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NOTES FROM THE FIELD

Integrated screening and testing for TB and COVID-19 in Peru

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We describe the experience of integrating COVID-19 screening and testing into a mobile TB screening unit in Lima, Peru. All attendees received chest radiographs, which were analysed using CAD4TB and CAD4COVID; Xpert MTB/RIF Ultra was used to test for TB, and antibody and polymerase chain reaction (PCR) for SARS-CoV-2. One Xpert-positive TB case was diagnosed per 168 people screened, one person with SARS-CoV-2 antibodies per 3 people screened, and one PCR-confirmed SARS-CoV-2 infection per 8 people screened. Integrated screening can help to avoid delays in the diagnosis of both TB and COVID-19.

As of September 2021, Peru has reported the greatest number of COVID-19 deaths per capita globally.[1] The pandemic's effect on the Peruvian health system has strained its ability to deliver services for other health conditions, including TB; the number of healthcare visits decreased by 64% in 2020 compared to 2019.[2] Peru has an estimated TB incidence of 116 per 100,000 population, and a high burden of multidrug-resistant TB.[3] There was a 25% decline in TB case notifications in 2020 compared to 2019 as an indirect effect of the COVID-19 pandemic.[3] In the capital Lima, districts with the highest pre-pandemic TB case notification rates also had the highest COVID-19 case fatality rates in 2020, reflecting the convergence of these two epidemics in the same vulnerable communities.[4]

Countries with high TB burdens face a challenge of maintaining TB detection as health system resources are diverted for COVID-19 detection. Integrated screening and testing programmes could help address this challenge. We describe a programme integrating TB and COVID-19 screening and testing that was implemented in 2020 as a collaboration between the non-governmental organisation *Socios En Salud* and the Dirección de Redes Integradas de Salud Lima Norte, Peru.

ASPECT OF INTEREST

Socios En Salud had been operating a community-based mobile TB screening programme in Lima for over a year when the COVID-19 pandemic began in Peru.[5] The programme provides free chest radiography using CAD4TB computer-aided detection software to detect TB-related abnormalities (Delft Imaging, 's-Hertogenbosch, The Netherlands). While the programme was initially suspended at the start of the COVID-19 pandemic in March 2020, it re-started in June with new biosafety protocols and the incorporation of CAD4COVID computer-aided detection software (Delft Imaging) to identify COVID-19-related abnormalities. Both softwares produce a continuous abnormality score from 0 to 100 using a deep learning-based artificial intelligence system trained to recognise abnormalities in digital radiograph images.[6,7] In the integrated screening algorithm (Figure), those with a CAD4TB score >50 (corresponding to an estimated 90% sensitivity[6]) were tested using Xpert® MTB/RIF Ultra (Cepheid, Sunnyvale, CA, USA). Those with a CAD4COVID score >50 underwent a Standard Q COVID-19 IgG/IgM Duo SARS-CoV-2 antibody test (SD Biosensor, Suwon, Korea). After the first week of integrated screening, those with an abnormal CAD4COVID score were also administered a polymerase chain reaction (PCR test) performed by Socios En Salud. In the third week of this integrated screening programme, we started referring people with abnormal CAD4COVID scores to the public health system for evaluation, because limited access to SARS-CoV-2 testing in the rest of the country at this early point in the pandemic created such high demand that it was challenging to ensure equitable access and proper social distancing at the mobile unit.

This report focuses on the initial 2 weeks of integrated screening (23 June–9 July 2020), when the programme was offering on-site SARS-CoV-2 antibody testing and PCR testing. Because all procedures were conducted by Socios En Salud during this period, we were able to assess both TB and SARS-CoV-2 testing results of all attendees. Data were collected prospectively as part of public health response activities.

The Ethics Committee of the Universidad Peruana Cayetano Heredia, Lima, Peru, granted an exemption from review for our analysis of de-identified programmatic data.

A total of 672 people attended the mobile screening units and were screened using both CAD4TB and CAD4COVID. The median age of attendees was 40 years (interquartile range 27–52); 52% were male. Cough was reported by 251 (37%) and fever by 21 (3%) attendees. Overall, 184 (27%) had an abnormal CAD4TB score, while 443 (66%) had an abnormal CAD4COVID score (Table). While most people were tested according to the algorithm, some were not tested because they were unable to produce sputum or felt the queue for testing was too long. A total of four Xpert-positive TB cases were diagnosed, and 195 peo-

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KEY WORDS
SARS-CoV-2; community health services; mass chest X-ray

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TABLE TB and COVID-19 evaluation results for people screened at mobile TB units (*n* = 672)

	CAD chest radiography result			
	CAD4TB abnormal, CAD4COVID abnormal (*n* = 148, 22%) *n* (%)	CAD4TB abnormal, CAD4COVID normal (*n* = 36, 5%) *n* (%)	CAD4TB normal, CAD4COVID abnormal (*n* = 295, 44%) *n* (%)	CAD4TB normal, CAD4COVID normal (*n* = 193, 29%) *n* (%)
CAD4TB score, median [IQR]	63 [55–75]	58 [53–63]	44 [31–47]	43 [26–47]
CAD4COVID score, median [IQR]	75 [62–98]	30 [27–42]	51 [55–69]	31 [27–41]
Xpert MTB/RIF result				
Positive	3 (5)	0 (0)	1 (<1)	0 (0)
Negative	129 (87)	29 (81)	5 (2)	1 (1)
Not done	16 (11)	7 (19)	289 (98)	192 (99)
SARS-CoV2 antibody test result				
Positive	70 (47)	2 (6)	123 (42)	0 (0)
Negative	67 (45)	4 (11)	152 (52)	7 (4)
Not done	11 (7)	30 (83)	20 (7)	186 (96)
SARS-CoV2 PCR test result				
Positive	20 (14)	0 (0)	33 (11)	2 (1)
Negative	27 (18)	0 (0)	74 (25)	3 (2)
Not done	101 (68)	36 (100)	188 (64)	189 (98)

CAD = computer-aided detection; IQR = interquartile range; PCR = polymerase chain reaction.

ple tested positive for SARS-CoV-2 antibodies. Thus, one Xpert-positive TB case was diagnosed for every 168 people screened, and one person with SARS-CoV-2 antibodies was identified for every 3 people screened. During the week when SARS-CoV-2 PCR testing was available, of the 419 attendees, 54 people had a positive PCR test, corresponding to 1 PCR-positive case for every 8 people screened despite incomplete testing coverage. Three of the four people with Xpert-positive TB had a positive antibody test to SARS-CoV-2, but none had COVID-19 symptoms; none underwent PCR testing, because they were diagnosed in the week before PCR testing became available.

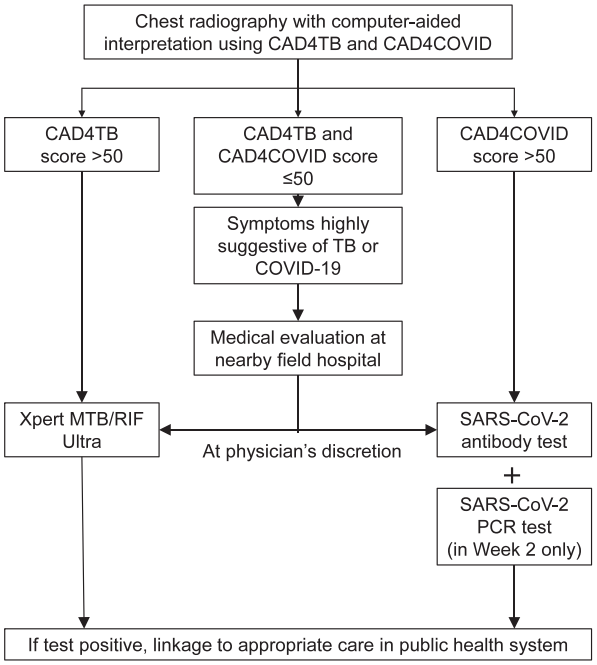

FIGURE Integrated TB and COVID-19 screening algorithm at mobile screening units in Lima, Peru, 23 June–9 July 2020.

DISCUSSION

Our experience illustrates the potential for simultaneous integrated radiography-based screening and testing for TB and COVID-19. This approach could complement other integration strategies such as sequential screening for COVID-19, followed by TB.[8] Although our assessment is limited by the short study period and a relatively small number of screened individuals, our integrated programme resulted in the detection of both TB and SARS-CoV-2 infection. The yield of Xpert-confirmed TB was similar to what was detected by the mobile screening programme in this area before the COVID-19 pandemic.[5] The high proportion of attendees with SARS-CoV-2 antibodies was consistent with a seroprevalence survey carried out in this area 4 months later, in which antibodies were detected in a quarter of residents (Socios En Salud, unpublished data); this underscores the need for access to PCR or antigen-based testing at community screening units. Given the overlap between symptoms of TB and COVID-19, integrated screening can help to avoid delays in the diagnosis of both conditions, but particularly TB, which has been de-prioritised by many health systems during the COVID-19 pandemic.[3]

During the period analysed, which was just after the peak of the first wave of COVID-19 in Peru, the overwhelming concern in the community over COVID-19 posed some challenges to TB screening. Those who visited the mobile TB screening units during the period that on-site testing was available did so in search of the SARS-CoV-2 test rather than for TB screening. When on-site SARS-CoV-2 testing was stopped, the influx of people decreased. Acceptance of TB screening was sometimes a challenge, as people argued that their prolonged cough was due to COVID-19 rather than being at risk of TB. However, communication and education strategies highlighting the ability of radiography to detect both TB-related abnormalities and COVID-19 lesions led to increased acceptance of screening for both diseases.

CONCLUSIONS

Integrated TB and COVID-19 screening and testing services can help ensure that TB case detection is maintained during the pan-

demic. When there is great demand for SARS-CoV-2 testing in the population, adding COVID-19 screening could potentially increase the uptake of TB active case-finding activities. Using X-ray and automated detection provides an efficient way to screen for both conditions simultaneously, and further research can help us better understand the performance of CAD4COVID in community-based screening programmes. However, the feasibility of the approach depends on having sufficient access to SARS-CoV-2 testing to meet the population's needs.

References

1 Worldometer. COVID Live Update: 225,741,125 cases and 4,648,489 deaths from the coronavirus. https://www.worldometers.info/coronavirus/?fbclid=IwAR35ZFiRZJ8tyBCwazX2N-k7yJjZOLDQiZSA_MsJAfdK74s8f2a_Dgx-4iVk Accessed September 2021.

2 Linares EN. The pandemic and health systems in Latin America: the case of Peru. Lima, Peru: Universidad Peruana de Ciencias Aplicadas, 2020. https://www.campusvirtualsp.org/sites/default/files/la_pandemia_y_los_sistemas_de_salud_en_america_latina-_el_caso_peru.pdf

3 World Health Organization. Global tuberculosis report, 2021. Geneva, Switzerland: WHO, 2021.

4 Rojas-Bolivar D, et al. COVID-19 case fatality rate and tuberculosis in a metropolitan setting. J Med Virol 2021; 95: 3273–3276.

5 Yuen CM, et al. Community-based tuberculosis active case-finding with mobile X-ray units in Lima, Peru: a RE-AIM evaluation. BMJ Open 2021; 11: e050314.

6 Qin ZZ, et al. Tuberculosis detection from chest x-rays for triaging in a high tuberculosis-burden setting: an evaluation of five artificial intelligence algorithms. Lancet Digit Health 2021; 3: e543–e554.

7 Murphy K, et al. COVID-19 on chest radiographs: a multireader evaluation of an artificial intelligence system. Radiology 2020; 296: E166–172.

8 Chan G, et al. Adapting active case-finding for TB during the COVID-19 pandemic in Yogyakarta, Indonesia. Public Health Action 2021; 11: 41–49.

Nous décrivons l'expérience de l'intégration du dépistage et du test COVID-19 dans une unité mobile de dépistage de la TB à Lima, au Pérou. Toutes les personnes présentes ont reçu des radiographies pulmonaires, qui ont été analysées à l'aide de CAD4TB et CAD4COVID ; Xpert® MTB/RIF Ultra a été utilisé pour le dépistage de la TB, et les anticorps et la réaction en chaîne par polymérase (PCR) pour le SARS-CoV-2. Un cas de TB Xpert-positif a été diagnostiqué pour 168 personnes dépistées, une personne présentant des anticorps du SARS-CoV-2 pour 3 personnes dépistées et une infection du SARS-CoV-2 confirmée par PCR pour 8 personnes dépistées. Le dépistage intégré peut contribuer à éviter les retards dans le diagnostic de la TB et du COVID-19.

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