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Assessing time requirements of two models of SARS-CoV-2 screening and testing in routine healthcare services in Kenya and Cameroon: a descriptive study

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ABSTRACT

Introduction Incorporating SARS-CoV-2 antigen-detecting rapid diagnostic tests (Ag-RDTs) into routine care settings can facilitate efficient case identification and management in low-resource settings. We assessed the time required to complete SARS-CoV-2 screening and Ag-RDT testing in maternal, neonatal and child health (MNCH), HIV and tuberculosis clinics in selected facilities in Kenya and Cameroon.

Methods We conducted a descriptive, time-motion analysis comparing SARS-CoV-2 screening and testing through standard-of-care 'screen-and-test' (ST) and 'test-all' (TA) models. Study staff observed and documented time in minutes taken by healthcare workers to provide SARS-CoV-2 services. Time taken per model was compared using the Wilcoxon rank-sum (Mann-Whitney) or Kruskal-Wallis test.

Results A total of 116 observations of SARS-CoV-2 screening and testing using Ag-RDTs were conducted. The overall time spent on SARS-CoV-2 activities for clients was a median of 34 min (IQR: 25, 41) for ST sites and 21 min (IQR: 15, 27) at TA sites, p=0.001. Screening took a median time of 3 min (IQR: 2, 7) at ST sites. Among activities observed, test processing took the longest at 19 min (IQR: 17, 21) in ST sites versus 16 min (IQR: 15, 18.5) in TA sites, p=0.001.

Conclusions SARS-CoV-2 screening and testing services in routine healthcare services took slightly longer in the ST model compared with the TA model, with the majority of additional time needed for sample processing/testing in both models. However, in high-volume clinics, the additional 21 min of personnel and client time needed to test every attendee may not be feasible compared with the 34 min of additional time needed for testing only eligible attendees. When considering the model to use, clinic workload and human resource availability need to be considered to manage the time required for providing SARS-CoV-2 services.

Trial registration number NCT05382130 17 May 2022.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Identification of people infected with SARS-CoV-2 in low- and middle-income countries (LMICs) was initially difficult due to weak health systems.

⇒ The approved use of antigen-detecting rapid diagnostic tests (Ag-RDTs) has eased surveillance and case identification in LMICs.

⇒ Integrating services to minimise the effects of health services weaknesses has helped to make services available for populations that need them the most.

WHAT THIS STUDY ADDS

⇒ There are limited data on the integration of SARS-CoV-2 screening and testing within routine healthcare settings in LMICs and the time it takes to provide SARS-CoV-2 services within integrated services.

⇒ Integrating SARS-CoV-2 services into the maternal, neonatal and child health (MNCH), HIV and tuberculosis (TB) clinics requires additional staff time. The majority of time is taken during test processing.

⇒ Clinic workload and availability of personnel need to be considered when making decisions about the model of integrating SARS-CoV-2 Ag-RDTs into primary care clinic settings.

HOW MIGHT THIS AFFECT RESEARCH, POLICY OR PRACTICE

⇒ The findings of this study provide new evidence on the time required for integrating SARS-CoV-2 screening and testing in MNCH, HIV and TB using different testing models.

INTRODUCTION

The emergence of the novel SARS-CoV-2 was accompanied by difficulties in identifying and managing people affected by coronavirus

2019 (COVID-19) disease caused by the virus, especially in low- and middle-income countries (LMICs).[1] Limited diagnostic capacity was associated with under-reporting of cases and deaths, including in Kenya.[2] To increase the accessibility of testing and identification of positive cases, countries adopted various strategies, including increasing sample collection points and pooled testing.[3] Acknowledging the difficulties experienced with timely and efficient case detection in LMICs, the WHO approved the use of antigen-detecting rapid diagnostic tests (Ag-RDTs) to enhance SARS-CoV-2 diagnosis, care, treatment and surveillance.[4] Ag-RDT assays are low cost and easy to use, with rapid turnaround time and results expected 15–30 min from when the test is administered,[5] although this does not take into consideration other logistical and administrative procedures required to administer the tests such as fidelity to standard operating procedures of administering the tests[6] and patient caseload.[7] The Ag-RDTs can be used to identify asymptomatic individuals[8] and to expand access to testing in low-resource settings through integration into primary healthcare settings that are easily accessible as they do not require complex procedures, specialised skills or use of electricity in comparison with the gold-standard PCR assay.[9]

Once SARS-CoV-2 diagnostics were developed for the novel virus, countries developed context-specific integrated health service delivery approaches to incorporate SARS-CoV-2 testing into health services.[10] With the shift away from COVID-19 emergency response, there was added impetus to integrate SARS-CoV-2 testing in routine health services, including specialty clinics for maternal, neonatal and child health (MNCH), HIV, tuberculosis (TB) services, where patients may have been at higher risk for severe COVID-19 disease.[11] With integration comes considerations for concerns raised by healthcare workers (HCWs) relating to resources, patient flow processes and staffing.[12] There are limited data on the integration of SARS-CoV-2 screening and testing within routine healthcare settings in LMICs, including in Africa,[10] though researchers have suggested integrating TB and malaria testing with SARS-CoV-2 testing based on the potential similarity of clinical presentation.[13 14] Similarly, limited data exist on the time it takes to provide SARS-CoV-2-related services. Available literature points to initial difficulties with the provision of SARS-CoV-2 testing and availability of timely results, resulting in suboptimal clinical decision-making and control of transmission, primarily due to the long turnaround time for SARS-CoV-2 PCR assay testing results,[15–17] as well as the time required to provide SARS-CoV-2 vaccination services.[18] Documentation of the time required by HCWs to perform clinic-specific services at MNCH, HIV and TB clinics has been previously evaluated, such as the time to provide antenatal care services in Tanzania[19] and Mozambique,[20] and average time per month to provide TB services, and HIV prevention and antiretroviral therapy (ART) adherence counselling in Kenya.[21] Using innovative technologies for point-of-care testing for HIV, such as for early infant diagnosis and viral load, has demonstrated improved and wider reach, and ease and speed in diagnosis, return of testing results, decision-making, and prompt management of clinical conditions.[22–24]

Integrating SARS-CoV-2 Ag-RDTs into MNCH, HIV and TB services requires additional time by the facility HCWs and likely by the clinic attendees seeking these services. Studies on the integration of other healthcare services have found integration to be acceptable by HCWs when there is minimal disruption of patient flow and compatibility with training and work schedules.[25–27] Patients perceive that integration reduces stigma, promotes holistic care and reduces care-related costs.[28] Considering the limitations in LMIC health settings, integration of SARS-CoV-2 screening and Ag-RDT testing at points of care in routine healthcare services can support timely clinical diagnosis and disease surveillance initiatives, assuming service delivery is not disrupted. The aim of this study was to assess the time taken by the different HCW cadres to provide SARS-CoV-2 screening and testing services, using Ag-RDTs, in MNCH, HIV and TB clinics and to compare test results of two SARS-CoV-2 screening and testing models, 'screen-and-test' (ST), the standard of care, and 'test-all' (TA). In the 'screen and test' model, all clinic attendees were screened for SARS-CoV-2 infection followed by SARS-CoV-2 Ag-RDT testing only for attendees who meet testing eligibility requirements. In the 'test all' model, all clinic attendees were screened for SARS-CoV-2 infection followed by SARS-CoV-2 Ag-RDT testing irrespective of screening results.

MATERIALS AND METHODS

Study design and setting

We conducted a cross-sectional study using time-motion methodology as part of the integrating rapid antigen testing for SARS-CoV-2 study (INTEGRATE study), a cluster randomised trial. The INTEGRATE study had health facilities as clusters randomised to the SARS-CoV-2 'test all' model (intervention arm) or to the "screen and test" according to the Ministry of Health (MOH) testing guidelines model (control arm) in MNCH, HIV and TB clinics in Kenya and Cameroon. Screen and test model, which was the standard of care, was based on the MOH guidance and a testing algorithm. All patients with COVID-19-like symptoms were tested using the SARS-CoV-2 rapid antigen test. In both screen and test and test all sites, those who tested positive were managed appropriately. Those who were negative but symptomatic were further tested using PCR. The study was conducted in selected facilities in Kenya and Cameroon as part of the Catalysing COVID-19 Action (CCA) Project. The project aimed to decentralise SARS-CoV-2 testing and COVID-19 treatment through enhanced access to quality diagnosis and therapeutics. The INTEGRATE study was conducted in 20 health facilities in both Kenya and Cameroon. The 20 sites were randomised to 10 TA (five in Kenya and five in Cameroon) and 10 ST (five in Kenya and five in

Cameroon). From the 20 INTEGRATE study sites, for the time-motion observation, eight facilities were randomly selected, four TA (two in Kenya and two in Cameroon) and four ST (two in Kenya and two in Cameroon). This number was chosen based on available resources, time and funding to effectively manage the study. Site randomisation was done through computer software. The primary objective of the INTEGRATE study was to estimate the effectiveness of the 'test all' strategy on the proportion of patients diagnosed with SARS-CoV-2 infection compared with the screen and test strategy following SARS-CoV-2 Ag-RDT integration in MNCH, HIV and TB clinics. This paper addresses the secondary objective, which is to assess the time required for Screening and Testing using SARS-CoV-2 Ag-RDT in MNCH, HIV and TB services in both 'test all' and 'screen and test' models.

Procedures and participants

Time-motion observations were conducted from August 2022 to December 2022 for a total of 5 months. Data were collected in a total of eight randomly selected sites. We conducted a minimum of four observations of each service per clinic after 2 months of the INTEGRATE study implementation. Clinic attendees aged ≥2 years who were receiving SARS-CoV-2 screening and testing services were eligible for observation. HCWs were eligible if they were directly providing counselling, testing, or care to attendees in the study MNCH, HIV and TB clinics and had worked for at least 3 months during the study period.

At each site, trained study staff conducted the observations. Prior to the observations, study staff liaised with the clinic in charge to identify an appropriate day to conduct the time-motion observation. On the day of observation, participants were randomly selected by the study staff posted at the entry of the clinic. Participants were informed that observations were taking place. If the clinic attendee was not willing to be part of the observation, the next eligible clinic attendee was considered for the study. No individual information was collected from the HCWs and clinic attendees being observed.

Study staff observed and documented the time it took for each step of the SARS-CoV-2 screening and testing process, such as screening, counselling, performing the Ag-RDTs, provision of results to the patient and documentation of the overall time the patient spent to receive SARS-CoV-2 services in the clinic, stratified by the cadre of the HCW providing the service. Study staff collected the data electronically using study tablets that had the data collection tool with a stopwatch calibrated to record the time taken as the service provided was observed. The study staff was required to start the stopwatch once the service was initiated and stop once the service was completed. A standard operating procedure providing detailed instructions on when to start and stop the observation was provided, and study staff were trained prior to data collection to ensure standardisation of data collected. The same trained study staff conducted all observations and measurements throughout the study period. The services were observed where they normally took place within the clinic. Screening was observed at the waiting area, and pretest and post-test counselling, test assay preparation, sample collection and processing and provision and documentation of results were observed at the designated points in each clinic. A study staff would follow the participant to all procedures from when they enter the clinic to the last procedure point. These strategies helped ensure the accuracy and consistency of time measurements throughout the study.

The services provided depended on the cadre of the HCW, with some HCWs providing all the services, while some were limited to the services they could provide. Nurses/midwives, nursing assistants, lab technicians and testing agents provided all the SARS-CoV-2-related testing services, whereas registration clerks and community health workers were restricted to conducting screening. Test preparation, sample collection and test processing are interrelated processes and were done by the same staff.

Table 1 describes the activities observed, including time taken for screening, counselling, sample collection, testing, interpretation and giving of results to the client and documentation of test results.

Study data were collected electronically through Open Data Kit (ODK-X) and entered in a study database. A research assistant stationed in each clinic would take note of the time when each participant arrived in the specific clinic and when the first procedure, screening, was conducted. Once a clinic attendee started receiving the observed service, the exact time needed to provide the specific service was recorded in minutes.

Statistical analysis

The length (in minutes) of each activity was calculated as the difference between activity start and its end time. All observations that took less than 1 min due to the fact that start time and end time were the same (activity length less than a minute) were imputed to half a minute. Since we know that an activity that took less than a minute to complete is either less than or greater than 30 s, we chose to impute to 30 s, which corresponds to half a minute. Our analysis included the median, which is less sensitive to extreme values. This imputation could only have an impact on the median if the preimputation median was <1 min (ie, zero) and then adjusted to 0.5 min. In this case, the interpretation of the median should be the same (less than a minute) with the advantage of being closer to the true median. In addition, the imputation did not affect the comparison between groups (models) as shown by a sensitivity analysis. We excluded six observations of sample processing and testing that were found to be 5 min or below, hence clearly inadequate, from analysis (two in ST and four in TA sites). For each service, we estimated the median time and associated IQRs. We compared the distribution of time taken for each service using the Wilcoxon rank-sum (Mann-Whitney) or Kruskal-Wallis test as appropriate. Survey data were

Table 1 Description of tasks observed

Tasks observed	Description
Waiting time	Duration between when the clinic attendee arrived at the clinic to the time the clinic attendee was screened
Screening	Duration of time taken for screening personnel to ask about signs and symptoms and complete the screening form
Precounselling	Duration of time taken to inform the clinic attendee about the need and benefits of getting tested for SARS-CoV-2, how and by whom it would be done and how long testing would take
Testing preparation	Started with settling of the clinic attendee, wearing of personal protective equipment (PPE), and ended with opening and labelling the test strip.
Sample collection	Duration of time taken to collect a nasopharyngeal sample from the clinic attendee until insertion of the swab into buffer solution to get the nasopharyngeal sample ready for testing.
Sample testing/ processing	Recorded as the time taken to put the sample (in solution) into the assay device and allow for sample migration until the time the strip was read by the HCW, after 15 min but not beyond 30 min according to test manufacturer specification.
Interpretation and giving of results to the client	The duration of time taken to read the strip and interpret if the clinic attendee's test result is negative, positive or invalid and inform the clinic attendee of the test result.
Post-test counselling	Duration of time taken to provide counselling to the clinic attendee and inform them of the next steps for care, depending on test outcome. For those testing negative, this included emphasising prevention messaging, including referring for vaccination for those not vaccinated. Among those testing positive, this included a discussion on COVID-19 management and minimising the spread of infection.
Result documentation	Duration of time taken to report clinic attendee results on the COVID-19 result form, investigation form or any other source document at the entry point.

*Some tasks may have overlapped, such as pretest counselling and test preparation and interpretation and giving of results to clients and result documentation.
HCWs, healthcare workers.

analysed using STATA V.17.0 (StataCorp 2021. Stata Statistical Software: Release 17. College Station, Texas: StataCorp LLC). P values <0.05 were considered statistically significant.

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

RESULTS

A total of 116 attendees were observed, 61 in ST sites and 55 in TA sites. We conducted 51 observations of screening procedures (only done for ST), 75 for pretest counselling; 74 for test preparation, sample collection, sample processing and testing and giving results; 66 for post-test counselling and 75 for result documentation (figure 1).

Time spent providing SARS-CoV-2 services

Table 2 presents the time taken for the different services by testing model. Screening took a median 3.0 min (IQR: 2.0, 7.0) in ST sites. Most of the screening in ST sites took place at the time of registration. Pretest counselling was offered to those who agreed to proceed with testing. Pre-test counselling was conducted mainly by laboratory technicians (56%), testing agents (10.6%), community health workers (18.7%) and nurses (14.7%). Pretest counselling took a median of 2.0 min (IQR: 1.0, 3.0) in ST and 1.0 min (IQR: 0.5, 2.0) in TA sites, p=0.016.

Median time for test preparation in ST and TA sites was 1.0 min (IQR: 1.0, 2.0) and 1.0 min (IQR: 0.5, 1.0), respectively, p=0.50. Median time for sample collection was 1.0 min (IQR:1.0, 1.0) for ST sites and 1.0 min (IQR:1.0, 2.0) for TA sites, p=0.22. Disparities in test processing time between the two models were observed, with TA sites having a shorter median time of 16.0 min (IQR: 15.0, 18.5) compared with the ST model with a median time of 19.0 min (IQR: 17.0, 21.0), p=0.001. There were no significant differences in time when comparing between the two countries (data not shown).

The time for the entire SARS-CoV-2 testing process at ST sites took slightly longer than TA sites, median 34.0 min (IQR: 25.0, 41.0) versus 21 min (IQR: 15.0, 27.0), respectively (p=0.001), with a 13-minute difference between the two models of integration. Additionally, the waiting time at ST sites (4 min) was 3 min shorter than at TA sites (7 min). Aside from the test processing time, which took the most time to provide, all other SARS-CoV-2-related tasks took between 1 min and 3 min to perform.

In ST sites, test preparation was mainly done by laboratory staff (57.8%), testing agents (22.2%) and nurses/midwives (11.1%). In TA sites, about three-quarters of the tests were conducted by laboratory technicians (75.9%), followed by nurses/midwives, 17.2%. In Kenya, this process was exclusively done by laboratory technicians for both ST and TA sites; while in Cameroon, other trained non-laboratory HCWs also performed the tasks.

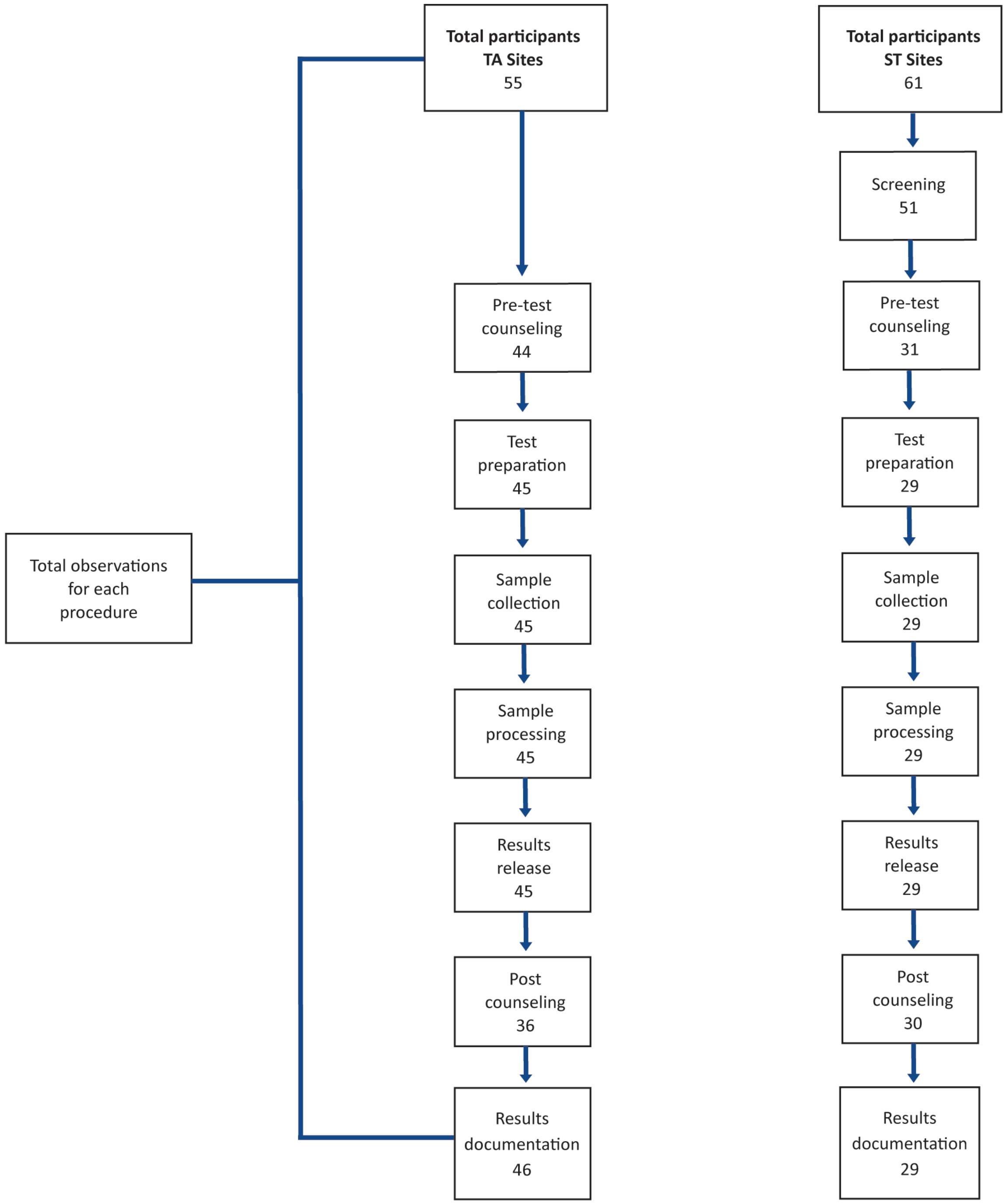

Figure 1 Flowchart of SARS-CoV-2 screening and testing services observed. Study flowchart of SARS-CoV-2 screening and testing procedures observed disaggregated by ST and TA model. ST, screen-and-test; TA, test-all.

Time taken by clinic type

Tables 3 and 4 present the time taken to provide services per clinic entry point, for ST and TA sites, respectively. Variations were noted in time between the three clinic types. The sample processing time per entry point had variations, although falling between the 15-minute and 30-minute manufacturer specification, with the exception of TA sites, where there were some tests processed at less than the manufacturer specified time (online supplemental figure 1).

The median time of sample testing/processing was significantly shorter in the TA compared with ST sites (p=0.001), and ST sites were more likely to have testing/processing time near the upper range and TA sites more likely to have testing/processing time near the lower range of that recommended by the manufacturer.

Time taken by service provider

Clinical officers took the longest time for screening (median 9.0 min, IQR: 6.5, 12.0) and post-test counselling

Table 2 Median (IQR) time in minutes for service delivery by facility testing model

	ST sites Median (IQR)	TA sites Median (IQR)	P value*
Screening	3.0 (2.0, 7.0)		
Precounselling	2.0 (1.0, 3.0)	1.0 (0.5, 2.0)	0.016
Testing preparation	1.0 (1.0, 2.0)	1.0 (0.5, 1.0)	0.500
Sample collection	1.0 (1.0, 2.0)	1.0 (1.0, 1.0)	0.220
Sample testing/processing	19.0 (17.0, 21.0)	16.0 (15.0, 18.5)	0.001
Results release	1.0 (0.5, 1.0)	0.5 (0.5, 1.0)	0.330
Postcounselling	1.0 (1.0, 2.0)	1.0 (0.5, 2.0)	0.220
Results documentation	1.0 (0.5, 1.0)	0.5 (0.5, 1.0)	0.260
Waiting	4.0 (1.0, 10.0)	7.0 (1.0, 17.0)	0.150
Cumulative service*	34.0 (25.0, 41.0)	21.0 (15.0, 27.0)	0.001

*Mann-Whitney test.
*Cumulative service time obtained from observations across the full cascade from screening to results documentation.

(median 3.0 min, IQR: 2.0, 3.0) (online supplemental table 1).

DISCUSSION

Integration of SARS-CoV-2 Ag RDT into routine care at MNCH, HIV and TB clinics in our study in Kenya and Cameroon was found to require additional time for clinic attendees and healthcare staff. While the total time taken for TA sites was less than ST considering that screening is not a prerequisite for TA sites, the overall volume of clinic attendees will significantly impact the feasibility of implementing a TA strategy. To our knowledge, there are no other studies reporting on time spent providing integrated SARS-CoV-2 screening and testing services in these clinics in LMIC settings using the two models. Other time-motion studies within the context of SARS-CoV-2 have focused on caesarean delivery surgeries for pregnant women with SARS-CoV-2 infection[29] and time spent at COVID-19 vaccination centres.[18] A study conducted in Kenya reported efficient use of SARS-CoV-2 Ag-RDTs in providing testing to patients who met the case definition to require testing according to the Ministry of Health in the context of a mixture of public and private facilities but did not indicate the time required to provide services.[5]

The additional sample processing time spent to receive immediate, point-of-care results is far shorter than the significant delay observed initially in the pandemic to receive SARS-CoV-2 PCR test results.[15 17 30] This has important implications for timely decision-making, mitigating local transmission, and strengthening patient management. In light of this, a TA approach for triage as a quick and cost-effective way of arresting epidemics and identifying those likely to transmit infection may be considered when managing epidemics.[31] When considering which approach to use between ST and TA, considerations need to account for additional time that would cumulatively be spent by attendees in a clinic in

Table 3 Time taken disaggregated by clinic type for ST sites

	HIV n=18 Median (IQR)	TB n=18 Median (IQR)	MNCH n=25 Median (IQR)	P value*
Screening	3.0 (2.0, 6.0)	3.0 (2.0, 8.0)	5.0 (2.0, 8.0)	0.60
Precounselling	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)	2.0 (1.0, 2.0)	0.86
Testing preparation	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.51
Sample collection	1.0 (1.0, 1.0)	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.53
Sample testing/processing	19.0 (17.0, 20.5)	19.0 (16.0, 21.0)	20.5 (19.5, 21.5)	0.29
Results release	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	0.60
Postcounselling	1.0 (1.0, 2.0)	2.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.93
Results documentation	1.0 (1.0, 1.0)	1.0 (1.0, 2.0)	1.0 (1.0, 1.0)	0.30

*Kruskal-Wallis test.
MNCH, maternal, neonatal and child health; TB, tuberculosis.

Table 4 Time taken disaggregated by clinic for test-all sites

	HIV	TB	MNCH	
	n=17	n=17	n=21	
	Median (IQR)	Median (IQR)	Median (IQR)	P value*
Precounselling	1.0 (1.0, 2.0)	1.0 (1.0, 5.0)	1.0 (1.0, 1.0)	0.85
Testing preparation	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 2.0)	0.89
Sample collection	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	0.75
Sample testing/processing	17.0 (15.0, 19.0)	16.0 (15.0, 17.0)	16.0 (15, 18.0)	0.83
Results release	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	0.39
Postcounselling	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.70
Results documentation	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	0.64

*Kruskal-Wallis test.
MNCH, maternal, neonatal and child health; TB, tuberculosis.

relation to the number of attendees within these clinics. In our study, as reported elsewhere,[29 30] the MNCH clinic was the busiest with a high client load, and testing all attendees may have additional time constraints on HCWs or require additional investment in human resources. Pretest time spent cumulatively based on clinic workload for TA sites could result in accumulated delays, which could be addressed by providing group rather than individual pretest counselling during health talks. Santre *et al* reported experiences conducting group counselling regarding SARS-CoV-2 testing for patients in a dedicated COVID-19 clinic, which took 7–8 min.[32]

Studies have demonstrated the added benefits, including improved health outcomes, of integrating other health services into routine care. In a systematic review and meta-analysis focused on the integration of HIV services with other services, uptake and treatment success of both HIV and non-HIV services were significantly higher in integrated programmes, and mortality was non-significantly lower.[33] A study looking at patient and provider costs in the context of integrating HIV, diabetes and hypertension services in Tanzania and Uganda reported no significant difference in time spent by HCWs addressing one condition versus addressing multiple conditions in an integrated setting.[34] Similarly, time spent by patients with a single condition was not statistically different from that spent by patients with multiple conditions. This is in contrast to our findings in which the addition of SARS-CoV-2 screening and testing added considerable time to the delivery of clinic services for both providers and attendees. These results can inform the development of future TA strategies by looking for more efficient ways to incorporate the testing time into other testing services to minimise the delays, such as reducing workload through task shifting and sharing and utilisation of retired HCWs during surges.[35]

Our results indicate mostly homogeneity but also a few disparities in time taken to conduct the SARS-CoV-2 testing services between models may indicate variation in how the staff approached the tasks. With continuous sensitisation, different cadres of existing HCWs can support the integration of SARS-CoV-2 services at clinic entry points.[35]

The sample testing/processing time in TA sites took a shorter median time compared with ST sites, which may have also been as a result of more experience conducting more tests in TA sites. Additionally, there was serial testing in TA sites for all who accepted to take the test, while intermittent testing was conducted in ST sites as only those who screened positive were offered a test. There were some irregularities observed in sample processing, with a trend towards less than the required time taken for processing in TA sites and an extended time for ST sites. The large volume of testing required in TA sites may have contributed to less time/attention spent on following the specified processing timelines. This could be addressed through sensitisation of staff on manufacturer specifications and following testing protocols. Considering that most diagnostic tests for SARS-CoV-2 are relatively novel, quality improvement through documenting practice and using the information to improve the process is recommended.

Our study had some limitations. First, we did not measure time spent at the facility before integration and thus are not able to compare time spent accessing other services within the clinic before and after integration. Second, some of the activities such as pretest counselling and post-test counselling were happening simultaneously with other activities such as test preparation, post-test counselling and result documentation. Lastly, we had direct observations of activities as they took place within the facility, which may have disturbed the participants under observation and also influenced HCW's performance of activities. This analysis was conducted for only a few sites in selected facilities in Kenya and Cameroon, and the results may not be generalisable across both countries. However, important lessons learnt can be applied during the integration of services in similar pandemics.

CONCLUSIONS

In the two models, SARS-CoV-2 screening and testing services in routine healthcare services took slightly longer in the ST model compared with the TA model, with the majority of additional time needed for sample processing/testing in both models. However, in high-volume clinics, the additional 21 min of personnel and client time needed to test every attendee may not be feasible compared with the 34 min of additional time needed for testing only eligible attendees. When considering the model to use, clinic workload and human resource availability need to be considered to manage the time required in providing integrated SARS-CoV-2 services. Efficiencies in integrating SARS-CoV-2 services can be enhanced by staff sensitisation on test manufacturer specifications, following testing protocols, training and mentorship.

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Contributors NB, BT and ROM are the principal investigators of the trial. NB, BT, ROM, RM, AT and AY designed the study and developed the study protocol. JN and TD were responsible for the implementation of the study. SS, RK and RM analysed the study data. JN, ROM, NB and TD wrote the first draft of the manuscript. SP, EW, CM-K and EE contributed to the preparation of the manuscript. All authors contributed to the interpretation of data and critically reviewed the manuscript. All authors approved the final version of the manuscript. ROM, as the guarantor, accepts full responsibility for the finished work and the conduct of the study, had access to the data and controlled the decision to publish.

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