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Tuberculosis control and care in the era of COVID-19

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Tuberculosis (TB) is the leading infectious cause of mortality globally, with almost 4000 daily deaths. The treatment coverage and success rate are ongoing challenges for low- and middle-income countries (WHO, 2019). To effectively control the TB epidemic and meet the EndTB goals, the Zero TB Initiative was launched in October 2015. It aims to create 'islands of TB elimination' using a comprehensive approach of search, treat and prevent. Unfortunately, the COVID-19 pandemic has upended much of these activities. Reports from India, China and Pakistan suggest a daily decline in case notification of 75–80% in the last few months (Glaziou, 2020; Stop TB Partnership, 2020a) with testing in Pakistan decreasing up to 80%.

COVID-19 has led to massive health system disruption with the cancellation of routine health services in many settings (Roberts, 2020; Riley *et al.*, 2020). Physical distancing has been prescribed to contain the pandemic. This has major implications for TB service delivery. During the Ebola outbreak in Liberia, case notifications declined and the TB treatment success rate dropped from 80% to 69% (Konwloh *et al.*, 2017; Desta *et al.*, 2019). The success rate increased during the post-Ebola period, but remained low at 77%, indicating the impact on TB treatment outcomes (Desta *et al.*, 2019). Some of the reasons for this decrease include closure of the health facilities and laboratories, healthcare workers becoming sick, stock out of medical supplies and repurposing of existing facilities and staff (Zachariah *et al.*, 2015). During the outbreak, a modelling study estimated 10 632 deaths from TB, malaria and HIV/AIDS in West African countries with 50% reduction in health services (Parpia *et al.*, 2016). These deaths would be more than those caused by Ebola itself. Likewise, the 1918 Spanish Flu pandemic had also resulted in increased mortality from TB by a factor of 1.5 (95%CI: 1.1–1.9) (Noymer, 2011; Zürcher *et al.*, 2016).

Similar to Ebola and Spanish Flu, we can expect a decrease in access to TB care and increase in mortality from COVID-19 (Glaziou, 2020; Stop TB Partnership, 2020b). An impact modelling study showed that mostly due to delayed diagnoses tuberculosis-related deaths can increase up to 20% in the next 5 years (Hogan *et al.*, 2020). A Stop TB Partnership survey in 20 high-burden TB countries found that NTP staff are engaged in COVID-19-related activities disrupting TB activities. TB isolation wards have been re-purposed to manage COVID-19 patient while TB/infectious disease specialists are being redirected to COVID-19 care. TB laboratories are being used to detect SARS-CoV-2 affecting TB testing. TB drug supply and shipments have been disrupted. Critical research activities for TB have either been decreased or abandoned (Stop TB Partnership, 2020a,b). With the SARS-CoV-2 rapid diagnostic test utilizing the same platform as TB testing, there is concern that TB testing may be further disrupted. Negative impacts may become evident on other programmes of public health importance. Decrease in Bacillus Calmette–Guérin (BCG) vaccination coverage for newborns can lead to decreased protection against TB in the early years of life. The impact of COVID-19 on routine immunization in Pakistan has shown a 63.8% decrease in all immunizations and 66.8% decrease in BCG immunizations (Chandir, 2020). On average, 10 991 children (aged 0–23 months) per day are missing routine immunizations in one of the major provinces of Pakistan. To avoid reversing the progress made in public health programmes, it is important that all stakeholders adapt their approaches to providing essential health services.

COVID-19, just like TB, is affected by the socio-economic determinants with poorer and marginalized groups worse off (Wingfield *et al.*, 2020). Pakistan sets an example that can be followed by other high TB burden countries to adapt during this pandemic. The Zero TB cities team in Pakistan have pivoted on their active case-finding strategies to combine screening for COVID-19 and TB to provide a comprehensive approach in the highly populous city of Karachi. Teams have started screening patients in emergency department of a tertiary care private sector hospital. As a proof of concept for integrated screening, the team using a TB Van and fixed facility-based

X-ray systems piloted verbal screening along with an artificial intelligence (AI)-based Infinity software (qXR detects various abnormalities on Chest X-Rays, 2020), which provides risk assessment for TB and COVID-19-associated pneumonia simultaneously. The objective was to see how an existing X-ray-based screening can be extended for COVID-19 and TB in parallel. The pilot was conducted in the population seeking care at the hospital emergency room (ER) or community screening camps for TB and COVID-19. The new AI decision support tool (1) provided decision support for next steps after X-ray whether to take sputum and/or NP swab for diagnosis of the two diseases and (2) a detailed radiograph report in real time to aid the clinical decisions by doctors. Till 15th July 2020, we have screened 26 225 individuals for COVID-19 and TB, with 1673 (6.4%) presumptive for COVID-19, and 1883 (7.2%) presumptive for TB. We are currently evaluating results and considering expanding this intervention in our primary care network. Lessons learned from this intervention will be used to design disease surveillance systems at the primary healthcare level.

Community health workers (CHWs), trained for contact tracing for TB and equipped with personal protection equipment (PPE), are now engaged in tracing people exposed to COVID-19. Dedicated TB facilities are being prepared for screening, management and isolation of TB patients co-infected with COVID-19. While TB preventive treatment is currently on hold, teams plan to re-start activities with the help of CHWs that visit patients for follow-up and medicine delivery. Studies have shown the importance of decision support tools and e/m-health tools for TB diagnosis (Malik *et al.*, 2018). Similar telehealth approaches are being piloted and will be integrated with CHW home visits to offer preventive TB treatment and other follow-up services.

Stakeholders and governments also need to consider the funding for TB control, especially in low-income, high-burden countries. The funding mobilization for COVID-19 stands in stark contrast to the budgetary challenges that the TB community faces in spite of the fact that TB is likely to end the lives of more people than COVID-19 in the first half of 2020 globally. Malik *et al.* (2019) have shown that additional funding is required to maintain and increase TB case notifications. For many low- and middle-income countries, a large proportion of funding for TB programmes come from external donors. However, with COVID-19-related economic downturns, there is a risk of resource re-allocation away from TB care. Domestic funding for TB will need to increase proportionally to offset any decrease in external funding for TB programmes to function. This would require careful planning as the countries that are most affected by TB are also the least equipped to handle the COVID-19 crises.

To avoid increasing the indirect consequences of COVID-19 on TB, it is of immense importance that stakeholders support ongoing TB services during the physical distancing measures where health facilities remain open and to ramp up activities as these measures are eased. We recommend (1) combining the screening for both TB and COVID-19 using AI-based X-ray solutions where feasible, (2) utilizing the available infrastructure to provide TB care along with COVID-19-related activities to avoid health workforce redundancies while increasing public health capacity and preparedness, (3) provision of proper PPE to healthcare workers visiting houses for contact tracing, (4) using e/m-health solutions for providing TB care at home, (5) planning for massive vaccination catch-up campaigns after easing of lockdown and (6) discussion and stakeholder engagement to increase domestic funding for TB. Above all, without prioritizing additional funding and resources towards co-managing diseases such as TB and COVID-19, public health systems will continue to suffer with an already under-resourced infrastructure.

Authors' contribution

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