Rapid point of care nucleic acid testing for SARS-CoV-2 in hospitalised patients: a clinical trial and implementation study.

Dami Collier, specialist registrar 1,2*, Sonny M. Assennato, post-doctoral researcher 3*, Ben Warne, specialist registrar 4, Nyarie Sithole, specialist registrar 4, Katherine Sharrocks, specialist registrar 4, Allyson Ritchie, post-doctoral researcher 3, Pooja Ravji, specialist registrar 4, Matthew Routledge, specialist registrar 4, Dominic Sparkes, specialist registrar 4, Jordan Skittrall, specialist registrar 4, Anna Smielewska, specialist registrar 4, Isobel Ramsey, specialist registrar 4, Neha Goel, doctoral student 3, Martin Curran, Clinical Scientist 5, David Enoch, consultant microbiologist 5, Rhys Tassell, POC testing lead 6, Michelle Lineham, POC team member 6, Devan Vaghela, specialist registrar 4, Clare Leong, specialist registrar 4, Hoi Ping Mok, consultant physician 4, John Bradley, professor of medicine 7,8, Kenneth GC Smith, professor of medicine 7,8, Vivienne Mendoza 9, Nikos Demiris 10, Martin Besser 11, Gordon Dougan 2,7, professor, Paul J. Lehner, professor of immunology and medicine 2,7, Hongyi Zhang, consultant microbiologist 5, Claire S. Waddington, clinical lecturer 4,7, Helen Lee, CEO 3*, Ravindra K. Gupta, professor of clinical microbiology 2,4,7,11* and the CITIID-NIHR COVID BioResource Collaboration

*Equal contribution

1 Division of Infection and Immunity, University College London, UK. WC1E 6BT

2 Cambridge Institute of Therapeutic Immunology & Infectious Disease (CITIID), Cambridge, UK. CB2 0AW

3 Diagnostics for the Real World EU Ltd., Chesterford Research Park, UK. CB10 1XL

4 Department of Infectious Diseases, Cambridge University NHS Hospitals Foundation Trust, Cambridge, UK. CB2 0QQ

5 Clinical Microbiology & Public Health Laboratory, Public Health England, Cambridge, UK. CB2 0QQ

6 POC Testing, Department of Pathology, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK. CB2 0QQ

7 Department of Medicine, University of Cambridge, Cambridge, UK. CB2 0AW

8 National Institutes for Health Research Cambridge Biomedical Research Centre, Cambridge, UK. CB2 0QQ

9 NIHR Cambridge Clinical Research Facility, Cambridge, UK. CB2 0QQ

10 Department of Statistics, Athens University of Economics and Business, 28is Oktovriou 76, 104 34, Athens, Greece

11 Department of Haematology, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK. CB2 0QQ

12 Africa Health Research Institute, Durban, 4001. South Africa

The CITIID-NIHR COVID BioResource Collaboration

Principle Investigators: Stephen Baker, John Bradley, Gordon Dougan, Ian Goodfellow, Ravi Gupta, Paul J. Lehner, Paul Lyons, Nicholas J. Matheson, Kenneth G.C. Smith, Mark Toshner, Michael P. Weekes

Clinical Microbiology & Public Health Laboratory (PHE): Nick Brown, Martin Curran, Surendra Palmar, Hongyi Zhang, David Enoch.
Institute of Metabolic Science, University of Cambridge
Daniel Chapman

Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK
Ashley Shaw

NIHR Cambridge Clinical Research Facility: Vivien Mendoza, Sherly Jose, Areti Bermperi, Julie Ann Zerrudo, Evgenia Kourampa, Caroline Saunders, Ranalie de Jesus, Jason Domingo, Ciro Pasquale, Bensi Vergese, Phoebe Vargas, Marivic Fabiculana, Marlyn Perales, Richard Skells.

Cambridge Cancer Trial Centre: Lee Mynott, Elizabeth Blake, Amy Bates, Anne-laure Vallier, Alexandra Williams, Richard Skells, David Phillips, Edmund Chiu, Alex Overhill, Nicola Ramenante, Jamal Sipple, Steven Frost, Helena Knock, Richard Hardy, Emily Foster, Fiona Davidson, Viona Rundell, Purity Bundi, Richmond Abeseabe, Sarah Clark, Isabel Vicente

Corresponding author: Ravindra K Gupta
Professor of Clinical Microbiology
Cambridge Institute for Therapeutic Immunology and Infectious Diseases
Jeffrey Cheah Biomedical Centre
University of Cambridge
Puddicombe Way
Cambridge CB2 0AW

Tel: +44 1223 331491
EMAIL: rkg20@cam.ac.uk

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What is already known on this topic

- Five assays are known to have been developed for near patient SARS CoV-2 nucleic acid testing: Cepheid Xpert Xpress SARS CoV-2 (Cepheid, USA), ePlex SARS CoV-2 (GenMark, USA), ID NOW COVID-19 (Abbott, USA) and Simplexa SARS-CoV-2 (Diasorin, Italy) and SAMBA-SARS-CoV-2 (Chesterford, UK).
- Compared to reference assays in stored clinical samples, Cepheid has 99% concordance with reference, ePlex 91%, ID NOW 88%, and SAMBAII 99%.
- The Cepheid test requires two separate operations with use of a related computer and therefore is rather a near patient system.
- There are no prospective clinical studies with POC tests, and no data on the impact of POC SARS-CoV-2 tests on patient management in hospitals.
What this study adds
- The POC test has much shorter clinical turnaround time both in a trial setting (N=149), and post implementation (N=992), associated with faster time to appropriate clinical triage area, and shorter periods spent in COVID-19 ‘holding’ wards, where SARS-CoV-2 results are awaited and investigation for other diseases limited.
- Use of POC testing also significantly increased availability of isolation rooms and reduced unnecessary bay closures, critical as we move towards winter.
- Significant numbers of patients tested negative and could therefore access diagnostics and interventions more rapidly and safely.

Abstract
Objective To compare a point of care (POC) nucleic acid amplification based platform for rapid diagnosis of COVID-19 against the standard laboratory RT-PCR test and perform an implementation study.

Design: prospective clinical trial (COVIDx) and observational study

Setting: a large UK teaching hospital

Participants: patients presenting to hospital with possible COVID-19 disease and tested on a combined nasal/throat swab using the SAMBA II SARS-CoV-2 rapid POC test and in parallel a combined nasal/throat swab for standard lab RT-PCR testing. Implementation phase participants underwent SARS-CoV-2 POC testing for a range of indications over a ten day period pre and post SAMBA II platform implementation.

Main outcome measures: concordance and sensitivity and specificity of POC using the lab test as the reference standard, test turnaround time in trial and implementation periods; time to definitive patient triage from ED, time spent on COVID-19 holding wards, bay closures avoided, proportions of patients in isolation rooms following test, proportions of patients able to be moved to COVID negative areas following test.

Results
149 participants were included in the COVIDx trial. 32 (21.5%) tested positive and 117 (78.5%) tested negative by standard lab RT-PCR. Median age was 62.7 (IQR 37 to 79) years and 47% were male. Cohen's kappa correlation between the index and reference tests was 0.96, 95% CI (0.91, 1.00). Sensitivity and specificity of SAMBA against the RT-PCR lab test were 96.9% (95% CI 0.838-0.999) and 99.1% (0.953-0.999) respectively. Median time to result was 2.6 hours (IQR 2.3 to 4.8) for SAMBA II and 26.4 hours (IQR 21.4 to 31.4) for the standard lab RT-PCR test (p<0.001). In the first 10 days of the SAMBA II SARS-CoV-2 test implementation for all hospital COVID-19 testing, analysis of the first 992 tests showed 59.8% of tests were used for ED patients, and the remainder were done for pre-operative screening (11.3%), discharges to nursing homes (10%), in-hospital screening of new symptoms (9.7%), screening in asymptomatic patients requiring hospital admission screening (3.8%) and access to interventions such as dialysis and chemotherapy for high risk patients (1.2%). Use of single occupancy rooms amongst those tested fell from 30.8% before to 21.2% after testing (p=0.03). 11 bay closures were avoided by use of SAMBA over ten days. The post implementation group was then compared with 599 individuals who had a standard lab RT-PCR test in the 10 days prior to SAMBA introduction. Median time to result during implementation fell from 39.4 hours (IQR 24.7-51.3) to 3.6 hours (IQR 2.6-5.8), p<0.0001 and the median time to definitive ward move from ED was significantly reduced from 24.1
hours (9.2-48.6) to 18.5 hours (10.2-28.8), p=0.002. Mean length of stay on a COVID-19 ‘holding’ ward decreased from 58.5 hours to 29.9 hours (p<0.001) compared to the 10 days prior to implementation.

Conclusions
SAMBA II SARS-CoV-2 rapid POC test performed as well as standard lab RT-PCR and demonstrated shorter time to result both in trial and real-world settings. It was also associated with faster time to triage from the ED, release of isolation rooms, avoidance of hospital bay closures and movement of patients to COVID negative open “green” category wards, allowed discharge to care homes and expediting access to hospital investigations and procedures. POC testing will be instrumental in mitigating the impact of COVID-19 on hospital systems by allowing rapid triage and patient movement to safe and appropriate isolation wards in the hospital. This is also likely to reduce delays in patients accessing appropriate investigation and treatment, thereby improving clinical outcomes.

Study registration: NCT04326387

Introduction
The SARS-CoV-2 pandemic has resulted in over 300,000 deaths worldwide as of May 16th 2020, over 30,000 of which are in the UK1. Control of the epidemic moved from lockdown phase (implemented on March 23rd 2020) to strict social distancing with ‘test and isolate’ on May 11th, a change driven partly by a reduction in new cases of coronavirus disease (COVID-19). Given the lack of an effective vaccine or data on protection against re-infection with SARS-CoV-2, further waves of COVID-19 disease are likely to occur following relaxation of lockdown2.

SARS-CoV-2 PCR testing could be regarded as the most important hospital based test currently undertaken. This test result is the first piece of information requested when discussing patient care and will not change for the foreseeable future. Most hospitals have a 48-96-hour turnaround time for SARS-CoV-2 test result and there are immense pressures on virology laboratories, which are often centralised in tertiary centres. This could also lead to potential disparities in time to SARS-CoV-2 PCR test result.

Current clinical testing for acute SARS-CoV-2 infection and infection risk relies on nucleic acid detection using reverse transcription polymerase chain reaction (RT-PCR) on nose/throat swabs3,4. Antibodies to SARS-CoV-2 are detectable in only 50% by day 5-75 and are therefore not suitable as a test for early infection, although they are useful in the second phase of illness when virus detection wanes in upper respiratory tract samples4,6. Antigen tests for COVID-19 diagnosis have performed poorly to date and therefore nucleic acid detection remains the test of choice. Nucleic acid testing usually requires central laboratory testing with concomitant delays, and turnaround times are usually in excess of 24 hours, and often days7. Due to diverse presentations of COVID-198, lack of a timely diagnosis can have serious consequences, including deadly nosocomial outbreaks9.
Screening hospital admissions rapidly is therefore critical in order to manage patient flow and limit potential for nosocomial transmission\textsuperscript{10,11}. In the absence of a reliable POC test, hospitals have resorted to creating bespoke care pathways in order to use isolation rooms most effectively for vulnerable patients\textsuperscript{12}. Finally, given care home outbreaks, there is also urgent need to rapidly demonstrate negative COVID-19 status on discharge planning. This need for rapid and safe patient movement is likely to increase sharply in late 2020 when norovirus and influenza (with or without SARS-CoV-2\textsuperscript{13}) will likely compound pressure on hospitals and isolation capacity in particular. Such an approach would also relieve pressure on hospital virology laboratories so they can resume testing for other important viral infections such as HIV.

A number of near patient tests have been described, though without rigorous clinical trial data or ‘real world’ data on the impact on patient management\textsuperscript{14-18}. This is particularly important given the high risks related to false positives or negatives in the hospital setting for SARS-CoV-2. SAMBA (simple amplification based assay), an isothermal amplification based platform, was developed for near-patient HIV detection in low resource settings\textsuperscript{19,20}, and has been adapted for use in SARS-CoV-2 with successful pre-clinical testing\textsuperscript{21}. Here we present a clinical trial comparing SAMBA II SARS-CoV-2 performance against the standard lab RT-PCR test in suspected COVID-19 cases presenting to hospital, followed by a hospital-based implementation study.

**Method**

**Clinical trial**
The COVIDx Study was a prospective, comparative, real world trial of SAMBA II SARS-CoV-2 point of care testing compared to the standard lab RT-PCR test in participants admitted to Cambridge University Hospitals NHS Foundation Trust (CUH) with a possible diagnosis of COVID-19.

**Study Participants**
Recruitment started two weeks into the national lockdown implemented by the UK government in response to the pandemic. Eligible consecutive participants were recruited during 12-hour day shifts over a duration of 4 weeks from the 6\textsuperscript{th} of April 2020 to the 2\textsuperscript{nd} of May 2020. We recruited adults (>16 years old) presenting to the emergency department or acute medical assessment unit as a possible case of COVID-19 infection. This included participants who met the Public Heath England (PHE) definition of a possible COVID-19 case (see supplemental methods). This was later expanded to include any adult requiring hospital admission and who was symptomatic of SARS-CoV-2 infection, demonstrated by clinical or radiological findings. This was done due to the changing landscape of the COVID-19 epidemic and emergence of new symptoms such as anosmia and diarrhoea. Exclusion criteria included not having the standard lab RT-PCR test applied within an 18-hour window of SAMBA SARS-CoV-2 test and those unwilling or unable to comply with study swabbing procedures.

**Test methods**
Participants in the COVIDx trial were tested using SAMBA II SARS-CoV-2 on a combined nasal/throat swab within 18 hours of a similar swab for the standard lab RT-PCR test. The index test is the SAMBA II SARS-CoV-2 Test is a nucleic acid amplification test (NAAT) which uses loop mediated isothermal amplification (LAMP) to detect SARS-CoV-2 RNA from throat and nose swab specimens collected by dry sterile swab and inactivated in a
proprietary inactivation buffer prior to analyses. This obviates the need for a BSL3 laboratory for specimen handling or viral extraction. The SAMBA II SARS-CoV-2 targets 2 genes- Orf1 and the E genes. The limit of detection (LoD) of the SAMBA II SARS-CoV-2 Test is 250 copies/ml21. The reference test is an in-house RT-PCR test developed in the public health England (PHE) laboratory at CUH. The primer set employed targets one gene target the RdRP gene.

Demographic and clinical data were obtained at presentation from the hospital’s electronic patient records (EPIC) and entered into anonymised case report forms on MACRO electronic database. Biological specimens from a combined nose and throat swab were collected and stored by research nurses. Results were not made available to clinical teams during the study. The primary outcome measures were time to result, concordance with the standard lab RT-PCR test and sensitivity/specificity of the SAMBA II SARS-CoV-2 test.

**Analysis**

We assumed a target sensitivity of 0.95 and disease prevalence of 15%. Using a 5% significance level and allowing for an error of 10% gave a required sample size of 122. Descriptive analyses of clinical and demographic data are presented as median (IQR) when continuous and number (%) when categorical. Agreement between the two tests was assessed using Cohen's kappa, a correlation-like measure which accounts for agreement by chance alone, in which case $\kappa = 0$, while $\kappa = 1$ and $\kappa = -1$ correspond to perfect agreement and completely discordant pairs respectively. Sensitivity and specificity of SAMBA II SARS-CoV-2 test was compared using the standard lab RT-PCR test as a gold standard. Exact Clopper-Pearson 95% confidence intervals were calculated due to estimates being near 1. The difference in the median time to test result was assessed with a non-parametric test. Kaplan Meier time to event analysis was used to compare time to result for the two tests, with log rank testing. Indeterminate SAMBA II SARS-CoV-2 tests were repeated with a 1:2 dilution of sample to inactivation buffer according to manufacture Standard operating procedure until a valid result was obtained. Indeterminate standard lab RT-PCR tests were repeated on a repeated nose/throat swab until a valid result was obtained. Participants with missing SAMBA II SARS-CoV-2 or standard lab RT-PCR tests result were excluded from the analyses. The results of the SAMBA II SARS-CoV-2 was not known to the assessors of the standard lab RT-PCR prior.

**Implementation study**

Following the completion of the COVIDx study (May 1st) and demonstration of performance equivalent to the reference standard test, the hospital switched from standard lab RT-PCR testing to use of SAMBA II for all in-hospital testing due to shorter turnaround time. Twenty SAMBA II machines were operationalised by the CUH POC testing team, each machine capable of performing around 10-15 tests per day. To evaluate the real-world impact of SAMBA on clinical care, we retrospectively gathered data on clinically relevant endpoints from electronic patient records over a ten-day period before and after introduction of the SAMBA test for all patients who underwent COVID-19 testing.

All patients who underwent COVID-19 testing in a 10 day period before and after introduction of the SAMBA II SARS-CoV-2 test at CUH were included. Participants were identified from testing reports from the EPIC hospital records system. Clinical and hospital activity data were obtained from the same source.
The main study outcomes in the implementation study were the indication for SAMBA II SARS-CoV-2 test and perceived impact. Secondary outcomes were time to definitive patient triage from the emergency department (ED), time spent on COVID-19 holding wards, bay closures avoided, proportions of patients in isolation rooms following test and proportions of patients able to be moved to COVID negative open wards following test.

Descriptive analyses of clinical and demographic data are presented as median (IQR) when continuous and number (%) when categorical. Difference in continuous variables between the pre and post implementation groups were assessed using the Wilcoxon rank sum tests and difference in categories and proportion were assessed using the Chi-square test or test of proportions. STATA version 13 and R were used for statistical analysis.

Ethical approval
The protocol was approved by the East of England - Essex Research Ethics Committee. HRA and Health and Care Research Wales (HCRW) approval was received. Verbal informed consent was obtained from all participants or in the case of participants without capacity, from a consultant nominee who was involved in their clinical care but independent from the research team (see supplemental). COVIDx was registered with the ClinicalTrials.gov Identifier NCT04326387. The implementation study was registered as a service evaluation with Cambridge University Hospitals NHS Foundation Trust.

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research. There are no plans to directly feedback the results to participants.

Results
Clinical trial
Of 178 screened patients, 149 met eligibility criteria for inclusion in the clinical trial (Figure 1). Mean age was 62.7 years and 47% were male. 32/149 (21.6%) tested positive by the standard lab RT-PCR test. Mean temperature and respiratory rate were higher in the standard lab RT-PCR positive group (Table 1). Median duration of symptoms was 3 (IQR 1.75-10.5) and 4 (IQR 2-13) days in standard lab RT-PCR positive and negative participants respectively.

There were seven discrepant results between SAMBA and the laboratory test (7/149) after initial testing (see supplementary methods). Discrepancy analysis concluded that there was one false negative by SAMBA II SARS-CoV-2 test likely related to sampling variation, and no false positives. Cohen's kappa correlation between the two tests was 0.96, 95% CI (0.91, 1.00). Sensitivity of SAMBA II SARS-CoV-2 test as compared to the standard lab RT-PCR was 96.9% (95% CI 83.8-99.9), with specificity of 99.1% (95.3-99.9), table 2. However, since the standard lab RT-PCR had one false negative in a participant with clinical and radiological evidence of disease, the sensitivity and specificity of SAMBA II SARS-CoV-2 test was effectively 97.0% (95% CI 84.2-99.9) and 100% (95% CI 96.9-100) respectively (Table 2). SAMBA II SARS-CoV-2 test use was associated with shorter time from sampling to result (Figure 2); median time to result was 2.6 hours (IQR 2.3 to 4.8) for SAMBA II SARS-CoV-2 test and 26.4 hours (IQR 21.4 to 31.4) for the standard lab RT-PCR test (p<0.001).

Implementation study
992 SAMBA II SARS-CoV-2 tests were done between May 2nd and May 11th inclusive in 913 individuals. It was used for the following main indications: 59.8% of tests were used for ED patients, and the remainder were done for pre-operative screening (11.3%), discharges to nursing homes (10%), in-hospital screening of new symptoms (9.7%), screening in asymptomatic patients requiring hospital admission screening (3.8%) and access to interventions such as dialysis and chemotherapy for high risk patients (1.2%) (Figure 3 and Table 3). Median time to result was 3.6 hours (IQR 2.6 to 5.8h). The rapid result from a POC SAMBA II SARS-CoV-2 test was deemed to have a beneficial clinical impact in 77.4% of patients who had the test. (Table 3 and Figure 3).

Emergency admissions
Rapid turnaround of SAMBA II SARS-CoV-2 testing was beneficial in 436 (75.8%) tests performed at presentation to ED or the acute admission ward. In the 24.2% where no clinical benefit was derived the reasons for this were patients being discharged home from ED prior to the result becoming available, patients being triaged and moved to a ward before the results was available and in cases of a high clinical index of suspicion of COVID-19, a negative result did not change the initial risk assessment, isolation type of clinical management.

Pre-operative
110 (11.3%) of tests were done prior to surgical procedures, partly for infection control reasons, but mainly to screen patients in light of data suggesting increased peri-operative mortality associated with COVID-19. The majority of POC tests were deemed to have resulted in clinical benefit attributable to the rapid result (Table 3) in 106/110 (96.3%) instances. SAMBA II SARS-CoV-2 testing facilitated surgical intervention, including but not limited to exploratory laparotomy, eye and maxillofacial surgery, solid organ transplants and C-sections.

Discharge to nursing home or with a care package
Nursing homes were recognised as “hotspots” for COVID transmission and towards the end of April it became hospital policy to have a negative SARS-CoV-2 swab less than 48 hours before discharge to a nursing home or a setting where an individual was visited by carers. SAMBA II SARS-CoV-2 testing was successfully used to facilitate discharge in 76/96 (79.2%) instances. In the 20.8% where no benefit was derived the reasons for is due to systemic issues that resulted in delays to discharge that required another test to meet the hospital’s discharge policy.

Prevention of Health Care Associated Infection
New in-hospital COVID-19 infections are of particular concern, we found that 94 patients had the test carried out for the purpose of in-hospital triage and placement. The SAMBA II SARS-CoV-2 test was beneficial in 67% (63/94), allowing the patient to remain in a low risk open ward in 39.7% (25/63) instances, movement out of a side room in 11% (7/63), avoiding bay closures in 17.5% (11/63). In the remaining 33% of instances in which no beneficial impact was found, 3 of these had a previous positive test result and a SAMBA positive result had no further impact. In 8 instances, multiple previous negative test results were recorded and in the rest SAMBA II SARS-CoV-2 testing did not alter management, as clinical suspicion of COVID was high leading to triage prior to the result being known.

POC testing with negative results allowed a significant increase in the number of patients able to move to so called ‘green’ non COVID-19 areas [Green status (478/966) 49.5% prior
to test and (600/756) 79.4% afterwards, \( p < 0.001 \). The numbers in ‘amber’ areas (possible COVID-19) fell reciprocally (Figure 4A) [40% on Amber prior to test and 11.6% on Amber after, \( p < 0.001 \)], thereby allowing quicker access to potentially life-saving procedures such as CT Angiography or cardiac monitoring (Supplementary material). We observed a concomitant fall in use of single occupancy rooms amongst those tested for new in-hospital COVID-19 symptoms from 30.8% before to 21.2% (\( p = 0.03 \)) after the POC test result (Figure 4B).

We next identified 599 individuals tested using the standard lab RT-PCR in the 10 days prior to SAMBA II SARS-CoV-2 introduction, and compared them with 913 individuals tested by POC in the 10 day window post- SAMBA II SARS-CoV-2 introduction. Demographic characteristics of both groups were similar, though the proportion of positive tests was lower in the post implementation period (Supp Table 2). Nonetheless, not only did test turnaround time fall dramatically (Figure 5), time to definitive ward move from ED decreased also significantly after SAMBA II SARS-CoV-2 introduction [24.1 hours (9.2-48.6) to 18.5hours (10.2-28.8), \( p = 0.002 \), Figure 5 shows Kaplan-Meier analysis]. Finally, mean length of stay on a COVID-19 result wait/holding ward decreased from 58.5 hours to 29.9 hours (\( p < 0.001 \)) compared to the 10 days prior to implementation.

**Discussion**

Here we report data from the first prospective clinical trial data assessing the performance of a rapid, POC molecular SARS-CoV-2 test for diagnosis of COVID-19 infection, and present data on the real-world impact of the test in a high need clinical setting. These data demonstrate that POC testing can be reliable, accurate and provides clinicians with much quicker results compared to the current gold standard test. Furthermore, we demonstrated that the routine use of this test had a real-world impact on patient care and safety.

The POC nucleic acid platform SAMBA II SARS-CoV-2 test was compared to a reference RT-PCR test which is the standard of care, in combined nasal/throat swabs from participants admitted to hospital with a possible diagnosis of COVID-19. Trial participants were representative of UK COVID-19 patients\(^{22}\), and we found that concordance between the tests was extremely high with Cohen kappa coefficient 0.96. When the standard lab RT-PCR test was referenced as a ‘gold standard’, sensitivity of SAMBA was 96.9% and sensitivity 100%. Median time from swab to result was 2.6 hours as compared with 26.4 hours (\( p < 0.001 \)).

Patient placement during the COVID-19 pandemic has been a real challenge and has significantly impacted on ability to maintain flow and keep people safe in hospital. The trial data on SAMBA II raised the prospect of addressing these problems. Somewhat fortuitously, the hospital switched from standard lab RT-PCR testing to SAMBA II for all in-hospital testing immediately following the end of COVIDx, providing an opportunity to prospectively evaluate the first 992 patient tests over ten consecutive days. Most tests were done on new patients presenting to hospital and the large reduction in test turnaround time seen in the clinical trial was replicated during the first 10 days of implementation. SAMBA was also used to investigate newly symptomatic patients in hospital to avoid patients with respiratory symptoms being immediately placed in scarce isolation rooms, and also to rapidly identify new COVID-19 cases with appropriate isolation and prevent nosocomial outbreaks\(^{11}\). Inappropriate isolation is a large drain on staff and resources due to the need for repeated deep cleaning, in addition to distress and risk to patients from repeated bed moves\(^{23}\). As
expected, we observed a significant increase in the availability of isolation/ single occupancy rooms following POC introduction, and also patients testing negative were able to be placed in low risk open wards of the hospital and have interventions/procedures expedited.

We found that 11 ward closures were prevented in the ten-day post implementation phase by having negative tests in symptomatic hospital patients. Closed surgical bays in particular can result in cancellations of operations, as well as significant financial losses. Following this analysis, hospital guidelines will be adapted to recommend waiting for SAMBA test results before moving patients into isolation or closing bays.

When we conducted a formal pre versus post implementation comparison using ten day windows either side of May 2nd, we were able to demonstrate that not only was test turnaround time faster, but more importantly that the time from ED presentation to appropriate COVID-19 hospital triage was also reduced significantly, thus reducing the chances of overcrowding in ED. Length of stay on the main holding ward where test results were awaited also fell significantly, consistent with more rapid and accurate patient movement.

Limitations
The clinical trial component was limited by the fact that the same swab could not be tested on the two platforms being compared. This raised an issue of two separate samples being tested on the two assays. Nonetheless, we identified only 2 cases where the sampling explained discrepant results. In addition, the SAMBA II SARS-CoV-2 test is not able to give viral load or cycle threshold values for more nuanced research oriented analysis.

The East of England has had relatively low numbers of cases in comparison to other areas of the UK and the implementation phase took place just before the lockdown was partially lifted. Therefore, new infections were low both in patients coming to hospital and in health care workers. Nonetheless, the study highlights the importance of rapid test results in the COVID-19 era, regardless of whether they are positive or negative.

Although we did not conduct a detailed cost benefit analysis in our study, it is likely that SAMBA II SARS-CoV-2 implementation would prove to be a cost-efficient intervention. Per assay, SAMBA II SARS-CoV-2 test costs approximately £30 per sample tested in comparison to each additional bed day at around £200 (approx. £400 for surgical beds). The likely reduction in delayed discharge, bed movement and unnecessary use of personal protective equipment alone would outweigh this cost many times over.

SAMBA II SARS-CoV-2 test is being implemented in a very limited number of prisons and hospitals in the UK, but there is urgent need for POC in care homes and possibly educational establishments. A POC platform also has the potential to reduce disparities between secondary and tertiary medical centres that have specialised virology laboratories, and ensure equitable access to timely SARS-CoV-2 testing results. SAMBA II machines are already in use in Uganda, Zimbabwe and Kenya for HIV testing and monitoring. If scale up can be achieved in those settings, POC testing could be vital for controlling COVID-19 in sub-Saharan Africa and our data will inform their optimal use.

Finally, based on the data presented, we predict that implementation of POC testing for SARS-CoV-2 could have a critical impact on hospital management of suspected cases as we
move towards a second wave likely extending into flu and norovirus season where UK hospitals are under most strain.

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Competing interests: All authors have completed the Unified Competing Interest form (available on request from the corresponding author) and declare: Dr. Besser reports personal fees from STAGO, personal fees from Novartis, personal fees from Cosmopharma, personal fees from Werfen, personal fees from Agios, grants from Mitsubishi Pharma, outside the submitted work; RKG reports fees from ad hoc consulting from ViiV, Gilead and UMOVIS.

The lead author (the manuscript’s guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

The study sponsor had no role in the design, execution or analysis of the study.

The funders had had no role in the design, execution or analysis of the study and researchers were fully independent from funders.
Figure 1: Prospective clinical study flow chart CONSORT diagram. VTM: viral transport medium; PHE: Public Health England

| Variable                  | Statistics | Negative  | Positive  | Total  |
|---------------------------|------------|-----------|-----------|--------|
| Age                       | n          | 117       | 32        | 149    |
|                           | Mean (SD)  | 60.4 (19.8)| 72.8 (17.8)| 62.7 (20.0)|
|                           | Median     | 62.5      | 75.5      | 63     |
| Gender                    |            |           |           |        |
| Female                    |            | 67/116 (58%)| 11/32 (34%)| 83/158 (53%)|
| Male                      |            | 49/116 (42%)| 21/32 (66%)| 75/158 (47%)|
| SpO2                      | Mean (SD)  | 95.9 (3.20)| 94.2 (4.23)| 95.3 (3.78)|
|                           | Median     | 97        | 95        | 96     |
| Temperature/°C             | Mean (SD)  | 37.5 (0.914)| 38.4 (1.030)| 37.7 (1.015)|
| Respiratory rate/min       | Mean (SD)  | 20.2 (4.16)| 23.4 (6.01)| 21.1 (5.16)|
| Systolic blood pressure mmHg| Mean (SD)  | 136 (22.6)| 137 (26.5)| 137 (22.9)|
| Diastolic blood pressure mmHg| Mean (SD)  | 76.0 (12.7)| 70.0 (10.2)| 74.8 (12.3)|
| Lymphocyte count           | Mean (SD)  | 1.42 (0.926)| 1.08 (1.050)| 1.26 (0.999)|
| Platelet count             | Mean (SD)  | 270 (115.8)| 216 (88.2)| 244 (106.7)|

Table 1: Baseline characteristics of prospective participants in COVIDx trial
|                         | Standard RT-PCR Negative | Standard RT-PCR |
|---|---|---|
| SAMBA II SARS-CoV-2 Negative | 116 | 1 | 117 |
| SAMBA II SARS-CoV-2 Positive | 1 | 31 | 32 |
|                         | 117 | 32 | 149 |

Table 2: Contingency table of the SAMBA II SARS-CoV-2 test results by the Standard RT-PCR test results

**Figure 2**: Kaplan Meier analysis of time to test result for Point of Care SAMBA and RT-PCR lab test in the COVIDx study. P value shown is for Log rank test.
|                                | (N) Individual patients=913/ Tests=992 |
|--------------------------------|----------------------------------------|
| **Male sex (%)**               | n=857/913                              |
|                                | 389 (44.6)                             |
| **Median age years (IQR)**     | n=909/913                              |
|                                | 63 (37-79)                             |
| **Duration of illness days(IQR)** | 2 (1-7)                             |
| **SAMBA II SARS-CoV2 result (%)** |                                       |
| Positive                       | 42 (4.2)                               |
| Negative                       | 950 (95.8)                             |
| **Triage at initial assessment (%)** |                                   |
| Low risk                       | 478 (49.5)                             |
| Medium risk                    | 387 (40.0)                             |
| High risk                      | 101 (10.5)                             |
| **Inpatient Transfer (%)**     |                                        |
| Yes                            | 20 (2.0)                               |
| No                             | 956 (98.0)                             |
| **Triage following SAMBA II SARS-CoV2 result (%)** |     |
| Low risk                       | 600 (79.4)                             |
| Medium risk                    | 88 (11.6)                              |
| High risk                      | 68 (9.0)                               |
| **Reason for SARS-CoV-2 test** |                                        |
| Admission triage and placement | 580 (59.8)                             |
| In-hospital triage and placement | 94 (9.7)                             |
| Discharge to nursing home/carers | 97 (10.0)                             |
| Pre-operative                  | 110 (11.3)                             |
| Facilitate other investigations | 12 (1.2)                               |
| Asymptomatic screening         | 37 (3.8)                               |
| Other                          | 40 (4.1)                               |
| **Perceived benefit**          |                                        |
| Yes                            | 747 (77.4)                             |
| No                             | 218 (22.6)                             |
| **Impact of test (%)**         |                                        |
| Bed placement at admission     | 271 (28.0)                             |
| Facilitate discharge to another inpatient facility | 10 (1.0) |
| Release of a side room         | 32 (3.3)                               |
| Expedited discharge            | 100 (10.3)                             |
| Expedited discharge to a nursing home/carers | 58 (6.0) |
| Expedited surgery and other interventions | 128 (13.2) |
| Safe to remain or move to a green ward | 112 (11.6) |
| Avoided a bay closure          | 11 (1.1)                               |
| Facilitated a planned admission | 7 (0.7)                               |
| No perceived impact            | 228 (23.5)                             |
| Other                          | 13 (1.3)                               |

**Table 3:** Clinical and demographic data of 992 tests in 913 patients who had the SAMBA II SARS-CoV-2 test in the post-implementation period. Note that some individuals had multiple admissions each with associated POC tests.
Figure 3: SAMBA II SARS-CoV-2 testing by test indication.

Figure 4: Impact of SAMBA II SARS-CoV-2 testing on risk stratification of patients tested with in the post implementation period (left panel, p<0.001 chi squared test) and change in use of single occupancy isolation rooms (right panel, p<0.001 chi squared test). Red, amber and green represent high, medium and low risk clinical areas.
Figure 5: Time to test results (left panel, log rank test p<0.001) and definitive ward move (right panel, log rank test p=0.04) for SAMBA SARS-CoV-2 POC tests in the post implementation period compared to lab RT-PCR in the pre-implementation period.

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