

Challenges and Adaptations of TB-DOTS Services during the COVID-19 Pandemic in South Cotabato Province, Philippines: A Mixed Methods Study

Lee Daniel E. Suelan, MD,¹ Nemuel S. Fajutagana, MD, MHPed,² Katherine C. Ciño, RN, MPA,¹
Joel E. Genzon, LPT, MAED, EdD,¹ Charmae B. Corvera, LPT,¹
Kristine Joy L. Tomanan, RN, MCD¹ and Amebella G. Taruc, MD, MPM¹

¹DOH-Center for Health Development SOCCSKSARGEN Region

²University of the Philippines Manila

ABSTRACT

Background and Objective. The COVID-19 pandemic has adversely affected various healthcare services worldwide, including tuberculosis (TB) control programs. This paper examines the impact of the COVID-19 pandemic on TB case notification rate (CNR) and treatment success rate (TSR), and the challenges and interventions in TB-DOTS (directly observed treatment short-course) services in the Province of South Cotabato, SOCCSKSARGEN Region, Philippines.

Methods. An explanatory sequential mixed methods design was used to describe the experiences of South Cotabato in implementing TB-DOTS services during COVID-19 pandemic. Monthly data on CNR and TSR under TB-DOTS from March 2019 to February 2022 were retrieved from the Department of Health's Integrated Tuberculosis Information System (ITIS) through records review. One-way analysis of variance (ANOVA) and Tukey's test were used to analyze quantitative data. Focus group discussions (FGD) were conducted among four groups of program implementers (NTP coordinators, nurses, medical technologists, and barangay health workers) encompassing the challenges encountered in the implementation of TB-DOTS services as well as interventions done before and during the COVID-19 pandemic.

Results. During the pre-COVID-19 period (March 2019-February 2020), a CNR of 334 per 100,000 population was reported in the province. There is a 35.19% decrease in TB CNR during COVID-19 Year 1 (March 2020-February 2021) at 216 per 100,000 population, followed by a 37.63% increase in Year 2 at 298 per 100,000 population. The mean TSR covering the pre-COVID period was 96% (SD = 0.01) while the mean TSR in COVID-19 Year 1 was 93% (SD = 0.02), significantly lower than that of the pre-pandemic period, followed by monthly TSR ranging from 91% to 98% (SD = 0.02), an increase in Year 2. From the FGDs, six pre-existing barriers were identified such as patients' financial constraints, hard-to-reach areas, poor health seeking behavior, persistence of TB stigma, medicine and supply shortages, and inadequate health workforce were experienced before and during the COVID-19 pandemic. On the other hand, six emerging challenges brought by the COVID-19 pandemic were reallocation of services, movement restriction, additional protocols, reporting delays, and fears among patients and health workers. The decrease in CNR and TSR during COVID-19 Year 1 aligned with the emergence of new challenges

Paper presentation – 19th Science and Technology Week –
University of the Philippines Manila, November 28 –
December 1, 2023, Manila, Philippines.

Corresponding author: Lee Daniel E. Suelan, MD
DOH-Center for Health Development SOCCSKSARGEN Region
Purok San Miguel, Barangay Paraiso,
Koronadal City, South Cotabato, Philippines
Email: leedaniel.suelan@ro12.doh.gov.ph
ORCID: <https://orcid.org/0009-0008-9765-6407>

in TB-DOTS services brought by the pandemic. These aggravated pre-existing barriers which further caused delays in the diagnosis and treatment of TB patients. Nine interventions done to address these challenges were also described, the most critical being health education, strengthening community-based services, use of telecommunications, resource pooling for essential medicines, adjusting medication dispensing, and coordination with local government units and policy enhancements.

Conclusion. TB-DOTS services in South Cotabato experienced various difficulties during the COVID-19 pandemic which led to initial declines in CNR and TSR. Addressing barriers and challenges were vital in ensuring the continuity of TB services and mitigating the impact of COVID-19 crisis on CNR and TSR. This study demonstrates the adaptability and resilience of South Cotabato's TB-DOTS services in response to COVID-19 challenges and highlights the need for strategies ensuring continuity of TB services and healthcare system resilience in light of Universal Health Care. Recommendations are outlined to improve current policies and practices as well as lay future directions for research on health service delivery and program implementation in relation to pandemics and other types of disasters.

Keywords: tuberculosis, COVID-19 pandemic, Philippines, case notification rate, treatment success rate, TB-DOTS, health system resilience

INTRODUCTION

Tuberculosis (TB) remains a leading cause of morbidity and mortality worldwide, caused by *Mycobacterium tuberculosis* and transmitted via air droplets. It was the foremost cause of death from a single infectious agent until the emergence of the COVID-19 pandemic.¹ The COVID-19 pandemic has significantly impacted various healthcare services globally, including TB control programs. According to the World Health Organization (WHO), the pandemic disrupted TB preventive measures and access to treatment, particularly in countries with a high TB burden.² Modeling studies projected that disruptions could lead to an increase in TB deaths of up to 20% over five years in high-burden countries, compared if there was no COVID-19 pandemic.³

The effect of the COVID-19 pandemic on TB control has been estimated to be dramatic, especially in high-burden, low- to middle-income countries, with many problems emerging that challenge existing national TB control programs (NTP). A rapid review of global literature revealed that the COVID-19 pandemic disrupted TB care and prevention; specifically, decrease in TB diagnostic services, case finding activities, LTBI management, and a decline in TB case notification rate were observed among 65 research

articles reviewed.⁴ In Indonesia, the COVID-19 pandemic adversely affected their NTP and primarily observed in districts with the lowest health-system capacity, leading to escalation of TB transmission.⁵

According to Lipman et al., the causes of setbacks in TB control during the COVID-19 pandemic include staff redeployment and resource reallocation from TB to other COVID-19-related services, lack of TB staff due to sickness and quarantine protocols, difficulties of staff traveling to work due to decreased public transport and movement restrictions, and disruption to supply chains.⁶ Furthermore, WHO identified the following factors as plausible explanations for the decreasing monthly TB case notifications: to reduce crowding in medical facilities, patients with chronic conditions or mild symptoms have been discouraged from seeking care; decrease in the number of health facilities providing TB diagnosis and treatment; delays in the purchase and transport of medicines and laboratory supplies; concerns about stigma due to the similarities between the signs and symptoms of TB and COVID-19; and data and reporting delays.⁷

To address these identified challenges to TB control during the COVID-19 pandemic, the WHO's Global TB Programme issued the following guidance to NTPs and partners: (1) utilize the expertise of NTPs for the COVID-19 response, particularly in rapid testing and contact tracing; (2) explore digital technology alternatives to maximize remote care and support for people with TB; minimize number of health services visits during treatment; (3) provide fundamental infection prevention and control protocols for medical personnel and patients, cough etiquette, and patient triage, to reduce the spread of TB and COVID-19 in congregate settings and health care facilities; (4) strengthen the delivery of TB preventive care by creating synergies with COVID-19 contact-tracing efforts; (5) ensure co-testing for TB and COVID-19 for individuals when indicated; and (6) ensure proactive planning and budgeting, procurement of supplies, and risk management for both situations.²

In the Philippines, a country with the third highest total TB incidence globally at around 554 cases per 100,000 Filipinos, the pandemic led to a significant decrease in the monthly number of detected TB cases.⁷ Approximately 268,816 new and relapse cases were reported to the Department of Health (DOH), a 35% decrease from cases detected in 2019.⁸

Under the Philippines' NTP, the Infectious Disease Prevention and Control Division of the DOH Central Office, is tasked with developing TB control policies, standards, and guidelines; formulating the national strategic plan; managing program logistics; providing leadership and technical assistance to lower health offices and units; managing data, and evaluating the program. NTP's primary strategy since 1996 is the implementation of the directly observed treatment short-course (DOTS), consisting of five core components: (1) availability of sputum microscopy with quality assurance; (2) uninterrupted supply of anti-TB

medications; (3) supervised therapy; (4) patient and program surveillance; and (5) political will.⁹ NTP uses the Philippine Plan of Action to Control Tuberculosis (PhilPACT) as a guide for dealing with the TB problem in the country.¹⁰ TB services are provided nationwide in all government health facilities, selected government hospitals, and public-private mix DOTS (PPMD) units following NTP guidelines and recommendations to detect all TB patients and guarantee successful treatment.¹¹ To meet the needs of the TB program, the adoption, maintenance, and country-wide implementation of the Integrated TB Information System (ITIS) was enacted in 2015.¹⁰

Since March 2020, the Philippine government has implemented several restrictions, including community quarantines, lockdowns, and alert levels to curb COVID-19 transmission in the country.¹² On March 3, the DOH declared the first local case of COVID-19 in the Philippines: a 62-year-old Filipino with unknown travel history to nations with documented incidents of the said viral infection.¹² By March 8, a state of public health emergency was declared by former President Duterte throughout the country.¹³ On March 12, Duterte announced a 30-day community quarantine or "lockdown" in Metro Manila due to the local transmission and rapid spread of COVID-19 infections throughout the country and by March 16, a national state of calamity was additionally proclaimed.¹⁴ Stringent quarantine measures outside of Metro Manila were further imposed to limit people's movement and prevent the spread of COVID-19. All government agencies and local government units (LGUs) were instructed to provide full assistance, cooperation, and mobilize resources to timely and appropriately respond to the threat of COVID-19.

Consequently, guidelines for COVID-19 testing were issued. On March 31, 2020, DOH released Department Memorandum No. 2020-0151 which determined RT-PCR testing as the gold standard confirmatory test for COVID-19 based on current available evidence.¹⁵ Use of point-of-care rapid antigen test kits was not recommended as stand-alone tests during the early pandemic period. Until the last quarter of 2020, various quarantine measures and issuance of policy guidelines continued.

A year later, the Duterte administration initiated the COVID-19 national vaccination program upon receiving various vaccine donations abroad. On March 4, 2021, 480,000 doses of AstraZeneca vaccines arrived from the COVAX facility, an international partnership for equitable COVID-19 vaccine distribution and between March 23-24, the national government received 1.4 million CoronaVac vaccines from Sinovac Biotech, a Chinese pharmaceutical company.^{16,17}

Throughout 2021, the community quarantine levels in the National Capital Region (NCR) and other provinces in the Philippines increased and decreased alternately. On November 2, 2021, the lowest single-day new COVID-19 infection rate in eight months was reported, which prompted Metro Manila mayors to suspend NCR curfew hours for the

first time since the pandemic.¹² By November 11, Duterte approved the nationwide shift to the alert level system (ALS) to revive the economy, which was significantly affected by the protracted crisis.¹⁸

To address the challenges in TB control, on November 9, 2020, the DOH issued Administrative Order No. 2020-0056, the National TB Control Program Adaptive Plan for the COVID-19 pandemic, to provide comprehensive guidance on maintaining the TB continuum of care despite disruptions.¹⁹ It aimed to guide LGUs on how to adapt and move forward on the circumstances brought by the COVID-19 pandemic and its associated socioeconomic effects. The Department of Interior and Local Government (DILG) further supported the implementation of the NTP Adaptive Plan through the issuance of DILG Advisory dated February 4, 2021.²⁰

While relevant studies conducted during the early pandemic period identified potential disruptions, they often started before complete data was available or focused on factors like poverty in other contexts. Local studies on the impact of the COVID-19 pandemic and the associated challenges on TB control have been very limited. The Philippines encountered significant challenges during the pandemic due to its pre-existing high burden of TB, which made co-infecting with COVID-19 particularly severe resulting in worse clinical outcomes and higher mortality rates for affected individuals.²¹ Additional challenges include the diversion of resources and personnel away from TB services where severe logistical and mobility restrictions negatively impact patients' adherence to treatment.²²

Global TB community infection control experience, including screening, testing, and contact tracing, proved valuable for COVID-19.²³ TB program staff were strategically positioned to provide technical and logistical support.²⁴ USAID and the Stop TB Partnership recommended integrated simultaneous testing for TB and COVID-19, especially in high-burden countries.²⁵ It has been demonstrated that the integration of TB and HIV program staff for COVID-19 contact tracing rapidly scaled capacity.²⁶

In the Philippines, existing TB infrastructure and training influenced detection for both TB and COVID-19.²⁷ DOH released policies directing the NTP laboratory network to perform RT-PCR testing for COVID-19 (Department Circular No. 2020-0187); for TB culture labs and hospital-based GeneXpert sites to augment as COVID-19 testing facilities (Department Memorandum No. 2020-0191); and for health facilities to perform simultaneous screening for COVID-19 and TB as well as efficient use of roving vehicles to collect specimens and provide medication supplies.^{19,28,29} The Specimen Transport Rider (STRider) network, initially for TB, was expanded to cover all 17 regions of the country and was maximized to transport TB and HIV specimens for diagnosis, reducing turnaround time and facilitating treatment initiation and adherence through home delivery of medicines. The STRider network was further extended to serve 24 COVID-19 facilities.³⁰

Furthermore, integrating digital advancements with health services is one way to avoid TB treatment delays.³¹ Accordingly, the NTP Adaptive Plan for the COVID-19 Pandemic (DOH Administrative Order No. 2020-0056) encouraged the use of alternative measures such as digital adherence technology (DAT) and telemedicine or telecounseling to monitor treatment adherence and active drug safety monitoring and management; as well as minimizing travel and reducing face-to-face clinic visits during treatment by provision of at least one (1) month supply of medications to patients and/or treatment supporters.¹⁹

A study conducted by Gler et al. in the Province of Cavite concluded that DATs such as SureAdhere is acceptable for patients and health workers because of the good adherence rate (i.e., intake of equal or more than 90% of prescribed doses) among cured MDR-TB patients and patients whose treatments are both ongoing and complete.³² SureAdhere, a video observed therapy (VOT), provided smartphones for patients which allowed them to film and submit videos of themselves taking their medications as well as receive daily reminders and text messages.³² Another DAT intervention is 99DOTS, implemented in three highly urbanized cities in Metro Manila from December 2018 until June 2020. 99DOTS detects the presence of anti-TB medication isoniazid and was confirmed as accurate in monitoring TB treatment adherence. Patients and health care workers noted that 99DOTS is an acceptable intervention to be used.³³ International studies further support that 99DOTS is an effective approach for improving TB medication adherence.^{34,35} However, local studies on the effectiveness of interventions implemented to ensure the continuous rollout of TB control services are still needed, particularly in areas outside major cities like Metro Manila and Cavite, which are home to less than 50% of the Philippine population.³³

This study was conducted to generally compare the TB-DOTS services during the pre-COVID-19 period and the COVID-19 pandemic in South Cotabato, a province located in SOCCSKSARGEN Region, Mindanao. It is the second largest province in terms of total population in the region and includes Koronadal City, the region's political and socioeconomic center. In 2022, South Cotabato is one of the provinces with a "very high" COVID-19 positivity rate at 26.2%.³⁶ TB is the 10th leading cause of morbidity in SOCCSKSARGEN with a five-year average of 9,963 cases recorded from 2019-2023.

Specifically, using the WHO Health Systems Building Blocks framework, this study aimed to compare the TB case notification rate (CNR) and treatment success rate (TSR) of South Cotabato province, identify challenges in implementing TB-DOTS services, determine local interventions, and describe the effect of these interventions. This paper presents the findings and the recommendations of the study, and is expected to contribute to developing resilient sub-national and national TB control strategies in times of public health emergencies and beyond.

MATERIALS AND METHODS

An explanatory sequential mixed methods design was employed to investigate the impact of COVID-19 pandemic on TB case notification rate (CNR) and treatment success rate (TSR). The research was conducted in South Cotabato province, situated in the SOCCSKSARGEN Region of the Philippines. It has one component city (Koronadal City, the regional center) and 10 municipalities, constituting a total population of 975,476 as of 2020 census, the second highest in the region.³⁷ South Cotabato is one of the 58 Universal Health Care (UHC) integration sites, which refers to LGUs that have signified their commitment to the DOH to integrate their local health systems into province and city-wide health systems, in accordance to the different reforms indicated under RA 11223 or UHC Act of 2019. During the COVID-19 pandemic, the Province of South Cotabato and its component LGUs implemented community quarantines and border lockdowns due to the high number of COVID-19 cases, which disrupted the regular operations of TB-DOTS services, including screening, diagnosis, and treatment.

Quantitative data (i.e., CNR and TSR) were obtained to determine the performance of South Cotabato in terms of TB-DOTS, as part of National TB Program implementation. While treatment success evaluates the progress of TB management, DOH also highlighted the importance of case notification as an essential component of NTP, as prompt and timely identification and treatment of TB patients will help decrease its spread and lead to eventual eradication.⁸ Subsequently, qualitative data from participant narratives were gathered to compare and supplement understanding of quantitative findings.

Monthly data on CNR of new and relapse cases and TSR under TB-DOTS from March 2019 to February 2022 were retrieved last January 2023 from the DOH's Integrated TB Information System. Access to ITIS was secured from the DOH-CHD SOCCSKSARGEN program managers of NTP. From DOH ITIS data, the proportion of CNR and TSR across three distinct periods were compared: the pre-COVID-19 period (March 2019 to February 2020), COVID-19 Year 1 (cases from March 2020 to February 2021), and COVID-19 Year 2 (cases from March 2021 to February 2022). In this study, a cohort is defined as a number of diagnosed TB patients who started treatment within the specified time period.

To determine the statistical significance of any observed differences in CNR and TSR among these periods, ANOVA was conducted using IBM SPSS software version 26. Tukey's test was applied as post hoc analysis to determine pairwise differences between any two of the defined periods. It is important to note that treatment outcomes for cases notified in January and February 2022 were excluded from the TSR analysis. This exclusion was necessary due to the limited number of evaluated outcomes from these cohorts available in ITIS as of March 2023.

Furthermore, qualitative data regarding challenges encountered in TB-DOTS services and the interventions implemented were collected through face-to-face focus group discussions (FGDs) in March 2023. FGD participants were purposively selected to represent various roles involved in NTP implementation in South Cotabato province, which includes 10 municipalities and one component city.

Eligible participants were those who had at least six months of continuous service in the program between April 2019 and March 2022. They included NTP coordinators, community nurses, medical technologists, and barangay health workers (BHWs) from LGUs, as well as program managers and coordinators from the DOH-CHD SOCCSKSARGEN Region and the South Cotabato Integrated Provincial Health Office. Selection aimed to ensure that key perspectives across different levels of the health system were represented. A total of 28 respondents which were grouped according to their roles participated in the FGD: 10 community nurses, 10 BHWs, 3 LGU medical technologists, and 5 regional program coordinators. Grouping by role allowed for more open but focused discussion and peer-level interaction while enabling comparison across different levels of TB program implementation. Participants were recruited through a communication letter sent via e-mail. Communication to the participants was facilitated by the DOH-CHD SOCCSKSARGEN Region NTP coordinators.

FGD participants were interviewed using a pre-tested guide questionnaire, validated by program managers of DOH-CHD SOCCSKSARGEN. The discussions were facilitated by four research team members using a mix of English, Filipino, and Hiligaynon. FGDs for all groups lasted for 60-90 minutes each, documented through audio and video recording. Recordings from the focus group discussions were transcribed verbatim and translated into English. Transcripts were reviewed and open coded by three research team members using NVivo 14 software. Anderson's thematic content analysis was employed to determine challenges and interventions that may have hindered or facilitated the implementation of TB-DOTS services during the COVID-19 pandemic.³⁸ Key elements and recurring responses were identified, leading to the generation of initial codes and themes, which were then further developed into overarching themes and subthemes based on the participants' responses and their direct relevance to the guide questions.³⁸

This study adopted the World Health Organization's Health Systems Building Blocks as the analytical framework to assess TB-DOTS services during the COVID-19 pandemic in South Cotabato province. This framework provided a structured approach for examining how key components of health systems were affected by and adapted in the context of TB service delivery and COVID-19 pandemic, highlighting both operational and structural challenges encountered by TB-DOTS programs.

The research protocol, an output of the authors under the Scaling Up of Centers for Health Development Capacity in

Operations and Implementation Research Project, underwent technical reviews from the DOH, University of the Philippines Manila, and Vital Strategies. Thereafter, the protocol was submitted to the DOH Single Joint Research Ethics Board (SJREB) and was issued a certificate of exemption from ethics review (SJREB-2023-12). Prior to the commencement of the FGDs, all participants were provided with informed consent forms. The study objectives, procedures, and participants' rights were explained thoroughly.

RESULTS

Quantitative Findings

TB Case Notification Rate

According to DOH ITIS data, during the pre-COVID-19 pandemic period (March 2019 to February 2020), a total of 3,225 new and relapsed TB cases were reported under the TB-DOTS program in South Cotabato, resulting in a CNR of 334 per 100,000 population. The mean monthly CNR was 27.83 (SD = 5.89). As shown in Table 1, during COVID-19 Year 1 period (March 2020 to February 2021), reported TB cases decreased to 2,110, yielding a CNR of 216 per 100,000 population. This represented a 35.19% decrease in CNR compared to the pre-pandemic period. The mean monthly CNR during this time was 18.00 (SD = 4.71). Subsequently, in the COVID-19 Year 2 period (March 2021 to February 2022), the reported CNR increased to 298 per 100,000 population, a 37.63% increase from COVID-19 Year 1. The mean monthly CNR was 24.75 (SD = 4.97).

A one-way analysis of variance (ANOVA) demonstrated a significant difference in CNR across time periods ($F(2, 33) = 11.16, p = 0.00, \eta^2 = 0.40$). Tukey's HSD post hoc analysis revealed that the mean CNR during the pre-COVID-19 period was significantly higher than in COVID-19 Year 1 ($p < 0.001$). The mean CNR in COVID-19 Year 2 was also significantly higher than in COVID-19 Year 1 ($p = 0.009$). There was no statistically significant difference between the mean CNRs of the pre-COVID-19 and COVID-19 Year 2 periods ($p = 0.329$).

TB Treatment Success Rate

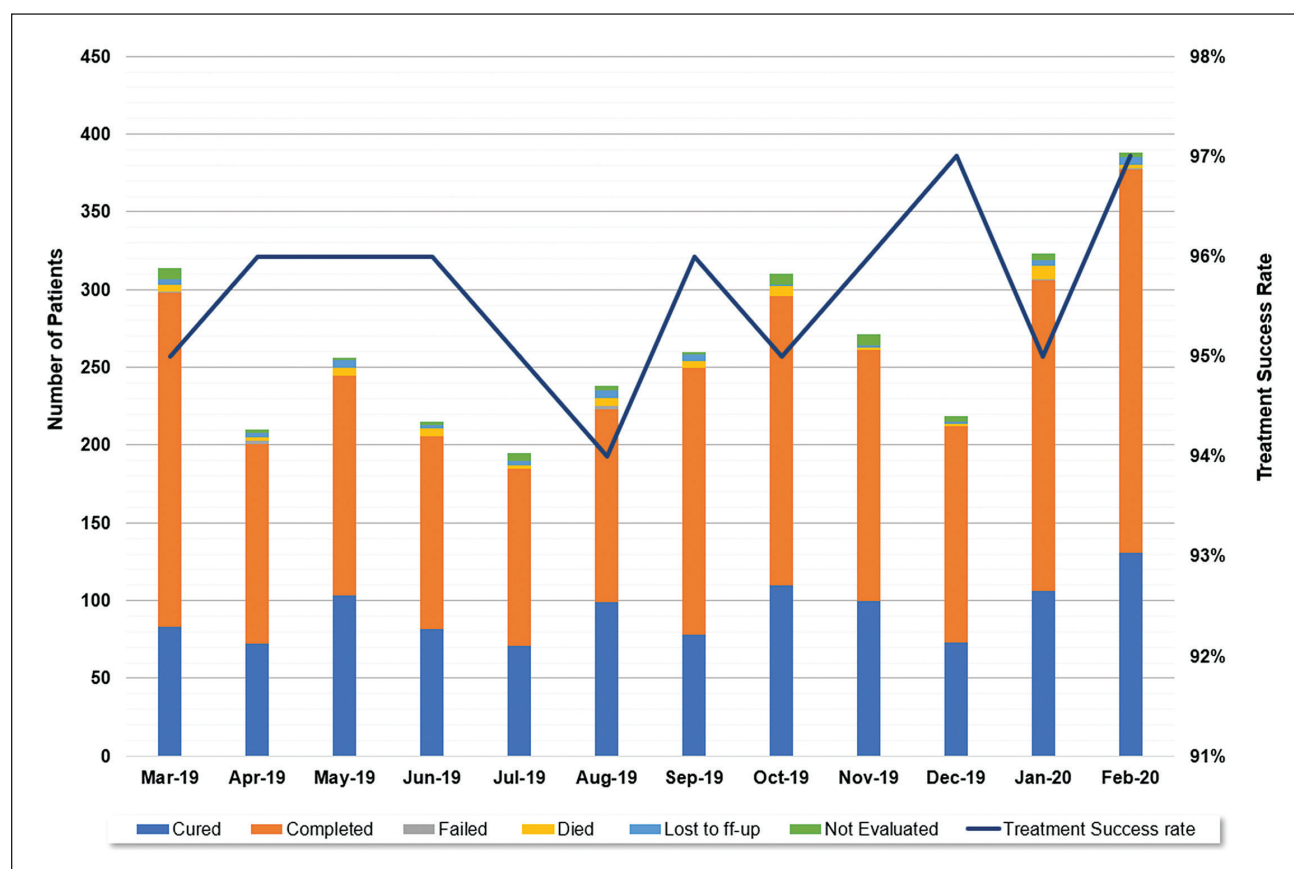
Monthly treatment outcomes were analyzed for cohorts reported in the DOH ITIS from March 2019 to December 2021, with a total treatment success rate (TSR) of 95%. Definitions for each treatment outcome according to the latest DOH NTP Manual Procedures are displayed in Table 2.

Shown in Figure 1, during the pre-COVID-19 period (March 2019 to February 2020 cohorts), the monthly TSR ranged from 94% to 97%. The mean TSR was 96% (SD = 0.01). In the COVID-19 Year 1 period (March 2020 to February 2021 cohorts, Figure 2), the monthly TSR ranged from 90% to 98%. The mean TSR was 93% (SD = 0.02). For the COVID-19 Year 2 period (March 2021 to December 2021 cohorts, Figure 3), the monthly TSR ranged from 91%

Table 1. Monthly Reported TB Cases and Case Notification Rate under TB DOTS in South Cotabato from March 2019 - February 2022

Month	Pre-COVID-19		COVID-19 Year 1		COVID-19 Year 2	
	Reported TB Cases	CNR	Reported TB Cases	CNR	Reported TB Cases	CNR
March	313	32	275	28	336	34
April	212	22	105	11	292	30
May	262	27	166	17	220	23
June	228	23	204	21	227	23
July	198	20	178	18	235	24
August	243	25	188	19	263	27
September	260	27	147	15	167	17
October	318	33	128	13	199	20
November	276	28	154	16	194	20
December	224	23	146	15	223	23
January	327	34	187	19	307	31
February	393	40	232	24	241	25
Total	3255	334	2110	216	2904	298

*CNR = Case notification rate

**Figure 1.** Monthly treatment outcomes and treatment success rates, pre-COVID-19 cohorts (March 2019-February 2020).

to 98% (SD = 0.02). ANOVA revealed a significant difference in TSR across the time periods ($F(2, 31) = 3.616$, $p = 0.039$, $\eta^2 = 0.17$).

Tukey's HSD post hoc analysis showed that the mean TSR during the pre-COVID-19 period was significantly higher than during the COVID-19 Year 1 period ($p = 0.045$). This indicates a decrease in successful treatment outcomes

during the initial phases of the pandemic. There was no sufficient evidence to conclude a statistically significant difference in TSR between pre-COVID-19 and COVID-19 Year 2 periods ($p = 0.118$), nor between the COVID-19 Year 1 and COVID-19 Year 2 periods ($p = 0.936$). This suggests that treatment outcomes improved after the first year of the pandemic.

Table 2. Treatment Outcomes for Drug-sensitive TB (2020 DOH NTP Manual of Procedures, 6th Edition)³⁹

Treatment Outcome	Definition
Cured	Patients with bacteriologically-confirmed TB at the start of treatment and who was smear- or culture-negative in the last month of treatment and on at least one previous occasion in the continuation phase.
Completed	Patients who complete treatment without evidence of failure but with no sputum smear-negative results in the last month of treatment and on at least one previous occasion, either because tests were not done or because results are unavailable. Only includes clinically diagnosed patients who completed treatment.
Failed	- A patient whose sputum smear or culture is positive at five months or later during treatment. - Treatment terminated because of evidence of additional acquired resistance (e.g., RIF resistance on Xpert at 2nd month). - A patient for whom follow-up sputum examination was not done (e.g., child or extrapulmonary TB) and who does not show clinical improvement anytime during treatment. - Severe uncontrolled adverse drug reaction
Died	A patient who dies for any reason during the course of treatment.
Lost to follow-up (LTFU)	- A patient whose treatment was interrupted for at least two consecutive months. - A patient diagnosed with active TB but was not started on treatment (i.e., initial LTFU).
Not evaluated	A patient for whom no treatment outcome is assigned. This includes patients transferred to another facility for continuation of treatment but the final outcome was not determined.

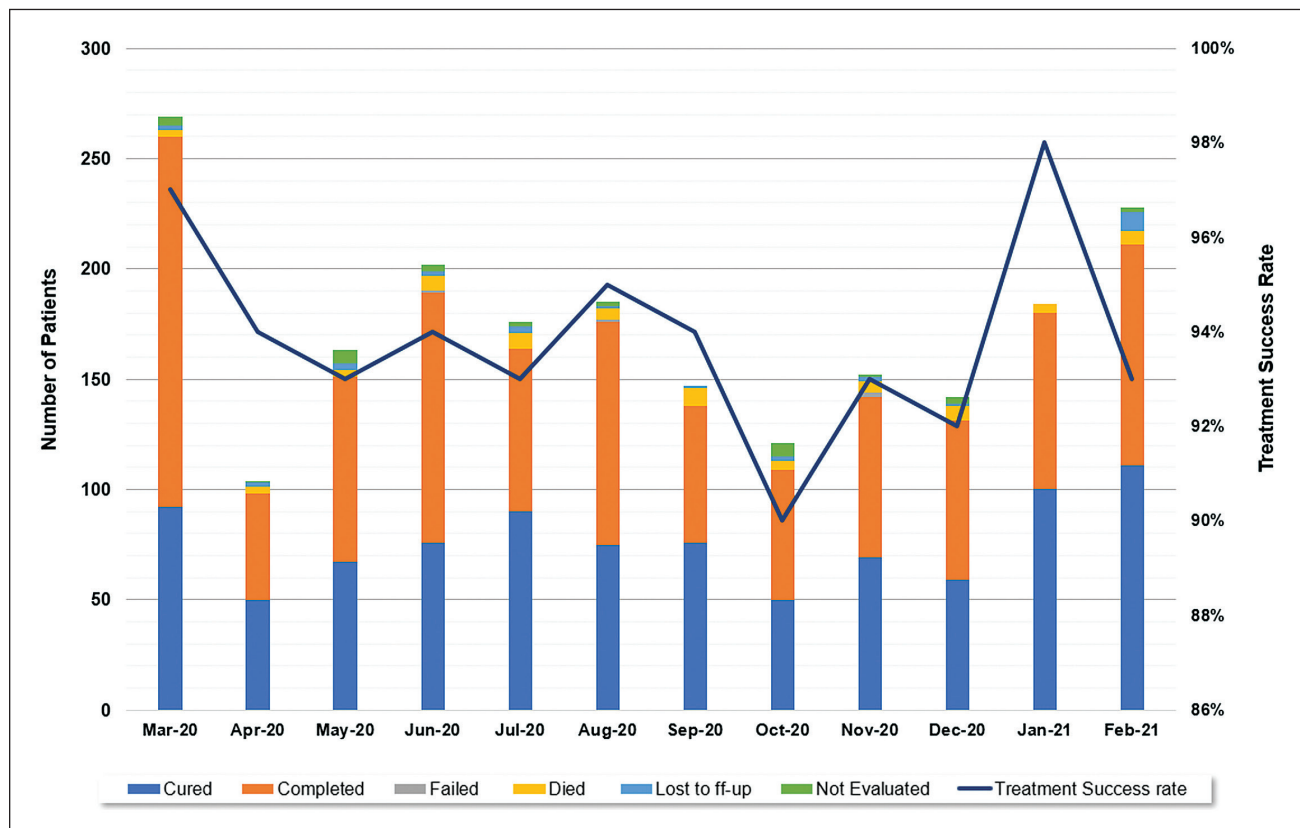


Figure 2. Monthly treatment outcomes and treatment success rates, COVID-19 Year 1 cohorts (March 2020-February 2021).

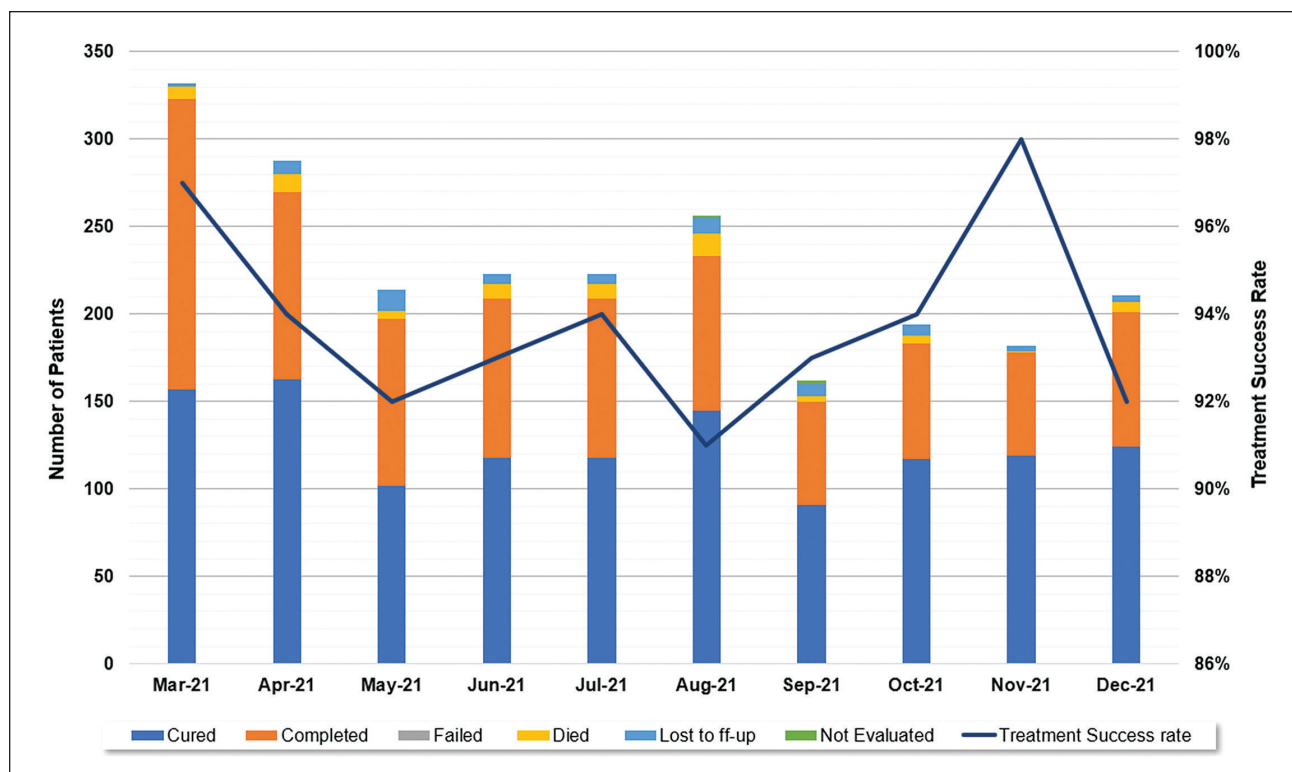


Figure 3. Monthly treatment outcomes and treatment success rates, COVID-19 Year 2 cohorts (March-December 2021).

Qualitative Findings

Challenges on TB-DOTS Services

Focus group discussions among participants identified challenges in implementing TB-DOTS services during the COVID-19 pandemic in the province. The study identified twelve key difficulties: six pre-existing barriers and six emerging challenges (Figure 4). Pre-existing barriers were problems determined by participants as occurring prior to COVID-19 pandemic but continued to affect NTP implementation throughout the early pandemic period. These were: (1) financial, (2) geographical, (3) behavioral, (4) social, (5) logistical, and (6) health workforce.

In contrast, emerging challenges were recognized by participants as difficulties introduced during the COVID-19 pandemic and exacerbated existing problems. These were: (1) reallocation of services, (2) movement restriction, (3) additional protocols, (4) reporting delays, (5) fears among patients, and (6) fears among health workers. The subsequent sections describe these challenges experienced by the FGD participants in detail.

Pre-existing Barriers

Financial

Majority of participants emphasized the financial capabilities of constituents as a significant barrier on the access to TB-DOTS services in South Cotabato even before

and especially during the COVID-19 pandemic. According to them, many constituents prioritize their work over seeking care due to financial constraints. Laboratory fees for blood chemistry and x-rays were unaffordable for some patients, causing diagnostic and treatment delays.

"If I ask them to consult at the BHS, they will tell me that they have work. If we will not work, we will not be able to eat. Our children will not have allowances and rice [for school], that's what they would say to us." (P5, BHW)

A nurse added:

"One of the challenges in our municipality is before we start treatment, we request patients to have a blood chemistry. However, not all patients can afford to pay these laboratory fees. Instead of having a timely TB treatment, their treatment becomes delayed because they would look for money first to pay for the blood chemistry." (P5, Nurse)

Nurses shared that financial barriers among patients would result in diagnostic delays, and ultimately in treatment delays. These delays were worsened during the start of the COVID-19 pandemic due to the additional infection prevention and control (IPC) measures that were implemented, such as COVID-19 antigen or RT-PCR testing TB diagnostic procedures.

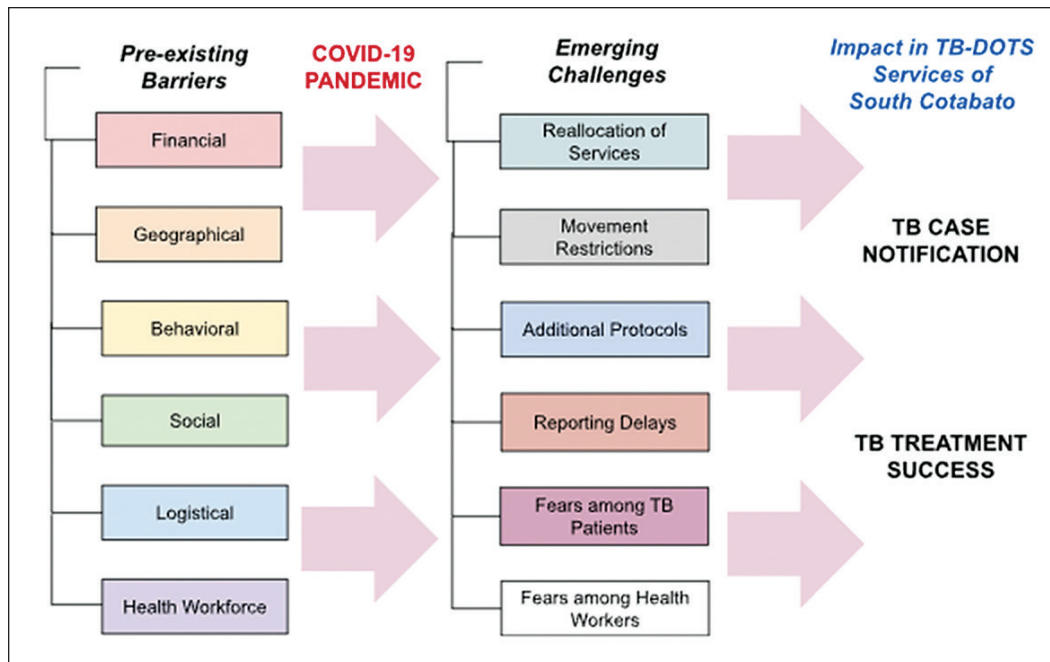


Figure 4. Pre-existing barriers and emerging challenges affecting TB-DOTS services in South Cotabato during COVID-19 pandemic.

Geographical

FGD participants highlighted that one of the challenges on the access to TB-DOTS service before and during the COVID-19 pandemic is due to the geographical location of certain barangays in South Cotabato. Geographically isolated and disadvantaged areas (GIDAs) in the province made it difficult for patients to reach clinics and for health workers to conduct follow-ups, leading to diagnostic and treatment delays. A nurse participant stated:

"Because our municipality has GIDAs, those that are hard to reach, sometimes we can catch them [presumptive TB patients] after one week [of having TB symptoms]. It is hard for them to go to the [rural health unit] RHU to submit requirements, like submission of specimen. That is why their treatment is delayed. Sometimes, they can't be reached [by our TB services] at all because they don't have time and it's difficult for them to go to the nearest RHU." (P3, Nurse)

During the emergence of COVID-19 pandemic, the use of telecommunication platforms was utilized to address service delivery difficulties, especially in far-flung areas, due to border restrictions and lack of public transportation. However, mobile signals in GIDAs have been very limited, if not absent.

Behavioral

Participants also highlighted poor health-seeking behavior as one of the major challenges on the provision of TB-DOTS services in the province of South Cotabato,

before and during the COVID-19 pandemic. As one of the BHWs expressed:

"What I experienced is that patients have different attitudes [towards seeking care]. Some patients are lazy to go to the health center. They would not complete the six months [of TB treatment], even if they have been coughing continuously." (P6, BHW)

Poor health-seeking behavior, where patients delay seeking care until symptoms worsen, was more challenging during COVID-19 pandemic due to fears among patients and additional protocols brought by the crisis. Participants reported that this adversely affected TB-DOTS services, from consultation, diagnosis, and even up to treatment.

Social

Stigma associated with TB discouraged patients from seeking care and disclosing their condition, hindering case identification. This has been identified by FGD participants as a major challenge before and during the COVID-19 pandemic. A BHW participant explained:

"Patients are reluctant to know their condition because they are shy that the people around would know that they have TB. Because the people understand that TB is contagious, they would say that 'That person has TB, and should be separated'. Some people would say that 'TB patients are scary, and we should not get close to them', because they believe that TB can be transmitted easily. Sometimes, we just must explain to them what is right because there are some people in the community

that would say, 'That person has TB, that person is dangerous!'" (P2, BHW)

This social stigma against presumptive and TB patients in the community discouraged them from seeking medical care.

Logistical

Shortages of medicine and supplies like stains and sputum cups caused diagnostic and treatment delays before and during COVID-19 pandemic. A nurse noted:

"What we experienced before the pandemic is that we have more patients, and that all of them would avail [of our services]. So, our problem is usually with our supply of medicines. There was a time that for almost a month, we did not have a supply [of TB drugs]." (P10, Nurse)

An NTP Coordinator added:

"During the first year of the pandemic, there was really no supply of [TB] drugs. We expected that the drugs will be delivered by land, that is why we experienced stock-out. That's why our case finding stopped as well, because why will we find TB cases if we don't have medicines." (P4, NTP Coordinator)

Medicine shortages worsened during the COVID-19 pandemic. Participants reported this directly resulted in treatment delays, and indirectly resulted in diagnostic delays as TB-DOTS facilities slowed down their active case findings, because they have no TB drugs to give to diagnosed patients.

Health Workforce

Many participants shared that inadequate human resources for health is one of the major gaps that TB-DOTS services in South Cotabato have been facing before, and most especially during the COVID-19 pandemic. A chronic lack of healthcare workers, particularly nurses juggling multiple programs, resulted in increased workloads and limited time for focused TB care, contributing to diagnostic and treatment delays and lost to follow-up cases. A nurse described the situation:

"I am the only nurse [in our rural health unit]. Because I handle different programs, it is difficult to focus on one. Hence, I cannot immediately facilitate the requirements needed for a patient's treatment to start. For example, the doctor has ordered [to start a patient's treatment] now, and I am out [of the RHU] because of clinics and seminars, the tendency is that the patient will not go back [to the RHU] to start treatment." (P6, Nurse)

A nurse added that:

"We, the nurses and midwives assigned to different barangays, admit that we cannot focus in our barangay

because we would also go on duty at the isolation [facility], hence we cannot monitor them [our TB patients]. I can say that TB [program] is always being left out. We may have the master list [of TB patients], there are times that we cannot follow them up. This resulted in cases of lost to follow-up, especially during the pandemic." (P1, Nurse)

Furthermore, FGD participants shared that the additional workload brought by the COVID-19 pandemic caused fatigue among the health workers.

Emerging Challenges

Reallocation of Services

Participants revealed that TB-DOTS centers were converted into COVID-19 testing facilities, which resulted in the delay of TB diagnostic services and consequently, delay in TB case finding in the region. An NTP Coordinator shared:

"Pre-pandemic, the case finding diagnostics of the region was about to take off. Then here comes COVID-19, our TB center which performs GeneXpert was converted to a COVID-19 testing facility." (P1, NTP Coordinator)

Additionally, medical technologists were reassigned to perform COVID-19 testing, which resulted in staff shortage for TB services.

Movement Restriction

FGD participants reported that movement restrictions were a significant challenge in the provision of TB-DOTS services in the province during the pandemic. Lockdowns and limited public transportation hindered patients' access to TB centers and health workers' ability to conduct monitoring visits, leading to treatment non-compliance and interruptions. A nurse participant stated:

"Additional [challenge] during pandemic is the compliance of the patients with the medicine because there's a lockdown, especially in our municipality where vehicles are very limited. Those from the mountains cannot pass because of the lockdown on certain barangays. Their tendency is that they stopped taking medicines." (P4, Nurse)

In addition, non-compliance with medications and interrupted treatment raised concerns among participants regarding the development of drug-resistant TB.

Additional Protocols

The WHO recommended the use of COVID-19 screening protocols for presumptive TB patients during the pandemic to reduce the risk of COVID-19 transmission in health facilities.⁴⁰ Participants expressed that requirements for COVID-19 testing (antigen or RT-PCR) prior to TB

diagnostic procedures like GeneXpert added financial burden on patients and delayed diagnosis. A medical technologist noted:

"TB patients should be negative for [COVID-19] antigen before they will be screened for GeneXpert." (P1, NTP coordinator).

Furthermore, participants shared that performing this extra protocol added to the workload of healthcare workers in South Cotabato.

Reporting Delays

Another significant challenge mentioned in the FGDs during the COVID-19 pandemic was reporting delays. Difficulties in encoding and reporting due to pandemic-related disruptions led to delays in consolidating reports, impacting the timely provision of supplies. A medical technologist highlighted:

"Reporting was low during [the start of] COVID-19 pandemic, until after a year. It is a problem. Because if there is no report, there will also be no supplies because the provision of the supplies is based on the report. If we encounter problems when it comes to encoding and reporting, the regions and the province will also have difficulties in consolidating reports." (P1, Medical Technologist)

Fears among Patients

Participants reported COVID-19-related fears among TB patients, which also hindered the continuous provision of TB-DOTS services in the province. Patients were hesitant to seek care or submit specimens for testing due to fear of contracting COVID-19 or being subjected to quarantine. An NTP Coordinator shared:

"The submission [of sputum] declined because of the fear of the people submitting themselves to TB testing because they are afraid that they will turn out positive with COVID." (NTP Laboratory Coordinator, P3)

Fears among Healthcare Workers

FGD participants revealed that fear of COVID-19 further contributed to challenges in TB-DOTS services. Health workers feared contracting COVID-19 from patients, especially those with respiratory symptoms like cough and were hesitant to collect sputum samples, impacting case detection and follow-up. A BHW confessed:

"You just can't ask for their specimen easily because as a health worker, you also fear catching COVID virus [from patients with] cough of more than 2 weeks. For me, I am also worried to collect the patient's sputum because the patient might turn out to have COVID, you just wouldn't know." (P2, BHW)

Interventions Implemented by TB-DOTS South Cotabato

The initial decrease in CNR and TSR during COVID-19 Year 1 is directly linked to the impact of these emerging challenges and the aggravation of pre-existing barriers in the local health system. The disruptions to healthcare services, reduced access, delays in diagnosis and treatment, and fears among both patients and staff collectively contributed to these negative outcomes.

To further understand the subsequent improvement in CNR and TSR in COVID-19 Year 2, FGD participants were asked to describe various interventions implemented by South Cotabato's TB-DOTS services to adapt and ensure continuity of care. Interventions were then organized according to the different health systems building blocks outlined by WHO (Table 3).

Service Delivery

Participants shared that health education activities, including house-to-house visits, radio programs, and family counseling, were conducted by frontliners to improve health-seeking behavior and address stigma.

"We, as BHWs, educate the people to not be afraid or reluctant to have consultation. We explain to them that we should immediately manage whatever their symptoms are. We also conduct meetings to educate them. So that they will at least be encouraged to undergo consultation." (P9, BHW)

"In our municipality, we have a radio program to intensify our [TB] program. With the help of other healthcare workers, [we utilize this platform] to promote different programs, not only TB program. In fairness, the community was able to absorb that if they have symptoms, they will submit themselves to our RHU." (P6, Nurse)

"We would require our patient to bring a family member so that the family would understand the situation of our patient. With that, our assistance to the family is much easier." (P7, Nurse)

BHWs also served as TB treatment partners, directly monitoring medication adherence. In addition, collecting sputum at the household level was implemented to overcome financial and geographical barriers and movement restrictions.

"We are their treatment partners. We check how they take their medication until completion. We also inform them of their sputum monitoring schedule." (P4, BHW)

"If there is a patient in our area of responsibility who does not follow-up, we will go to that patient. Because there are patients who are financially poor, we will instead go to their houses and collect sputum. We would put the sputum cups inside an ice box, then we

Table 3. Interventions implemented and challenges addressed according to health systems building blocks

Building Block	Intervention	Challenges Addressed
Service Delivery	Health education	Behavioral barrier Social barrier Fears among patients
	BHW as treatment partners	Behavioral barrier
	Strengthening community-based services (including home-based treatment)	Financial barrier Geographical barrier Movement restrictions
Health Workforce	Infection prevention and control (IPC) measures	Fears among healthcare workers
Health Information Systems	Telecommunication and online platforms	Reporting delays Movement restrictions
Access to Essential Medicines	Resource pooling	Logistical barrier
	Adjustments in medication dispensing	Movement restrictions
Financing	Incentivization of BHWs	Health workforce barrier
Leadership and Governance	Coordination with BLGUs	Geographical barrier Movement restriction
	Local policies	Additional protocols Reallocation of services Movement restrictions

BLGUs – barangay local government units

bring it to our barangay health station (BHS) to smear.” (P2, BHW)

“During our field visits, many patients would turn out positive on [mobile] x-ray, hence they will be required to submit their sputum. What we do is that we will collect their sputum on site, so that the patient would be safe [from COVID-19 infection] and would not need to go to the RHU. We will bring their specimen and submit it at the RHU for GeneXpert.” (P1, Medical Technologist).

Health Workforce

According to FGD participants, the implementation of infection prevention and control measures and provision of personal protective equipment (PPE) helped alleviate fears among healthcare workers, enabling them to continue providing diagnostic services.

“We sacrifice ourselves, even though it is very uncomfortable, we wear our PPE so that we can face our patients. At the same time, we also built a glass box so that all sputum [collection] for GeneXpert will be collected inside. This is to at least prevent our technician from exposure to COVID-19, if ever a patient turns out positive.” (P10, Nurse)

Participants shared that these interventions boosted health workers' confidence on handling symptomatic patients especially during the COVID-19 pandemic, ensuring continuous provision of diagnostic services among presumptive TB patients in South Cotabato.

Health Information Systems

Participants noted that the COVID-19 pandemic adversely affected the timely reporting and cascade of training and orientation on new policies brought by government restrictions. In response, frontline healthcare workers utilized different telecommunication and online platforms for reporting, information dissemination, and remote consultations (telemedicine), mitigating reporting delays and restrictions in movement.

“Our training, mentoring, and orientation were also affected. But despite that, we were still able to cascade policies through online orientations.” (P4, NTP Coordinator)

“We created a group chat for medical technologists. At the same time, our nurse also has another group chat for announcements. Communication is faster through that.” (P1, Medical Technologist)

Access to Essential Medicines

To address medicine and logistical shortages, healthcare workers practiced resource pooling among RHUs as a short-term solution to continue provision of TB diagnosis and treatment services. Participants revealed that this has been their practice even before the COVID-19 pandemic; borrowed supplies are returned to the lending RHU once their allocations arrive.

“Another thing that we do [to address medicine and logistical shortages] is that we borrow from other RHU.” (P10, Nurse)

To ensure continuous access to TB drugs during the COVID-19 pandemic and address movement restrictions, adjustments in dispensing medications were done by providing patients with longer supplies of drugs (e.g., 15 days to 1-2 months) instead of weekly doses. An NTP Coordinator stated:

"There were some adjustments during the COVID-19 pandemic. For example, one week's worth of medicine was given to a patient before, now we provide them with a one- to two-month supply. So that, if ever a patient is quarantined, the patient will have enough supply of medicines. The patient will also not be affected if the health workers are quarantined as well." (P4, NTP Coordinator)

Financing

Incentives were provided to BHWs to recognize their crucial role and motivate their continued service in TB-DOTS even during the pandemic. A nurse mentioned:

"Our BHWs are given incentives yearly. This is to somewhat inspire them so that they will continue to work for TB-DOTS." (P7, Nurse)

"For every successful treatment of their treatment partner, we give the BHW an amount of 500 pesos. If the BHW won't be able to complete the required schedule of monitoring, we lessen their incentive." (P2, Nurse)

Leadership and Governance

According to participants, to address the challenges brought by geographical barriers, coordination with the barangay local government units (BLGUs) provided support such as transportation assistance and equipment for reaching remote areas. This is to ensure that TB patients in far flung communities are being monitored.

"We request a vehicle from our barangay [council] so that we can help [our patients]." (P8, BHW)

"We ask for help in our [barangay] council if they can provide us with digital weighing scale that we can bring with us when we go to our purok and sitio; so that we can also monitor the patient's weight when we give them their [TB] drugs." (P2, BHW)

Local policies were also adjusted, such as lifting the mandatory COVID-19 antigen testing requirement before TB testing and reallocating GeneXpert machines back to TB diagnostics (DOH Department Memorandum No. 2021-0296).⁴¹

"During the second year of the pandemic, the policy on antigen testing [required prior to TB testing] was removed." (P4, NTP Coordinator)

"In the TB center which was converted [to COVID-19 testing], two machines were designated back [for TB], to cater TB patients. So now, they have two GeneXpert machines for COVID-19, and the other two are being used for GeneXpert diagnosis." (P3, NTP Coordinator)

Furthermore, some LGUs in South Cotabato implemented clustering during lockdowns to facilitate access to essential services, including medical consultation. A nurse described:

"Our LGU implemented clustering. Back when there were still lockdowns, they created four clusters. If it is a cluster's schedule to go out, they can start treatment, if they are willing to go to our TB-DOTS. We were able to address their needs [despite the lockdown]." (P10, Nurse)

DISCUSSION

The study explored TB cases under the TB-DOTS program of South Cotabato province during the pre-COVID-19 period and the first two years of the COVID-19 pandemic. To date, this is the first to report specific experiences and valuable insights from the SOCCSKSARGEN Region using mixed methods in relation to NTP implementation and COVID-19 pandemic adaptation.

Relevant studies conducted during the early period of the COVID-19 pandemic reported that the COVID-19 pandemic could cause substantial disruptions to healthcare, including TB control services.^{3,42,43} In this study, analysis of data from the DOH ITIS showed a decrease in TB CNR during COVID-19 Year 1, specifically from March 2020 to February 2021, compared to the pre-COVID-19 period (March 2019 to February 2020) in South Cotabato. Specifically, the total reported new and relapse TB cases dropped from 3,225 (CNR of 334 per 100,000 population) in the pre-COVID-19 period to 2,110 (CNR of 216) in COVID-19 Year 1, representing a 35.19% decrease. This finding aligns with global observations that the COVID-19 pandemic disrupted TB control programs, leading to a decrease in detected cases in high-burden countries like the Philippines.²

The decline in CNR and TSR during the initial phase of the pandemic was attributed to a combination of pre-existing barriers and new challenges introduced by the COVID-19 pandemic. Following the presidential declaration of a national state of public health emergency in early March 2020, the governor of South Cotabato province directed all component LGUs and government offices to adopt stricter measures and guidelines to prevent and control COVID-19 transmission in communities (Executive Order No. 15, 2020).⁴⁴ Subsequently, the national declaration of a state of calamity prompted the provincial LGU to adopt a pre-emptive lockdown in the entire South Cotabato (Executive

Order No. 17, s. 2020) and enhanced community quarantine (Executive Order No. 18, s. 2020), which imposed border restrictions, curfews, and drastically limited transportation in the area.^{45,46} The spike of COVID-19 cases in August 2020 later drove the provincial government to prohibit the entry of non-South Cotabato residents (Executive Order No. 52, s. 2020).⁴⁷ These prevented patients from accessing TB-DOTS centers for diagnosis, treatment, as well as follow-up, and hindered health workers from reaching communities and facilities, reflecting similar experiences in other Philippine areas such as Metro Manila, Cebu, Negros Oriental; Davao City; and Surigao del Norte.^{22,48,49}

In 114 RHUs that submitted data to DOH, the median number of consultations for TB-DOTS decreased during the second quarter of 2020 and did not improve for the rest of the year.⁵⁰ Crowder et al. analyzed the daily counts of CNR from all health facilities implementing NTP before and after the community quarantine covering the first year of COVID-19 pandemic (January-December 2020), and found that all regions in the Philippines experienced a steep immediate decline in the first month of community quarantine implementation, followed by a moderate increase after one month and a plateau two months post-implementation.⁵¹

Meanwhile, geographical barriers, particularly residence in GIDAs, also led to delays in TB diagnosis and treatment. Difficulty reaching health facilities hindered patient access and health workers' ability to monitor patients before and during the COVID-19 period. While telemedicine use was reportedly explored by health workers during the pandemic, limited mobile signals in GIDAs posed a further challenge. This situation is similar to the study conducted in a mountainous province in China, where distance between patients' residences and healthcare facilities significantly impacted delays in seeking TB diagnosis and treatment, resulting in delays in accessing care.⁵² Enhancing transportation infrastructure and expanding healthcare services in remote areas can enable timely access to TB diagnosis and treatment.⁵² Similar findings were observed in Ethiopia where transportation shortage affected both patients and health care workers resulting to delays in seeking care.⁵³ This study further confirms the impact of geographical distance on delays in seeking TB diagnosis and treatment during the COVID-19 period.

Additionally, the COVID-19 pandemic has disrupted the delivery of essential health services including TB because of the repurposing of health facilities and staff for COVID-19 response.⁵⁴ Lasco and San Pedro described this conversion and shift of resources as "covidization" of health care.⁵⁵ During the early pandemic period, DOH released Department Circular No. 2020-0187 (April 2020) and Department Memorandum No. 2020-0376 (August 2020) which repurposed TB-DOTS centers and GeneXpert machines for COVID-19 testing, and reassigned medical technologists as swabbers and testers.^{28,56} Similarly, the Provincial Government of South Cotabato (April 2020)

through the Joint Regional Inter-Agency Task Force for the Management of Emerging Infectious Diseases 12, Regional Task Force on COVID-19, and Management of the Dead and Missing (MDM) Cluster, requested the Philippine Business for Social Progress (PBSP) to allow usage of one out of three GeneXpert machines for TB-DOTS for COVID-19 testing.⁵⁷ This shift drastically delayed TB diagnostic services and case finding at the local level.

Pre-existing inadequacy of human resources in South Cotabato, particularly nurses handling multiple programs, also made it difficult to focus on TB-DOTS services, echoing the pandemic experience of TB-DOTS nurses in Davao City.⁴⁸ The pandemic exacerbated this by reassigning staff to COVID-19 duties and isolation facilities, further straining the workforce and contributing to lost follow-up cases.^{3,6,22} Moreover, shortage of healthcare workers trained in TB care results in increased workloads for healthcare providers which led to limited time for patient care, decreased counseling and support services, and compromised quality of care.⁵⁸ Therefore, the COVID-19 pandemic had a significant impact on the delivery of various tuberculosis prevention, surveillance, and treatment programs, leading to excess workload and decreased human resources for routine TB activities.⁵⁹ This highlights the importance of developing strategies to ensure continuity of TB services during pandemic.²³

The WHO recommended the use of COVID-19 screening protocols for patients with suspected TB during the pandemic to reduce the risk of COVID-19 transmission in health facilities.² Consequently, DOH adopted mandatory COVID-19 testing (antigen or RT-PCR) for presumptive TB patients, which, as seen in the experiences of the study participants, created extra workload for health workers and financial burdens for patients leading to significant delays in diagnostics and treatment.¹⁹ Pre-pandemic, financial limitations were already identified as the primary obstacle to care affecting both TB and MDR-TB patients particularly those from ethnic minorities and rural areas; literature supports the strong link between poverty and TB prevalence and access to care.⁶⁰

According to FGD participants, fears of contracting COVID-19 at health facilities or being quarantined have discouraged presumptive TB patients from seeking care and submitting specimens. In addition, frontline health workers in this study mentioned patients' poor health-seeking behavior such as delaying consultation until symptoms worsened or reluctance to complete treatment as a challenge before and during the pandemic. This behavior is influenced by factors like ambiguous symptoms and perceived links between TB and lifestyle, which collectively discourages individuals with TB symptoms from seeking care, and the perception that going to public places like hospitals or health facilities could lead to COVID-19.^{61,62}

Social stigma associated with TB also hindered patients in South Cotabato from seeking timely care even before the pandemic. The perception that TB patients are contagious and

dangerous contributed to hesitancy in visiting health centers. Stigma is widely documented as a barrier to timely TB care and leads to delayed healthcare-seeking and psychological distress, and persistent social stigma among patients and their families hindering effective case identification and treatment.⁶³ Further, stigma collectively discourage individuals with TB symptoms from seeking care, as they consider the potential health, social, and financial implications of having TB and seeking or avoiding treatment.⁶⁴ Thus, policymakers are advised to enhance initiatives targeting the identification and resolution of the underlying issues that give rise to stigma.⁶⁵

On the other hand, frontline healthcare workers also experienced fears of exposure to COVID-19 from symptomatic patients, making them hesitant to collect specimens or conduct follow-ups, adding to workforce challenges by reducing available staff for direct patient interaction.⁶⁶ It is important to address this barrier from the side of the patients and health workers to ensure continuity of TB care.

Logistical challenges, including shortages of medicines and supplies like stains and sputum cups have caused diagnostic and treatment delays before and worsened during the COVID-19 pandemic. Medicine shortages were aggravated during the COVID-19 pandemic resulting in treatment delays, and indirectly resulted in diagnostic delays as TB-DOTS facilities slowed down their active case findings due to unavailability of TB drugs for diagnosed patients. It has been noted that even before pandemic, TB drugs procured by the DOH Central Office from India encountered delays. The Philippines was also not prioritized for allocation of TB medicines by the World Health Organization due to the higher number of TB cases from other countries like China and India.⁶⁷ Frequent stock-outs of TB medicines remain as the major challenge in treating and prevention of TB. Moreover, it was noted that the country's reliance on domestic procurement tends to be more vulnerable to stock-outs due to inadequate financing, delayed disbursement of funds, procurement delays, and poor supplier management.⁶⁸

Difficulties in data encoding by frontline health workers led to delays in reporting. Since supply distributions were based on reports, these delays consequently impacted the timely provision of supplies.²⁴ Disruptions in TB surveillance and reporting systems during the pandemic have been documented in several countries, emphasizing the need for effective surveillance and reporting systems to ensure that TB services continue to operate during a pandemic. In South Africa, prioritization of funding and mobilization of resources is required which helps strengthen TB control strategies against the disruptions of COVID-19 pandemic. Additionally, reporting systems set up should be expanded and should include TB and generate public engagement with the burden of TB.⁶⁹

The observed recovery in CNR and TSR after the initial year of disruption suggests that the various interventions implemented in South Cotabato province, aligned with different health systems building blocks, were deemed

effective in mitigating the adverse impact of the COVID-19 pandemic and addressing both pre-existing and emerging challenges. Local data indicated a subsequent increase in CNR during COVID-19 Year 2 (March 2021 to February 2022), with South Cotabato reaching 2,904 reported cases (CNR of 298), a 37.63% increase from COVID-19 Year 1. While the CNR in COVID-19 Year 2 was significantly higher than in Year 1, it was not statistically different from the pre-COVID-19 period. While this suggests a recovery in case notification rates after the initial shock of the pandemic, monthly notifications were statistically non-significant compared to pre-pandemic periods. The catch-up, externally driven by 2018 UN General Assembly High-level Meeting on TB targets, led to the belated issuance of DOH Department Memorandum No. 2021-0296⁴¹ in June 2021, which directed the revert to exclusive TB testing and co-sharing of TB and COVID-19 of specific laboratories within the NTP network.

The finding that TSR in COVID-19 Year 1 was significantly lower than that of the pre-COVID-19 period was already expected. Movement restrictions brought by national and local policies further contributed to non-compliance and treatment interruptions, which were already challenging for patients prior to the pandemic. The average TSR was 96% in the pre-COVID-19 period and decreased to 93% in COVID-19 Year 1. This indicates a decreased number of completed and cured outcomes among patients diagnosed during the first year of the pandemic. Similar to CNR, the TSR showed improvement in COVID-19 Year 2, becoming statistically comparable to the pre-COVID-19 period. This suggests an increase in completed and cured outcomes in the second year of the public health emergency in the province. However, no significant difference in TSR was observed between pre-COVID-19 and COVID-19 Year 2, as well as COVID-19 Year 1 and Year 2.

Various interventions implemented by South Cotabato such as health education activities, strengthening community-based services, infection prevention and control measures, utilization of telemedicine and online platforms, medication dispensing adjustments, and coordination with LGUs were aligned with the National TB Control Program Adaptive Plan.¹⁹ These interventions seem to have the most impact in improving local TB indicators because they target multiple, interconnected challenges in the health system. Resource pooling was noted as a local initiative which was vital in ensuring continuous provision of medicines and supplies among different TB-DOTS centers in the province. Another local initiative was the provision of incentives for BHWs which ensured they stay committed even during the COVID-19 pandemic.

Continuous health education activities, including house-to-house visits, meetings, radio programs, and family counseling, were conducted to educate the community, address poor health-seeking behavior, stigma, and encourage consultations. Literature highlights the importance of knowledge and family involvement in promoting attitudes

and health-seeking for TB.⁷⁰⁻⁷² BHWs served as crucial treatment partners, providing education and monitoring adherence, often through home visits. The vital role of BHWs in patient support, education, and community engagement helps in the improvement of TB outcomes due to their close relationships with community members, enabling them to deliver culturally appropriate messages and interventions to enhance community understanding and support.³⁰

To overcome financial, geographical, and movement restrictions, services like sputum collection, mobile x-ray, and drug delivery were brought closer to patients at the barangay and household levels. This shift towards strengthened community-based services is consistent with recommendations to ensure timely diagnosis and flexible treatment options during the pandemic.⁷³

In accordance with various national guidelines (such as DILG Memorandum Circular No. 2020-062; DOH Administrative Order No. 2020-0015, 2020-0056, 2021-0043), the implementation of IPC measures, including providing PPEs and creating glass booths for specimen collection, increased health workers' confidence in handling symptomatic patients and ensured the continuity of diagnostic services.⁷⁴⁻⁷⁶ This directly addressed documented fears among health workers regarding COVID-19 exposure from TB patients. However, the risks of acquiring COVID-19 are more associated with the organization and preparedness of health facilities rather than healthcare workers themselves.⁷⁷ Provision of appropriate PPE and adherence to IPC measures should be standard protocol.

As reported by participants, utilization of telecommunications and online platforms for training, orientations, information dissemination, telemedicine consultations, and online reporting helped mitigate issues caused by movement restrictions and reporting delays during the COVID-19 pandemic. Although this has emerged even before the pandemic as a way for healthcare to be more accessible for all, the increase in usage only began during the pandemic which has been noted as a catalyst for the modernization of healthcare.⁷⁸ It was also observed that while Filipinos' use of telemedicine consultation as an alternative to receiving care during the pandemic was driven by concerns of safety, convenience, accessibility, affordability, and privacy, patients were generally satisfied with the experience.⁷⁹ Meanwhile, another Philippine study showed a high level of acceptance for the use of digital adherence technology in differentiated TB care; however, inconsistencies were experienced by some of its users, emphasizing the importance of comprehensive training on DAT for health care workers to enhance intervention effectiveness.⁸⁰ Particularly for remote areas with limited access to internet and technology, continued use of telecommunications and online platforms beyond COVID-19 will require further national and LGU investments in infrastructure and equipment.⁸⁰

During the COVID-19 pandemic, as a practical, short-term solution to medicine and logistical shortages, TB-

DOTS facilities in South Cotabato coordinated to pool available TB resources from rural health units to ensure continuous provision of TB diagnosis and treatment services, only to be returned to the lending RHU once the allocated supplies arrive. Patients were provided with larger supplies of medication, up to 1-2 months, instead of weekly doses to ensure treatment continuity despite lockdowns and quarantine. This strategy aligns with the adaptation of the Philippines to dispense larger medication supplies and utilize home delivery.¹⁹ However, problems in the adequacy of TB drugs have already been existing prior to the COVID-19 pandemic. The Commission on Audit (COA) has also flagged DOH for four consecutive years (2020 to 2023) for nearly expired and expired medicines/commodities due to deficient procurement planning, poor distribution and monitoring systems, and weaknesses in internal control.⁸¹⁻⁸⁴ Although the DOH Devolution Transition Plan (2022-2024) indicates that all medicines under the National TB Control Program will be retained and continuously procured by DOH Central Office, lessons from the COVID-19 pandemic should push LGUs to adopt a more proactive approach of stockpiling and diversifying sources/funding of TB medicines and other drugs heavily reliant on DOH sourcing.⁸⁵

Providing incentives to BHWs served as a recognition of their service and encouraged their continued commitment to their work in TB-DOTS. It has been noted in a study that the provision of incentives such as financial assistance, appropriate personal protective equipment, and ample workforce motivated health workers to increase their contributions during times of pandemic.⁸⁶ This was also documented in the Philippines, where financial and non-financial incentives and adequate provision of support and resources contribute as a motivating factor to seek and sustain BHW roles.⁸⁷

Coordinating with the BLGUs was vital for reaching isolated communities, accessing transportation, and supporting monitoring efforts. Empowering local leaders and ensuring accessible transportation to health centers are recognized as important for effective TB service delivery, emphasizing the significant role of local leaders as frontline policymakers and service providers in TB prevention and control programs.^{88,89}

Policy adjustments initially released during the COVID-19 pandemic underscore the need for government flexibility during public health emergencies and other disasters. Nevertheless, the Philippine pandemic experience exposed insufficient capacities and resources for health particularly at the local level. Unlike other countries, the country was considered ill-prepared in mitigating its effects, observed in the implementation of early and long drawn national lockdowns while local capacities were still being strengthened by incremental policy adjustments.⁹⁰ The National TB Program proved to be invaluable for the COVID-19 response because of its decades' long experiences in infection control, technical capacities, and infrastructure embedded within the Philippine health care system. However, DOH policies during the early pandemic (such as Department Circular No. 2020-

0187, Department Memorandum No. 2020-0376) which directed TB-DOTS centers and NTP laboratory networks to shift its resources and assist in the COVID-19 response negatively affected the performance of TB implementation in local health systems that are already stretched thin, as seen in the experience of South Cotabato province as well as Davao City.⁴⁸

LGUs are the frontliners in the COVID-19 response and implementers of various programs, not only of the health sector. Many LGUs already grapple with limited resources and capacities but the worsening frequency and magnitude of disasters and public health emergencies points to a dire need to shift priorities. Local governments are being called to significantly invest in health as devolution and UHC reforms place more responsibility and even greater accountability upon them for people's health and well-being.⁹¹⁻⁹³

Overall, this study offers valuable implications for policy and practice. First, the continuity of TB and other health services during pandemics and other disasters requires foresight, prudent planning, and most importantly in the devolved set-up, local political will. National and local policies crafted during the COVID-19 pandemic were largely reactive, placing additional strains on already vulnerable local health systems in the Philippines. More than flexibility and adaptation, critical lessons from the COVID-19 crisis emphasize a more proactive, deliberate, brick by brick approach to building resilience in health systems. Building resilient health systems is a continuous process dependent on the interconnected actions of stakeholders at all levels, both within and outside the health sector.⁹⁴ Resilient health systems are fundamentally created by integrating the primary health care (PHC) approach with essential public health functions (EPHFs).⁹⁴ As one of the 58 UHC integration sites, this presents opportunities for South Cotabato province to further strengthen its province-wide health system.

As stewards of populations and communities, LGUs should effectively translate their learnings from the COVID-19 pandemic into progressive improvements in local policies, plans, operations, and monitoring and evaluation. The local government of Quezon City in the NCR is a notable example.⁹⁵ Local health systems should be strengthened to be able to deliver and maintain quality individual and population health services in both routine/normal and emergency contexts.⁹⁴ Practically, this means LGUs should pay significant attention to the local investment plan for health (LIPH) and the functionality of disaster risk reduction and management in health (DRRM-H) and not only do mere paper compliance with the LGU health scorecard. To a large extent, building resilient local health systems in the country can be realized through (1) LIPH as the medium-term public investment for health and (2) implementing the DRRM-H plan as the general plan of local health offices/rural health units. These could outline investment and action areas for the establishment of contingency and/or service continuity plans for the health sector to ensure uninterrupted

provision of diagnosis, treatment, and patient access to care. Thus, we reiterate Moncatar et al.'s recommendation highlighting the need to develop policies, standards, and mechanisms to aid LGUs in operationalizing resilient health systems specifically at the primary care level.⁹⁶

Second, health education activities should be strengthened specifically at the barangay and household/family levels to raise awareness about TB symptoms, prevention, and availability of TB-DOTS services. The importance of seeking timely care and addressing social stigma associated with TB, especially in times of emergencies are also emphasized. Third, to overcome geographical and financial barriers, enhancing access to diagnosis and treatment during normal and crisis periods requires strengthening community approaches. Continue mobilization of BHWs as TB treatment partners particularly in remote areas and maximizing mobile and home interventions.

Fourth, leverage telecommunication and online platforms to disseminate information about TB, provide remote consultations, support patient follow-up, treatment adherence, and data reporting. Fifth, ensure adequate supply and provision of PPEs, training on IPC measures, and monitoring consistency of implementation. Sixth, strengthen the capacities of BLGUs to address community health needs through improved budget allocation and development of appropriate policies, ensuring effective implementation of TB-DOTS and other essential health services especially during emergencies where lockdowns are warranted.

Seventh, while DOH is still mandated to supply all TB medicines to LGUs, resource pooling among TB-DOTS facilities may be utilized as a short-term solution in addressing logistical shortages and procurement delays during disasters and emergencies. An inventory control system should be established if resource pooling is needed to avoid depletion of resources of other health facilities. To ensure non-stockout, LGUs are encouraged to procure their own medicines and supplies, and during crisis, to coordinate with DOH Health Emergency Management Bureau (HEMB) and Centers for Health Development (regional offices) for augmentation of commodities specifically for non-devolved programs like TB.

Further, an adequate health workforce is critical for the delivery of health services and implementation of various health programs both in routine/normal and crisis times. Preparing for disasters and emergencies requires enhanced workforce planning for sufficient surge capacity.^{97,98} In LGUs with limited resources, staggered hiring of additional workers can be done annually, reflected in the LIPH. To address high demands during disasters/emergencies, strategies to increase the health workforce may include temporary hiring of additional workers and mobilization of volunteers.⁹⁷ In addition, recognizing the crucial role of community-based health workers particularly BHWs in TB-DOTS, it is imperative to continue the provision of training opportunities, incentives (money or in-kind), and awards to enhance their motivation and sustain commitment.

Limitations

Finally, the findings should be cautiously interpreted due to inherent limitations of the study. Foremost, the quantitative data retrieved from DOH ITIS relies on the accuracy and completeness of previously reported (retrospective) data. Moreover, data on TB treatment success rate for the last two months of the study periods from January to February 2022 were excluded due to limited evaluated outcomes, which might slightly affect the overall TSR calculation for the period. On the other hand, the qualitative data collected through focus group discussions with purposefully sampled participants may provide valuable insights into experiences and perspectives but may not be fully generalizable to all TB-DOTS staff or patients in South Cotabato province or other regions in the Philippines due to differences in contexts, resources, and challenges.

Potential role biases stemming from professional background or established relationships of the research team and participants might have influenced data interpretation. Participants' responses were also translated from the local languages to English, which may not adequately capture cultural nuances. This study was limited to the perspectives of frontline implementers of TB-DOTS services during the COVID-19 pandemic. Patients' perspectives were not included, which could have provided additional insights into the implementation of TB services at the ground level. Moreover, viewpoints of LGU officials were not captured, which would have provided information on their understanding and local response capacities to unprecedented public health emergencies such as COVID-19. Therefore, inclusion of patients' and LGU officials' perspectives in future studies are strongly suggested.

In addition, using Anderson's thematic content analysis approach limits the interpretation of data at a surface level. Nevertheless, the strength of this study is its mixed method design, and its contribution to the expanding local literature and recommendations on COVID-19, TB control, and disaster risk reduction adaptation of local health systems in the Philippines.

CONCLUSION

This mixed methods study explored the tuberculosis cases under the TB-DOTS services in South Cotabato during the pre-COVID-19 period and the first two years of the COVID-19 pandemic. This is the first to describe experiences and insights from the SOCCSKSARGEN Region related to the National TB program and COVID-19 period.

The implementation of TB-DOTS services in South Cotabato during the COVID-19 pandemic faced various difficulties, including pre-existing barriers and emerging challenges that led to decreases in TB case notification and TB treatment success rates. By addressing these barriers and challenges, the study found that TB-DOTS services in

South Cotabato was able to improve treatment outcomes and mitigate the impact of COVID-19 pandemic on TB cases.

Recommendations emphasize the need for local health systems to maintain continuity of essential services during pandemics and other disasters, and to develop strategies to ensure continuity of TB-DOTS. The COVID-19 pandemic tested the resilience of the Philippine health care system; lessons underscore the importance of adapting to uncertainties and evolving circumstances. However, much remains to be desired in terms of proactive national policy responses and progressive enhancements of local health systems by LGUs in the devolved set up, particularly in consideration of Universal Health Care. Further studies including patient perspectives and determining LGU capacities for building resilient health systems are recommended.

Acknowledgments

The authors are grateful for the support provided by the following institutions and individuals: DOH Health Policy Development and Planning Bureau, Vital Strategies, and University of the Philippines Manila - National Teacher Training Center for the Health Professions through the Scaling Up of Centers for Health Development Capacity in Operations and Implementation Research Project; Mr. Beau Benedict Costales for their invaluable assistance during the implementation of the study; and Mr. Randy D. Dizon for providing editorial services on the initial manuscript.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

Funding Source

This study was funded by Vital Strategies and DOH-Center for Health Development SOCCSKSARGEN Region.

REFERENCES

1. World Health Organization. Global tuberculosis report 2021 [Internet]. Geneva: World Health Organization. 2021 [cited 2025 May]. Available from: <https://www.who.int/publications/i/item/9789240037021>.
2. World Health Organization. Global tuberculosis report 2020 [Internet]. Geneva: World Health Organization. 2020. [cited 2025 May]. Available from: <https://www.who.int/publications/i/item/9789240013131>.
3. Hogan AB, Jewell BL, Sherrard-Smith E, Vesga JF, Watson OJ, Whittaker C, et al. Potential Impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income countries: a modelling study. *Lancet Glob Health*. 2022 Jul 13;8(9):e1132–41. doi:10.1016/S2214-109X(20)30288-6. PMID: 32673577. PMCID: PMC7357988.
4. Jeong Y, Min J. Impact of COVID-19 pandemic on tuberculosis preventive services and their post-pandemic recovery strategies: a rapid review of literature. *J Korean Med Sci*. 2023 Jan 1;38(5). doi:10.3346/jkms.2023.38.e43. PMID: 36747365. PMCID: PMC9902666.

5. Surendra H, Elyazar IRF, Puspaningrum E, Darmawan D, Pakasi TT, Lukitosari E, et al. Impact of the COVID-19 pandemic on tuberculosis control in Indonesia: a nationwide longitudinal analysis of programme data. *Lancet Glob Health*. 2023 Aug 15;11(9):e1412–21. doi:10.1016/S2214-109X(23)00312-1. PMID: 37591587.
6. Lipman M, McQuaid CF, Abubakar I, Khan M, Kranzer K, McHugh T, et al. The impact of COVID-19 on global tuberculosis control. *Indian J Med Res*. 2021 Apr 1;153(4):404–8. doi:10.4103/ijmr.IJMR_326_21. PMID: 34380784. PMCID: PMC8354050.
7. World Health Organization. Tuberculosis and COVID-19: Considerations for tuberculosis (TB) care services [Internet]. 2020 [cited 2025 May]. Available from: <https://www.who.int/publications/i/item/WHO-2019-nCoV-TB-care-2021.1>
8. Department of Health. DOH, partners aim to get TB care back on track [Internet]. Manila, Philippines; 2021 March 19 [cited 2025 May]. Available from: <https://doh.gov.ph/press-release/doh-partners-aim-to-get-tb-care-back-on-track/>
9. Department of Health. NTP – National TB Control Program [Internet]. Department of Health (n.d.) [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/about-ntp/>.
10. Department of Health. AO No. 2015-0024. June 05, 2015. Implementing guidelines on Integrated Tuberculosis Information System (ITIS) – National TB Control Program [Internet]. 2023 [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/download/ao2015-0024/>.
11. Nwe TT, Saw S, Win LL, Mon MM, Van Griensven J, Zhou S, et al. Engagement of public and private medical facilities in tuberculosis care in Myanmar: contributions and trends over an eight-year period. *Infect Dis Pov*. 2017 Jul 26;6(1). doi:10.1186/s40249-017-0337-8. PMID: 28859677. PMCID: PMC5579949.
12. Argosino F. COVID-19 response: A timeline of community quarantine, lockdowns, alert levels. *Manila Bulletin* [Internet]. 2021 [cited Aug 2025]. Available from: <https://mb.com.ph/2021/11/09/covid-19-response-a-timeline-of-community-quarantine-lockdowns-alert-levels/>.
13. Proclamation No. 922 s. 2020. Declaration of State of Public Health Emergency throughout the country due to the COVID-19 pandemic [Internet]. March 08, 2024 [cited 2025 Aug]. Available from: <https://www.officialgazette.gov.ph/2020/03/08/proclamation-no-922-s-2020/>.
14. Proclamation No. 929 s. 2020. Declaration of State of Calamity throughout the Philippines due to Corona Virus Disease 2019 [Internet]. March 16, 2024 [cited 2025 Aug]. Available from: <https://www.officialgazette.gov.ph/2020/03/16/proclamation-no-929-s-2020/>.
15. Department of Health. Interim Guidelines on Expanded Testing for COVID-19. Department Memorandum No. 2020-0151 [Internet]. March 31, 2020 [cited 2025 Aug]. Available from: <https://philprea.nationalarchives.gov.ph/uploads/DEPARTMENT-OF-HEALTH/Issuances/dm2020-0151.pdf>.
16. UNICEF Philippines. Philippines welcomes the arrival of COVID-19 vaccines via COVAX facility [Internet]. 2021 [cited 2025 Aug]. Available from: <https://www.unicef.org/philippines/press-releases/philippines-welcomes-arrival-covid-19-vaccines-covax-facility>.
17. Inter-Agency Task Force. Resolution No. 104 s. 2021 [Internet]. May 20, 2021 [cited 2025 Aug]. Available from: <https://depedro1.com/wp-content/uploads/2021/04/rm0276s2021.pdf>.
18. Presidential Executive No. 141 s. 2020. Approving the Nationwide Implementation of the Alert Level System for COVID-19 Response [Internet]. November 11, 2021 [cited 2025 Aug]. Available from: <https://elibrary.judiciary.gov.ph/thebookshelf/showdocs/5/93979>.
19. Department of Health. National TB Control Program Adaptive Plan for the COVID19 pandemic. Administrative Order No. 2020-0056. November 09, 2020 [cited 2025 May]. Available from: <https://law.upd.edu.ph/wp-content/uploads/2021/04/DOH-Administrative-Order-No-2020-0056.pdf>.
20. Department of Interior and Local Government. Support for the resumption of all tuberculosis (TB) active case finding activities and care provision in line with the National TB Control Program Adaptive Plan (NAP) for the COVID-19 pandemic [Internet]. DILG Advisory. February 4, 2021 [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/download/support-for-the-resumption-of-all-tuberculosis-tb-active-case-finding-activities-and-care-provision-in-line-with-the-national-tb-control-program-adaptive-plan-nap-for-the-covid-19-pandemic/>.
21. Benedicto JP, Cruz EJM, Quinto ML. A descriptive study on the clinical profile and outcomes of patients with COVID-19 and tuberculosis co-infection. *Acta Med Philipp*. 2024 May 15;58(8):42–9. doi:10.47895/amp.vi0.7855. PMID: 38812770. PMCID: PMC11132287.
22. Ferrer JP, Suzuki S, Alvarez C, Berido C, Caballero M, Carraig B, et al. Experiences, challenges and looking to the future in a clinical tuberculosis cohort in the time of COVID-19 in the Philippines. *Trans R Soc Trop Med Hyg*. 2021 Feb 9;115(6):579–82. doi:10.1093/trstmh/traab025. PMID: 33693916. PMCID: PMC7989158.
23. Croeser, H. TB Preventive Therapy During Covid-19 Pandemic - Impact4TB [Internet]. Impact4TB. 2020 [cited 2025 Aug]. Available from: <https://impact4tb.org/tb-preventive-therapy-during-covid-19-pandemic/>.
24. World Health Organization. Information Note Tuberculosis and COVID-19 [Internet]. 2020 [cited 2025 Aug]. Available from: <https://www.who.int/docs/default-source/documents/tuberculosis/infonote-tb-covid-19.pdf>.
25. David A, Genade L, Scott LE, Da Silva MP, Singh L, Stevens W, et al. Concurrent tuberculosis and COVID-19 testing from a single sputum specimen for enhanced disease detection. *BMC Infect Dis*. 2025 Mar 13;15(6):720. doi:10.3390/diagnostics15060720. PMID: 40150063. PMCID: PMC11940921.
26. Kalyanaraman N, Fraser MR. Containing COVID-19 through contact tracing. *Public Health Reports*. 2020 Nov 10;136(1):32–8. doi:10.1177/0033354920967910. PMID: 33170094. PMCID: PMC7856384.
27. Bowen W, Tri H, Romero S, Shaheen R, Kipngetich V, McGowan N, et al. Leveraging tuberculosis programs for future pandemic preparedness: A retrospective look on COVID-19. *PLoS Glob Public Health*. 2024 Sep 5;4(9):e0003454. doi:10.1371/journal.pgph.0003454. PMID: 39236018. PMCID: PMC11376540.
28. Department of Health-National Tuberculosis Control Program. Guidelines in the Interim Use of the Laboratories of the National TB Control Program as COVID-19 Testing Laboratories Performing Rapid PCR Testing for SARS-CoV-2. Department Circular No. 2020-0187 [Internet]. 2020 [cited 2025 Aug]. Available from: <https://ntp.doh.gov.ph/download/dc2020-0187/>.
29. Department of Health-National Tuberculosis Control Program. Department Memorandum No. 2020-0191. Designation of selected regional TB culture laboratories for GeneXpert Diagnosis of Coronavirus Disease 2019 (COVID-19) – National TB Control Program [Internet]. 2020 [cited 2025 Aug]. Available from: <https://ntp.doh.gov.ph/download/dm2020-0191/>.
30. World Health Organization. Country story [Internet]. 2025 [cited 2025 May]. Available from: <https://www.who.int/about/accountability/results/who-results-report-2020-mtr/country-story/2021/philippines>.
31. Alene KA, Wangdi K, Clements ACA. Impact of the COVID-19 pandemic on tuberculosis Control: An overview. *Trop Med Infect Dis*. 2020 Jul 24;5(3):123. doi:10.3390/tropicalmed5030123. PMID: 32722014. PMCID: PMC7558533.
32. Casame DJO, Marcelo DB, Cuesta DMD, Tonquin M, Frias MVG, Gler MT. Feasibility and acceptability of asynchronous VOT among patients with MDR-TB. *Int J Tuberc Lung Dis*. 2022 Aug 1;26(8):760–5. doi:10.5588/ijtld.21.0632. PMID: 35898139.
33. Villanueva A, de Morales M, Alacapa J, Powers R. Digital Adherence Technology in Action: 99 DOTS as a platforms for quality TB treatment by private providers in the Philippines – National TB Control Program [Internet]. 2022 [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/download/digital-adherence-technology-in-action-99-dots-as-a-platforms-for-quality-tb-treatment-by-private-providers-in-the-philippines/>

34. Thakkar D, Piparva KG, Lakkad SG. A pilot project: 99DOTS information communication technology-based approach for tuberculosis treatment in Rajkot district. *Lung India*. 2019 Jan 1;36(2): 108. doi:10.4103/lungindia.lungindia_86_18. PMID: 30829243. PMCID: PMC6410600.
35. Kiwanuka N, Kityamuwesi A, Crowder R, Guzman K, Berger CA, Lamunu M, et al. Implementation, feasibility, and acceptability of 99DOTS-based supervision of treatment for drug-susceptible TB in Uganda. *PLoS Digit Health*. 2023 Jun 30;2(6):e0000138. doi:10.1371/journal.pdig.0000138. PMID: 37390077. PMCID: PMC10313004.
36. Galvez D. COVID-19 positivity rate in Metro Manila down; very high in 7 provinces; OCTA. *INQUIRER.net* [Internet]. 2022 Oct 13 [cited 2025 May]. Available from: <https://newsinfo.inquirer.net/1679316/fwd-covid-19-positivity-rate-in-metro-manila-declines-very-high-in-7-areas>.
37. Philippine Statistics Authority. Highlights of the region 12 (SOCCSKSARGEN) population 2020 census of population and housing (2020 CPH) [Internet]. 2021 [cited 2025 May]. Available from: <https://psa.gov.ph/statistics/population-and-housing/node/165021>.
38. Anderson R. Thematic content analysis (TCA) descriptive presentation of qualitative data [Internet]. 2007 [cited 2025 May]. Available from: <https://rosemarieanderson.com/wp-content/uploads/2014/08/ThematicContentAnalysis.pdf>.
39. Department of Health. National Tuberculosis Control Program Manual of Procedures: 6th ed [Internet]. Manila: Department of Health; 2020 [cited 2025 May]. Available from <https://ntp.doh.gov.ph/download/ntp-mop-6th-edition/>.
40. World Health Organization. Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed [Internet]. 2021 [cited 2025 May]. Available from: <https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2021>.
41. Department of Health-National Tuberculosis Control Program. Guidelines on Testing for Tuberculosis (TB) and Coronavirus Disease (COVID-19) for Laboratories within the National Tuberculosis Control Program (NTP) Laboratory Network – National TB Control Program. Department Order No. 2021-0296 [Internet]. June 10, 2021 [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/download/dm2021-0296/>.
42. Nkereuwem O, Nkereuwem E, Fiogbe A, Usoroh EE, Sillah AK, Owolabi O, et al. Exploring the perspectives of members of international tuberculosis control and research networks on the impact of COVID-19 on tuberculosis services: a cross sectional survey. *BMC Health Serv Res*. 2021 Aug 12;21(1):798. doi:10.1186/s12913-021-06852-z. PMID: 34384439. PMCID: PMC8358254.
43. Migliori GB, Thong PM, Akkerman O, Alffenaar JW, Álvarez-Navascués F, Assao-Neino MM, et al. Worldwide effects of Coronavirus Disease pandemic on tuberculosis services, January–April 2020. *Emerg Infect Dis*. 2020 Nov;26(11):2709–12. doi:10.3201/eid2611.203163. doi 10.3201/eid2611.203163. PMID: 32917293. PMCID: PMC7588533.
44. South Cotabato Province. Directing all Local Government Units (LGUs) and Government Offices in the Province of South Cotabato to Adopt Stricter Measures and Guidelines in order to prevent, curtail and contain the spread of novel Corona Virus (COVID-19) in the entire Province of South Cotabato. Executive Order, No. 15 s. 2020 [Internet]. 2020 March 10 [cited 2025 May]. Available from: <https://www.facebook.com/provlgovtsocot/posts/governor-reynaldo-s-tamayo-jr-issued-executive-order-no-15-today-directing-all-1/2744229208993283/>.
45. South Cotabato Province. An Order Amending Executive Order No. 15 and Providing and Adoptive Pre-emptive Lockdown in the Entire Province of South Cotabato. Executive Order, No. 17 s. 2020 [Internet]. 2020 March 16 [cited 2025 May]. Available from: <https://www.facebook.com/provlgovtsocot/posts/just-ingov-reynaldo-s-tamayo-jr-issued-executive-order-number-17-today-amending-/2754357404647130/>.
46. South Cotabato province. An Order Declaring and Placing the Entire Province of South Cotabato under Enhanced Community Quarantine and Calibrated Total Lockdown. Executive Order, No. 18, s. 2020 [Internet]. 2021 March 19 [cited 2025 May]. Available from: <https://www.facebook.com/provlgovtsocot/posts/just-ingov-reynaldo-s-tamayo-jr-issued-executive-order-no-18-today-an-order-decl/2763065853776285/>.
47. South Cotabato Province. An Order Extending the Modified General Community Quarantine (MGCQ) and Imposing Border Lockdown within the Provincial Boundaries of the Province of South Cotabato until September 15, 2020. Executive No. 54 s. 2020 [Internet]. 2021 September 1 [cited 2025 May]. Available from: <https://www.facebook.com/photo/?fbid=2812384662371239&set=pcb.2812384809037891>.
48. Alimento GAA, Kulintang MBM, Ngo AD. Lived Experiences of TB DOTS Nurse in Davao during the Covid 19 Pandemic: A Phenomenological Study. *EBSCOhost* [Internet]. 2024 Jul 1 [cited 2025 May]. Available from: https://openurl.ebsco.com/EPDB%3Aagcd%3A5%3A18250885/detail?sid=ebsco%3Aplnk%3Ascholar&id=ebsco%3Aagcd%3A181669615&crl=c&link_origin=scholar.google.com.
49. Olvez CRA, Guibao EAE, Mejia FL, Guazon CGB, Ederio NT. Perceived impact of COVID-19 pandemic on clinical care and treatment of Tuberculosis-Directly Observed Treatment Short-Course (TB-DOTS) patients. *Int Curr Sci Res Rev*. 2024 May 28;7(5). doi: 10.47191/ijcsrr/V7-i5-79.
50. Ulep VG. The multifaceted health impacts of the COVID-19 pandemic. *PIDS Discussion Paper Series*, No. 2021-23 [Internet]. Quezon City, Philippines. 2021 [cited 2025 May]. Available from: <https://www.econstor.eu/bitstream/10419/256858/1/pidsdps2123.pdf>.
51. Crowder R, Geocaniga-Gaviola DM, Fabella RA, Lim A, Lopez E, Kadota JL, et al. Impact of shelter-in-place orders on TB case notifications and mortality in the Philippines during the COVID-19 pandemic. *J Clin Tuberc Other Mycobact Dis*. 2021 Oct 16;25:100282. doi:10.1016/j.jctube.2021.100282. PMID: 34693036. PMCID: PMC8519831.
52. Lin X, Chongsuvivatwong V, Geater A, Lijuan R. The effect of geographical distance on TB patient delays in a mountainous province of China. *Int J Tuberc Lung Dis*. 2008 Mar 1;12(3): 288–93. PMID: 18284834.
53. Asemahagn MA, Alene GD, Yimer SA. A qualitative insight into barriers to tuberculosis case detection in East Gojjam Zone, Ethiopia. *Am J Trop Med Hyg*. 2020 Aug 4;103(4):1455–65. doi:10.4269/ajtmh.20-0050. PMID: 32748766. PMCID: PMC7543819.
54. Narasimhan P, Wood N, Macintyre CR, Mathai D. Health systems preparedness for COVID-19: An urgent global response to counter the emerging novel coronavirus outbreak. *J Glob Health*. 2021;10(1):010331.
55. Lasco G, San Pedro J. The 'covidization' of healthcare. *Philippine Daily Inquirer*. [Internet]. 2020 Jun 7 [cited 2025 May]. Available from: <https://opinion.inquirer.net/130544/the-covidization-of-health-care>.
56. Department of Health-National Tuberculosis Program. Prioritization of COVID-19 Testing using Xpert Xpress SARS-CoV-2 Cartridges [Internet]. Department Memorandum 2020-0376. 2020 [cited 2025 May]. Available from: <https://ntp.doh.gov.ph/download/dm2020-0376/>.
57. Province of South Cotabato. An order placing the province of South Cotabato under alert level 2 of the approved alert level systems (ALS) for COVID-19 response by the IATF for the management of emerging infectious diseases [Internet]. Executive Order No. 51 s. 2021. 2021 [cited 2025 May]. Available from: <https://www.facebook.com/photo/?fbid=4442015555881298&set=pcb.4442016205881233>.
58. Lisboa M, Fronteira I, Mason PH, Martins MRO. National TB program shortages as potential factor for poor-quality TB care cascade: Healthcare workers' perspective from Beira, Mozambique. *PLoS One*. 2020 Feb 14;15(2):e0228927. doi:10.1371/journal.pone.0228927.
59. Mergenthaler C, Bhatnagar A, Dong D, Kumar V, Lakis C, Mutasa R, et al. Assessing the impact of COVID-19 management on the workload of human resources working in India's National Tuberculosis Elimination Program. *BMC Health Serv Res*. 2024 Aug 7;24(1):907. doi:10.1186/s12913-024-11131-8. PMID: 39113002. PMCID: PMC11308665.

60. Hutchison C, Khan MS, Yoong J, Lin X, Coker RJ. Financial barriers and coping strategies: a qualitative study of accessing multidrug-resistant tuberculosis and tuberculosis care in Yunnan, China. *BMC Public Health*. 2017 Feb 22;17(1). doi:10.1186/s12889-017-4089-y. PMID: 28222724. PMCID: PMC5320743.
61. Zemedu P, Seyoum D, Nedi T. Barriers to tuberculosis care during the COVID-19 pandemic in Ethiopia: A qualitative study. *PLoS One*. 2021;16(5):e0251513. doi:10.1371/journal.pone.0251513.
62. Feyisa JW, Kitila KM, Lemu JC, Hunde MD, Hunde AB. Healthcare-seeking delay during COVID-19 pandemic among tuberculosis patients in Ilubabor zone health facilities, south-west Ethiopia. *Sage Open Med*. 2022 Dec 12;10. doi:10.1177/20503121221142469. PMID: 36532950. PMCID: PMC9749068.
63. Chen X, Du L, Wu R, Xu J, Ji H, Zhang Y, et al. Tuberculosis-related stigma and its determinants in Dalian, Northeast China: A cross-sectional study. *BMC Public Health*. 2021 Dec;21:1-6. doi:10.1186/s12889-020-10055-2. PMID: 33397334. PMCID: PMC7780403.
64. Zimmerman E, Smith J, Banay R, Kau M, Garfin AMCG. Behavioural barriers and perceived trade-offs to care-seeking for tuberculosis in the Philippines. *Glob Public Health*. 2022 Feb 1;17(2): 210-22. doi:10.1080/17441692.2020.1855460.
65. Adiong SJ, Bangcola AA, Macalnas A. Exploring social stigma and awareness towards tuberculosis in a municipality in Southern Philippines: A mixed-methods study. *Malays J Nurs*. 2023 Jan 31; 14(3):94-101. doi:10.31674/mjn.2023.v14i03.011.
66. Getnet F, Demissie M, Worku A, Gobena T. Challenges and opportunities for tuberculosis control in the era of COVID-19 pandemic: A qualitative study of healthcare workers' perspectives in Ethiopia. *J Multidiscip Healthc*. 2021;14: 1299-1308.
67. Sotgiu G, Centis R, D'ambrosio L, Migliori GB. Tuberculosis treatment and drug regimens. *Cold Spring Harb Perspect Med*. 2015 Jan 8;5:a017822. doi:10.1101/cshperspect.a017822.
68. Mhazo A, Miyango S, Palani L, Maponga C. Tuberculosis commodities supply chain performance in the WHO African Region. A scoping review. *PLoS Glob Public Health*. 2024 May 16;4(5):e0003219. doi:10.1371/journal.pgph.0003219.
69. Loveday M, Cox H, Evans D, Furin J, Ndjeka N, Osman M, et al. Opportunities from a new disease for an old threat: Extending COVID-19 efforts to address tuberculosis in South Africa. *S Afr Med J*. 2020 Nov 5;110(12):1160. doi:10.7196/samj.2020.v110i12.15126. PMID: 33403958.
70. Lacerda SNB, Temoteo RCA, Figueiredo TMRM, de Luna FDT, de Sousa MAN, de Abreu LC, et al. Individual and social vulnerabilities upon acquiring tuberculosis: a literature systematic review. *Int Arch Med*. 2014 Dec; 7(1):1-8. doi:10.1186/1755-7682-7-35. PMID: 25067955. PMCID: PMC4110238.
71. Agrawal N, Kumar A, Ali N, Uppadhaya SK, Singh HK. Knowledge, attitude and practices regarding tuberculosis among outpatients of a rural field practice area: a cross-sectional study in Uttar Pradesh, India. *J Clinical Diagn Res*. 2022 Aug 1;16(8). doi:10.7860/JCDR/2022/57590.16691.
72. Auer C, Sarol Jr J, Tanner M, Weiss M. Health seeking and perceived causes of tuberculosis among patients in Manila, Philippines. *Tropical Med Int Health*. 2001 Dec;5(9):648-56. doi:10.1046/j.1365-3156.2000.00615.x.
73. Zimmer AJ, Klinton JS, Oga-Omenka C, Heitkamp P, Nyirenda CN, Furin J, et al. Tuberculosis in times of COVID-19. *J Epidemiol Community Health*. 2022 Mar;76(3):310-16. doi:10.1136/jech-2021-217529. PMID: 34535539. PMCID: PMC8453591.
74. Department of the Interior and Local Government. Supplementary LGU guidelines on the implementation of enhanced community quarantine in Luzon, and state of public health emergency in other parts of the country due to the COVID-19 threat [Internet]. Memorandum Circular No. 2020-062. 2020 [cited 2025 May]. Available from: http://city.eacomm.com/UserFiles/League_of_Cities/file/DILGMemo_2020-062.pdf.
75. Department of Health. Guidelines on the risk-based public health standards for COVID-19 mitigation [Internet]. Administrative Order No. 2020-0015. 2020 [cited 2025 May]. Available from: <https://law.upd.edu.ph/wp-content/uploads/2020/05/DOH-AO-No-2020-0015.pdf>.
76. Department of Health. Omnibus guidelines on the minimum public health standards for the safe reopening of institutions [Internet]. Administrative Order No. 2021-0043. 2021 [cited 2025 May]. Available from: <https://app.doh.gov.ph:1024/Rest/GetFile?id=692037>.
77. Cordeiro L, Gnatta J, Ciofo-Silva C, Price A, Albertina de Oliveira N, Almeida R, et al. Personal protective equipment implementation in healthcare: a scoping review. *Am J Infect Control*. 2022 Aug 1;50(8):898-905. doi:10.1016/j.ajic.2022.01.013.
78. Macariola A, Santarin TM, Villaflores FJ, Yonzon RS, Fermin J, Kee S, et al. Breaking barriers amid the pandemic: the status of telehealth in Southeast Asia and its potential as a mode of healthcare delivery in the Philippines. *Front Pharmacol*. 2021 Nov 8;12:754011. doi:10.3389/fphar.2021.754011.
79. Leung CL, Alacapa J, Tasca BG, Villanueva AD, Masulit S, Ignacio ML, et al. Digital adherence Technologies and Differentiated Care for tuberculosis treatment in the Philippines: Acceptability among persons with TB, healthcare workers and key Informants: Qualitative Interview Study. *JMIR Hum Factors*. 2024 May 1;11:e54117. doi:10.2196/54117. PMID: 39042889. PMCID: 11303897.
80. Noceda AV, Acierio LM, Bertiz MC, Dionisio DE, Laurito CB, Sanchez GA, et al. Patient satisfaction with telemedicine in the Philippines during the COVID-19 pandemic: a mixed methods study. *BMC Health Serv Res*. 2023 Mar 22;23(1):277. doi:10.1186/s12913-023-09127-x. PMID: 36949479. PMCID: PMC10032251.
81. Ornedo JM. COA flags DOH over P95.15M expired, near-expiry drugs, medical supplies. *GMA News Online* [Internet]. 2021 Aug 11 [cited 2025 May]. Available from: <https://www.gmanetwork.com/news/topstories/nation/798953/coa-flags-doh-over-p95-15m-expired-near-expiry-drugs-medical-supplies/story/>.
82. Marcelo E. DOH fails to use P6.6 billion COVID-19 funds for 2021 – COA. *Philstar.com* [Internet]. 2022 Aug 17 [cited 2025 May]. Available from: <https://www.philstar.com/headlines/2022/08/18/2203374/doh-fails-use-p66-billion-covid-19-funds-2021-coa>.
83. Oliquino E.P7.43-B Covid meds wasted. *Philippine Institute for Development*. [Internet] 2022 [cited 2025 May]. Available from: <https://www.pids.gov.ph/details/news/in-the-news/p7-43-b-covid-meds-wasted>.
84. Marcelo E. DOH flagged over P11.2 billion expired drugs, COVID-19 vax. *Philstar.com* [Internet]. 2024 Dec 4 [cited 2025 May]. Available from: <https://www.philstar.com/headlines/2024/12/05/2405095/doh-flagged-over-p112-billion-expired-drugs-covid-19-vax>.
85. Department of Health. Department of Health, Philippines Devolution Transition Plan 2022-2024 [Internet]. 2022 [cited 2025 May]. Available from: https://dilg.gov.ph/PDF_File/nga-dtps/DOH/Joint-DOH-NNC-DTP-Narrative-and-Annexes_20Jan2022_signed.pdf.
86. Razu SR, Yasmin T, Arif TB, Islam MS, Islam SMS, Gesesew HA, et al. Challenges faced by healthcare professionals during the COVID-19 pandemic: A qualitative inquiry from Bangladesh. *Front Public Health*. 2021 Aug 10;9:647315. doi:10.3389/fpubh.2021.647315. PMID: 34447734. PMCID: PMC8383315.
87. Mallari E, Lasco G, Sayman DJ, Amit AM, Balabanova D, McKee M, et al. Connecting communities to primary care: A qualitative study on the roles, motivations and lived experiences of community health workers in the Philippines. *BMC Health Serv Res*. 2020 Dec;20:1-0. doi:10.1186/s12913-020-05699-0.
88. Abelardo RAA, Bustamante KB, Cabanes JTO, Diana RG, Grande S, Dagohoy RG. Accounts of barangay health workers in geographically isolated and disadvantaged areas in the new normal. *Int J Res Innovation Soc Sci*. 2021 Jul;5(7):434. doi:10.2139/ssrn.3907452.
89. Nieva Jr RF. Assessment of local health system's responsiveness to tuberculosis in select municipalities in the Philippines. *Int J Health Life Sci*. 2017;3(2):178-93. doi:10.20319/ijhls.2017.32.178193.
90. Alampay E, Delos Santos M, Rye R. Revisiting health care decentralization in the Philippines during the pandemic: implications on national-local functional assignments and health information systems.

- Paper presented at: PSPA 2021 International Conference. Beyond the pandemic: Reexamining, Reimagining, Retooling, Refounding and Reenergizing Public Administration and Governance. [Internet]. 2021 [cited 2025 May]. Available from: https://www.researchgate.net/publication/356961192_Revisiting_health_care_decentralization_in_the_Philippines_during_the_pandemic_implications_on_national-local_functional_assignments_and_health_information_systems_1.
91. Amit AM, Pepito VC, Dayrit M. Early response to COVID-19 in the Philippines. *Western Pac Surveill Response J*. 2021 Feb 5;12(1): 56-60. doi:10.5365/wpsar.2020.11.1.014. PMID: 34094626. PMCID: PMC8143926.
 92. Amit AM, Pepito VC, Dayrit M. Advancing universal health coverage in the Philippines through self-care interventions. *Lancet Reg Health West Pac*. 2022 Sep 5;26:100579. doi:10.1016/j.lanwpc.2022.100579. PMID: 36105555. PMCID: PMC9465409.
 93. Talabis DA, Babiera A, Buhat CA, Lutero D, Quindala K, Rabajante J. Local government responses for COVID-19 management in the Philippines. *BMC Public Health*. 2021 Sep 21;21(1):1711. doi:10.1186/s12889-021-11746-0. PMID: 34544423. PMCID: PMC8452379.
 94. World Health Organization. Building health system resilience to public health challenges: Guidance for implementation in countries [Internet]. Geneva: World Health Organization. 2024 [cited 2025 May]. Available from: <https://iris.who.int/server/api/core/bitstreams/70b880e5-ccf1-4b59-a6cd-57d7ecfe017b/content>.
 95. Escano-Arias EA, Abarquez RA, Cruz R, Espeleta R, Ong MM, Loreche AM, et al. Strengthening local health systems and governance for Universal Health Coverage: experiences and lessons from the COVID-19 pandemic response in Quezon City, Philippines. *Health Policy Plan*. 2025 Mar 7;40(3):436-42. doi:10.1093/heapol/czaf002. PMID: 39801295. PMCID: PMC11886787.
 96. Moncatar TRT, Gomez AVD, Lorenzo FME, Sanial OP, Faraon EJA, Rosadia RAF, et al. Effects of the COVID-19 pandemic on the implementation of NCD care at the primary care level in the Philippines: A qualitative inquiry. *Acta Med Philipp*. 2024 Mar 22;58(5):10-21. doi:10.47895/amp.vi0.7678. PMID: 39005619. PMCID: PMC11239989.
 97. Williams G, Maier C, Scarpetti G, Galodé J, Lenormand MC, Ptak-Bufken K, et al. Human resources for health during COVID-19: creating surge capacity and rethinking skill mix. *Eurohealth*. 2022;28(1):19-23.
 98. World Health Organization Western Pacific Region. Role of primary care in the COVID-19 response [Internet]. Manila, Philippines: World Health Organization Western Pacific Region. 2020 [cited 2025 May]. Available from: <https://iris.who.int/bitstream/handle/10665/331921/Primary-care-COVID-19-eng.pdf>.