

Received : 10 January 2024, Accepted: 15 April 2024

DOI: <https://doi.org/10.33282/rr.vx9i2.97>

## PRESENTATION PATTERNS OF TUBERCULOSIS AND STATUS OF THEIR BCG VACCINATION IN CHILDREN: A CROSS SECTIONAL STUDY

Sasui Wadho<sup>1</sup>, Muhammad Aslam Chandio<sup>2</sup>, Asif Ali Khuhro<sup>3</sup>, Kaleemullah Abro<sup>4</sup>

Nazimuddin<sup>5</sup>, Nazia Faraz Shaikh<sup>6</sup>, Muhammad Parial Shahani<sup>7</sup>, Manzoor Ahmed Shahani<sup>8</sup>

1. **Sasui Wadho**, Provincial Coordinator SS, HIV/AIDS, Health Department, Sindh.
2. **Muhammad Aslam Chandio**, Department of Pediatric Medicine, Shaheed Mohtarma Benazir Bhutto Medical University Lyari, Karachi.
3. **Asif Ali Khuhro**, Department of Pediatric Medicine, Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences Gambat, Khairpur
4. **Kaleemullah Abro**, Department of Community Medicine, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana
5. **Nazimuddin**, Department of Pediatric Medicine, CMC Children Hospital @ Shaheed Mohtarma Benazir Bhutto Medical University, Larkana
6. **Nazia Faraz Shaikh**, Department of Pediatric Medicine, CMC Children Hospital @ Shaheed Mohtarma Benazir Bhutto Medical University, Larkana
7. **Muhammad Parial Shahani**, Department of Community Medicine, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana
8. **Manzoor Ahmed Shahani**, Department of Community Medicine, LUMHS Jamshoro

### Corresponding Author

Muhammad Parial Shahani  
drmpshahni@gmail.com

Chandio and Asif Ali Khuhro drafted the manuscript, Nazimuddin and Nazia Faraz Shaikh created the SPSS spreadsheet, Muhammad Parial Shahani Analyzed the data and Manzoor Ahmed Shahani critically reviewed the manuscript.

### AUTHORS CONTRIBUTION

Sasui Wadho and Kaleemullah Abro collected the data, Muhammad Aslam

### ABSTRACT

**OBJECTIVE:** To evaluate the disease pattern of tuberculosis and BCG vaccination status among children.

**BACKGROUND:** The Bacillus Calmette-Guérin (BCG) vaccine, which protects against TB, is one of the most extensively used vaccinations worldwide. There is occasional available research on patterns of presentations of tuberculosis in association with status of BCG vaccination in the study settings even though the BCG vaccine is included in Pakistan's EPI programme.

**MATERIALS AND METHODS:** In this cross sectional survey, 160 children aged 01 year to 13 years were studied at pediatric units at a tertiary care hospital in Karachi during the year 2022. Tuberculosis cases were confirmed on X-ray chest were made part of the study. The vaccination status of the each patients was confirmed bases on the BCG scar exclusively. We used the Microsoft Excel 2016 spread sheet for data entry and analysis.

**RESULTS:** In the present study there were 94 (58.75%) male and 66(41.25%) females, 47.5% of the participants were aged below 5 years, more than half (51.88%) of the cases presented with Pulmonary TB, and 76.25% were not vaccinated. Proportion of unvaccinated cases were significantly higher across all the types of tuberculosis

**CONCLUSION:** Tuberculosis was more common among males and children under five years, compared to all the variants, the pulmonary TB was more common. More than 3/4<sup>th</sup> of participants were not vaccinated.

**KEY WORDS:** Pulmonary tuberculosis, Disease Pattern, BCG, Vaccination

## INTRODUCTION

The Bacillus Calmette-Guérin (BCG) vaccine, which protects against TB, is one of the most extensively used vaccinations worldwide. If TB is endemic, the WHO advises include BCG in the paediatric immunisation programme [1]. There is mounting clinical evidence that BCG has a positive nonspecific effect on nontuberculous mortality [2,3,4,] and infectious diseases in low-income countries, as well as an ecological study indicating a positive effect on hospitalisations in a high-income country [5,6], resulting in a public health benefit that may go beyond tuberculosis protection.

Several immunological pathways have been postulated to explain these effects [7, 8, 9]. There is occasional available research on patterns of presentations of tuberculosis in association with status of BCG vaccination in the study settings even though the BCG vaccine is included in Pakistan's EPI programme. A research found that newborn

BCG vaccination did not reduce the incidence of hospital admissions for infectious illnesses if the mother had not been immunised against BCG [10]. However, children of BCG-vaccinated mothers who were randomly assigned to receive the BCG vaccine had a 35% (95% confidence interval [CI], 6%-55%) lower rate of hospital admissions for infectious diseases than those in the control group [10], as well as fewer general practitioner visits and parental reports of infection [11].

Therefore this cross sectional study examined the patterns of presentation of various cases of tuberculosis and the vaccination status of the children.

## MATERIALS AND METHODS

### *Study Design, Setting and Sample Selection*

In this cross sectional survey, 160 children aged 01 year to 13 years were studied at pediatric units at a tertiary care children hospital in Karachi during the year 2022. All

the male and female children presenting with tuberculosis, confirmed on X-ray chest were made part of the study. However, we excluded the patients with history of asthma, recurrent episodes of wheezing, cystic fibrosis, encephalitis and acute bacterial meningitis. After seeking the formal informed consent we obtained the data from the patients' guardian or attendant available. In our questionnaire, we documented the sociodemographic details of the patient viz, MR no. gender, age of patient, address. In this study four patterns of presentation of tuberculosis were recorded as pulmonary tuberculosis, tuberculosis of the abdominal cavity, tuberculous meningitis and tuberculous lymphadenitis. The vaccination status of the each patients was confirmed bases on the BCG scar exclusively.

#### ***Labelling of Types of Tuberculosis***

Labelling the different presentation of tuberculosis, we used the following criteria: patients were labeled to have pulmonary tuberculosis if there was history of increased ESR with fever for more than weeks, and AFB tested positive in sputum. The patients were labeled to have tuberculosis meningitis if CSF revealed pleocytosis and there were focal neurological signs for more than two weeks. The patients were labeled to have tuberculosis lymphadenitis if

histopathological examination of tuberculosis confirmed via biopsy (excluding the lymph nodes), The patients were labeled to have tuberculosis of abdominal cavity if there fever for more than two weeks with mesenteric lymphadenitis, anorexia with history of history of weight loss and lesions suggesting tuberculosis on biopsy.

#### ***Data Analysis Plan***

We used the Microsoft Excel 2016 spreadsheet for data entry and analysis. We presented the quantitative variables using in frequency and percentage however mean and standard deviation were used to present the qualitative data using tables and pie charts.

#### **RESULTS**

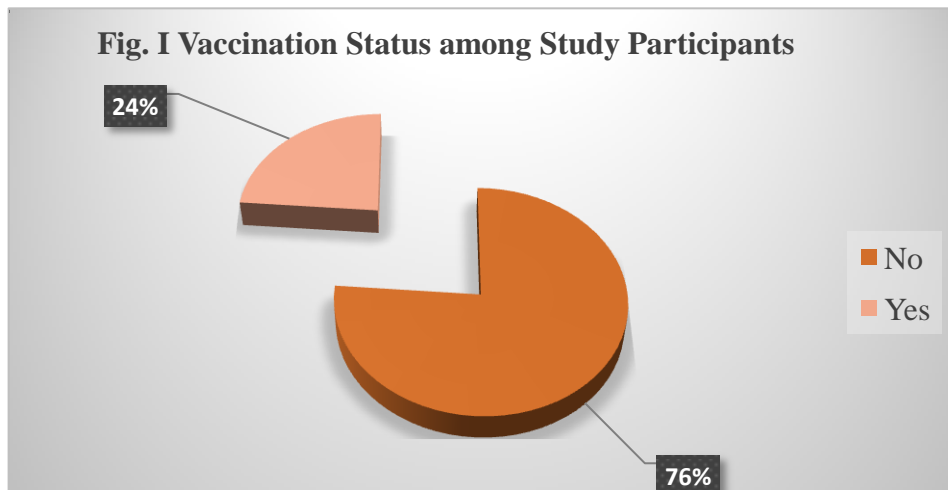
In the present study there were 94 (58.75%) male and 66(41.25%) females, nearly half (47.5%) of the participants were aged below 5 years, 38.13 were aged between 5 to 9 years and rest of 23 (14.38%) were aged between 10 to 13 years. Less than 1/3<sup>rd</sup> (31.88%) belonged to urban area. More than half (51.88%) of the cases presented with Pulmonary TB, there were 17(10.63%) cases of Abdominal tuberculosis, there were 34(21.25%) cases of TB Meningitis, and there were 26 (16.25%) cases of Tuberculous Lymphadenitis. Table I

Table I Distribution of Age, Gender, Type and Vaccination Status of Tuberculosis among Study Participants

	Variable	n (160)	%
Age	01 to 05 Years	76	47.50
	05 to 09 Years	61	38.13
	10 to 13 Years	23	14.38
Gender	Male	94	58.75
	Female	66	41.25
Residence	Rural	109	68.13
	Urban	51	31.88
Type	Pulmonary TB	83	51.88
	Abdominal tuberculosis	17	10.63
	TB Meningitis	34	21.25
	Tuberculous lymphadenitis	26	16.25
Vaccinated for TB	No	122	76.25
	Yes	38	23.75

In our Findings, there were 38 (23.75%) children vaccinated for Tuberculosis

however, 122 (76.25%) were not vaccinated.  
Fig. I



In this study, we employed Chi Square test of association to evaluate the association cases of tuberculosis with the status of vaccination. We observed that unvaccinated

cases were significantly higher than vaccinated cases across all the types of tuberculosis.

Table II Association of Vaccination Status with Different Types of Tuberculosis among Study Participants

Type Tuberculosis	n (160)	Vaccination Status				P-value
		Yes	%	No		
Pulmonary TB	83	26	31.33	57	68.67	0.04
Abdominal tuberculosis	17	2	11.76	15	88.24	0.01
TB Meningitis	34	7	20.59	27	61.76	0.04
Tuberculous lymphadenitis	26	3	30.77	23	88.46	0.03

## DISCUSSION

Tuberculosis (TB) is an infectious disease caused mostly by *Mycobacterium tuberculosis*. It mostly affects the lungs (pulmonary tuberculosis), although it can affect any organ system (extra-pulmonary tuberculosis). Tuberculosis (TB) is presently the leading cause of death from a curable infectious illness [12-13]. BCG has been shown to give substantial resistance to common and miliary TB in 80% of patients. In pulmonary TB, protection is substantially lower (50% of cases) [14].

According to the current study's findings, over half (51.88%) of the patients were diagnosed with pulmonary tuberculosis, 17 (10.63%) with abdominal tuberculosis, 34 (21.25%) with TB meningitis, and 26 (16.25%) with tuberculous lymphadenitis. In our findings, 38 (23.75%) children were vaccinated against tuberculosis, whereas 122 (76.25%) were not. In contrast to our observations, a research done at the Bahawal Victoria Hospital Paediatric Unit II in Bahawalpur found that 76 of the 100 TB

patients hospitalized during this period were vaccinated, whereas 24 were unvaccinated [15].

Comparatively a much higher proportion vaccinated cases was observed in Birmingham, the study found that 62 of 108 cases (57%) received BCG and 336 of 432 (78%) controls received BCG. The estimated protective efficacy of the vaccines was 64% (95%, 43% and 77% confidence limits) [16]. International studies show that the BCG vaccine is very beneficial in preventing childhood tuberculosis. Contrary to international data, local reports have shown controversy over the role of the BCG vaccine [17]. However, the effectiveness of the BCG vaccine has been heavily questioned. Studies of older children and adults showed 77% protection in the UK, only 14% in the southern US, and no protection in Madras [18]. International data showing that BCG has a greater preventive effect in meningeal tuberculosis and less in pulmonary tuberculosis. Therefore, BCG vaccination was significantly associated

with the reduction of extra-pulmonary disease [19].

In the present study, the Chi Square test of association to evaluate the association cases of tuberculosis with the status of vaccination. We observed that unvaccinated cases were significantly higher than across all the types of tuberculosis.

Data gathering from a single tertiary hospital was a study drawback, and a bigger study is required to establish the BCG vaccine's true efficiency and preventative benefit. More research is needed on novel TB vaccines that are equally effective against all types of tuberculosis. Because TB is relatively frequent in our culture, the BCG vaccination should be administered immediately after birth.

## CONCLUSION

Our study found that tuberculosis was more common among males and children under five years, compared to all the variants, the pulmonary TB was more common. More

## REFERENCES

1. World Health Organization. Position paper: BCG Vaccine. *Wkly Epidemiol Rec* 2004;79:27–48.
2. Aaby P, Roth A, Ravn H, et al. Randomized trial of BCG vaccination at birth to low-birth-weight children: beneficial nonspecific effects in the neonatal period? *J Infect Dis* 2011;204:245–52.
3. Roth A, Gustafson P, Nhaga A, et al. BCG vaccination scar associated with better childhood survival in Guinea-Bissau. *Int J Epidemiol* 2005;34:540–7.
4. Roth A, Sodemann M, Jensen H, et al. Tuberculin reaction, BCG scar, and lower female mortality. *Epidemiology* 2006;17:562–8.
5. Storgaard L, Rodrigues A, Martins C, et al. Development of BCG scar and subsequent morbidity and mortality in rural Guinea-Bissau. *Clin Infect Dis* 2015;61:950–9.
6. de Castro MJ, Pardo-Seco J, Martín-Torres F. Nonspecific (Heterologous) protection of neonatal BCG vaccination against hospitalization due to respiratory infection and sepsis. *Clin Infect Dis* 2015;60:1611–9.
7. Jensen KJ, Larsen N, Biering-Sørensen S, et al. Heterologous immunological effects of early BCG vaccination in low-birth-weight infants in Guinea-Bissau: a randomized-controlled trial. *J Infect Dis* 2015;211:956–67.
8. Kleinnijenhuis J, Quintin J, Preijers F, et al. Bacille Calmette-Guerin induces NOD2-dependent nonspecific protection from reinfection via epigenetic reprogramming of monocytes. *Proc Natl Acad Sci USA* 2012;109:17537–42.

than 3/4<sup>th</sup> of participants were not vaccinated. BCG is efficient against most kinds of TB, especially meningeal and abdominal tuberculosis, but less effective against pulmonary tuberculosis.

## CONFLICT OF INTEREST

The authors declared no any conflict of interest

## SOURCE OF FUNDING

There was no any funding involved.

## AUTHORS CONTRIBUTION

Sasui Wadho and Kaleemullah Abro collected the data, Muhammad Aslam Chandio and Asif Ali Khuhro drafted the manuscript, Nazimuddin and Nazia Faraz Shaikh created the SPSS spreadsheet, Muhammad Parial Shahani Analyzed the data and Manzoor Ahmed Shahani critically reviewed the manuscript.

9. Netea MG, Quintin J, van der Meer JW. Trained immunity: a memory for innate host defense. *Cell Host Microbe* 2011;9:355–61.
10. Stensballe LG, Ravn H, Birk NM, Kjærgaard J, Nissen TN, Pihl GT, Thøstesen LM, Greisen G, Jeppesen DL, Kofoed PE, Pryds O. BCG vaccination at birth and rate of hospitalization for infection until 15 months of age in Danish children: a randomized clinical multicenter trial. *Journal of the Pediatric Infectious Diseases Society*. 2019 Jul;8(3):213-20.
11. Kjærgaard J, Birk NM, Nissen TN, Thøstesen LM, Pihl GT, Benn CS, Jeppesen DL, Pryds O, Kofoed PE, Aaby P, Greisen G. Nonspecific effect of BCG vaccination at birth on early childhood infections: a randomized, clinical multicenter trial. *Pediatric research*. 2016 Nov;80(5):681-5.
12. Funch KM, Thysen SM, Rodrigues A, Martins CL, Aaby P, Benn CS, Fisker AB. Determinants of BCG scarification among children in rural Guinea-Bissau: a prospective cohort study. *Human vaccines & immunotherapeutics*. 2018 Oct 3;14(10):2434-42.
13. Pelzer PT, Mutayoba B, Cobelens FG. BCG vaccination protects against infection with *Mycobacterium tuberculosis* ascertained by tuberculin skin testing. *Journal of Infection*. 2018 Oct 1;77(4):335-40
14. Salmon C, Conus F, Parent MÉ, Benedetti A, Rousseau MC. Association between *Bacillus Calmette–Guérin* vaccination and lymphoma: a population-based birth cohort study. *Journal of Internal Medicine*. 2019 Nov; 286(5):583-95.
15. Chacon-Cruz E, Arellano-Estrada JL, Lopatynsky-Reyes E, AlvelaisPalacios J, Becka C. Children with lymphadenitis associated with *Bacillus Calmette–Guérin* (BCG) vaccination do not experience more infections when compared with BCG-vaccinated children without lymphadenitis: a three years paired-cohort in Mexico. *Therapeutic Advances in Vaccines*. 2017 Aug;5(4-5):103-7.
16. Kusnanto K, Arifin H, Kurniawati Y. Determinant of BCG vaccine coverage among Indonesian children aged 0–2 months. *Children and Youth Services Review*. 2020 Sep 1;116:105238.
17. Choi YY, Han MS, Lee HJ, Yun KW, Shin CH, Yoo WJ, Cho TJ, Cheon JE, Park KU, Choi EH. *Mycobacterium bovis* osteitis following immunization with *Bacille Calmette–Guérin* (BCG) in Korea. *Journal of Korean medical science*. 2019 Jan 7;34(1).
18. Salmon C, Conus F, Parent MÉ, Benedetti A, Rousseau MC. Association between *Bacillus Calmette–Guerin* (BCG) vaccination and lymphoma risk: A systematic review and meta-analysis. *Cancer Epidemiology*. 2020 Apr 1;65:101696
19. Zimmermann P, Donath S, Perrett KP, Messina NL, Ritz N, Netea MG, Flanagan KL, van der Klis FR, Curtis N. The influence of neonatal *Bacille Calmette–Guerin* (BCG) immunization on heterologous vaccine responses in infants. *Vaccine*. 2019 Jun 19;37(28):3735-44