

Original Research Article

Perceptions of post vaccination *Bacillus Calmette-Guérin* scar formation among caregivers in tertiary health institution in North-East, Nigeria

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ABSTRACT

Background: Tuberculosis continues to be one of the major causes of morbidity and a leading cause of mortality worldwide, especially in low- and middle-income countries like Nigeria. To effectively contribute to the fight against tuberculosis (TB), mothers must be well-informed about TB and how to prevent TB in children. The objective of this study was to evaluate the knowledge and perception of mothers about *Bacillus Calmette-Guérin* (BCG) scarring.

Methods: This was a cross-sectional descriptive study performed from July to December 2024 in a tertiary health care facility in Yola, Nigeria.

Results: Majority (80%) of the caregivers were aware that BCG protects against tuberculosis, about 95% believed BCG can result in scar formation and 61% agree that presence of scar indicates that BCG vaccine is working. About 90% of the caregivers would report to a health facility when the scar fails to appear after BCG vaccination.

Conclusions: Majority of the caregivers (mothers) were found to be aware that BCG protects against TB and accept BCG scarring following vaccination. We recommend regular health education to mothers during routine immunization to maintain adequate and accurate health information on vaccines.

Keywords: *Bacillus Calmette Guérin* vaccine, BCG scarring, Perceptions

INTRODUCTION

Bacillus Calmette-Guérin (BCG) vaccination against tuberculosis have shown to have beneficial effect on child survival and the presence of BCG scar following vaccination may be associated with lower child mortality.¹ Tuberculosis continues to be one of the major causes of morbidity and a leading cause of mortality worldwide, especially in low- and middle-income countries.²

According to the WHO global tuberculosis report 2022, an estimated 10.6 million new cases of tuberculosis were reported in 2021, an increase of 4.5% from 10.1 million

new cases recorded in 2020. Most cases of TB occur in the South-East Asia (35%), African (30%) and Western Pacific (20%) regions. Nigeria, along with seven other countries account for two-third cases of tuberculosis worldwide.³

BCG, a live-attenuated *Mycobacterium bovis* vaccine that protects against tuberculosis and other *Mycobacterium* diseases, remains one of the most widely used vaccines in the world.⁴ It is essential for preventing severe forms of tuberculosis, especially in children, such as TB meningitis and military TB.⁵ The World Health Organization recommends that newborns be vaccinated with the BCG vaccine at birth or upon first contact with medical

services, particularly in developing nations or areas where tuberculosis is prevalent.

As part of the childhood vaccination program, the vaccine is regularly administered to newborns in more than 100 countries.⁷ Countries differ in their BCG immunization coverage. According to the World Health Organization's estimated BCG coverage report in 2022, levels ranged from 84 percent in South Africa and 74 percent in Nigeria to 91 percent and 100 percent in China and India, respectively.⁸

TB continues to be major health hazard and BCG vaccination coverage is important. BCG coverage is important indicator in TB control and caregivers have an important role in ensuring optimal coverage of BCG vaccine.⁹

Few studies have been done on perception of caregivers on BCG vaccination scar among children in African setting. To our knowledge, no studies have explored the perception of caregivers on scarring following BCG vaccination. A comprehensive systematic review by Mills et al, identified several barriers to childhood vaccinations, including fear of adverse effects, concerns that the vaccine may cause disease, previous negative experiences with vaccination, the belief that it is administered at too young an age and the perception that it causes pain for the child.¹⁰

The decision to vaccinate children is made by parents and in settings where vaccination is not mandatory, parental perception plays a crucial role, as perception of parents on BCG vaccination scar on their children may influence their opinion on the uptake of BCG vaccine.⁹ In the current cross-sectional study we evaluated the perception of caregivers towards BCG vaccination scar in our locality.

METHODS

Study design and study population

A cross-sectional study was carried out for a period of 6 months between July to December 2024. The study subjects were women with children attending immunization clinic at MAUTH Yola.

Study place

The study was conducted in Modibbo Adama University Teaching Hospital (MAUTH) Yola, Adamawa State, Nigeria. Adamawa State is located in North Eastern part of Nigeria and lies between latitude 80N and 110N and longitude 11.50E and 13.50E.

MAUTH is a tertiary health institution in Yola town, Adamawa State. The hospital has a bed capacity of 400. It provides primary, secondary and tertiary health care services to inhabitants of the State and serves as a referral

centre to neighboring States and parts of Cameroon Republic.

Sample size calculation

The minimum sample size was calculated using this formula

$$n = Z^2 pq/d^2^{11}$$

Where,

n=Minimum sample size

p=The proportion of the target population estimated to have a particular characteristic (in this case, the prevalence of 81.5% was used as obtained from ABUTH study by Gambo et al.¹²

q= 1- p, d=Tolerable margin of error=0.05

Z=Standard normal deviate, usually set at 1.96 which corresponds to 95% confidence interval.

p=81.5%, p=81.5/100=0.815, q=1-0.815=0.185

$$n = (1.96)^2 \times 0.815 \times 0.185 / 0.05^2$$

n=232

Twenty percent of 232 will be added for non-response that is 46+232=278.

Inclusion criteria

Caregivers who brought their children for routine Immunization and have received BCG vaccination. All caregivers from whom signed informed consent has been obtained for the study

Exclusion criteria

Caregivers who brought their children for the first time for BCG vaccination. Caregivers whose children have acute illness

Sampling technique

All caregivers who brought their children to the immunization clinic and met the inclusion criteria were consecutively enrolled in the study after obtaining an informed consent.

Study instrument

The research instrument utilised in this study is a questionnaire, designed by the researcher, that takes the form of a declarative statement. Its primary objective is to assess the degree of knowledge and perception that mothers possess concerning BCG scarring in Yola. The questionnaire's validity was established through a

rigorous face and content validation procedure, carried out by three unrelated research professionals in the discipline of public health, ensuring its clarity and appropriateness for this study.

The questionnaire comprises of two sections. Section A contains information about caregiver's general characteristics; the caregivers age, educational status, employment status, family history of TB. Additionally, other information obtained includes place of last birth and ANC attendance during pregnancy. Section B assessed the caregiver's knowledge of the BCG vaccination, its side effects, caregivers view on BCG scar, importance of BCG scar, reaction of caregivers to absence of BCG scar and the significance of BCG scar.

Statistical analysis

The data collected was recorded in Microsoft Excel spreadsheet and transferred to SPSS version 22 where the analysis was performed. Frequencies, means and proportions used to describe quantitative variable, while qualitative variables were summarized using proportions. To describe the level of knowledge and perception of caregivers a univariate analysis was carried out on the research variables. The study results are then displayed in the form of a frequency distribution table.

RESULTS

General characteristics of the study population.

A total of 277 caregivers (all mothers) were enrolled in the study over a period of six months. Only 3(1%) had a family history of TB. Almost ninety percent 87.4% (242) had their delivery in a hospital and half of the mothers were between 25-34 (139) age group. Over 95% (267) had ANC during their last delivery but only (163)58% percent did exclusive breastfeeding for their children. Four (1.4%) had no form of formal education and 45 (16.2%) were also employed (Table 1).

Parental perception of BCG vaccination (n=277).

Vast majority of mothers (80.5%) stated that BCG vaccine protects against tuberculosis. 72.5% believes that BCG vaccine can result in unwanted side effects, while 94.6% are aware that it can also result in scar formation. More than 90% say they are don't mind (Prefer) the scar, but are concerned when it is absent. About 90% would report to health facility when BCG scar is absent after vaccination while 60% believes that BCG scar signifies that that vaccine is working (Table 2).

Table 1: Characteristics of the study participants (n=277).

Variable	Frequency	%
Family history of TB		
Yes	274	98.9
No	3	1.1
Place of birth		
Home	35	12.6
Hospital	242	87.4
Exclusive breastfeeding		
No	114	41.2
Yes	163	58.8
Ante natal care (ANC)		
Yes	267	96.4
No	10	3.6
Mother's age group		
15-24	92	33.2
25-34	139	50.2
≥35	46	16.6
Mean mother's age±SD	27.9±6.2	
Religion of Parents		
Christianity	76	27.4
Islam	201	72.6
Mother's educational status		
No formal education	4	1.4
Formal education	273	98.6
Mother's occupation		
Employed	45	16.2
Not employed	232	83.8

Table 2: Parental perception about BCG vaccination (n=277).

Variable	Frequency	%
BCG vaccine protects against TB		
Yes	223	80.5
No	16	5.8
Don't know	38	13.7
BCG vaccinations can cause unwanted effects on the baby		
Yes	50	18.1
No	201	72.5
Don't know	26	9.4
Aware that BCG vaccination may result in scar formation		
Yes	262	94.6
No	10	3.6
Don't know	5	1.8
View on BCG scar formation		
Don't mind (Prefer)	263	94.9
Indifferent	13	4.7
Prefer not having the scar	1	0.4
Concerned if scar is absent		
Yes	258	93.1
No	19	6.9
Think BCG scar is important		
Yes	262	94.6
No	6	2.2
Don't know	9	3.2
What will you do if the scar is absent		
Report to health facility	246	88.8
Don't mind	31	11.2
Significance of BCG scar		
Vaccine working	168	60.6
Vaccine not working	2	0.8
Mark of identification	107	38.6

DISCUSSION

All the caregivers interviewed in this study were mothers (100%) with almost 99% having some form of formal education and over 95% attended ante natal clinic during pregnancy. This is similar to the studies carried out by Enwonwu et al, at Onitsha Nigeria, where they evaluated the perception of childhood immunization among mothers and reported 100 percent of mothers have some form of formal education and most had ante natal care during pregnancy.¹³ This could be attributed to the achievement of a certain degree of formal education by majority of the mothers.

The perceptions of the caregivers in this study reveals that majority agrees that BCG vaccine protects against tuberculosis (80%), this is similar findings reported by Mereena et al, in India where majority of mothers (over 90%) know that BCG vaccine protects against tuberculosis.¹⁴ This is in contrast to Aketi et al, work in Kinshasa where only 14% of mothers know that BCG vaccine protects against tuberculosis.⁹ This difference could be due to relatively higher number of mothers with

low level education (24%) in Aketi et al, study population as compared to our study where only 1.5% had no formal education. About 95% are aware that BCG vaccine can result in scar formation and would prefer to have the scar following BCG vaccination. This is consistent with findings reported by Rohit et al and Wija et al, who both found that the knowledge of scar formation after BCG vaccination were 91% and 78% respectively among the mothers in their study.^{15,16} This high level of knowledge on BCG scarring could be due to the fact that 96% of mothers attend ante natal clinic during pregnancy where they receive health education on routine immunization for their children.

Only 18% of our study participants reported that BCG vaccination can cause unwanted side effects on their babies, this is in contrast to the findings reported in India by Rohit et al, where majority (90%) are aware that BCG can cause unwanted side effects on these babies.¹⁵ The possible reason for this difference is not known to the researchers. This low level of knowledge on BCG side effects could be due to low incidence of adverse effects of BCG vaccine following vaccination.¹⁷

On situations where BCG scar fails to appear after vaccination, 90% of caregivers in our study admitted they will report to the hospital when the scar fails to appear because they agree that the presence of the scar signifies that the vaccine is working. This observation is similar to the study of Srisaravanapavananthan et al, who reported that 84% will seek for advice in the event of absence of BCG scar following vaccination.¹⁸ This observation could possibly be explained by the high literacy rate of the caregivers in our study and additionally, over 95% had ANC during their last delivery.

CONCLUSION

From the outcome of this research, majority of the caregivers (mothers) were found to be aware that BCG vaccine protects against tuberculosis and accept BCG scarring following vaccination as an indication that the vaccine is working. We recommend regular health education to mothers during routine immunization to maintain adequate and accurate health information on vaccines.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Roth A, Gustafson P, Nhaga A, Djana Q, Poulsen A, Garly ML, et al. BCG vaccination scar associated with better childhood survival in Guinea-Bissau. *Int J Epidemiol*. 2005;34(3):540–7.
- Kheir AEM, Alhaj AA, Ibrahim SA. The sensitivity of BCG scar as an indicator of previous vaccination among Sudanese infants. *Vaccine*. 2011;29(46):8189–91.
- World Health Organization. Global tuberculosis report 2022. Geneva: World Health Organization. 2022. Available at: <https://www.who.int/publications>. Accessed on 21 January 2025.
- Roy A, Eisenhut M, Harris RJ, Rodrigues LC, Sridhar S, Habermann S, et al. Effect of BCG vaccination against Mycobacterium tuberculosis infection in children: systematic review and meta-analysis. *BMJ*. 2014;349:4643.
- Moliva JJ, Turner J, Torrelles JB. Immune responses to bacillus Calmette-Guérin vaccination: why do they fail to protect against Mycobacterium tuberculosis. *Front Immunol*. 2017;8:407.
- Fine PEM, Carneiro IAM, Milstien JB, Clements CJ. Issues relating to the use of BCG in immunization programmes: a discussion document. Geneva: World Health Organization. 1999.
- Zwerling A, Behr MA, Verma A, Brewer TF, Menzies D, Pai M. The BCG World Atlas: A database of global BCG vaccination policies and practices. *PLoS Med*. 2011;8(3):1001012.
- World Health Organization. 2024 global tuberculosis report. Geneva: WHO. 2024.
- Aketi L, Diayisu JS, Kashongwe Z, Nkabikueni G, Kalambay PK, Kayembe JM. Maternal knowledge of tuberculosis and Bacillus Calmette-Guérin vaccination in pediatric health services in Kinshasa. *J Tuberc Res*. 2017;5(1):30–43.
- Mills EJ, Montori VM, Ross CP, Shea B, Wilson K, Guyatt GH. Systematically reviewing qualitative studies complements survey design: An exploratory study of barriers to paediatric immunisations. *J Clin Epidemiol*. 2005;58(11):1101–8.
- Lwanga SK, Lameshow S. Sample Size Determination in Health Studies. Geneva: World Health Organization. 2025.
- Gambo MJ, Lawan UM, Ahmad HR, Ogala WN. Assessment of tuberculin reactivity of BCG vaccinated infants in Zaria, Nigeria. *Niger J Basic Clin Sci*. 2014;11(2):104–9.
- Enwonwu KG, Ilika A, Ifeadike C, Aniemena C, Egeonu RO. Perception of Childhood Immunization among Mothers of Under-Five Children in Onitsha, Anambra State. *Afrimed J*. 2018;6(1):59–64.
- A Study on Knowledge and Attitude Regarding Vaccines among Mothers of Under Five Children attending Pediatric OPD in a Selected Hospital at Mangalore. *J Nurs Health Sci*. 2014;3(5):39–46.
- Rohit A, Chaya K, Poornima M, Balu P, Manu A. Perception about BCG vaccination and tuberculosis among urban mothers. *J Community Health Manag*. 2020;5(1):37–40.
- Wija IBEU, Ronny, Prihantini NN. Description of Mother's Knowledge Level about BCG Immunization in Infants Age 0-2 Months at Posyandu, Kebun Pala Village, Makassar, East Jakarta. *J Drug Deliv Ther*. 2022;12(3-S):142–9.
- World Health Organization. WHO operational handbook on tuberculosis. Module 5: management of tuberculosis in children and adolescents. World Health Organization. 2022.
- Srisaravanapavananthan N, Dissanayake NN, Sarathchandra J. BCG vaccination scars of children under five years in a tertiary care hospital. *Sri Lanka J Child Health*. 2008;37(3):7621.

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