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## Facility-based directly observed therapy (DOT) for tuberculosis during COVID-19: A community perspective

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### ABSTRACT

Facility-based directly observed therapy (DOT) has been the standard for treating people with TB since the early 1990s. As the commitment to promote a people-centred model of care for TB grows, the use of facility-based DOT has been questioned as issues of freedom, privacy, and human rights have been raised. The disruptions caused by the COVID-19 pandemic and ensuing lockdown measures have fast-tracked the need to find alternative methods to provide treatment to people with TB. In this study, we present quantitative and qualitative findings from a global community-based survey on the challenges of administering facility-based DOT during a pandemic as well as potential alternatives. Our results found that decreased access to transportation, the fear of COVID-19, stigmatization due to overlapping symptoms, and punitive measures against quarantine violations have made it difficult for persons with TB to receive treatment at facilities, particularly in low-resource settings. Potential replacements included greater focus on community-based DOT, home delivery of treatment, multi-month dispensing, and video DOT strategies. Our study highlights the need for TB programs to re-evaluate their approach to providing treatment to people with TB, and that these changes must be made in consultation with people affected by TB and TB survivors to provide a true people-centred model of care.

### 1. Introduction

Despite being treatable and curable, tuberculosis (TB) remains a public health priority and was the leading infectious disease killer pre-COVID-19 causing more than 1.4 million deaths in 2019 [1]. While the current 6-month anti-TB regimens for drug-sensitive pulmonary TB can achieve relapse-free cure, these long and intensive regimens are challenging to administer without interruption and can lead to drug-resistant TB strains. In response to this challenge, the World Health Organization (WHO) endorsed a TB case management strategy in the 1990s known as Directly Observed Therapy, Short Course (DOTS) [2]. In addition to promoting political commitment, case detection, uninterrupted anti-TB drugs, and impact measurement systems, the DOTS

strategy mandates directly observed therapy (DOT). Under DOT, an individual is trained to observe a person with TB as they swallow their anti-TB treatment for the duration of the treatment regimen.

DOT can be administered at the facility or community level. Under facility-based DOT, people with TB are required to visit the facility to take their treatment under the supervision of a healthcare worker. According to a 2003 WHO report on community contribution to TB care, community health workers, peer groups, or family members can act as supervisors for community-based DOT [3].

The evaluation of DOT has historically focused on measuring the proportion of people that failed treatment or the proportion of people that relapsed compared to self-administered therapy (SAT). Several studies (including meta-analyses) have found that DOT improves

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treatment outcomes based on these scales [4–7]. However, these measurements fail to grasp underlying issues of administering DOT, including limitations of individual freedom, privacy, stigmatization, confidentiality, impact on work, and family and community commitments [8]. Because of these human rights violations, TB civil societies and organizations have called for more people-centred approaches to TB care that, ultimately, require a complete departure from the current facility-based DOT [9,10].

The ongoing COVID-19 pandemic has served to amplify these human rights issues by disrupting essential TB healthcare services, uncovering the need and the urgency for developing people-centred alternatives. A 2020 civil society-led survey broadly characterized the impact of COVID-19 on TB services and people with TB from a community-based perspective [11]. In this study, we used qualitative and quantitative data collected from the community-based survey to demonstrate that the barriers and human rights violations associated with facility-based DOT have been amplified during the COVID-19 pandemic, rendering facility-based DOT an inefficient strategy for treatment and treatment adherence. We will present the key issues associated with facility-based DOT for drug-susceptible TB identified by the respondents, as well as possible solutions to overcome these barriers during a pandemic.

## 2. Methods

The survey was developed and piloted by a core working group of TB advocates and researchers using SurveyMonkey. The scope of the survey was to broadly characterize the impact of COVID-19 on TB. The final survey was disseminated online in English, French, Spanish, Russian, Telugu, Tamil, and Hindi using the networks of the study team, which was composed of researchers and active advocates from not-for-profit

organizations and groups (ACTION Global Health Advocacy Partnership, Global Coalition of TB Activists, Global TB Caucus, KANCO, McGill International TB Centre, Results Canada, Stop TB Partnership, TB People, TB PPM, We Are TB) [12–21]. Their access to relevant networks was leveraged to deploy snowball sampling via relevant email list serves, social media channels (Twitter, Facebook) and other communication channels reaching target participants (WhatsApp groups). In some areas, active outreach to affected communities networks through phone-calls were made to collect data. The geographical focus of the response was global. Data was collected between May 26, 2020 and July 2, 2020 from key TB stakeholders including, people with TB; healthcare workers; national TB program and policy officers (NTP); TB researchers; and TB civil societies, advocates, and survivors. Survey responses were anonymous and no personal identifying information was collected.

Each stakeholder group responded to a set of quantitative and qualitative questions to understand on-the-ground experiences during the early stages of the COVID-19 pandemic/lockdown. The quantitative questions were consistently presented across stakeholder groups as statements in seven-point Likert scale format, with responses ranging from “strongly agree” to “strongly disagree”. For persons with TB, quantitative questions focused on care-seeking, travel restrictions, treatment supplies, TB care/support received, and emotions (feelings of shame, fear of COVID-19). For healthcare workers, quantitative questions explored issues surrounding healthcare capacity, patient attendance, treatment availability, PPE, TB care/support, and reassignment to COVID-19. For NTP officers, quantitative questions addressed health services, TB notifications, funding, reassignment to COVID-19, treatment availability, and TB care/support. For civil societies/advocates, quantitative questions addressed politics and media, funding, treatment availability, misinformation, and TB care/support. All quantitative

**Table 1**  
Demographic characteristics of respondents by stakeholder group.

	People with TB (N=237)	Healthcare workers (N=170)	NTP officers (N=136)	Civil societies / advocates / TB survivors (N=299)
<b>Region, n (%)</b>				
African	163 (68.8)	37 (21.8)	28 (20.6)	150 (50.2)
Canada/USA	1 (0.4)	80 (47.1)	55 (40.4)	7 (2.3)
South/Central America	6 (2.5)	8 (4.7)	10 (7.4)	27 (9.0)
South-East Asia	60 (25.3)	12 (7.1)	21 (15.4)	55 (18.5)
Europe	5 (2.1)	12 (7.1)	11 (8.1)	38 (12.7)
Eastern Mediterranean	1 (0.4)	5 (2.9)	2 (1.5)	3 (1.0)
Western Pacific	1 (0.4)	16 (9.4)	9 (6.6)	19 (6.4)
<b>Global Fund eligible countries, n (%)*</b>	228 (96.2)	75 (44.1)	67 (49.3)	268 (89.6)
<b>Country-specific responses, n (%)</b>				
India	58 (24.5)	10 (5.9)	14 (10.3)	42 (14.0)
Kenya	159 (67.1)	25 (14.7)	6 (4.4)	22 (7.4)
United States	1 (0.4)	74 (43.5)	47 (34.6)	4 (1.3)
<b>Lockdown status, n (%)</b>				
Complete lockdown	18 (7.6)	14 (8.2)	4 (2.9)	24 (8.0)
Partial lockdown	201 (84.8)	136 (80.0)	112 (78.7)	210 (70.2)
No lockdown	11 (4.6)	19 (11.2)	17 (12.5)	54 (18.1)
Unknown	6 (2.5)	0 (0.0)	0 (0.0)	1 (0.3)
Other	1 (0.4)	1 (0.6)	3 (2.2)	10 (3.3)
<b>Health setting, n (%)†</b>				
Private hospital	39 (16.5)	16 (9.4)		
Private clinic	15 (6.3)	23 (13.5)		
Public hospital	113 (47.7)	54 (31.8)	N/A	N/A
Public clinic	71 (30.0)	68 (40.0)		
NGO/charity	9 (3.8)	17 (10.0)		
Other	0 (0.0)	19 (11.1)		

\* Based on The Global Fund 2020 Eligibility List [49].

† People with TB: eight respondents attended a combination of different public/private clinics/hospitals.

‡ Healthcare workers: 18 respondents worked at a combination of different public/private clinics/hospitals.

NTP = National TB Program and Policy.

Likert-scale questions and results have been presented in the report *The impact of COVID-19 on the TB epidemic: a community perspective* [11]. Qualitative, open-ended questions were similar across all stakeholder groups and sought to understand key challenges and resource needs, potential solutions, and opportunities being presented by the pandemic. In this study, we only included data relevant to TB DOT services and TB treatment. Responses from TB researchers are not included in this analysis as the nature of their responses did not cover our research question about facility-based DOT and program implementation.

Quantitative data was analysed using Stata software v16.1. Likert-scale responses (strongly agree/disagree, agree/disagree, somewhat agree/disagree) were aggregated to reflect overall agreement and disagreement levels. Thematic analysis of the qualitative data was analysed using Quirkos v2.2.1. A thematic coding system was developed independently by two study members (AJZ and RCW) and then cross-referenced for similarities and discrepancies. Discrepancies were resolved via discussion and there was agreement among all study team members regarding the final analytical framework and the quotes selected to represent each theme.

### 3. Results

Responses were collected from 842 respondents. [Table 1](#) presents the demographic characteristics of the respondents by stakeholder group. Most people with TB were from Kenya, representing 67.1% of all respondents. Healthcare workers and NTP officers were primarily from Canada or the United States. Finally, half (50.2%) of all civil society, advocate, and TB survivor respondents were based in Africa.

Across all stakeholder groups, most respondents reported being under partial lockdown (i.e., people are free to leave their homes while practicing social distancing but are under certain restrictions and have access to limited services). Most people with TB attended public healthcare facilities, at either a public hospital (47.7%) or public clinic (30.0%). Similarly, most healthcare workers worked in public clinics (40.0%) or public hospitals (31.8%).

#### 3.1. Challenges of DOT during a pandemic

From the survey results, we identified an overall decrease in people with TB receiving anti-TB treatment, particularly among Global Fund eligible countries: 70% of NTP officers and 71% of healthcare workers from Global Fund eligible countries reported a decrease in the number of people with TB receiving treatment since the beginning of the pandemic. In this first section, we will discuss how the facility-based DOT framework of administering treatment during a pandemic contributed to the observed decrease in treatment received.

##### 3.1.1. Transportation

The COVID-19 pandemic and lockdown measures have restricted local public transportation services, making it more difficult for individuals to travel. This directly impacts people with TB seeking facility-based DOT as they are required to commute to the facility weekly, or sometimes daily, to receive anti-TB treatment. Approximately half (49%) of all people with TB reported that they had trouble accessing TB care due to limited transportation during COVID-19. Even when public transport was operational, fare prices increased to compensate for the decrease in demand: “the cost of transport has gone up due to COVID-19 as we have to meet the extra cost of fewer passengers in public vehicles” (person with TB, Kenya). In many settings, people with TB must burden the cost of transportation, which is a clear barrier even in a pre-pandemic world. Because of the increase in transportation costs, a person with TB from Zambia reported that they are now forced “to walk a long way to the hospital” as they “do not have enough money for transport”. Compounding the challenges of accessing DOT are lockdown measures that have forced facilities to close. This was highlighted by a person with TB from Kenya where the facility they regularly attended

shut down due to the presence of COVID-19 at the facility: “I now need transport to enable me [to] attend another far away facility”.

As the COVID-19 pandemic forces people with TB to travel further and pay higher transportation fees, many will default treatment. This was noted by an NTP officer in Pakistan who stated that “many of the already diagnosed and registered [people with TB] missed their appointment due to lack of transport [to the] facility and were not able to get the next month medication”. These restrictions have a particular impact on low-resource, rural communities. A pre-COVID-19 study by Shiotani et al. in rural India reported that poor agricultural workers “equated the cost of transportation to feeding one child” [22]. People with TB, particularly in low resource settings, are faced with a situation where they must choose between paying more to travel further to reach DOT facilities or defaulting essential anti-TB treatment during COVID-19.

##### 3.1.2. Fear of COVID-19

Early data has shown that people currently and previously infected with TB are at increased risk of COVID-19 mortality [50]. Irrespective of the true co-morbidity, the perceived risk has caused people with TB to avoid seeking DOT at health facilities. More than half (55%) of all people with TB from the survey reported that they did not want to visit their regular health facility out of fear of contracting COVID-19. This fear of COVID-19 is related to their perceived vulnerability: “I fear to go to a health facility because I was told that my immunity is low” (person with TB, Kenya). Limited access to adequate infection control resources, such as masks, also contribute to this fear: “[people with TB] are afraid to go to the health units because it is mandatory to use masks and they are unable to acquire or are afraid of becoming infected with COVID-19” (civil society/advocate, Mozambique). Thus, even in situations where transportation is accessible, the fear of COVID-19 prevents people with TB from receiving treatment. This fear permeates across both Global Fund eligible and ineligible countries: “[people with TB are] afraid to come to health care centre[s] so they miss their drugs” (healthcare worker, India) and “[people with TB] are afraid to come to the hospital [...] because they are afraid of contracting COVID-19. This leads to conditions not being treated in a timely and appropriate fashion” (healthcare worker, USA).

The fear of COVID-19 also affects healthcare workers, rendering them “reluctant and afraid of seeing patients” (healthcare worker, Somalia). Over half (52%) of all healthcare workers reported that they were significantly lacking personal protective equipment (PPE). Several healthcare workers qualitatively identified a lack of PPE as one of the top three challenges in their TB work during COVID-19, with a healthcare worker from Canada linking the lack of PPE directly to DOT: “inability to deliver DOTS due to lack of PPE”. This was even more pronounced among Global Fund eligible countries where 69% of healthcare workers reported insufficient PPE.

A healthcare worker from Australia noted that people with TB began returning to the facility only once the “perception that attending [the] clinic [was] safe”. This perception of safety must be achieved through proper counselling on the risks of COVID-19 and by ensuring PPE is accessible to all who attend the facility.

##### 3.1.3. Stigmatization

People with TB have been stigmatized long before COVID-19. This stigmatization has contributed to delays in treatment seeking and treatment adherence, particularly in Global Fund eligible countries [24]. COVID-19 has exacerbated the stigma associated with TB, mainly because of the overlapping symptoms of cough and fever. Among all people with TB surveyed, 47% reported feelings of shame because COVID-19 has overlapping symptoms with TB. Many people with TB also reported qualitatively that they “have shame of coughing” (person with TB, Kenya) and that the act of coughing results in stigmatization. Among civil societies, advocates, and TB survivors from Global Fund eligible countries, 61% agreed that misinformation and stigma against

people with TB significantly increased since the beginning of the COVID-19 pandemic.

Respondents highlighted that much of the stigma “comes from the health personnel [...] afraid of being infected with COVID-19” (NTP officer, Philippines). Previous studies have shown that, prior to COVID-19, some healthcare workers resisted interacting with people with TB out of fear of being infected with TB [25,26]. Such stigmatization by healthcare workers creates perceptual barriers that directly undermines access to care and leads to unsuccessful treatment outcomes in persons with TB [27]. The increased stigma against people with TB brought about by the COVID-19 pandemic may cause more DOT healthcare workers to avoid treating people with TB. Interventions that address TB stigma are lacking as is highlighted by two systematic reviews [28,29], among which only one study by Wu et al. addressed healthcare worker stigma [30]. Without proper interventions to reduce TB- and COVID-19-related stigma among healthcare workers, many facility-based DOT strategies will fail to appropriately treat people with TB.

#### 3.1.4. Restriction of liberties

In order to control the spread of COVID-19, many governments have imposed lockdown measures to restrict the movement of civilians. These COVID-19 restrictions vary across geographical regions and over time.

While these restrictions are necessary during a pandemic, there have been situations where the restrictive measures disproportionately impacted marginalized populations, including people with TB. One healthcare worker in India, who reported being under complete lockdown, noted that “[people with TB are] scared to come for follow-up due to [the] risk of being punished by authorities”. An advocate from Kenya linked these paternalistic measures with the stigma of coughing: “‘You cannot cough in peace’ [a person with TB] said since any cough is mistaken to be COVID and when you become a suspected (*sic*) you are forcefully quarantined” while a Kenyan NTP officer highlighted that “the forced quarantine and contract tracing [is] not done the right way”. Such forced quarantines, fines, and other punitive measures have instilled fear in people with TB, making them less likely to seek treatment at the facility.

### 3.2. The people-centred model of care

In recent years, many reports and technical documents have advocated for a people-centred model of care that preserves the human rights of people with TB at every step of the cascade of TB care, including treatment. The ‘Global Plan to End TB’ prioritises a people-centred and equitable human rights-based approach to TB care [31]. The ‘Declaration of the Rights of People Affected by TB’, a community report written by a network TB survivors and affected communities, frames TB care in the context of human rights [32]. The ‘Activating a Human Rights-Based TB Response’ technical brief provides 20 recommendations for policymakers and program implementers to activate a human rights-based TB response [9].

According to the WHO, DOT is “an effective way to ensure adherence to treatment” and is “ethically justifiable when done as part of a people-centred approach” [33]. This people-centred approach includes the following components (among others):

- minimizing the burdens of care on people with TB, including indirect costs;
- taking steps to avoid stigmatization of people with TB;
- giving people with TB a choice about who will observe them and where [33].

The findings from the survey have demonstrated that people with TB are faced with barriers that prevent them from receiving traditional DOT services during the COVID-19 pandemic. Under such circumstances, current facility-based DOT programs around the world are not able to meet the criteria for a people-centred approach to providing anti-TB

treatment. These barriers work synergistically to prevent people with TB from accessing the necessary treatment, the outcomes of which are often fatal: “the main challenge is that it appears that overall, there is delayed care-seeking. Many of our newly-diagnosed TB patients are VERY sick by the time they have sought out care” (NTP officer, USA).

In order to make treatment accessible to people with TB, health providers must change the way they deliver anti-TB treatment and ensure adherence is maintained, informed by policies that should be developed and implemented by health authorities and legislative power. 78% of healthcare workers from Global Fund eligible countries reported that they are adapting their methods of giving TB medicine to people during COVID-19 so that people with TB can successfully continue their treatment. In this next section, we will explore how respondents have adapted their treatment strategies and evaluate whether they can help address the issues of facility-based DOT during COVID-19.

### 3.3. Proposed alternatives to facility-based DOT

#### 3.3.1. Community-based DOT

To overcome access-related barriers, several respondents identified alternative ways of providing treatment to people with TB, including community-based DOT: “we offer DOT treatment at home thanks to our volunteers and a specific methodology approved [...] and applied to very complicated cases, now all [people with TB] from Balti are assisted in TB treatment at home, being consulted and provided medicines daily. In this way we increased treatment adherence to treatment.” (civil society/advocate, Moldova). Previous studies have demonstrated that people with TB often prefer community-based care over clinic-based care, particularly when people affected by TB were severely ill or had difficulty reaching the health facility [34–36]. Additional studies have demonstrated that community-based DOT has higher treatment success than facility-based DOT [37–39].

Community-based DOT allows non-healthcare professionals to be the observer: “[A] department Memorandum was issued to ensure [the] continuity in the delivery of TB services during this pandemic. [...] This memo recommended home DOT (daily observed treatment) with family members as treatment partners providing a month’s worth of second line anti-TB drugs.” (NTP officer, Philippines). A family-based DOT approach would reduce healthcare worker stigmatization and make the experience more comfortable for some people [40]. However, family-DOT may not work for people with TB who do not have family support or among family members who do not have the proper training or capacity to perform DOT. In addition, asking family members to oversee another family member who is resistant to taking their medications could lead to tension or worsen familial relationships. Therefore, in addition to promoting family-DOT, community healthcare workers must also be available to administer DOT. An advocate from Kenya called for investment in community led responses: “Empower community [h]ealth workers to handle TB and [COVID] within the community”.

Community-based DOT is a person-centred approach to treating TB, giving a person with TB the flexibility to decide where they should be treated and by whom. This flexibility in treatment services is essential during COVID-19 and beyond, particularly among decentralized, rural communities. Nevertheless, limited access to transportation remains an issue, preventing community health workers from reaching remote communities: “We are failing to reach out to TB [p]atients to provide care and support services since public transportation is limited” (civil society/advocate, Malawi). Additionally, funding to support community outreach workers is often limited and a lot of the work is done on a voluntary basis, a position difficult to fill during a pandemic. Finally, some people with TB appear to resist the idea of having an outsider enter their homes: “Many [people with] TB/LTBI aren’t leaving their house nor will they allow a home visit” (NTP officer, USA). Therefore, while community-based DOT may benefit certain individuals, it may not be flexible enough to accommodate all people with TB during a pandemic.



### 3.3.2. Home delivery of treatment and multi-month dispensing

To overcome the persisting challenges of community-based DOT, several respondents advocated for home delivery of treatment (through courier services) and multi-month dispensing: "Instead of one month, medicine of two months is being issued keeping in view the lockdown situation. The Tehsil TB Assistants are being utilized to deliver medicine to [people with] TB at their doorsteps." (NTP officer, Pakistan). In the USA, one NTP officer noted that they were delivering the medication by mail. The HIV community has demonstrated that these strategies reduce people with TB's burden, the cost of travel, and hours of work or school lost [41]. Under COVID-19, these strategies would also safeguard the health of people with TB and healthcare workers by encouraging social distancing measures, and should be reflected on countries' policies and other regulatory measures.

A major issue with multi-month dispensing is its dependence on the availability of sufficient anti-TB medication. Among healthcare workers from Global Fund eligible countries, 48% reported that their facilities have seen a significant increase in stock-outs and/or delays in the delivery of anti-TB medication during the COVID-19 pandemic. Without adequate supplies of treatment, people with TB cannot receive long-term treatment: "TB [p]atients have to continue [to go] to [the] health facility to receive their medication instead of receiving for several months due to lack of medication" (civil society/advocate, Mozambique).

Home delivery and multi-month dispensing promote self-administered therapy (SAT). Under SAT, people with TB take their drugs without the usual DOT supervision. Moving a person with TB from DOT to SAT is a decision made by healthcare workers. One healthcare worker from Peru listed "[t]rust in the responsibilities of [people with TB] to do their treatment" as one of the top three challenges during COVID-19. In Mexico, a healthcare worker outlined that they are only "giving away medication for a week or [two] to [people with TB] that have demonstrated trust". Therefore, under the discretion of the healthcare worker, not all people with TB may be eligible to switch to SAT, hence the need for the development of policy and regulations to ensure implementation of human rights-based approaches during this pandemic and beyond.

### 3.3.3. Video DOT

In recent years, video DOT (vDOT) has been proposed as a novel strategy for observing people with TB taking their treatment. This strategy involves the use of synchronous technologies (e.g. Skype) [42,43] or asynchronous technologies (storing digital videos for later review) [44,45]. The asynchronous strategy has the advantage of allowing people with TB to record themselves taking the treatment at a time convenient to them. A randomized control trial by Story et al. found that people with TB who used asynchronous vDOT had higher treatment adherence than people who used community-based DOT [46]. Many respondents referenced the use of vDOT strategies during the COVID-19 pandemic: "Revising, together with the TB service (*sic*), outpatient treatment observation modes, giving preference to remote treatment observation methods (video DOT). Wherever video DOT is impossible to organize, other remote reminders should be used (phone calls, text messages, smart boxes, etc.)" (NTP officer, Ukraine).

Some studies have piloted vDOT strategies in resource-limited environments, such as India [47] and Vietnam [48], and determined that vDOT was feasible. Nevertheless, many people with TB in resource-limited settings do not have access to such technologies. Even when the technology is available, the cellular service needed to virtually connect with health workers or upload asynchronous vDOT videos can be limited: "We have no opportunities to visit our communities and [are] challenged with virtual meetings due to connectivity and most of our clients' phones do not have [the] facilities to connect [to] a virtual call" (civil society/advocate, Malawi). This digital divide creates a treatment divide between those who have the technological resources and those who do not: "During the lockdown, drug taking goes without observation, because not all people have smartphones for video DOT." (civil

society/advocate, Ukraine).

## 4. Discussion

Requiring people with TB to visit a facility daily or weekly to receive essential treatment during a pandemic is not realistic, particularly in low-resource settings. The ongoing COVID-19 pandemic has amplified the urgent need to move away from facility-based DOT towards people-centred and human-rights based models of care. It is important that these alternative models integrate biomedical aspect of treatment with the empowerment of people affected by TB through information, capacity building, coordination, and access to inclusive and comprehensive social protection systems in order to create enabling environments of effective treatment and care needed to save lives and end TB.

In this study, we summarized key barriers to administering facility-based DOT identified by TB stakeholders. People with TB are unable to access facility-based DOT due to transportation restrictions or because of concerns related to COVID-19 and lockdown measures. Enhanced stigmatization of people with TB, particularly by healthcare workers, further contributes to treatment noncompletion.

To overcome these challenges, systemic changes to in how we deliver anti-TB treatment must be made. Additional support should be dedicated to strengthening community-led monitoring where people affected by TB and TB survivors are empowered to provide treatment services and support. The global supply chains for anti-TB medication must be strengthened and adequate supplies of treatment must be distributed in low-resource settings. Facility-based DOT should be replaced with more flexible options such as vDOT in combination with multi-month dispensing. Where vDOT is not available, people with TB should be supported by peer networks and healthcare workers to use SAT or community-based DOT. Future studies are needed to evaluate the impact of COVID-19 on DOT services and to evaluate the effectiveness of the proposed solutions in different contexts.

This study was subject to some limitations. First, the data reflects a specific moment in the COVID-19 pandemic (May-July 2020). As the COVID-19 is a rapidly evolving situation, some of the data may not reflect current or future perspectives of DOT services. Second, while the scope of the survey was global, the results were not equally representative of all geographical regions. This is particularly true among people with TB who were primarily from Kenya. Third, our analysis did not include responses from people with multidrug-resistant (MDR TB) or extensively drug-resistant TB, (XDR TB) a population that may have different treatment needs compared to drug-susceptible TB. Finally, we were not able to evaluate barriers to treatment across gender and across different vulnerable populations (prisoners, urban poor, people who use drugs, people living with HIV, migrant refugees, miners, Indigenous peoples etc.) as this data was not captured in the survey. It is important to acknowledge that treatment challenges, particularly stigma, manifest differently across gender and vulnerable populations. Future studies should investigate how the COVID-19 pandemic has impacted access to facility-based DOT across key populations.

The COVID-19 pandemic has changed and will continue to change the way in which we treat TB. TB programs must re-think their approach to delivery of care to a model that is founded on tenants of human rights and is collaborative in nature. Moving away from facility-based DOT is an ongoing discussion that must bring together people affected by TB, health professionals, human rights experts, donors, and technical agencies. It is essential that people affected by TB must be empowered to participate in the TB response to enable a true person-centred model of care that moves away from the outdated paternalism of DOT.

### CRedit authorship contribution statement

**Alexandra J. Zimmer:** Conceptualization, Methodology, Formal analysis, Data curation, Writing - original draft. **Petra Heitkamp:** Conceptualization, Writing - review & editing, Project administration.

**James Malar:** Conceptualization, Writing - review & editing. **Cintia Dantas:** Conceptualization, Writing - review & editing. **Kate O'Brien:** Conceptualization, Writing - review & editing. **Aakriti Pandita:** Writing - review & editing. **Robyn C. Waite:** Conceptualization, Methodology, Writing - review & editing, Formal analysis, Supervision.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Author contributions

AJZ, PH, JM, CD, KO and RCW contributed to the design and dissemination of the survey. AJZ and RCW did the data analysis. AJZ wrote the first manuscript draft. PH, JM, CD, KO, AP and RCW edited the article and approved the final version of the manuscript.

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