Early experience in implementation of an integrated COVID-19 and TB community-based active case finding in Nigeria

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Abstract

Background: Nearly all countries around the world have felt the great impact of COVID-19, resulting in a global health crisis. The KNCV TB foundation Nigeria-funded by USAID for comprehensive TB care leveraged on existing structure and resources to partner with Kaduna state government to roll out an integrated COVID-19 and TB case-finding intervention. This was implemented using a mobile diagnostic van equipped with GeneXpert and digital X-ray from June to July 2020 in Kaduna State. The community-based strategy also integrated screening for HIV, HBsAg, and Malaria. Screening algorithm, recording tools and SOPs were developed that guided the intervention. Of 1,931 persons enrolled and 1,928 (99.8%) screened using CAD4TB x-ray, 83 presumptive TB were identified; 11 (13%) cases of TB diagnosed with GeneXpert. Among persons screened, 1,252 nasopharyngeal swabs were collected and tested with SARS COV-2, and all screened for HIV with 183 (15%) COVID-19 and 12 (1.0%) HIV cases diagnosed. COVID-19/HIV co-infection rate was 0.5% and COVID TB co-infection rate was 0%.. The integrated approach to COVID-19 testing was built on existing TB structure and successfully implemented through a multi-stakeholder collaboration backed by a strong political commitment at the sub-national level. Key lessons from this early intervention are informing scale-up across other states in Nigeria.

Key words: Nigeria; TB; COVID-19; Integrated diagnostic platform; Stakeholder partnership

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Introduction

The COVID-19 data from January to June 2020 is catching up with global incidence (10.0 million) and mortality (1.2 million) rates of tuberculosis (TB) 2018; as at the end of July 2020, 15,296,926 cases of COVID-19 including 628,903 deaths, have been reported based on case definitions, access to testing and testing strategies.[1,2,3] COVID-19 and TB share some similarities despite being caused by different biological agents. These include transmission via close contact, infected patients showing respiratory symptoms and pulmonary involvement, social stigma and discrimination, the need for early testing and care initiation, as well as risk of exposure for healthcare workers.[4,5,6,7,8]

The world is still counting losses associated with the COVID-19 pandemic. A more stringent measure has to be adopted to mitigate the pandemic. The disruption of economic activities and other health-related services resulted in an increase in incidence and mortality for TB and worsened the poverty level among many nations, including India, Nigeria, Russia, DRC and Mexico.[5,9,10,11,12,13] The burden of COVID-19 in Africa at the time of this paper stands at 655,841 cases; the five countries reporting most cases are South Africa (408,052), Egypt (91,072), Nigeria (39,539), Ghana (29,672) and Algeria (25,484).[2] The low number of COVID-19 cases reported in Africa has raised the concern of whether it is as a result of weak laboratory infrastructure, low testing capacity, lack of test kits, weak healthcare structure or unpreparedness to response, rather than the perceived low risk.[5,14,15,16] Under-diagnosis or under-reporting because of inadequate capacity can mislead the intervention of appropriate control measures and lead to misallocation of resources.[6,17]

COVID-19 diagnostics challenges are reminders to the early days of Multi-Drug Resistance TB (MDR-TB) that was highly centralized and made available to high-risk groups because of the laboratory equipment, safety requirements (BSL2/3), and the need for highly trained personnel.[15,18] The gold standard for COVID-19 diagnosis is RT-PCR (Reverse Transcription Polymerase Chain Reaction) which, in addition to cost, requires what is limited in Africa reliable power supply, functional laboratory network link with the effective specimen transportation system, and trained

personnel.[16,17] Therefore, the need for a rapid point-of-care test with good turnaround time, robust, cost-efficient, and requiring minimal staff training was crucial and urgently needed; and in March 2020, the United States FDA (Food and Drug Administration) approved two-point of care diagnostic test for COVID-19 (Xpert Xpress SARS-CoV-2 and Abbott ID NOW).[15,19] The Xpert Xpress SARS-CoV-2 test cartridge detects the nucleic acid from SARS-CoV-2 via a real-time PCR within an average time of 45 minutes that can be operated in near-patient setting on existing GeneXpert MTB/RIF machines which is widely in use in Africa by TB programs.[19,20,21,22] Nigeria, like many African countries, was initially relying only on RT-PCR technique for testing and diagnosis of COVID-19. By the end of June 2020, the testing capacity of Nigeria for COVID-19 stood at 127,158 for a population of near 200 million; only 39,539 and 845 confirmed cases and death were reported.[23,24] The limited testing capacity posed a serious challenge for designing and implementation of effective containment strategies and deployment of resources among the 36 States and the Federal Capital Territory.[23,24,25]

The Nigerian Centre for Disease Control (NCDC) took advantage of the US FDA approval of Xpert Xpress SARS-CoV-2 to adapt the test as a complement to existing RT-PCR capacity.[25] With at least 48% coverage of Local Government Areas with nearly 400 GeneXpert machines for TB program and suboptimal utilization of the machines in some facilities, this provides an opportunity for an integrated approach for both TB and COVID-19 response.[18,24,26] Following the overall lockdown strategy for COVID-19 response, there were negative consequences leading to low health facility utilization and thus, inadequate TB diagnosis. The National Tuberculosis and Leprosy Control Program (NTBLCP) in collaboration with NCDC and other key stakeholders designed a win-win situation to mitigate the impact of COVID-19 on the disruption of TB and HIV services by allowing the use of community diagnostic van with GeneXpert machine.

This paper aims to describe the coordination process, design, and implementation of an integrated platform for diagnosis of TB and COVID-19, enabling factors and best practices, and report the current results of COVID-19, TB and HIV screening and testing including access to care.

Methods

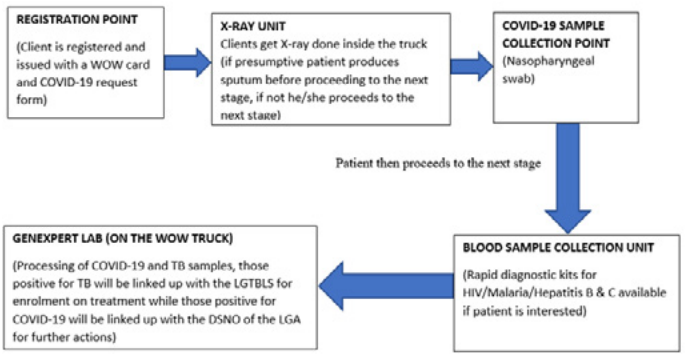
Intervention design and setting

The community-based intervention was implemented in Kaduna state from 11 June to 16 July 2020, targeting persons with either presumptive COVID-19 or TB. The strategy was operationalized using a mobile diagnostic van tagged Wellness on Wheels (WoW). The WoW van provides one-stop access to digital chest X-ray (fitted with Computed Aided Detection for Tuberculosis (CAD4TB) software) and GeneXpert testing.

Intervention

The deployment of the WOW van for integrated COVID-19 and TB testing was sequel to stakeholders' engagement between KNCV TB Foundation, Kaduna state government, NCDC and the NTBLCP. Prior to field implementation, an integrated TB and COVID-19 testing algorithm and recording tools were developed followed by capacity building, provision of Xpert Xpress SARS-CoV-2 cartridges and personal protective equipment (PPE) such as hand glove, disposable gown and footwear, face shield and mask (N95 and surgical), goggle, and rain boots. Advocacy and sensitization meetings were held with community gatekeepers and Local government health authorities. WOW team collected nasopharyngeal swab from presumptive COVID-19 (defined as any person with symptoms such as cough, fever, and shortness of breath) after client registration and chest X-ray examination. Presumptive TB clients (defined as any person with abnormal chest x-ray based on CAD4TB threshold score of 56) produced sputum specimen, which was tested using GeneXpert (Figure 1). Other tests such as HIV, Malaria and HBsAg/HCV were offered on an opt-in basis. Individuals positive with COVID-19 or TB were linked up with a local government Disease Surveillance and Notification Officer (DSNO) or TB supervisor for care.

Figure 1: Integrated COVID 19 and TB testing Algorithm



Data Analysis

Data were extracted from the integrated COVID-19, and TB register and forms. Descriptive analysis was performed to compute the percentages of the sociodemographic and clinical characteristics of the participants and detected cases.

Ethics Consideration

The study was determined to be a non-research program evaluation. It required no direct contact with human subjects (via interview nor sample collection) and only utilized de-identified pooled program data that formed part

of standard of care thus no informed consent was required.

Results

Of the 1,931 persons enrolled, 46.6% were male and the mean age was 37.8 ± 14.1 years. Figure 2 shows the flow diagram for X-ray screening and combined COVID-19 and TB sample collection in the WOW operational setting. Overall, 1,928 (99.8%) persons were screened using digital X-ray, of which 83 (4.3%) presumptive TB were identified. Among the 1,928 persons screened, 1,252 (64.9%) provided nasopharyngeal swab for COVID-19 testing, comprising 80 presumptive TB and 1,170 non-presumptive TB clients.

Figure 2: The flowchart of integrated COVID-19 and TB screening and testing

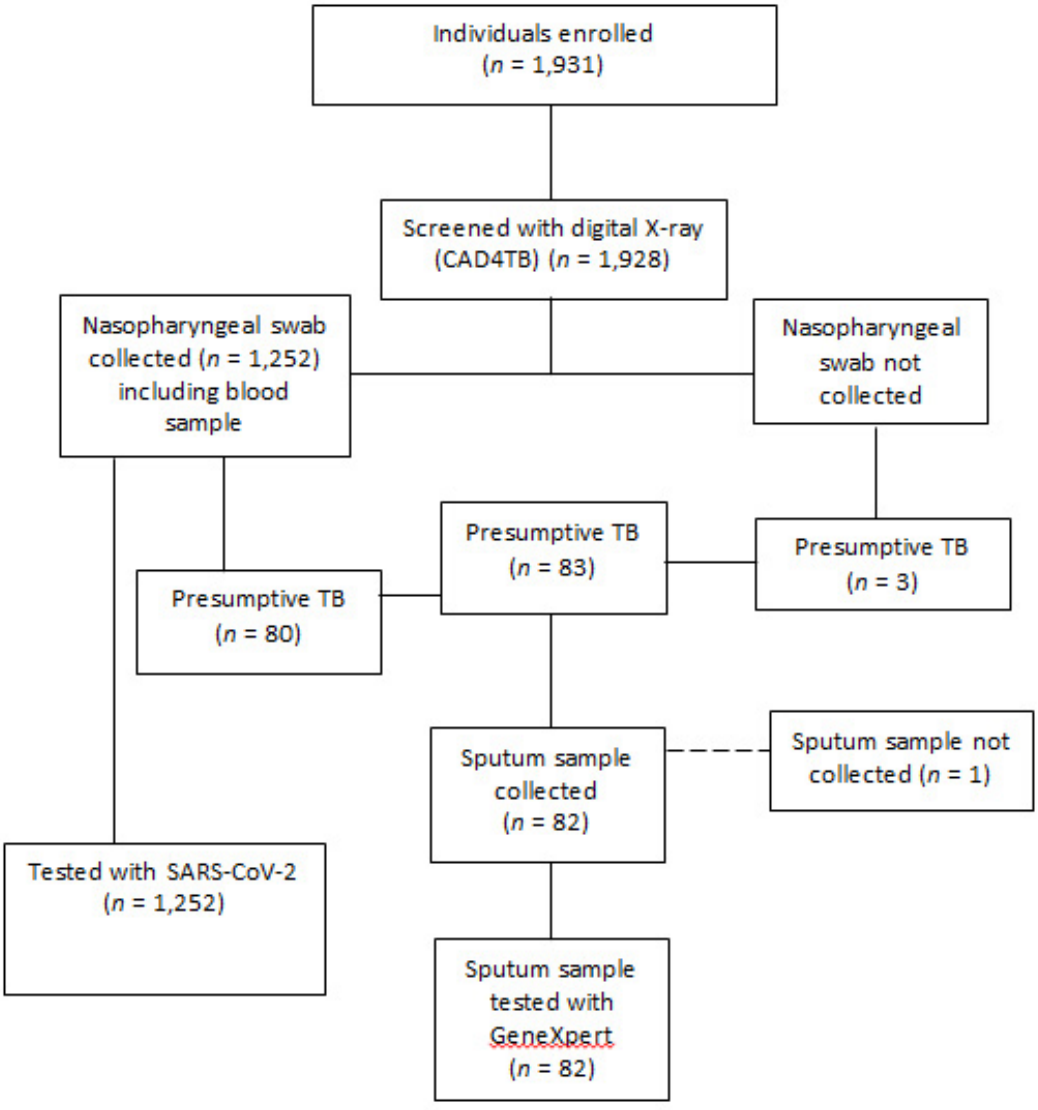


Table 1 shows the yield of COVID-19 and TB testing. Of the 1,252 nasopharyngeal swab samples tested for COVID-19 using Xpress SARS-CoV-2, 183 (14.6%) were positive. Also, 82 sputum samples were tested for TB using GeneXpert MTB/Rif, of which 11 (13.4%) were MTB positive. None of the COVID-19 positive clients was co-infected with TB. All 1,252 clients were tested for HIV and Hepatitis B (HBV), of which 12 (1.0%) were HIV-positive, and 7 (0.6%) were HBV-positive. COVID-19 and HIV co-infection rate was 0.5% (1/183). None of the COVID-19 clients was co-infected with HBV. Also, none of the TB positive clients was co-infected with HIV. All TB positive and COVID-19 clients were referred and initiated on care.

Table 1: Demographic and clinical characteristics with screening outcomes of clients

Category	Male (%)	Female (%)	Total (%)
Clients enrolment	900 (46.4)	1,031 (53.4)	1,931 (100.0)
Age group, years			
0-14 years	1 (0.1)	0 (0.0)	1 (0.1)
15 and more	899 (99.9)	1,031 (100.0)	1,930 (99.9)
Radiography			
CXR performed	900 (100.0)	1,028 (99.7)	1,928 (99.8)
Abnormal	42 (4.7)	41 (4.0)	83 (4.3)
Normal	858 (95.3)	987 (96.0)	1,845 (95.7)
Diagnosis: Covid-19, TB, HIV and HBV			
Xpress SARS-CoV-2 performed	665 (73.9)	587 (57.1)	1,252 (64.9)
SARS-CoV-2 positive	100 (15.0)	83 (14.1)	183 (14.6)
GeneXpert MTB/Rif performed	42 (100.0)	40 (97.6)	82 (98.8)
MTB positive	6 (14.3)	5 (12.5%)	11 (13.4)
HIV test performed	665 (73.9)	587 (57.1)	1,252 (64.9)
HIV positive	5 (0.8)	7 (1.2)	12 (1.0)
HBV test performed	665 (73.9)	587 (57.1)	1,252 (64.9)
HBV positive	5 (0.8)	2 (0.3)	7 (0.6)
Co-infection: COVID-19, TB, HIV and HBV			
TB and COVID-19	0 (0.0)	0 (0.0)	0 (0.0)
TB and HIV	0 (0.0)	0 (0.0)	0 (0.0)
TB and HBV	0 (0.0)	0 (0.0)	0 (0.0)
COVID-19 and HIV	0 (0.0)	1 (1.2)	1 (0.5)
COVID-19 and HBV	1 (1.0)	0 (0.0)	1 (0.5)
CXR=Chest radiography; CAD4TB=Computed Aided Detection for Tuberculosis; HIV=human immunodeficiency virus; HBV=hepatitis B; MTB=Mycobacterium tuberculosis; Rif=Rifampicin			

Discussions

This was a proof of concept on the provision of community service using an integrated diagnostic platform during a pandemic. With the impact of lockdown and limited diagnostic facilities for both TB and Covid-19; the community integrated platform provided access to early diagnosis and linkage to care.[23,24,25] In addition to individuals screened, diagnosed, and linked to care, this approach provided the opportunity for community engagement and community awareness that could address stigma. All these benefits would have been impossible with the on-going lockdown and challenges within health care facilities.

The COVID-19 epidemic response in Nigeria took off following the inauguration of the Presidential Task Force on COVID-19 response on by the President. The task force was mandated to coordinate the epidemic response. The Nigeria Centre for Disease Control is at the forefront of the epidemic control, coordinating key technical activities. The KNCV team worked under the COVID-19 PTF with key technical team members from NCDC, NTBLCP, United US Agency for International Development, CDC and IHVN (Institute for Human Virology Nigeria) to initiate the processes for tools development for integrated COVID and TB response. The stakeholders developed an SOP for the use of Xpress SARS COV-2 cartridges for COVID-19 testing as well as an integrated algorithm for COVID-19 and TB diagnosis. The KNCV team also worked with the NTBLCP to develop the integrated COVID-19/TB register and request and result forms. Working with KNCV/Cepheid, the Kaduna State Government procured the first set of the Xpress SARS COV-2 cartridges and reached out to KNCV for support using the mobile WoW van for an integrated community COVID case search. Kaduna state is one of the 14 states where KNCV has current funding through USAID for the TB LON project. The KNCV team

developed an implementation strategy with the Kaduna State COVID-19 Response Team to target COVID-19 case finding within border communities. The community sites were mapped, and systems for case referral for both COVID-19 and TB drawn up.[5,7] Data management system was also set up, and the daily report of the intervention are compiled and shared with the Kaduna State Ministry of Health and COVID-19 Response Team.

The COVID-19 epidemic is impacting negatively on TB programs, with demonstrable effect on TB case detection and treatment in Nigeria.[5,11] Clinic attendance dropped significantly, and some clients due to the fear of being labelled a COVID-19 suspect denied TB symptoms leading to decreased presumptive TB identification. To improve TB case finding, the TB programs re-strategized to optimized community TB case finding, taking TB services to the community level based on previous experiences which suggested high TB yield could be obtained.[27,28] The community-based COVID-19 case search presented this opportunity for the TB program. The integrated approach to COVID-19 case search with TB ensured that clients are offered both services leveraging on available resources for the COVID response for TB active case finding.[23] The commitment of the state government was unparalleled, leading to the earliest procurement of the SARS COV-2 cartridges in the country. The successes recorded in the Kaduna experience show that refocusing attention at the sub-national level building needed partnerships and collaboration with key state actors can ensure an early and sustainable impact is made in program interventions. The NTBLCP working with KNCV and other partners ensured the development of the integrated tools for both TB and COVID-19 presenting a seamlessly integrated case reporting system for both diseases. The State government learning from the experience had concluded plans to procure mobile van to ensure that the intervention is taken to scale. The community intervention using the mobile truck with the GeneXpert, a multi-disease testing platform has informed the planned multi-disease diagnostic mobile services by the State Government. The mobile van with the GeneXpert provided opportunities for TB, COVID-19, HIV and HBV testing within targeted communities. This ensured that disease surveillance is taken to hard-to-reach communities that have lacked access to health care services. Currently, to ensure uptake of services, some other free screening services were provided, ranging from RT for malaria to Hepatitis test.

Conclusion

Key enabling factors for the strategy included building on an existing structure, multi-stakeholder collaboration, integrated tools for co-reporting, increased community sensitization for TB and COVID-19, screening for other diseases, as well as political will with needed government support. The deployment of WOW truck by KNCV Nigeria with staff experienced and skilled in advocacy, community engagement and active case search was key to the successful intervention. Procurement of SARS-COV-2 cartridges by the Kaduna State Government in addition to integrating COVID-19 screening and testing with other routine medical tests helped in reducing the stigma associated with the screening. Key lessons from this early intervention are informing scale-up across different states. The NTBLCP, in collaboration with the NCDC, plans a nation-wide rollout of the integrated approach, including training of key personnel and engagement of existing GeneXpert sites for TB and COVID-19 testing. Both stakeholders have adopted the testing algorithm, SOPs and recording tools for the expanded implementation strategy. For better use of resources, mobile diagnostic platform should be targeted and complementary to other community and health care facility interventions. Areas of focus should be hard-to-reach communities and vulnerable populations (example urban slums, persons living in internally displaced camps, or migrant population).

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Authors' Contributions

GM, OB and OC designed the study and wrote the manuscript. OC and TM designed the information system, conducted quality-assurance and analyzed data. US provided input to the methodology. AP and SI provided input to the study protocol and SOPs. CO reviewed the manuscript. YK and AL informed the theoretical framework.

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