

## Survey on Coverage and Factors Influencing Delays in BCG Immunization in Hayin Mallam Zango, Zaria, North Western Nigeria

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### Abstract

BCG immunization at birth is an evidence-based intervention for the reduction of tuberculosis transmission. While performance of BCG immunization is commonly measured by coverage, ensuring that every child is immunized immediately after birth is an important public health goal. This study was aimed at assessing the coverage and factors influencing BCG immunization delays in Hayin Mallam, Zango Zaria, Kaduna Nigeria. A cross-sectional study was conducted among 210 mothers of under-fives who were enrolled into the survey. A pre-tested semi-structured interviewer-administered questionnaire was used to collect data from these mothers. Data was analyzed using IBM SPSS 20. Majorities (76.7%) of the children were immunized with BCG, but only 44.7% of them received the vaccine in the first 7 days of life. Majority of the mothers (42.9%) had post-secondary education; this did not translate to being aware of the correct timing of BCG vaccination. The major determinants of delay in a child receiving BCG were mothers' educational status, whether she attended ANC and whether she delivered in a health facility. Even though most of the under-fives were immunized with BCG, a significant number received it later than the recommended time. Efforts to improve female education must be intensified, and antenatal care attendance and hospital delivery improved so that these could serve as avenues for educating mothers on the usefulness of immunization, particularly if done according to schedule.

**Keywords:** BCG; Immunization; Under-fives; Kaduna; Tuberculosis

### Background

Tuberculosis (TB) caused by *Mycobacterium tuberculosis* remains a disease of great public health concern, accounting for high morbidity and mortality. Its co-infection with HIV and the development and spread of multi and extensively drug-resistant tuberculosis has really made it of great concern [1]. After HIV, it is next on the list of infectious diseases recording highest number of deaths. In 2013, it was estimated that 9 million people were found to have developed tuberculosis and 1.5 million deaths were recorded from TB out of which 360, 000 were HIV positive. Majority of these estimates occurred in Africa (24%) and Asia (56%). African subcontinent accounts for 80% of HIV – positive TB cases and TB mortality in people who were HIV – positive. Nigeria accounts for 1 of the 6 countries with largest number of incident cases, third to India and China [1].

Bacille Calmette-Guérin (BCG) is the vaccine used for TB and has been in existence for 80 years. It forms part of the national childhood immunization in most countries where TB is endemic and it has been found to have protective effect against disseminated TB and meningitis in Children [2]. A meta-analysis of 18 case control studies on BCG efficacy against tuberculous meningitis and miliary tuberculosis in children, revealed an efficacy for tuberculous meningitis of 73% and miliary tuberculosis of 77% [3]. Global coverage for BCG vaccine stood at 89% while that for Africa was 82% [4]. Nigeria has a coverage of 51% which however varies across the 6 geo-political regions, with the least being in northwestern region where this study was conducted.

Within this region, there is an inter-state variation with Kaduna State having the highest coverage of 57.9% in this zone [5].

Each BCG vial being used in this part of the world contains 20 dose ampules and in handling an opened multi-dose vial, World Health Organization (WHO) recommends that the opened vial be discarded 6 hours after opening [6]. In an attempt to cut down on BCG wastage, health workers in this part of the world delay opening a BCG vial unless a minimum of 10 children are present to be vaccinated. Studies have revealed that most neonatal mortality occur in the first 7 days of live, hence delay in BCG vaccination will pose a major disadvantage because the infants do not benefit from BCG when they are prone to the highest risk [7,8]. Therefore, in June – September 2012, immunization coverage and factors influencing delays to early BCG vaccination were assessed in Zango Hayin Mallam Zaria Kaduna State to help inform targeted interventions at improving BCG vaccination, particularly in this part of the world where infant mortality rate is high (69 per 1000) [5].

### Methods

#### Study design and population

This study was a descriptive cross-sectional study carried out in Zango community which is one of the 10 wards in Sabon Gari Local government Area Kaduna State North Western Nigeria. Zango has an undulating landscape with farming as the major occupation of the people living in the area. It has a varied ethnicity that includes Hausa, Yoruba, Igbo, Fulani and people of other ethnic tribes living together but majority of the population is made up of the Hausa ethnic group.

At the time of this study, Zango had two government primary health care centers. Before the commencement of this study, routine immunization consisted of BCG, OPV0 and Hep B0 at birth, OPV1 and DPT1 at 6 weeks, DPT2, OPV2 and Hep B1 at 10 weeks, DPT3, OPV3 and Hep B3 at 14 weeks and Yellow fever and Measles vaccines at 9 months of age. All of these vaccines were administered for free at health centers and during outreach campaigns which are strengthened by support from donor organizations. The BCG immunization coverage for this geopolitical zone then was 21.7% 5 compared to national coverage of 51%. A total of 210 mothers/caregivers residing in Hayin Mallam Zango were enrolled into the study and the vaccination status of children less than 5 years were assessed using pre-tested semi-structure interviewer administered questionnaire. Mothers or caregivers with children <5 years of age were included in the study while those with children >5 years of age were excluded.

Variables	Frequency	Percentage (%)
<b>Age of under-fives (months)</b>		
0 - 11	83	39.5
12 – 23	46	21.9
24 – 35	35	16.7
36 – 47	18	8.6
48 - 59	28	13.3
<b>Sex of under-fives</b>		
Males	107	51.0
Females	103	49.0
<b>BCG immunization status</b>		
Immunized	161	76.7
Not immunized	49	23.3
<b>Time of BCG immunization (days)</b>		
Timely ≤ 7	72	44.7
Delayed > 7	89	55.3

**Table 1:** Socio-demographic characteristics and BCG status of under-fives in Hayin Malla Zango.

For respondents who met the inclusion criteria, information was gathered on age, ethnicity and educational status. For those whose last pregnancy fell within the stipulated period, information was gathered around the ante-natal care, delivery and post-natal care. For the children, information on date of birth, place of birth, sex of child, who conducted the delivery, caregivers' age and ethnicity were also collected. To ascertain immunization status during the visits, vaccination cards were presented by the care giver and information on date of BCG immunization is copied on the questionnaire. In the absence of adequate vaccination information on the card, the caregiver is asked to recall the BCG immunization status of her child or the presence of a typical BCG scar is checked [9]. During the study period, caregivers of children under-five years of age were interrogated on their efforts to get their children to be BCG vaccinated at the health facilities. They were interrogated in their knowledge of BCG such as;

the appropriate time of BCG vaccination and their commitment towards getting their children vaccinated. Mothers who had not taken their children for the vaccination were also interrogated on the likely reasons responsible.

Ethical approval was sort from Ahmadu Bello University Teaching Hospital Zaria Kaduna State Nigeria, ethical committee. Informed consent was also sort from the heads of households of participating mothers in written or by thumb printing.

### Statistical analysis

WHO has recommended that BCG vaccine should be administered as soon as possible after birth [9]. Therefore, to assess the BCG immunization coverage, the age at immunization was estimated in days and categorized into two groups for the purpose of this study. The first group was termed “Timely group” comprising children immunized within the first 7 days of life while those immunized greater than 7 days of life were termed “delayed BCG group”.

Thereafter, a bivariate analysis between the timing of BCG immunization and some selected variables was assessed using Pearson's chi-square test. IBM SPSS version 20 was used for all statistical analyses.

Variable	Frequency	Percentage
<b>Mother's level of education</b>		
No formal education	55	26.2
Primary	15	7.1
Secondary	50	23.8
Post-secondary	90	42.9
<b>Age of mothers (years)</b>		
< 20	26	12.4
20-34	155	73.8
35-49	29	13.8
<b>Employment status of mother</b>		
Employed	77	36.7
Unemployed	133	63.3
<b>Antenatal care</b>		
Received	179	85.2
Not received	31	14.8
<b>Place of delivery</b>		
Traditional maternity home (TBA)	5	2.4
Home	59	28.1
Hospital	146	69.5

**Table 2:** Socio-demographic characteristics of caregivers in Hayin-Mallam Zango.

## Results

BCG was found to be 76.7% (161) out of which non-delayed group accounted for 44.7% (72) while delayed group accounted for 55.3% (89). Majority of the under-fives were within the age group 0-11months accounting for 39.5% (83) and there were more males (Table 1). Amongst the BCG vaccinated under-fives, 5.6% were vaccinated within 24 hours, 39.1% within 2-7 days, 20.5% within 7-30days and 34.8% after 30 days (Table 1).

Of the mothers/caregivers of under-fives who did not receive BCG vaccination, 49.2% attributed this to their lack of awareness of the vaccine, 29.9% attributed it to their husband's refusal, 8.2% attributed it to unavailability of the vaccine, while 3.3% attributed it to religious reasons.

Mothers/caregivers characteristics revealed that 42.9% had post-secondary education followed by 26.2% with no formal education, majority (73.8%) were in the age range 20-34 followed by 35-49 which accounted for 13.8%, 63.3% were unemployed, 85.5% did receive antenatal care for the current child and 69.5% had the delivery of their last child in a hospital (Table 2).

Concerning awareness for timeliness of BCG vaccination, 53.2% knew that it should be at birth, 21.4% said that it should be within the first 7 days and another 13.5% said that it should be within the first two weeks.

There was a statistically significant association ( $p < 0.0001$ ) between time child was BCG vaccinated and mother's level of education, place of delivery, ANC attendance and history of neonatal jaundice ( $p < 0.007$ ) (Table 3).

## Discussion

This preliminary survey revealed BCG coverage of 76.7% amongst mothers/caregivers of under-fives in Hayin Mallam Zango, Kaduna State, Nigeria. This coverage is higher compared to the national estimate of 69% for Nigeria reported in 2010 [10]. It is also higher than the state estimate reported during the National Demographic and Health Survey (NDHS) which recorded BCG coverage of 57.9% [5]. This high coverage could possibly be due to the fact that Hayin Mallam Zango is a Sub-urban community and can be easily accessed during immunization campaigns. Also contributing to this high coverage is the fact that majority of the mothers/caregivers have post-secondary school education which could have influenced their decision at seeking care hence better BCG coverage. Of note is the population of mothers/caregivers in the 20-34 age range accounting for 73.8%. This is similar to the findings in a study in a sub-Saharan community [10] indicating that this group is an important one to be targeted at intervention to improve BCG coverage.

The survey also revealed a timely BCG vaccination coverage of 44.7%. This is in contrast to a study in 3 South African areas which reported a rate of timely vaccinated children to range between 57%-88% even though the cut-off for delays was different [11]. This timely BCG coverage could be attributed to the educational status of the respondents as earlier mentioned and access to vaccination information during ANC attendance.

Timely BCG vaccination was found to be statistically significant with mother's educational level, ANC attendance and place of delivery. Mother's educational level which was high in this study could have influenced their health seeking behavior hence influence their ANC

attendance leading to favourable pregnancy outcomes and timely BCG vaccination.

Factors	Time child received BCG vaccine (days)		P - value
	Timely $\leq 7$ Frequency (%)	Delayed $> 7$ Frequency (%)	
<b>Mother's level of education</b>			
No formal education	8(19.0)	34(81.0)	<0.0001
Primary	3 (25.0)	9 (75.0)	
Secondary	12 (31.6)	26 (68.4)	
Post – secondary	49 (71.0)	20 (29.0)	
<b>Place of delivery</b>			
Home delivery	5 (10.2)	44 (89.8)	<0.0001
Hospital	67 (59.8)	45 (40.2)	
<b>Birth order</b>			
1st	23 (44.2)	29 (55.8)	<0.0001
2nd	30 (62.5)	18 (37.5)	
> 2nd	19 (31.1)	42 (68.9)	
<b>History of neonatal jaundice</b>			
Present	6 (23.1)	20 (76.9)	<0.007
Absent	66 (48.9)	69 (51.1)	
<b>ANC attendance</b>			
Yes	70 (51.1)	67 (48.9)	<0.0001
No	2 (8.3)	22 (91.7)	

**Table 3:** Factors influencing BCG immunization delays among under-fives in Hayin Mallam Zango.

This corroborated findings of similar studies conducted among socio-economically disadvantaged urban children and infants in northern Nigeria [12,13]. Timely BCG vaccination was also statistically significant with birth order. It is logical reasoning that the higher the birth order the less the willingness of the mother to get the child vaccinated with BCG. This finding corroborates the reports of NDHS 2013 which revealed that vaccination status for BCG decreased as the birth order increased.

About 50% of respondents attributed lack of awareness of the vaccine as the reason for not getting their children vaccinated, this concurs with the report by NDHS 2008 which reported lack of information as the most common reason accounting for 27% of mothers not vaccinating their children [14]. Even though the ANC attendance for this preliminary survey was high (85.2%), inconsistency at attendance could have resulted to the low level of awareness amongst respondents. The refusal of husbands to permit their wives to attend vaccination sessions in health facilities contributed to about a third of the reason why some under-fives were un-vaccinated. This is not surprising as the study population is predominantly a Hausa-Muslim community where a woman is not allowed to go out without

the consent of her husband. About a tenth of the mothers/caregivers attributed their under-fives un-vaccinated status to the unavailability of the vaccine at the health facility. This could be attributed to the restriction policy on the 20 dose-ampule vial that should be discarded 6 hours after opening. For this reason, some health facilities wait until they have adequate number of caregivers before opening the vial. The set back to this approach is that some mothers/caregivers are discouraged from presenting to the health facility on a subsequent date with their children for BCG vaccination.

## Conclusion

There was a high BCG vaccination coverage of 76.7%, with a timely vaccination of 44.7%. However, there was 55.3% delay in administration of the BCG vaccination. Major factors influencing this reported delay were maternal education, ANC attendance, hospital delivery and birth order. Efforts to improve female education must be intensified, and antenatal care attendance and hospital delivery improved so that these could serve as avenues for educating mothers on the usefulness of immunization, particularly if done according to schedule.

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