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The Impact of COVID-19 on Case Detection Rate of Tuberculosis Cases in Baluchistan, Pakistan

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Abstract

High morbidity and mortality rates are associated with COVID-19, nations across the globe are committing more healthcare resources and efforts to battle this disease. The simultaneous disruption of healthcare services, reassignment of healthcare staff from other units to COVID-19 units, and the use of laboratories for COVID-19 testing has affected the management of other chronic diseases such as tuberculosis, Diabetes mellitus, hypertension, AIDS, and chronic obstructive pulmonary disease. During the initial year of the COVID-19 pandemic, it is estimated that TB services experienced a global decline of 20% to 40%. Hence the current study was designed to consider the effects of COVID-19 pandemic on Tuberculosis control in Balochistan.

The study was retrospective designed and the data was collected from National TB Control Program Balochistan, a representative body of the province to control and manage TB cases. Medical charts of all patients enrolled from 2019 to 2020 at study site suffering from TB irrespective of age, gender or ethnicity were accessed.

In our study it was found that there was a decrease of 17% in the detection rate of TB from the year 2019 to 2020. However, the COVID-19 lockdown had a significant impact on the TB case notification with a 57% decline in Q2-2020 compared to the same quarter in 2019. These findings highlight the complex challenges posed by the pandemic, including resource diversion, decreased laboratory capacity, and stigma hindering access to diagnostic services.

Keywords: COVID-19; Case detection; Lockdown; Tuberculosis

Introduction

The COVID-19 pandemic, caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), has interrupted healthcare systems in the whole world [1]. COVID- 19 has been associated with high morbidity and mortality rates, nations across the globe are promising more healthcare resources and efforts to encounter this disease [2]. The implementation of non-pharmacological measures such as strict restrictions on public movement, social distancing, hygiene and quarantine, aimed at improving the situation, has accidentally led to a decrease in access to and utilization of healthcare services. The simultaneous disruption of healthcare services, relocation of healthcare staff from other units to COVID-19 units, and the use of laboratories for COVID-19 testing has affected the management of other chronic diseases such as tuberculosis, Diabetes mellitus, hypertension, AIDS, and Chronic Obstructive Pulmonary Disease (COPD) [3-5]. Tuberculosis is the most important disease in terms of mortality rate globally, surpassing infections like AIDS and malaria. In 2019, these infections had ten million new cases and one and a half million deaths. Due to its high prevalence, the UN Sustainable Development Goals (SDGs) propose to end TB by the year 2030 [6].

However, the global fight against TB has faced setbacks due to the COVID-19 pandemic, compromising the progresses made in the last decade. Throughout the world, TB services have encountered various disruptions, including people avoiding hospitals out of fear, interruptions in the supply chain, challenges in transportation, and the redirection of TB testing platforms for COVID-19 testing [7]. During the initial year of the COVID-19 pandemic, it is estimated that TB services experienced a global decline of 20% to 40% [6]. This reduction in TB detection and treatment carries significant implications for increased transmission and mortality. Projections indicate that a 25% decrease in case detection over a span of 3 months could lead to a 13% rise in TB-related deaths worldwide. Additionally, alternative models suggest that disruptions caused by COVID-19 may contribute to a potential 20% increase in TB mortality by 2025, with the most

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significant impacts arising from delays in diagnosis and treatment [8,9]. According to studies, South Asia, including Pakistan, has witnessed a significant decline of 80% in diagnosis and testing, along with a substantial 75% to 80% reduction in the notification of new TB cases during the course of the COVID-19 pandemic. Moreover, there has been a pronounced 66.8% decrease in routine Bacille Calmette-Guérin (BCG) vaccination amid the ongoing COVID-19 crisis. Notably, resources allocated for TB elimination, such as National TB Program (NTP) workers, TB isolation wards, TB testing centers, and medical professionals, have been diverted to address COVID-19 emergencies [10]. This redirection has led to a major disruption in the management of TB at the national level. Currently less studies are available on the impact of COVID-19 on tuberculosis management, assumptions are discussed in this perspective without published data as input [11-13] or some studies on situation/current position of TB notification or testing due to COVID-19 pandemic [14]. Hence the current study was designed to consider the effects of COVID-19 pandemic on Tuberculosis control in Blaochistan Pakistan.

Materials and Methods

Study design and study settings

The study was retrospective designed and the data was collected from National TB Control Program (NTP) Balochistan, a representative body of the province to control and manage TB cases. Medical charts of all patients enrolled from 2019 to 2020 at study site suffering from TB irrespective of age, gender or ethnicity were accessed and Information like demographics such as age, sex, and address, information based on diagnosis for instance the date of onset of the symptoms along with seeking medical care and diagnosis were recorded.

Data collection

The overall data on notified TB cases and their treatment outcomes for the years 2019-2020 were obtained from the quarterly case notification report form (TB-07) and quarterly outcome report form (TB-09), respectively. These forms compile data on patients reported to the National TB Program (NTP) by participating TB facilities. Each patient reported on TB-07 form also has a corresponding TB-09 form. TB-07 form captures patient demographics such as gender, age, district, province, type of patient, and disease classification, while TB-09 form records the treatment outcomes of patients who are notified on TB-07 form. These forms are updated quarterly, and Microsoft Excel spreadsheets are generated at the district level. These quarterly reports are then gathered at the provincial and national NTP. Data collection occurred at different time periods for TB case notification and treatment outcomes because once a TB case is notified at a TB facility on TB-07, Upon the diagnosis of active TB, appropriate anti-TB treatment was initiated, beginning with a four-drug regimen (rifampicin, isoniazid, pyrazinamide, and ethambutol) for two months, followed by a two-drug regimen (isoniazid and rifampin) for at least six months. TB treatment outcomes were defined according to the WHO reporting framework for TB. Treatment success included patients achieving microbiologic cure (negative AFB or Xpert MTB RIF) or completing at least 6 months of anti-TB treatment. Patients who were lost to follow up, transferred, experienced treatment failure, or died without any other understandable cause of death while on anti-TB treatment were considered as unsuccessful outcomes.

The treatment outcome is recorded on TB-09 after 6 to 9 months of initiating drug-susceptible TB treatment, typically by the end or after the third NTP quarterly review meeting from the date of notification. Therefore, we collected all TB-07 forms of the study population (notified TB cases from January 2019 to December 2020) and compiled data from all available TB-09 forms in the NTP database for the study period.

Statistical analyses

The data was collected and entered in Microsoft Excel, where it was imported, organized, and cleaned. After cleaning, the accuracy of data entry was verified, and descriptive analysis was performed for the study period. For categorical variables, frequencies and percentages (%) were used to present the data. The significance of the statistical test (Chi-square) was determined at a p-value of less than 0.05.

Ethical considerations

For Ethical approval was granted by the Ethics committee of Faculty of Pharmacy and Health Sciences University of Baluchistan, Pakistan and the Ethics Committee of NTP Baluchistan, Pakistan.

Results

The Table 1 shows the number of TB cases registered from Q1 2019 to Q4 2020, presenting the quarterly counts of pulmonary and extra-pulmonary tuberculosis cases. The number of new pulmonary tuberculosis cases are consistently high, ranging from 1951 to 2186 across the reporting periods. Where the new cases for Extra-Pulmonary TB with counts ranging from 531 to 732. The Age Categories 0 to 14 and 15 to 24 both consistently showed considerable number of tuberculosis cases, ranging from 374 to 516 for the 0 to 14 and from 219 to 494 for the 15 to 24 age categories. The 25 to 34 age group also consistently had a high number of TB cases, with counts ranging from 361 to 419. The number of TB cases among females consistently demonstrate high frequencies, ranging from 1437 to 1541 across the reporting periods.

The Table 2 showed a detailed quarterly analysis of TB data for the periods Q1 2019 - Q4 2020. The total number of new Outpatient Department (OPD) visits shows differences across the quarters, with a significant peak in Q4 2019 at 1,061,719, followed by a notable decrease in Q1 2020 to 566,999. The identification of presumptive TB cases followed an unstable pattern, with the highest number recorded in Q4 2019 (15,346) and a subsequent decreased in Q1 2020 (7,485). The testing of presumptive TB patients, utilizing methods such as AFB, SM, and Xpert, showed variations throughout the observed periods. Bacteriologically confirmed TB cases among presumptive cases display fluctuations, with the highest number in Q1 2019 (904) and a subsequent decline in Q2 2020 (539). The number of new and relapse TB cases tested using Xpert also fluctuated, reaching its peak in Q2 2019 (3,324). The case detection rate (N+R) varied across the quarters, with the highest rate recorded in Q3 2019 at 37%, and lowest 20% in Q2 2020, while the case notification rate for bacteriologically

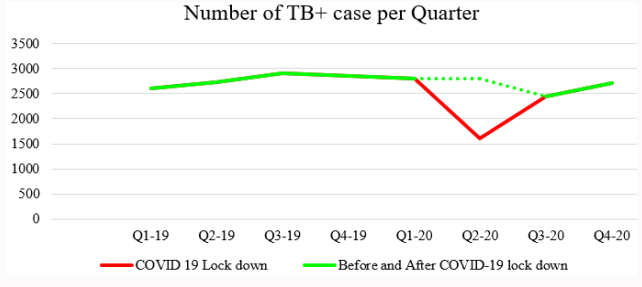

Figure 1: The number of TB+ cases per quarter during the COVID-19 lockdown and before and after COVID-19 lock down.

Table 1: The demographics and frequency of TB cases registered from 2019-2020.

Period		Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020
Pulmonary	New	1951	1983	2144	2125	2186	1216	1876	1938
	Relapse	39	42	54	46	39	23	39	31
Extra Pulmonary	New	612	698	705	674	577	361	531	732
	Relapse	1	0	2	1	2	0	4	2
Age Categories	0-14	393	460	516	473	374	371	455	501
	15-24	420	405	494	441	463	219	414	406
	25-34	361	407	419	389	399	243	369	398
	35-44	341	317	337	385	376	195	296	284
	45-54	343	362	343	362	386	189	313	348
	55-64	379	405	411	421	414	204	344	419
	65<	366	367	385	375	392	179	259	347
Gender	Male	1166	1262	1363	1363	1274	731	1152	1290
	Female	1437	1462	1541	1483	1530	869	1298	1413
Total		2603	2723	2905	2846	2804	1600	2450	2703

Table 2: The frequency and percentage of OPDs, N+R case detection and case notification rate during 2019-2020.

Period	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020
Total new OPD in quarter	734056	702479	717921	1061719	566999	315420	427441	499519
No. of presumptive TB cases identified	23607	10967	12973	15346	7485	10293	25660	37169
No of presumptive TB patient tested using AFB or SM .and /or xpert	9133	11040	9358	11385	10275	4904	7606	9576
Among presumptive TB cases tested those detected having bacteriological confirmed TB	904	941	865	1076	1086	539	834	908
No of new and relapse TB cases tested using xpert	1682	3324	947	1479	964	415	832	1006
Case detection rate (N+R)	31%	33%	37%	36%	34%	20%	31%	34%
Case notification rate b+ve	34	35	38	42	42	20	35	37
Case notification rate (N+R)	84	88	97	95	91	54	82	91
Proportion of b+ cases among pulmonary cases	53%	54%	52%	52%	51%	48%	55%	57%
Presumptive positivity rate	10%	9%	9%	9%	11%	11%	11%	9%
Percentage of childhood TB cases	14%	14%	17%	18%	16%	20%	19%	15%
percentage of adult TB cases	86%	86%	83%	82%	84%	80%	81%	85%

confirmed cases peaks at 42% in both Q4 2019 and Q1 2020 and low at 20% in Q2 2020. The proportion of bacteriologically confirmed cases among pulmonary cases remains relatively stable, ranging from 48% to 57%. The presumptive positivity rate fluctuates, reaching its peak at 11% in Q1 2020.

The Table 3 shows comprehensive detailed of TB cases between the years 2019 and 2020, with the percentage differences in various categories. In terms of pulmonary cases, it was found that there was a 13% decrease in new cases and a significant 25% decrease in relapse cases from 2019 to 2020 while the extra-pulmonary cases are noteworthy, showing a substantial 27% reduction in new cases from 2019 to 2020. According to age categories, there was a consistent decrease ranging from 12% to 26% across different age groups however the elderly population age 65 and above experienced the highest percentage decrease. Gender-wise, both male and female TB cases showed a uniform 17% reduction from 2019 to 2020 and the overall decrease was 17% in total TB cases.

The Figure 1 presents the number of TB+ cases per quarter during the COVID-19 lockdown and before and after COVID-19 lock down. This line chart presents the quarterly variation in the number of reported cases during the both periods. It appears that there is a decline in reported cases of 57% during Q2-20. The subsequent quarters (Q3-20 and Q4-20) show fluctuations, with case numbers returning to higher levels but not surpassing the pre-lockdown quarters. The chart shows a portrait of how the lockdown may have influenced the reported case numbers during the specific periods.

Discussion

The findings of the current study show the quarterly case detection of pulmonary and extra-pulmonary TB cases highlighting the distribution across different demographics. Consistently high numbers of new pulmonary tuberculosis cases align with the global trend where pulmonary TB accounts for the majority of reported cases. Similar findings were observed in other studies conducted worldwide, such as the World Health Organization's Global Tuberculosis Report [6,15]. The constant proportion of bacteriologically confirmed among pulmonary cases, ranging from 48% to 57%, indicates a consistent

Table 3: Percentage differences in various categories of TB cases from 2019-2020.

Period		2019	2020	% Difference
Pulmonary	New	6078	5278	-13%
	Relapse	135	101	-25%
Extra Pulmonary	New	2015	1469	-27%
	Relapse	3	6	100%
Age Categories	0-14	1369	1200	-12%
	15-24	1319	1096	-17%
	25-34	1187	1011	-15%
	35-44	995	867	-13%
	45-54	1048	888	-15%
	55-64	1195	962	-19%
	65<	1118	830	-26%
Gender	Male	3791	3157	-17%
	Female	4440	3697	-17%
Total		8231	6854	-17%

pattern in the type of TB cases identified. This aligns with the general understanding that pulmonary TB is more commonly identified due to its infectious nature [16]. The predominance of pulmonary cases may be attributed to the respiratory transmission of the MTB making it the more commonly identified form of the disease. However, the counts of new extra-pulmonary TB cases ranging from 531 to 732 highlight the substantial burden of extra-pulmonary TB. While pulmonary TB receives more attention due to its infectious nature, studies emphasize the importance of recognizing and addressing extra-pulmonary TB's clinical challenges and potential for severe outcomes [17]. In the current study it was found that majority of the TB cases were in the age categories 0 to 14, 15 to 24, and 25 to 34 which was is in line with the age distribution patterns reported by WHO and in various studies [18-20]. Younger age groups often show higher TB incidence rates, due to possible factors such as more social contact, susceptibility, and challenges in early diagnosis. Similarly high frequencies of TB cases among females (1437 to 1541) are consistent with other studies [21,22]. Moreover, gender-specific biological factors may play a role in the manifestation and progression of TB. Hormonal differences between males and females can influence immune responses and susceptibility to infections, including TB. Additionally, women may be more exposed to TB in certain settings, such as households with active TB cases, due to caregiving roles or close contact with family members [23].

In the current study high fluctuations were observed in the total number of new OPD visits, with a peak in Q4 2019 and a later decrease in Q1 2020, are consistent with broader patterns seen in healthcare-seeking behavior during the COVID-19 pandemic. Studies from various regions have reported disruptions in healthcare services and changes in patient behavior during the pandemic, potentially influencing TB case detection rates [24-26].

The unbalanced pattern in the identification of presumptive TB cases, the case detection rate (N+R), case notification rate and testing methods such as AFB, SM, and Xpert among presumptive TB patient with a peak in Q4 2019 and a decrease in Q1 2020, aligns with reports highlighting the impact of the pandemic on TB case finding. Studies have suggested that disruptions in routine health services, lockdown measures, and shifts in healthcare priorities during the pandemic have contributed to variations in TB case identification globally [9,27,28].

In our study it was found that there was a decrease of 17% in the detection rate of TB from the year 2019 to 2020 which is lower than the WHO report and other studies ranging 20% to 40% [29-32]. However, the COVID-19 lockdown had a significant impact on the TB case notification with a 57% decline in Q2-2020 compared to the same quarter in 2019. This is consistent with the global trend of reduced TB case notification in 2020 due to the COVID-19 pandemic, as reported by the WHO and other studies [33-35]. These findings highlight the global disruption of TB services and the challenges posed by the pandemic, including diversion of resources to COVID-19 response, decreased laboratory capacity, and stigma preventing access to diagnostic services. It is evident that the pandemic has had a profound impact on TB detection and management, highlighting the urgent need for sustained efforts to ensure continuity of TB diagnostic services and the development of strategies to mitigate the long-term effects of the COVID-19 pandemic on TB control. Furthermore, the study also showed that the TB case notification rebounded in Q3-20 and Q4-20, although it did not reach the pre-lockdown levels. This may reflect the easing of lockdown restrictions and the increased involvement of private facilities in TB case finding and reporting.

Our study had some limitations that are important to acknowledge. Firstly, the study was retrospective record-based study. Which depends on the back data how accurately the clinics kept records, which might have been affected during the COVID-19 lockdowns. We only evaluated case detection during the second year 2019 and 2020. However, the treatment outcomes were not properly reported during the lockdown period of COVID-19.

These findings highlight the complex challenges posed by the pandemic, including resource diversion, decreased laboratory capacity, and stigma hindering access to diagnostic services. Urgent action is needed to ensure the continuity of TB diagnostic services and develop strategies to alleviate the pandemic's long-term effects on TB control. While TB case notification rebounded in the latter quarters of 2020, it did not reach pre-lockdown levels, indicating ongoing challenges despite easing restrictions and increased involvement of private facilities in TB case finding and reporting. Moving forward, sustained efforts and collaborative approaches are essential to address the evolving landscape of TB control amidst the COVID-19 pandemic.

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