The Journal of Infectious Diseases

MAJOR ARTICLE

Screening for Severe Acute Respiratory Syndrome Coronavirus 2 in Close Contacts of Individuals With Confirmed Infection: Performance and Operational Considerations

Stephanie Zobrist,[1,a] Michelle Oliveira-Silva,[2,a] Alexia Martines Vieira,[2] Pooja Bansil,[1] Emily Gerth-Guyette,[1] Brandon T. Leader,[1] Allison Golden,[1] Hannah Slater,[1] Catherine Duran de Lucena Cruz,[2] Eduardo Garbin,[2] Mariana Sagalovsky,[1] Sampa Pal,[1] Vin Gupta,[3] Leo Wolansky,[4] Deusilene Souza Vieira Dall'Acqua,[5] Felipe Gomes Naveca,[6] Valdinete Alves do Nascimento,[6] Juan Miguel Villalobos Salcedo,[5] Paul K. Drain,[7] Alexandre Dias Tavares Costa,[8] Gonzalo J. Domingo,[1] and Dhélio Pereira[2]

[1]Diagnostics, PATH, Seattle, Washington, USA; [2]Centro de Pesquisa em Medicina Tropical (CEPEM), Porto Velho, Rondônia, Brazil; [3]Amazon.com, Seattle, Washington, USA; [4]The Rockefeller Foundation, Pandemic Prevention Institute, New York, New York, USA; [5]Fundação Oswaldo Cruz (Fiocruz), Porto Velho, Rondônia, Brazil; [6]Instituto Leônidas e Maria Deane, Fundação Oswaldo Cruz (Fiocruz), Manaus, Amazonas, Brazil; [7]Departments of Global Health and Medicine, University of Washington, Seattle, Washington, USA; and [8]Instituto Carlos Chagas, Fundação Oswaldo Cruz (Fiocruz), Curitiba, Paraná, Brazil

Background. Point-of-care and decentralized testing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is critical to inform public health responses. Performance evaluations in priority use cases such as contact tracing can highlight trade-offs in test selection and testing strategies.

Methods. A prospective diagnostic accuracy study was conducted among close contacts of coronavirus disease 2019 (COVID-19) cases in Brazil. Two anterior nares swabs (ANS), a nasopharyngeal swab (NPS), and saliva were collected at all visits. Vaccination history and symptoms were assessed. Household contacts were followed longitudinally. Three rapid antigen tests and 1 molecular method were evaluated for usability and performance against reference reverse-transcription polymerase chain reaction (RT-PCR) on nasopharyngeal swab specimens.

Results. Fifty index cases and 214 contacts (64 household) were enrolled. Sixty-five contacts were RT-PCR positive during ≥1 visit. Vaccination did not influence viral load. Gamma variants were most prevalent; Delta variants emerged increasingly during implementation. The overall sensitivity of evaluated tests ranged from 33% to 76%. Performance was higher among symptomatic cases and those with cycle threshold (Ct) values <34 and lower among oligosymptomatic or asymptomatic cases. Assuming a 24-hour time to results for RT-PCR, the cumulative sensitivity of an anterior nares swab rapid antigen test was >70% and almost 90% after 4 days.

Conclusions. The near-immediate time to results for antigen tests significantly offsets lower analytical sensitivity in settings where RT-PCR results are delayed or unavailable.

Keywords. Porto Velho; Rondônia; Allplex SARS-CoV-2 assay; SalivaDirect; SD Biosensor STANDARD Q COVID-19 Ag; LumiraDx SARS-CoV-2 Ag test.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19), has significantly burdened health systems globally, with >22 million confirmed cases in Brazil alone as of 2021 [1]. A key challenge of the pandemic response is access to appropriate diagnostic testing, which is critical to inform timely and targeted clinical management and public health strategies [2].

The reference standard for SARS-CoV-2 testing is reverse-transcription polymerase chain reaction (RT-PCR). While accurate, this method has many practical limitations, including cost, laboratory infrastructure requirements, and often invasive sampling. RT-PCR testing is typically centralized, which can lead to delays in reporting results to patients. Such delays have important public health implications, including increased risk for transmission during the period before results are available to infected individuals [3, 4]. Expanded access to decentralized and point-of-care (POC) testing is essential to identify cases early and limit community transmission, particularly where RT-PCR is unavailable.

Received 31 January 2022; editorial decision 09 May 2022; accepted 18 May 2022; published online 20 May 2022

[a]S. Z. and M. O. S. contributed equally to this work.

Correspondence: Stephanie Zobrist, 2201 Westlake Ave, Ste 200, Seattle, WA 98121 (szobrist@path.org).

The Journal of Infectious Diseases®

https://doi.org/10.1093/infdis/jiac204

With or without symptoms, infected persons can transmit SARS-CoV-2 [5–7]. Due to the significance of asymptomatic transmission [8], testing these populations is often recommended, including close contacts of individuals with confirmed infection as part of contact tracing, testing, and isolation strategies [9, 10]. However, contact tracing can be time and resource intensive, particularly during periods of high transmission, which can limit its implementation in practice.

Multiple platforms have been developed to enable decentralized and POC SARS-CoV-2 testing [11]. In particular, rapid antigen tests have garnered interest due to their lower cost, ease of use, and rapid turnaround time for results (typically <30 minutes) [10, 12]. The World Health Organization advises that rapid antigen tests meeting minimum performance criteria can be used in a range of use cases, including for testing asymptomatic contacts of cases [10]. Previous studies of rapid antigen test performance have shown variability, with strongest performance among symptomatic individuals with high viral loads in early stages of infection [11, 13–15]. Several studies have investigated test performance among contacts of confirmed cases [16, 17]; however, more data are needed to understand trade-offs in test selection and inform screening strategies regarding the timing and frequency of testing and performance characteristics.

METHODS

Study Design and Population

A prospective diagnostic accuracy study was conducted among close contacts of COVID-19–positive index cases in Porto Velho, Brazil, between July and September 2021. Symptomatic adults within 7 days of symptom onset who tested positive on a rapid SARS-CoV-2 antigen test (STANDARD Q COVID-19 Ag Nasal Test; SD Biosensor, Republic of Korea) were recruited as index cases through clinical platforms. Close contacts were identified through interviews administered at enrollment of the index case. Individuals ≥12 years of age who resided in Porto Velho were eligible for inclusion as close contacts if they met ≥1 of Brazil's criteria within the investigation period of the index case (from 2 days before symptom onset to the time of the interview) (Supplementary Material A) [18]. Contacts with prior positive COVID-19 test results within the past 3 months were not eligible. A subset of household contacts (who shared a primary residence with the index cases) had serial visits for clinical evaluations and testing every other day over a 9-day period, for a total of up to 5 visits.

Tests Evaluated

This study evaluated 4 SARS-CoV-2 tests: the STANDARD Q COVID-19 Ag Nasal and Saliva tests, the SARS-CoV-2 Ag Test (LumiraDx Limited, United Kingdom), and the SalivaDirect protocol (Yale School of Public Health, United States). The STANDARD Q tests are rapid chromatographic immunoassays for qualitative detection of antigens from SARS-CoV-2 in human nasal and saliva specimens, respectively. The LumiraDx test is a microfluidic immunofluorescence assay for qualitative detection of antigen in nasal specimens [19–24]. SalivaDirect is a dual-plexed RT-PCR method for SARS-CoV-2 detection from minimally processed saliva [25, 26].

Study Procedures at the POC

At enrollment, information was collected on participant demographics, health status, and medical history. The presence, duration, and severity of symptoms were assessed at all visits. At each visit, 2 paired anterior nares swab (ANS) samples were collected, along with one nasopharyngeal swab and saliva (Supplementary Material B). One ANS sample was used to perform the STANDARD Q COVID-19 Ag Nasal Test during the visit. All specimens were then transferred to a laboratory where the remaining tests were performed.

For the longitudinal study, household contacts were followed up every other day for up to a total of 5 visits or until the POC screening test was positive. One additional visit was performed after this positive result, during which nasopharyngeal swab samples were not collected to minimize staff exposure. Participants were considered lost to follow-up after 2 missed visits.

Laboratory Procedures

The extracted ANS sample mixed with LumiraDx buffer was frozen within 5 hours of collection and thawed before testing, no more than 5 days after freezing. The saliva sample was also frozen, and aliquots were thawed for testing with the STANDARD Q COVID-19 Ag Saliva Test (within 5 days of freezing) and the SalivaDirect assay. Evaluated tests were conducted according to manufacturer instructions and by operators blinded to POC and reference results for close contacts.

Nasopharyngeal swab samples were used for reference testing with the Allplex SARS-CoV-2 Assay (Seegene Inc., Republic of Korea), a multiplex real-time PCR assay, on a CFX96 real-time PCR machine (Bio-Rad, United States) [27]. Automated RNA extraction was conducted using the Loccus Extracta kit (Loccus, Brazil). For all SARS-CoV-2–positive specimens, testing was repeated with the same assay for quantitative estimation of viral load. Specimens with cycle threshold (Ct) values <30 underwent genomic sequencing (Supplementary Material C). Staff conducting reference testing were blinded to the close contact results for tests under evaluation.

Usability Assessment

Study staff responsible for use of the antigen tests were invited to participate in a usability assessment. The System Usability Scale was used, and an ease of use questionnaire was adapted

[21, 28] (Supplementary Material D). System Usability Scale scores >68 were considered acceptable [29, 30]. To analyze data from the ease of use questionnaire, a matrix was used to rank aspects of products' usability as "satisfactory," "average," or "unsatisfactory" (Supplementary Material E) [21].

Sample Size and Statistical Analysis

The sample size targeted at least 50 contacts with a positive reference result, including at least 20 asymptomatic individuals, to meet US Food and Drug Administration Emergency Use Authorization requirements [31]. Participants with no symptoms at the time of sampling were classified as asymptomatic. Participants were considered symptomatic if they presented with cough, shortness of breath, difficulty breathing, or ≥2 of the following symptoms at the time of sampling: fever, chills, rigor, myalgia, headache, sore throat, and new olfactory or taste disorder [32]. Participants who presented with ≥1 mild symptom but did not fit the symptomatic case definition and reported no care seeking or changes to behavior were considered oligosymptomatic.

Sensitivity, specificity, and positive and negative predictive values were calculated using standard formulas and presented with 95% confidence intervals (CIs). Samples for which both RT-PCR and evaluated test results were available were included in the analysis. Using the longitudinal data set, trade-offs between performance and utility of the evaluated tests in terms of cumulative sensitivity at specified time points were assessed as a function of time to results. Here, we use the term *cumulative sensitivity* to refer to the probability that a rapid test will identify a SARS-CoV-2–positive individual at any point during the 9-day serial-testing follow-up period. For all household contacts in the longitudinal sample with a positive reference result (Ct <34) at any time point, time to positivity from the date of enrollment was evaluated as the proportion of participants with a positive result by visit on a rapid test, compared with the reference RT-PCR result.

Data were collected and managed using Research Electronic Data Capture (REDCap) tools hosted at the Institute of Translational Health Sciences [33]. Statistical analyses were conducted using Stata 15.0 (StataCorp, College Station, Texas, USA) and R 4.0.3 (R Foundation for Statistical Computing, Vienna, Austria) software.

Ethical Considerations

The WCG Institutional Review Board (no. 1301165), the Centro de Pesquisa em Medicina Tropical (CEPEM) ethics committee, and Brazil's National Research Ethics Commission approved this study (no. 44351421.0.0000.0011). Written informed consent was obtained for all participants. Minors under 18 years of age provided assent, and written informed consent was obtained from parents/legal guardians.

Table 1. Characteristics of study participants[a]

Characteristic	Index Cases (n = 50)	Close Contacts	
		Nonhousehold (n = 150)	Household (n = 64)
Age			
Mean (SD)	40.1 (12.8)	38.4 (14.6)	34.7 (17.2)
Range	19–68	13–86	14–79
Sex[b]			
Female	32 (64.0)	81 (54.0)	37 (57.8)
Male	18 (36.0)	69 (46.0)	27 (42.2)
Vaccination status[c]			
Fully vaccinated	12 (24.0)	43 (28.7)	15 (23.4)
Partially vaccinated	24 (48.0)	69 (46.0)	25 (39.0)
Unvaccinated	14 (28.0)	38 (25.3)	24 (37.5)
Vaccine type			
AstraZeneca	19 (52.8)	47 (42.0)	11 (27.5)
CoronaVac	9 (25.0)	28 (25.0)	10 (25.0)
Johnson & Johnson	2 (5.6)	4 (3.6)	0 (0.0)
Pfizer	6 (16.7)	33 (29.5)	19 (47.5)
Relationship to index case			
Family (same household)	…	0 (0.0)	64 (100.0)
Family (other household)	…	45 (29.3)	…
Neighbor	…	7 (4.7)	…
Friend	…	49 (32.7)	…
Coworker	…	41 (27.3)	…
Classmate	…	4 (2.7)	…
Other	…	4 (2.7)	…
Duration of estimated exposure			
15 min to 1 h	…	30 (20.0)	…
1–3 h	…	41 (27.3)	…
3–8 h	…	68 (45.3)	…
≥8 h	…	11 (7.4)	64 (100.0)
Location of exposure			
Home	…	84 (56.0)	64 (100.0)
Work	…	47 (31.3)	…
Social setting	…	15 (10.0)	…
Other	…	4 (2.7)	…

Abbreviation: SD, standard deviation.

[a]Data represent no. (%) of index cases or contacts, unless otherwise specified.

[b]No statistically significant differences were observed by sex in any of the 3 groups, using a *t* test.

[c]Fully vaccinated classification indicates that a participant had received all required vaccine doses and was enrolled >14 days after receipt of the last vaccine dose.

RESULTS

Participant Characteristics

Fifty symptomatic COVID-19–positive index cases and 214 of their associated close contacts were enrolled (Table 1). Sixty-four contacts shared a primary residence with an index case and were therefore included in the longitudinal sample. Contacts ranged in age from 13 to 79 years. The majority of participants across all groups were female. Of the 214 contacts,

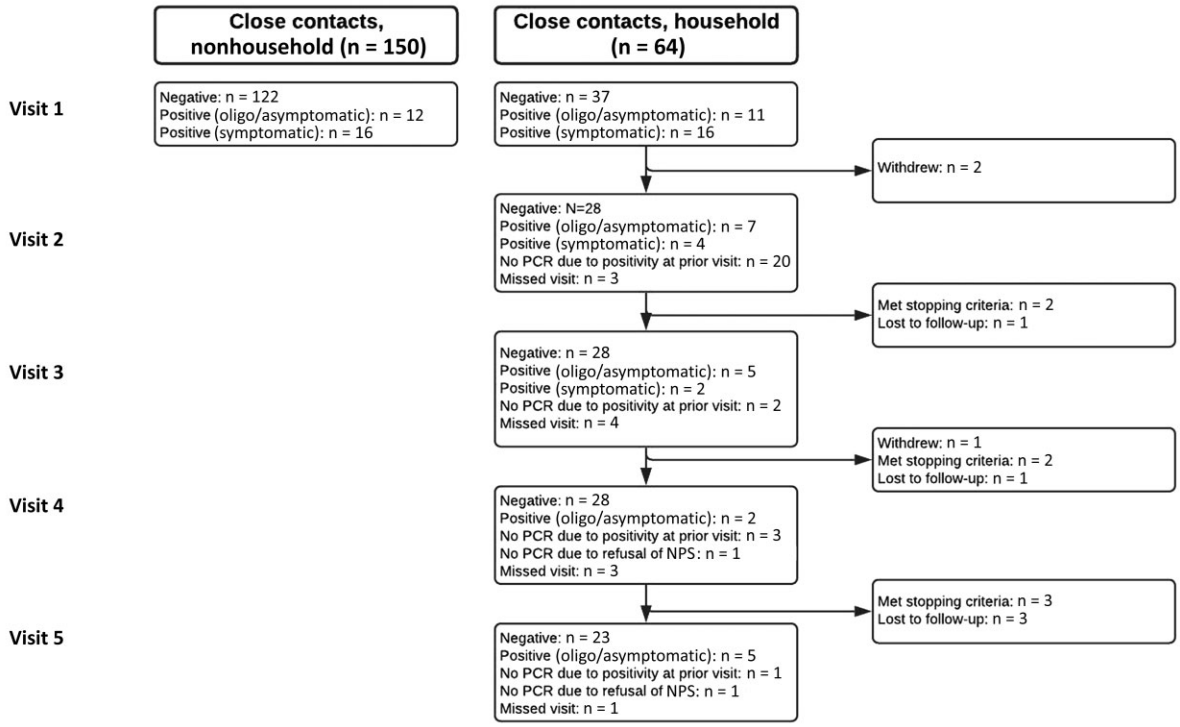

Figure 1. Status of study participants, by visit. Abbreviations: NPS, nasopharyngeal swab; PCR, polymerase chain reaction.

65 (30%) were SARS-CoV-2 positive by the reference assay during ≥1 visit (Figure 1). For household contacts, positivity rates and symptom status varied by visit. Twenty-seven of 64 household contacts (42%) tested positive by the reference test at the enrollment visit, 11 of 39 (28%) at visit 2, 7 of 35 (20%) at visit 3, 2 of 33 (6%) at visit 4, and 5 of 28 (18%) at visit 5. No SARS-CoV-2–positive household contacts presented with symptoms at visits 4 or 5 (Figure 1). In total, 42 paired samples were collected at unique visits with oligosymptomatic or asymptomatic positive contacts, from 32 participants.

Vaccination Status

Most participants were either partially (118 of 264 [45%]) or fully (70 of 264 [27%]) vaccinated at enrollment (Table 1). No statistically significant difference was observed in viral loads between vaccinated and unvaccinated individuals (Figure 2 and Supplementary Material F and G).

Sequencing

Sequences were available for 84 positive samples: 68 Gamma (P.1, P.1.4, and P.1.7), and 16 Delta (AY.36, AY.4, AY.43, and AY.99.2) variants, with 7 total lineages. The Delta strain became more prevalent among samples collected later in the study (Supplementary Material H).

Diagnostic Performance

The 2 POC ANS antigen tests demonstrated comparable performance, with overall sensitivity of 55.0% for STANDARD Q (95% CI, 43.5%–66.2%) and 50.6% for LumiraDx (95% CI, 39.1%–62.1%) tests (Tables 2 and 3). Performance increased to >80% sensitivity for both tests among symptomatic cases but decreased to <30% among those who were oligosymptomatic or asymptomatic. For specimens with Ct values <34, above which viral viability is negligent and quantification is not as reliable [34, 35], performance of both tests improved, with sensitivities in the ranges of 90% and 60% for symptomatic and for oligosymptomatic or asymptomatic cases, respectively.

The SalivaDirect PCR assay showed the highest overall performance at 75.9% sensitivity (95% CI, 65.0%–84.9%), which increased to 88.2% (95% CI, 76.1%–95.6%) among contacts with Ct values <34. In all scenarios, the rapid STANDARD Q Saliva Test had a sensitivity of <60%, although performance increased among symptomatic positive cases at lower Ct values.

Figure 3 presents the viral load of positive specimens, stratified by results of the STANDARD Q Nasal and Saliva tests. Overall, specimens with low viral loads were more likely to yield negative results; however, misclassification of specimens with high viral loads was more common with the saliva test.

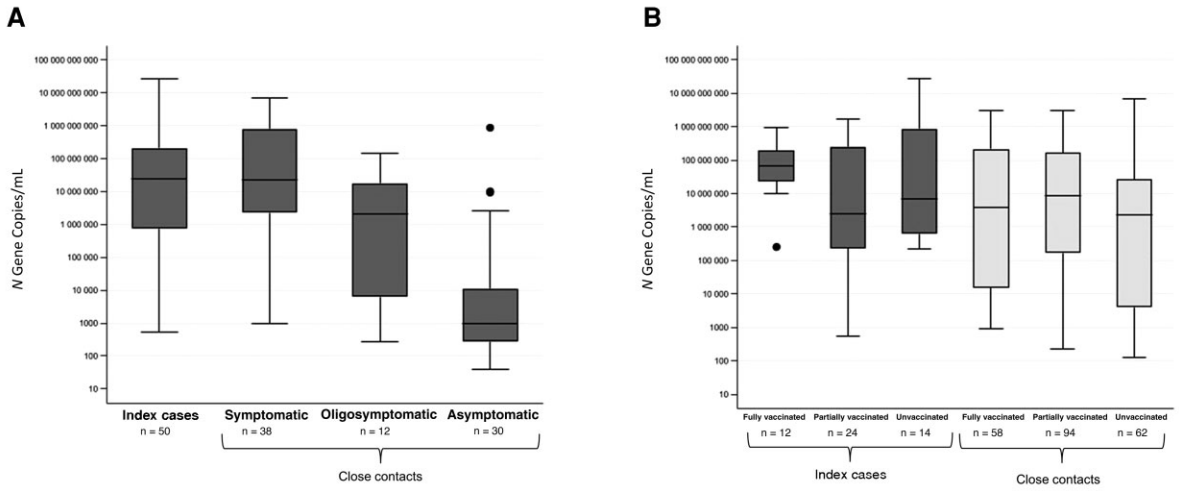

Figure 2. Viral load value relationships of study participants by infection category (*A*) and vaccination status (*B*).

Table 2. Performance indicators for tests evaluated using nasopharyngeal reverse-transcription polymerase chain reaction (RT-PCR) as the reference standard, among all close contacts and those with PCR cycle threshold values (Ct) <34. Value (95% CI), %

	All Close Contacts			Close Contacts With Ct <34		
Indicators by Test Type	Overall	Symptomatic Positive	Oligosymptomatic or Asymptomatic Positive	Overall	Symptomatic Positive	Oligosymptomatic or Asymptomatic Positive
STANDARD Q Nasal[a]	n = 340	n = 38	n = 42	n = 311	n = 34	n = 17
Sensitivity	55.0 (43.5–66.2)	84.2 (68.8–94.0)	28.6 (15.7–44.6)	82.4 (69.1–91.6)	91.2 (76.3–98.1)	64.7 (38.3–85.8)
Specificity	100.0 (98.6–100.0)	NA	NA	100.0 (98.6–100.0)	NA	NA
PPV	100.0 (92.0–100.0)	NA	NA	100.0 (91.6–100.0)	NA	NA
NPV	87.8 (83.6–91.3)	NA	NA	96.7 (93.7–98.5)	NA	NA
LumiraDx Nasal[a]	n = 345	n = 37	n = 42	n = 316	n = 33	n = 17
Sensitivity	50.6 (39.1–62.1)	81.1 (64.8–92.0)	23.8 (12.1–39.5)	78.0 (64.0–88.5)	87.9 (71.8–96.6)	58.8 (32.9–81.6)
Specificity	100.0 (98.6–100.0)	NA	NA	100.0 (98.6–100.0)	NA	NA
PPV	100.0 (91.2–100.0)	NA	NA	100.0 (91.0–100.0)	NA	NA
NPV	87.2 (82.9–90.7)	NA	NA	96.0 (93.0–98.0)	NA	NA
STANDARD Q Saliva[b]	n = 340	n = 38	n = 42	n = 311	n = 34	n = 17
Sensitivity	32.5 (22.4–43.9)	50.0 (33.4–66.6)	16.7 (7.0–31.4)	47.1 (32.9–61.5)	52.9 (35.1–70.2)	35.3 (14.2–61.7)
Specificity	98.8 (96.7–99.8)	NA	NA	98.8 (96.7–99.8)	NA	NA
PPV	89.7 (72.6–97.8)	NA	NA	88.9 (70.8–97.6)	NA	NA
NPV	82.6 (78.0–86.7)	NA	NA	90.5 (86.5–93.6)	NA	NA
SalivaDirect RT-PCR[b]	n = 339	n = 38	n = 41	n = 311	n = 34	n = 17
Sensitivity	75.9 (65.0–84.9)	89.5 (75.2–97.1)	63.4 (46.9–77.9)	88.2 (76.1–95.6)	94.1 (80.3–99.3)	76.5 (50.1–93.2)
Specificity	97.7 (95.0–99.1)	NA	NA	97.7 (95.0–99.1)	NA	NA
PPV	90.9 (81.3–96.6)	NA	NA	88.2 (76.1–95.6)	NA	NA
NPV	93.0 (89.3–95.8)	NA	NA	97.7 (95.0–99.1)	NA	NA

Abbreviations: CI, confidence interval; Ct, cycle threshold; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value; RT-PCR, reverse-transcription polymerase chain reaction.

[a]Tests performed on anterior nares swab specimens.

[b]Tests performed on saliva specimens.

Table 3. Performance indicators for tests evaluated using nasopharyngeal reverse-transcription polymerase chain reaction (RT-PCR) as the reference standard, among close contacts with PCR cycle threshold (Ct) values <30 and<25. Value (95% CI), %

	Close Contacts With Ct <30			Close Contacts With Ct <25		
Indicators by Test Type	Overall	Symptomatic Positive	Oligosymptomatic or Asymptomatic Positive	Overall	Symptomatic Positive	Oligosymptomatic or Asymptomatic Positive
STANDARD Q Nasal[a]	n = 305	n = 30	n = 15	n = 292	n = 22	n = 10
Sensitivity	84.4 (70.5–93.5)	93.3 (77.9–99.2)	66.7 (38.4–88.2)	87.5 (71.0–96.5)	95.5 (77.2–99.9)	70.0 (34.8–93.3)
Specificity	100.0 (98.6–100.0)	NA	NA	100.0 (98.6–100.0)	NA	NA
PPV	100.0 (90.7–100.0)	NA	NA	100.0 (87.7–100.0)	NA	NA
NPV	97.4 (94.7–98.9)	NA	NA	98.5 (96.2–99.6)	NA	NA
LumiraDx Nasal[a]	n = 310	n = 29	n = 15	n = 297	n = 21	n = 10
Sensitivity	79.5 (64.7–90.2)	89.7 (72.7–97.8)	60.0 (32.3–83.7)	87.1 (70.2–96.4)	100.0 (83.9–100.0)	60.0 (26.2–87.8)
Specificity	100.0 (98.6–100.0)	NA	NA	100.0 (98.6–100.0)	NA	NA
PPV	100.0 (90.0–100.0)	NA	NA	100.0 (87.2–100.0)	NA	NA
NPV	96.7 (93.9–98.5)	NA	NA	98.5 (96.3–99.6)	NA	NA
STANDARD Q Saliva[b]	n = 305	n = 30	n = 15	n = 292	n = 22	n = 10
Sensitivity	48.9 (33.7–64.2)	53.3 (34.3–71.7)	40.0 (16.3–67.7)	50.0 (31.9–68.1)	59.1 (36.4–79.3)	30.0 (6.7–65.3)
Specificity	98.8 (96.7–99.8)	NA	NA	98.8 (96.7–99.8)	NA	NA
PPV	88.0 (68.8–97.5)	NA	NA	84.2 (60.4–96.6)	NA	NA
NPV	91.8 (87.9–94.7)	NA	NA	94.1 (90.7–96.6)	NA	NA
SalivaDirect RT-PCR[b]	n = 305	n = 30	n = 15	n = 292	n = 22	n = 10
Sensitivity	88.9 (75.9–96.3)	96.7 (82.8–99.9)	73.3 (44.9–92.2)	87.5 (71.0–96.5)	95.5 (77.2–99.9)	70.0 (34.8–93.3)
Specificity	97.7 (95.0–99.1)	NA	NA	97.7 (95.0–99.1)	NA	NA
PPV	87.0 (73.7–95.1)	NA	NA	82.4 (65.5–93.2)	NA	NA
NPV	98.1 (95.6–99.4)	NA	NA	98.4 (96.1–99.6)	NA	NA

Abbreviations: CI, confidence interval; Ct, cycle threshold; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value; RT-PCR, reverse-transcription polymerase chain reaction.

[a]Tests performed on anterior nares swab specimens.

[b]Tests performed on saliva specimens.

Longitudinal Analysis

To investigate how test results changed over time, descriptive grid plots were generated for all household contacts with a positive reference result at any time point (Supplementary Material I). Figure 4 includes 2 examples of overall patterns observed in the data set: (A) a symptomatic individual with a low Ct value who tested positive by all assays at the first visit and met the stopping criteria on the second visit and (B) an individual with no or mild symptoms, whose reference positivity status fluctuated between visits, with high Ct values overall, and no positive results on any rapid test.

The time to positivity from the days since enrollment for close contacts with a positive reference result (Ct <34) at any time point was assessed by comparing the proportion of participants with positive reference results by RT-PCR and a POC ANS antigen test (STANDARD Q Nasal Test) under different scenarios for RT-PCR result turnaround time (Figure 5). Even with a relatively rapid RT-PCR result turnaround of 24 hours, >70% of contacts would have been identified by a POC test. At 48 hours, the cumulative sensitivity is 80%, increasing to nearly 90% at 4 days.

Usability

In total, 12 study staff completed the usability assessment. All 3 POC antigen tests were considered easy to use and System Usability Scale scores were acceptable (>77) (Supplementary Material J).

DISCUSSION

In this study, performances of 3 POC antigen tests (2 ANS and 1 saliva) and 1 molecular assay for SARS-CoV-2 in saliva were assessed among close contacts of COVID-19–positive index cases. All evaluated tests demonstrated strongest performance among symptomatic cases—and particularly those with Ct values <34. Performance decreased among oligosymptomatic or asymptomatic cases, which is consistent with results of prior studies [11, 13] and may indicate that the tests are best able to detect those most likely to be infectious [34, 35]. However, there is no universal Ct value cutoff point that corresponds to infectivity, and the relationship between Ct values and viral load varies by laboratory [11].

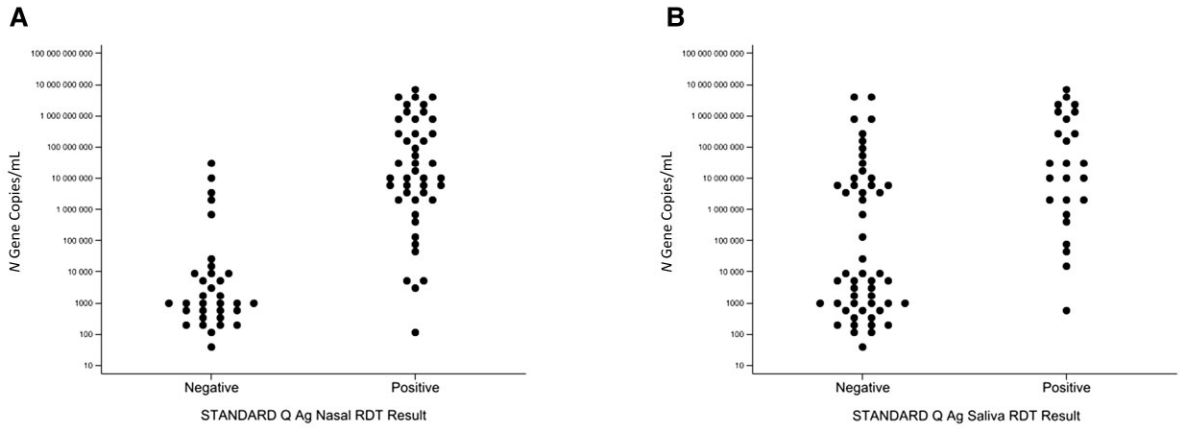

Figure 3. Viral load value distributions across antigen tests among close contacts for the STANDARD Q COVID-19 Ag Nasal Test (*A*) and the STANDARD Q COVID-19 Ag Saliva Test (*B*). Abbreviations: Ag, antigen; COVID-19, coronavirus disease 2019; RDT, rapid diagnostic test.

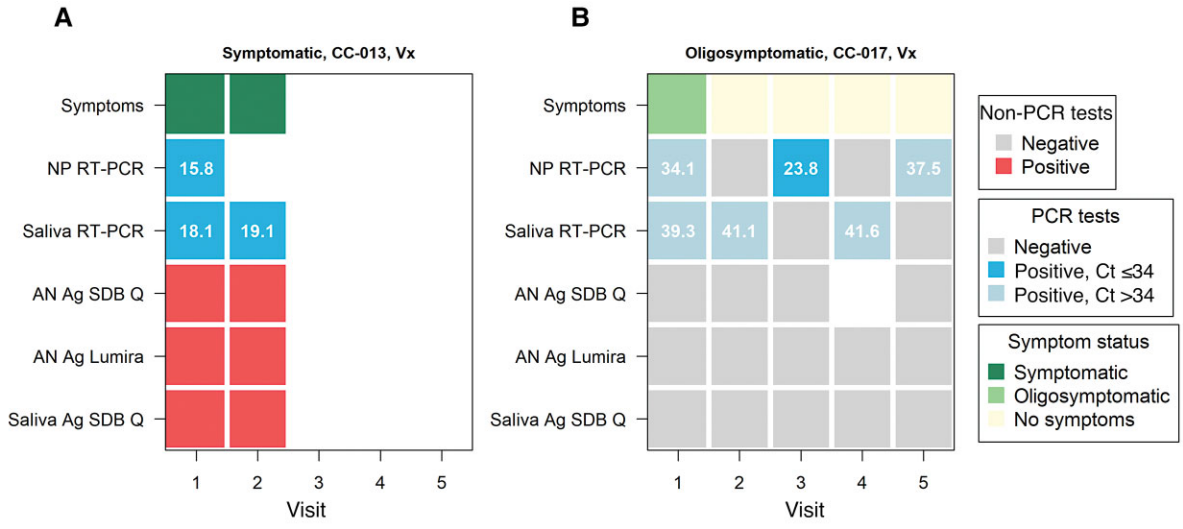

Figure 4. Descriptive plots for a subset of close contacts positive by the reverse-transcription polymerase chain reaction (RT-PCR) reference assay. Visit numbers are shown on the x-axis, and test results and symptom status on the y-axis. For PCR tests, numbers within boxes represent Ct values for positive specimens. CC-103 and CC-017 refer to each participant's unique identification codes. Abbreviations: Ag, antigen; AN, anterior nares; Ct, cycle threshold; NP, nasopharyngeal; SDB Q, SD Biosensor STANDARD Q Ag Test; Vx, vaccinated; RT-PCR, reverse-transcription polymerase chain reaction.

The SalivaDirect assay had the best performance, with sensitivity of up to 90% among contacts with Ct values <34. Although this assay uses a noninvasive sample type and a simplified procedure that minimizes processing time and costs, infrastructure and training requirements still limit the feasibility of implementing this test in many settings, with potential implications for time to results.

The saliva antigen test had the lowest overall performance. Other evaluations of POC saliva antigen tests have also shown variable but generally suboptimal performance [36, 37]. One recent evaluation of this test reported an overall sensitivity of 66.1%; however, the reference assay was conducted on saliva [38]. In this study, the test was performed on passively collected saliva. This may have impacted performance, as the manufacturer recommends use of actively collected saliva with snorted nasal mucus.

The 2 POC ANS antigen tests—STANDARD Q Nasal Test and LumiraDx—demonstrated comparable performance, which was best among cases with Ct values <34, with sensitivities in the ranges of 90% and 60% for symptomatic and asymptomatic cases, respectively. Among symptomatic cases and those with Ct values <34, both tests met World Health Organization performance criteria (≥ 80% sensitivity and ≥ 97% specificity) [10]. Both tests were also considered easy to

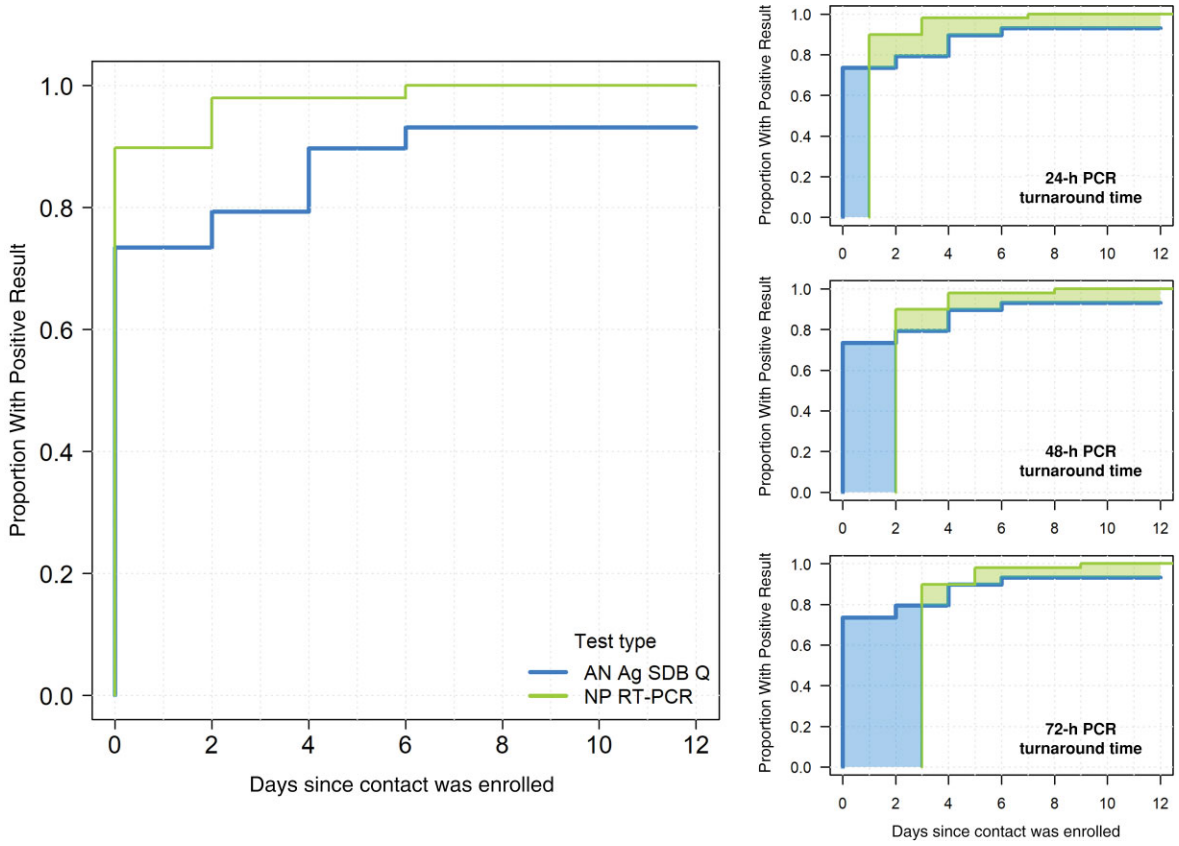

Figure 5. Time to positivity from time of first visit for close contacts with a positive nasopharyngeal (NP) reverse-transcription polymerase chain reaction (RT-PCR) result (cycle threshold <34) at any time. The blue line represents the proportion of NP RT-PCR–positive cases identified as positive by the point-of-care antigen test (STANDARD Q COVID-19 Ag test) on nasal samples. The green line represents those identified by the reference NP RT-PCR result. Four different scenarios for RT-PCR result turnaround times are presented. Abbreviations: Ag, antigen; AN, anterior nares; NP, nasopharyngeal; SDB Q, STANDARD Q Test; RT-PCR, reverse-transcription polymerase chain reaction.

use; however, the LumiraDx test requires the use of an instrument.

Overall, the observed positivity rate among close contacts in this study (65 of 214 [30%]) highlights the importance of contact tracing and testing as a public health strategy [39]. The longitudinal data demonstrate the value of serial testing (particularly for individuals with known exposures) and the practical benefits of timely results [40, 41]. In this study, we show that in settings where RT-PCR is unavailable or where the time to results is >4 days, close to 90% of individuals with Ct values <34 could benefit from an earlier result via a POC test. Even in settings where RT-PCR results are available within 24 hours, the cumulative sensitivity of a POC test is >70%. With repeated serial testing over a period of 9 days, the cumulative sensitivity of a POC ANS antigen test increases from 70% to near 90%. In many settings, limited RT-PCR testing capacity—especially during periods of high demand—can lead to delays in results. Immediate results can affect the behavior of potentially infectious individuals, encouraging earlier isolation and signaling where additional testing is warranted [4]. The emergence of antiviral therapies—which are more effective the sooner they are taken—further underscores the value of timely results.

Limitations of the current study include its modest sample size, reflected in the 95% CIs reported with performance indicators. Further, the STANDARD Q Nasal and LumiraDx Tests are among the best-in-class commercial POC antigen tests. Other tests with lower performance may increase the risk of missing infections against the benefit of identifying cases, to the extent that other strategies may be needed if RT-PCR is unavailable. Lastly, only Gamma and Delta SARS-CoV-2 variants were observed in this study; future research should investigate the implications of new variants on diagnostic performance across sample types.

In conclusion, the near-immediate time to results of rapid antigen tests is a significant benefit that offsets reduced sensitivity by decreasing diagnostic delays and onward viral transmission. In the current study, we demonstrate that POC ANS antigen tests for SARS-CoV-2 are easy to use and perform adequately to provide prompt, actionable information to both the health system and individuals.

Supplementary Data

Supplementary materials are available at *The Journal of Infectious Diseases* online (http://jid.oxfordjournals.org/). Supplementary materials consist of data provided by the author that are published to benefit the reader. The posted materials are not copyedited. The contents of all supplementary data are the sole responsibility of the authors. Questions or messages regarding errors should be addressed to the author.

Notes

Acknowledgments. We thank all study participants, as well as the clinical and laboratory staff at the Centro de Pesquisa em Medicina Tropical (CEPEM) involved with this study. We also thank SD Biosensor and LumiraDx for facilitating the availability of their tests for this study. We would also like to thank Global Health Strategies for their support with this study. Finally, we thank Amanda Tsang and Christine Waresak for editorial support with the manuscript.

Financial support. This work was supported by The Rockefeller Foundation (grant 2020 HTH 039 to G. J. D.); Amazon.com (grant 2D-04020007 to G. J. D.); and the National Center For Advancing Translational Sciences, National Institutes of Health (award UL1 TR002319 supporting Research Electronic Data Capture [REDCap], hosted at the Institute of Translational Health Sciences). F. G. N. and V. A. N. were supported by the National Council for Scientific and Technological Development (grant 403276/2020-9) and Inova Fiocruz/Fundação Oswaldo Cruz (grant VPPCB-007-FIO-18-2-30 [knowledge generation]). F. G. N is a fellow with the Brazilian National Council for Scientific and Technological Development (CNPq; fellowship to F. G. N.).

Potential conflicts of interest. All authors: No reported conflicts. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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