear" bias, then the study was judged as having a "high" risk of bias. If a study was assessed as "unclear" in one of the four domains, the risk of bias was ranked as "unclear."[9] Discrepancies were resolved by consensus between the two authors.

2.4 | Data synthesis and statistical analysis

For the diagnostic meta-analysis, the bivariate random-effects model was used for analysis, and diagnostic performance measures were pooled across studies.[10] The bivariate model estimates pairs of logit-transformed sensitivity and specificity from studies, incorporating the correlation that can exist between sensitivity and specificity.[10] We extracted the numbers of patients with true-positive, false-positive, false-negative, and

true-negative test results either directly or through recalculation based on the reported measures of accuracy in combination with the prevalence in and sample size of the included study. We calculated the pooled sensitivity, specificity, positive likelihood ratio (PLR), and negative likelihood ratio (NLR) as pooled estimates with 95% confidence intervals (CIs).[10] The likelihood ratios represent the likelihood that an index test result would be expected in a patient with a certain disease as compared with the likelihood of that same result among patients without that disease. PLR was calculated by dividing the pooled sensitivity by 1 – specificity, and NLR was calculated by dividing 1 – sensitivity by specificity. In the presence of significant heterogeneity by visual inspection of the forest plots, meta-regression analysis was performed to identify a potential source of bias using the following as covariates: study design (single-center vs. multicenter study), number of patients (<150 vs. ≥150), number of comparators (one vs. ≥two), and specimens (NP vs. NP and nasal swabs).[11] $p < 0.05$ was considered statistically significant. Statistical analyses were performed using Stata statistical software (Version 14.2; Stata Corp LP) and Review Manager (Version 5.3; Nordic Cochrane Centre, The Cochrane Collaboration).

3 | RESULTS

3.1 | Study search and characteristics and quality of included studies

The literature search process is shown in Figure 1. We initially identified 138 articles from PubMed, 164 articles from Embase, 224 articles from the Cochrane COVID-19 Study Register, and one additional article from hand-searching. After removing duplicate articles, we screened 369 potentially eligible articles. After reviewing the title and abstracts, 316 search records were removed; the remaining 52 articles were eligible for full-text review. Thirty-one articles were excluded for the reasons shown in Figure 1. With quantitative synthesis, 17 studies were included in our final analysis.[12–28]

Table 1 summarizes the features of the included studies. For the Xpert Xpress assay, we identified 11 studies comprising 1734 participants.[13,16–19,22–25,27,28] Four studies were designed as multi-center trials,[14,16,19,20] and 13 studies were conducted only in the United States.[12,14,15,17,18,20–26,28] The number of patients in each trial ranged from 26 to 524. For the ID NOW assay, 10 studies involving 1778 subjects met the defined inclusion criteria.[12,14,15,17,20,21,23,24,26,28] Four studies assessed samples using both the Xpert Xpress and the ID NOW assays.[14,17,23,26] As the reference standard, more than two types of RT-PCR methods were used in seven studies.[12,17–20,23,26] Eleven studies used NP swab specimens only.[12,13,15,18–21,24–26,28]

The QUADAS-2 assessment results are presented in Figures S1 and S2. The included studies were generally at high or unclear risk of bias. Patient selection procedures involved mostly high or unclear risk of bias, as most studies did not describe a consecutive cohort. The index tests involved mostly unclear risk of bias, because it was frequently unclear whether the index tests were interpreted without knowledge of the results of the reference standard. For the reference standard domain, we mostly judged the risk of bias as


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Records identified  through database searching (n=526)
                    Pubmed (n=138)
                    EMBASE (n=164)
          Cochrane COVID-19 study Register (n=224)
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→ Records owing to duplication(n=158)
← Additional article identified from hand searching (n=1)
Records screened (n=369)
→ Records excluded after screening titles and abstracts (n=316)
Full-text articles assessed for eligibility (n=52)
→ Full-text articles excluded with following reasons (n=31)
  Absence of target outcomes (n=12)
  Absence/inappropriate of reference standard (n=10)
  Review or meta-analysis (n=5)
  Index test different from eligibility criteria (n=4)
Studies included in qualitative synthesis (n=21)
→ Construction of 2X2 tables impossible (n=4)
Studies included in quantitative synthesis /meta-analysis (n=17)
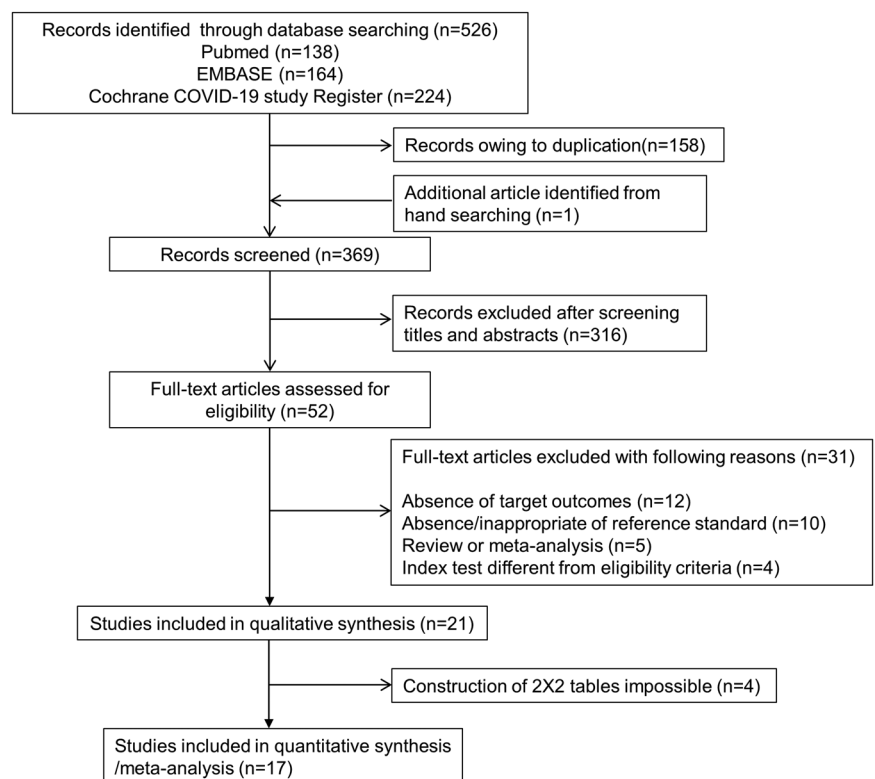
FIGURE 1 Flow diagram for identification of eligible studies

TABLE 1 Characteristics of the studies included in the meta-analysis

Study	Design	Country	Number of samples	Age, years (mean or median)	Male (%)	Index test	Comparison test	Type of specimens
Cradic et al.[12]	Single-center study	USA	184	NA	NA	The Abbott ID NOW SARS-CoV-2 assay	The DiaSorin Molecular Simplexa COVID-19 Direct and the Roche cobas 6800 SARS-CoV-2	NP swabs
Goldenberger et al.[13]	Single-center study	Switzerland	27	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	Cobas® SARS-CoV-2 assay	NP swabs
Harrington et al.[14]	Multicenter study	USA	524	NA	NA	The Abbott ID NOW SARS-CoV-2 assay	The Abbott RealTime SARS-CoV-2	NP and nasal swabs
Hogan et al.[15]	Single-center study	USA	100	NA	NA	The Abbott ID NOW SARS-CoV-2 assay	The Hologic Panther Fusion SARS-CoV-2 assay	NP swabs
Hou et al.[16]	Multicenter study	China	285	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	RT-PCR assays approved by the National Medical Products Administration	Oropharyngeal swabs
Lephart et al.[17]	Single-center study	USA	88	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 and the Abbott ID NOW SARS-CoV-2 assay	At least 2 of 4 NAAT results (RealTime m2000 SARS-CoV-2 Assay, Simplexa™ COVID-19 Direct, Xpert Xpress SARS-CoV-2, and ID NOW COVID-19)	NP and nasal swabs
Lieberman et al.[18]	Single-center study	USA	26	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	Laboratory-developed tests	NP swabs
Loeffelholz et al.[19]	Multicenter study	France, Italy, United Kingdom, USA	481	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	The sites' standard-of-care methods	NP swabs
Mitchell and George[20]	Multicenter study	USA	61	NA	NA	The Abbott ID NOW SARS-CoV-2 assay	The CDC or New York EUA assays	NP swabs
Moore et al.[21]	Single-center study	USA	200	50	46	The Abbott ID NOW SARS-CoV-2 assay	Modified CDC RT-PCR assays	NP swabs
Moran et al.[22]	Single-center study	USA	103	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	The Roche cobas SARS-CoV-2 assay	NP and nasal swabs

TABLE 1 (Continued)

Study	Design	Country	Number of samples	Age, years (mean or median)	Male (%)	Index test	Comparison test	Type of specimens
Procop et al.[23]	Single-center study	USA	239	49	45.2	The Cepheid Xpert Xpress SARS-CoV-2 and the Abbott ID NOW SARS-CoV-2 assay	At least two of five NAAT results (Centers for Disease Control and Prevention 2019 nCoV Real-Time RT-PCR Diagnostic Panel, TIB MOLBIOL/Roche z 480 Assay, Xpert Xpress SARS-CoV-2, Simplexa COVID-19 Direct Kit, and ID Now COVID-19)	NP and nasal swabs
Smithgall et al.[24]	Single-center study	USA	113	60.0	54.0	The Cepheid Xpert Xpress SARS-CoV-2 and the Abbott ID NOW SARS-CoV-2 assay	The Roche cobas SARS-CoV-2 assay	NP swabs
Stevens et al.[25]	Single-center study	USA	104	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 assay	The Hologic Panther Fusion SARS-CoV-2 assay	NP swabs
Thwe and Ren[26]	Single-center study	USA	161	NA	NA	The Abbott ID NOW SARS-CoV-2 assay	The Abbott RealTime SARS-CoV-2 assay, the Panther Fusion® SARS-CoV-2 assay, and LDT	NP swabs
Wong et al.[27]	Single-center study	Hong Kong	162	46	43.7	The Cepheid Xpert Xpress SARS-CoV-2 assay	The TIB-Molbiol LightMix® SarbecoV E-gene assay	Deep throat saliva and lower respiratory tract specimens
Zhen et al.[28]	Single-center study	USA	108	NA	NA	The Cepheid Xpert Xpress SARS-CoV-2 and the Abbott ID NOW SARS-CoV-2 assay	The Hologic Panther Fusion SARS-CoV-2 assay	NP swabs

Abbreviations: COVID-19, coronavirus disease 2019; CDC, Centers for Disease Control and Prevention; EUA, Emergency Use Authorization; LDT, laboratory-developed test; NA, not available; NAAT, nucleic acid amplification test; NP, nasopharyngeal; RT-PCR, reverse transcription-polymerase chain reaction; RVP, respiratory virus panel; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

unclear, because it was not clear whether the reference standard was interpreted blind to the index test. The study flow and timing involved mostly high or unclear risk of bias owing to unclear intervals between the index test and the reference standard. Considering our eligibility criteria, we had little concern about the applicability of our results across the included studies in the two domains of the index test and the reference standard. However, we had concerns regarding high applicability for 50% of studies in one domain of patient selection.

3.2 | Diagnostic accuracy of the Xpert Xpress assay for detecting SARS-CoV-2

Figure 2 shows paired forest plots of sensitivity and specificity of the Xpert Xpress assay for detection of SARS-CoV-2. The pooled sensitivity across studies of the Xpert Xpress assay for identifying SARS-CoV-2 was 0.99 (95% CI, 0.97 to 0.99), and the pooled specificity was 0.97 (95% CI, 0.95 to 0.98). The pooled PLR was 29.87 (95% CI, 20.11 to 44.36), and the corresponding NLR was 0.01 (95% CI, 0.01 to 0.03).

3.3 | Diagnostic accuracy of the ID Now assay for detecting SARS-CoV-2

Figure 3 shows paired forest plots of sensitivity and specificity of the ID NOW assay for detection of SARS-CoV-2. The pooled sensitivity across studies of the ID NOW assay for identifying SARS-CoV-2 was

0.79 (95% CI, 0.69 to 0.86), and the pooled specificity was 1.00 (95% CI, 0.98 to 1.00). The pooled PLR and NLR were 184.77 (95% CI, 37.59 to 908.28) and 0.21 (95% CI, 0.14 to 0.32), respectively. Visual inspection of the forest plots for the ID now assay showed significant heterogeneity in both sensitivity and specificity. Meta-regression was conducted to investigate potential sources of heterogeneity (Table 2). Among the several covariates, no significant factors affected heterogeneity in the joint model.

4 | DISCUSSION

Ideal performance of tests for SARS-CoV-2 detection is judged by accuracy and turnaround time. The two NAATs evaluated in the present study were used for rapid diagnosis of SARS-CoV-2 infection: the Xpert Xpress assay, which provides results within 45 min, and the ID NOW assay, which delivers results in approximately 5–13 min.[14] Given the impact on public health applications, accurate results from SARS-CoV-2 testing are more important than rapid results.[12] False-negative results could have serious consequences, especially in vulnerable elderly patients.[12] Also, false-positive results could have a negative impact by delaying management of the causative disease or causing unnecessary isolation.[12] Our findings provide evidence of the diagnostic properties of two rapid molecular tests. The Xpert Xpress assay showed conspicuous diagnostic accuracy with a sensitivity and specificity >95% for detection of SARS-CoV-2, compared with a reference standard. These findings mean that the Xpert Xpress assay satisfies the requirements of a rapid and simple assay for SARS-CoV-2 detection. However, the pooled
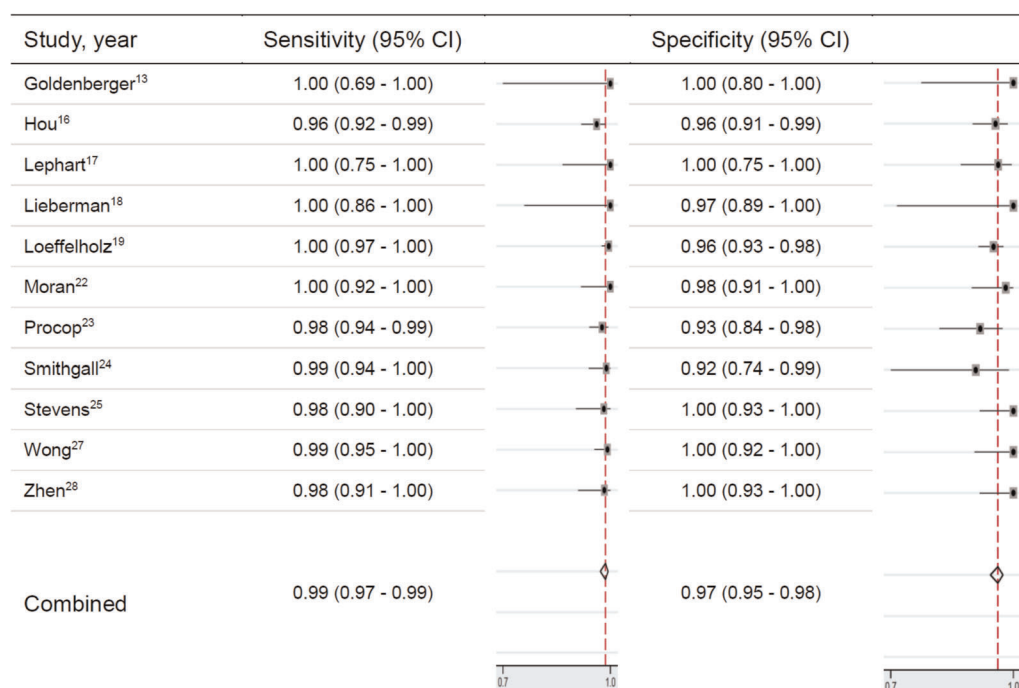

Study, year	Sensitivity (95% CI)		Specificity (95% CI)	
Goldenberger[13]	1.00 (0.69 - 1.00)		1.00 (0.80 - 1.00)	
Hou[16]	0.96 (0.92 - 0.99)		0.96 (0.91 - 0.99)	
Lephart[17]	1.00 (0.75 - 1.00)		1.00 (0.75 - 1.00)	
Lieberman[18]	1.00 (0.86 - 1.00)		0.97 (0.89 - 1.00)	
Loeffelholz[19]	1.00 (0.97 - 1.00)		0.96 (0.93 - 0.98)	
Moran[22]	1.00 (0.92 - 1.00)		0.98 (0.91 - 1.00)	
Procop[23]	0.98 (0.94 - 0.99)		0.93 (0.84 - 0.98)	
Smithgall[24]	0.99 (0.94 - 1.00)		0.92 (0.74 - 0.99)	
Stevens[25]	0.98 (0.90 - 1.00)		1.00 (0.93 - 1.00)	
Wong[27]	0.99 (0.95 - 1.00)		1.00 (0.92 - 1.00)	
Zhen[28]	0.98 (0.91 - 1.00)		1.00 (0.93 - 1.00)	
Combined	0.99 (0.97 - 0.99)		0.97 (0.95 - 0.98)	

FIGURE 2 Paired forest plots of sensitivity and specificity of the Xpert Xpress assay for detection of SARS-CoV-2

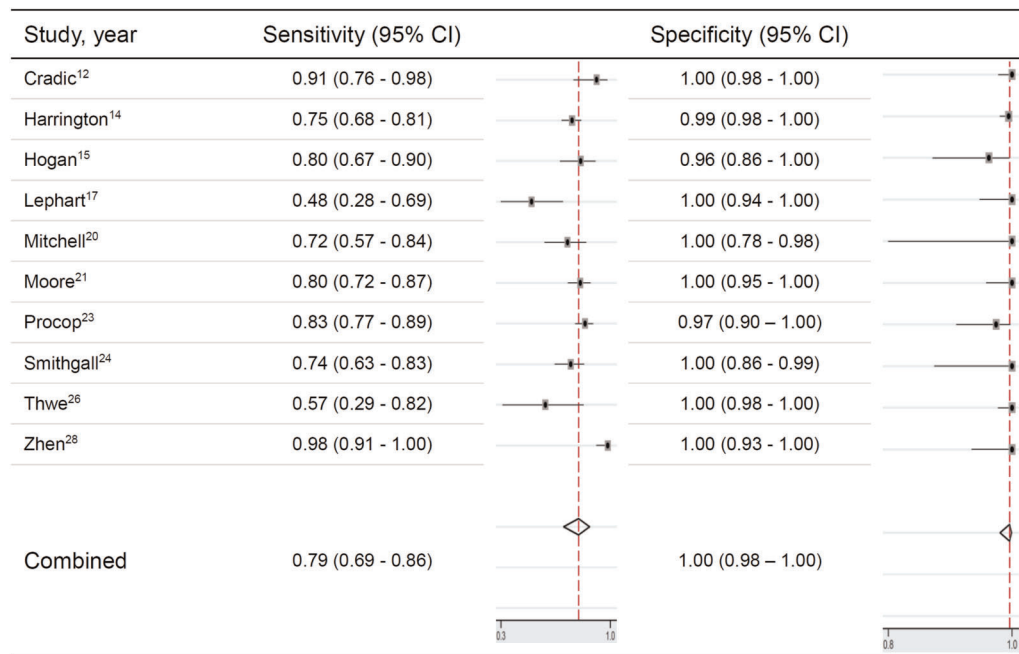| Study, year	Sensitivity (95% CI)		Specificity (95% CI)	
Cradic[12]	0.91 (0.76 - 0.98)		1.00 (0.98 - 1.00)	
Harrington[14]	0.75 (0.68 - 0.81)		0.99 (0.98 - 1.00)	
Hogan[15]	0.80 (0.67 - 0.90)		0.96 (0.86 - 1.00)	
Lephart[17]	0.48 (0.28 - 0.69)		1.00 (0.94 - 1.00)	
Mitchell[20]	0.72 (0.57 - 0.84)		1.00 (0.78 - 0.98)	
Moore[21]	0.80 (0.72 - 0.87)		1.00 (0.95 - 1.00)	
Procop[23]	0.83 (0.77 - 0.89)		0.97 (0.90 – 1.00)	
Smithgall[24]	0.74 (0.63 - 0.83)		1.00 (0.86 - 0.99)	
Thwe[26]	0.57 (0.29 - 0.82)		1.00 (0.98 - 1.00)	
Zhen[28]	0.98 (0.91 - 1.00)		1.00 (0.93 - 1.00)	
Combined	0.79 (0.69 - 0.86)		1.00 (0.98 – 1.00)	

FIGURE 3 Paired forest plots of sensitivity and specificity of the ID Now assay for detection of SARS-CoV-2. CI, confidence interval

TABLE 2 Meta-regression analysis to identify potential sources of heterogeneity in the diagnostic accuracy of the ID Now SARS-CoV-2 assay

Variable	No. of studies	Sensitivity Pooled (95% CI)	p value	Specificity Pooled (95% CI)	p value	LRT χ^2	p value (joint model)
Study design							
Single-center	8	0.80 (0.71–0.89)	0.20	1.00 (0.99–1.00)	0.03	0.40	0.82
Multicenter	2	0.74 (0.53–0.94)		1.00 (0.99–1.00)			
No. of patients							
<150	5	0.79 (0.66–0.91)	0.26	0.99 (0.98–1.00)	0.03	0.17	0.92
>150	5	0.79 (0.68–0.91)		1.00 (0.99–1.00)			
No. of comparator							
One	5	0.83 (0.73–0.93)	0.03	0.99 (0.98-1.00)	0.01	1.50	0.47
≥Two	5	0.74 (0.60–0.87)		1.00 (0.99–1.00)			
Swabs							
NP	7	0.82 (0.73–0.91)	0.05	1.00 (0.99–1.00)	0.21	2.29	0.32
Nasal and NP	3	0.72 (0.55–0.89)		0.99 (0.98–1.00)			

Abbreviations: LRT, likelihood-ratio test; NP, nasopharyngeal.

sensitivity of the ID NOW assay was only approximately 79% as compared with that of other NAATs, indicating the likelihood of false-negative results when using the ID Now assay.

The PLR expresses the increase in odds of a disease by a positive test, whereas NLR expresses the decrease in odds by a negative test. Larger PLR indicates greater diagnostic accuracy, whereas a smaller NLR is better. In the present study, the pooled PLR of the Xpert Xpress and the ID NOW assay was 29.87 and 184.77, respectively. This means that patients with SARS-CoV-2 infection had approximately 30- and 185-fold higher respective chance of having a positive result for the Xpert Xpress and the ID NOW assay result than did patients without SARS-CoV-2. The pooled NLR of the Xpert Xpress assay was 0.01, indicating 1% probability that a patient with a negative result actually had

SARS-CoV-2 infection, which is low enough to exclude SARS-CoV-2 in the clinical setting.[29] The pooled NLR was 0.21, which is a concern for exclusion of SARS-CoV-2.[29]

A possible explanation for the low sensitivity of the ID NOW assay is the difference in detection accuracy related to viral burden.[24] A recent study compared the Xpert Xpress assay and the ID NOW assay with the Roche Cobas SARS-CoV-2 assay for samples with low, medium, and high SARS-CoV-2 viral concentrations.[22] The two tests showed 100% positive agreement for medium and high viral concentrations, defined as C_t value <30. However, for low viral concentrations defined as C_t value >30, positive agreement for the Xpert Xpress assay was 97.1% (95% CI, 83.4% to 99.8%), whereas it was 34.3% (95% CI, 19.7% to 52.2%) for the ID NOW assay.[24] In addition, a short article concerning the ID NOW assay reported that all false-negative results were recorded from samples that had low viral concentration with C_t values between 35 and 40.[20] Another trial indicated that false-negative rates of the ID NOW assay exceeded 10% for samples with low viral concentrations.[23] On the basis of these findings, the ID NOW assay seems to have insufficient sensitivity for samples with low viral concentrations.

To the best of our knowledge, four molecular tests have currently been approved for diagnosis of the SARS-CoV-2 virus under EUA from the FDA.[5] We first tried to investigate the diagnostic accuracy of the approved rapid molecular tests. However, as the Accula SARS-CoV-2 rapid molecular test was used in only one study, we did not include this test in our analysis.[30] Meanwhile, the sensitivity and specificity of the Accula SARS-CoV-2 test were reported to be 0.68 (95% CI, 0.53 to 0.81) and 1.00 (95% CI, 0.93 to 1.00), respectively.[30] We could not find the article for the Cue COVID-19 assay corresponding to our eligibility criteria. Studies have been reported mainly on the remaining two rapid molecular tests: the Xpert Xpress and the ID NOW assays. We conducted individual analysis for the two tests, because the principles of the two are different. A recent systematic review and meta-analysis conducted early-stage evaluations of point-of-care tests for detection of the SARS-CoV-2 virus.[31] Rapid molecular tests showed a pooled sensitivity of 0.95 (95% CI, 0.87 to 0.98) and pooled specificity of 0.99 (95% CI, 0.97% to 1.00%) in 11 studies comprising 2255 samples.[31] Previous researchers also calculated results of individual tests for the Xpert Xpress assay (six evaluations) and the ID NOW assay (five evaluations).[31] Their results were consistent with those of the present study; the pooled sensitivity for the Xpert Xpress assay was 0.99 (95% CI, 0.98 to 1.00), and that for the ID NOW assay was 0.77 (95% CI, 0.73 to 0.80). The pooled specificity of the Xpert Xpress assay was 0.97 (95% CI, 0.91 to 0.99), and that of the ID NOW assay was 1.00 (95% CI, 0.98 to 1.00).[31]

Potential limitations of the present study should be considered when interpreting our results. First, the studies included in our meta-analysis were of low methodological quality based on QUADAS-2 assessment. As the studies often lacked reporting of key information, assessment of several criteria for risk of bias was "high" or "unclear." Therefore, our results should be carefully interpreted due to limited methodological quality. Second, we could not assess publication bias as no reliable methods exist to investigate this in diagnostic test accuracy studies.[32] Third, we used various types of commercial or laboratory-based RT-PCRs for reference comparisons in SARS-CoV-2 diagnosis, which can introduce bias due to diagnostic differences. Finally, significant heterogeneity was found in both the sensitivity and specificity of the ID NOW assay. Although meta-regression analysis was performed, we could not identify potential sources of bias.

5 | CONCLUSIONS

We demonstrated the excellent diagnostic accuracy of the Xpert Xpress assay as a robust diagnostic method for point-of-care diagnosis of SARS-CoV-2. On the contrary, as the ID NOW assay had relatively low pooled sensitivity, this test might miss several positive patient specimens. Therefore, some patients with negative results on the ID NOW assay require another confirmatory NAAT test. Individuals requiring rapid confirmation of SARS-CoV-2 infection might benefit from the findings of this study.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

Jae-Uk Song contributed to data acquisition, data interpretation, statistical analysis, and drafted the manuscript. Jonghoo Lee contributed to the study design, data acquisition, data interpretation, statistical analysis, writing of the manuscript, and critical revision of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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