

Factors Contributing to Low Immunization Coverage among Children 0-59 Months in Bolgatanga Municipality: A Study in Upper East Region, Ghana

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Abstract

Introduction: In Ghana, the Expanded Programme on Immunization has reduced infant mortality, with districts striving to meet national immunization targets. However, the Bolgatanga Municipality consistently fell short of these targets for most antigens from 2020 to 2022. This study explored factors behind low immunization rates among children aged 0-59 months in Bolgatanga Municipality, Ghana. Methods: A descriptive cross-sectional quantitative study involved 424 participants, including caregivers of children aged 12-23 months. Quantitative data were collected using pretested structured questionnaires. Data was entered into IBM SPSS statistics software version 23 for analysis. Results: Regression analysis revealed the frequency of immunization services significantly impacted coverage ($p = 0.0000$, weekly AOR = 3.69 (C.I = 1.47 - 9.23), monthly AOR = 7.89 (CI = 2.94 - 21.20)). Reminder systems varied in effectiveness, with SMS being statistically significant (C.L = 95%, $p = 0.0003$), alongside verbal and written reminders (C.L = 95%, $p = 0.0040$; C.L = 95%, $p = 0.0000$). Conclusion: While accessibility to immunization services is not a major factor, frequency of immunization session and media of reminder systems significantly influenced coverage. More innovative strategies such as establishing formal reminder systems in all health facilities and practicing daily immunization sessions can improve coverage.

Keywords: *Bolgatanga, Caregiver's, Coverage, Immunization, Vaccine.*

Introduction

Immunization has been recognized as one of the cost-effective public health interventions for reducing childhood morbidity, mortality and disability. Globally, 4.0 million childhood deaths are prevented annually, and more than 50 million deaths can be prevented by 2030 [1]. In Ghana, the Expanded Programme on Immunization (EPI) has helped reduce infant mortality from 77 per 1000 live births to 28 per 1000 live births in 2022. Under-5 mortality also decreased from 155 deaths per 1,000 live births in 1988 to less than 50 deaths per 1,000 live births in 2022. Infant and neonatal mortality have similarly declined [2].

This achievement resulted from districts striving to achieve immunization targets set at the national level. However, the Bolgatanga Municipality has performed below the national EPI target for most of the antigens for the past three years.

Problem Statement

A three-year (2020 to 2022) analysis of the routine EPI data from the Upper East Region indicates low coverages of antigens, less than 90% in all antigens in most of the districts, including the Bolgatanga Municipality. The around 80% coverage in all antigens in the Municipality is below the Global Vaccine Action Plan (GVAP) objective of 90% coverage as national target and at least 80%

target for districts in all antigens by 2020. The Bolgatanga Municipality was one of the high performing districts until the last three years where performance has been low compared with set targets of 95% for all antigens by the Expanded Programme on Immunization. (E.g., Penta 1 for 2020=86%, 2021= 79.7%, and 2022= 80.9%; Measles Rubella 1 coverage for 2020= 88.7%, 2021= 81.3% and 2022=79.8%) all these were less than the 95% set. These low coverages could be caused by several factors as already documented [3] and peculiar factors in the Upper East Region. Some of these factors may include inadequate transport, difficulty in reaching communities, poor vaccine data collation and analytic skills of health staff, and inadequate community engagement.

Accessibility to immunization services is a problem especially if caregivers must travel long distances to reach to the nearest vaccination site. Longer distance requiring more than an hour of travel remains a demotivating factor for childhood immunization uptake [4]. Bolgatanga Municipality was chosen for the study because is one kind in the region with different dynamics consisting of mixture of urban and rural communities, tertiary and primary health care facilities, as well as occupations that keep caregivers less and very busy.

Also, reminder systems for vaccination have been shown to improve healthcare-seeking behaviours and have been recommended for application in routine and supplemental immunization activities. From some studies, facilities with reminder systems in place had an 89.3% chance of achieving high coverage for targeted children compared to facilities without reminder systems [5]. This however has some challenges: most health workers do not perceive the practice to work in their settings.

Also, the success of immunization in disease reduction has made the benefit of immunization less obvious to caregivers hence

communities no longer see current preventive interventions with the same sense of urgency as they did before [6].

In 2018, the Deputy Director-General for programs at the World Health Organization stated, “without urgent efforts to identify causes of low coverages to increase vaccination coverage and identify populations with unacceptable levels of under or unimmunized children, we risk losing decades of progress made in protecting children and communities against devastating, but entirely preventable diseases with emphasis on measles” [7]. This is evident as the Upper East Region saw 3 confirmed cases of measles, 2 confirmed cases of yellow fever and two compatible polio cases.

Despite all the global bodies' efforts to sustain the gains made in immunization, there are substantial challenges to achieving the universal coverage of childhood immunization in developing countries, especially within the Sub-Saharan African region [8].

Therefore, this study is to assess factors contributing to low immunization coverages among children 0-59 months in the Bolgatanga Municipality of the Upper East Region of Ghana and make the necessary recommendations to address them. This study recruited only participants who were within the Bolgatanga Municipality and had a child within the ages of 12-59 months. Caregivers who were not accessing immunization services within the Bolgatanga Municipality were excluded.

Conceptual Framework

Figure 1 below outlines some of the hypothesized factors that contribute to immunization uptake which were applicable in the case of this study. It helped to organise thought by defining how different factors interact with each other. Example sociodemographic factors, health system factors and community/caregivers factors. Again, the framework clarified the theoretical

foundation underlying the study and guided the researcher on what variables were important to consider in this study. Finally, it

guided the interpretation of results/findings based on established theories.

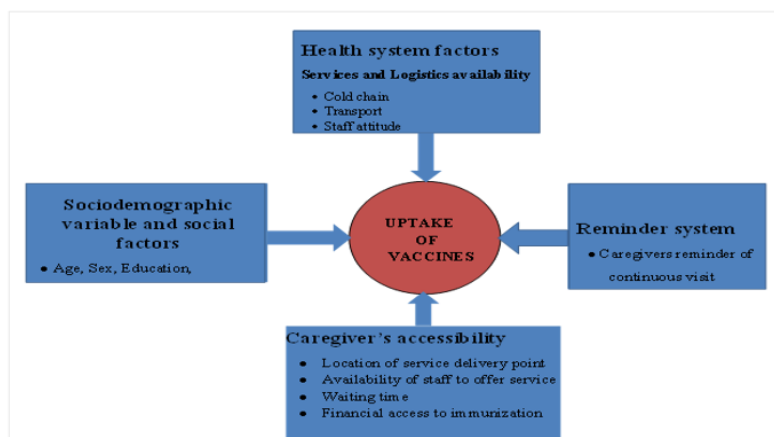


Figure 1. Conceptual Framework

Source: Authors construct. Adapted from [9]

Objective

This study seeks to determine the factors that contribute to low immunization coverages among children aged 0-59 months in the Bolgatanga Municipality - Ghana

Materials and Methods

Study Area, Design and Population

The study was conducted in Bolgatanga Municipality in Upper East region, Ghana; the Municipality which is subdivided into nine sub-Municipalities and 85 communities. The Bolgatanga Municipality has been the parent district for four (4) adjoining districts of Bongo, Talensi, Nabdam and Bolgatanga East, which has high numbers of low-income earners with an adult population of 142,661 made up of females 73,042 (51.2%) and males 69,619 (48.8%). A descriptive cross-sectional study design was used involving caregivers of children between 12-23 months residing in the Bolgatanga Municipality of the Upper East Region of Ghana as at the time of this study. The inclusion criteria were, participants should have children between 12-23 months who have completed their first year immunizations. This criterion ensured that the study focused on the targeted population of interest. Those that did not give consent were

excluded from the study. The study was conducted within four weeks from April, 2023 to May, 2023.

Sample Size Determination and Sampling Technique

The sample size was the proportion of the population studied (i.e. caregivers of children 12-23 months and selected health staff). Population proportion sample size formula with a 95% confidence level, 5% margin of error, and 50% sample proportion in the study area and 10% non-response rate was used to calculate for the number of caregivers. A multistage sampling technique was used in selecting the respondents. The total number of caregivers from the selected study area out of which the desired sample size was selected.

Study Instrument and Data Collection

A structured questionnaire based on the updated Immunization Standards Guidelines for implementing immunization practices was adopted and edited to suit the study. The questionnaire was in English language, made up of closed-ended questions. The questionnaire was put on a Kobo collect mobile data collection tool. Kobo collect enables one to design survey, collect data offline, store data securely and export data into

various forms (like Excel, CSV, and Google sheet) from the Kobo Toolbox website. The Forms (Barcode) was given to five (5) research assistants who speak the local language “Gurune” who had been trained to collect the data. The mode of administration of the questionnaire to caregivers was direct one-on-one interview. According to the sample size determination, a total of 424 were administered for the study. Maximum of nine days were used to collect the data from caregivers. Maximum of ten (10) questionnaires were administered by each of the five-research assistant in a day bringing a total of fifty (50) questionnaires per day. The questionnaire was used to quantify the demographic characteristics, caregiver’s accessibility to immunization services and availability of reminder system in the facilities. This study involved the use of smart phones that had Kobo collect app downloaded and installed on them.

Statistical analysis

Data collected were entered into IBM SPSS Statistics software version 23 for cleaning and analysis. Quantitative data was collated, summarized and analysed descriptively. A general linear model univariate analysis was run for both socio-demographic and hypothesized factors to find the linear association between the dependent and independent variables and chi square (R^2) to measure the variation if the dependent variable can be attributed to the independent variables. Beyond descriptive statistics, association between the dependent variables and the

independent variables was analysed by calculating the Odds Ratios and 95% confidence interval.

Ethics Approvals and Permissions

All ethical issues were considered with approval from the Navrongo Health Research Centre Institutional Review Board (NHRCIRB). Confidentiality and data protection were put in place. Permission was also obtained from the Bolgatanga Municipal Health Directorate and the authorities at the selected health facilities through written letters by the Municipal Director of Health Service.

Results

Socio-demographic Parameters of the Study Participants

The results showed that most respondents were females (96.7%). About 32.3% were aged between 25 to 29 years while only 9% were under 20 years. Respondents above 35 years accounted for 8.7%. The mean age of respondents was 25.1 with standard deviation of 1.2. Also, most (74.1%) respondents were married. In terms of occupation, 38.2% were into trading while farming accounted for 27.8%. In addition, only 9.2% attained tertiary education and 31.1% had only primary education. With parity, 64.3% had one to two children while 33.7% had five children and above. In terms of the nature of residence, almost all (96%) residents were residing in rural areas. Most respondents were Christians (78.5%) followed by Muslims (19.6%) as indicated in table 1 below.

Table 1. Socio-demographic Parameters of the Study Respondents

Variable	Number (n=424)	Percentage (%)
1. Sex of respondent		
Female	410	96.7
Male	14	3.3
2. Age of respondents		
15 – 19	38	9.0

20 – 24	117	27.6
25 – 29	137	32.3
30 – 35	95	22.4
Above 35	37	8.7
3. Marital status		
Single	88	20.8
Divorced	10	2.4
Married	314	74.1
Widowed	12	2.8
4. Occupation		
Civil service	35	8.3
Farming	118	27.8
Trading	162	38.2
Unemployed	70	16.5
Others (Specify)	39	9.2
5. Religion		
Christian	333	78.5
Muslim	83	19.6
Pagan	8	1.9
6. Level of Education		
Primary	132	31.1
JHS/Middle school	180	42.5
Secondary	71	16.7
Tertiary	41	9.7
7. Number of children		
1	126	29.7
2	143	33.7
3	88	20.8
4+	67	15.8
8. Description of community		
Rural	410	96.7
Urban	14	3.3

Note: Data presented as frequency and percentages.

Accessibility to Immunization Services by Caregivers

Table 3 below showed that, almost all (97.9%) respondents have access to a health facility in their communities. Immunization services are run monthly for 39.4% of respondents while 50.9% have weekly services. The results showed that 38.7% of mothers ever took their children to the immunization point but did not receive the required vaccines. Also, 66.5% indicated that they live less than 2 kilometers from the

nearest health facility while only about 1% live beyond 5 kilometers from the nearest health facility. In addition, 71.7% indicated that their travel time to the nearest health facility was less than 30 minutes while only 1.4% said their travel time was 1-3 hours. Furthermore, 31.4% said they usually incur cost for immunization services. Among those who indicated that they incur cost for immunization, the amount was between GHC 1 to GHC 10.

Table 2. Univariate Analysis of Caregiver Accessibility to Immunization Services and Availability of Reminder Systems to Immunization Services

Variable	Number (n=424)	Percentage (%)
1. Health facility in locality		
Yes	415	97.9
No	9	2.1
2. Frequency of immunization services		
Daily	37	8.7
Twice a week	3	0.7
Weekly	216	50.9
Monthly	168	39.6
3. Ever missed vaccine (immunization status)		
Yes	164	38.7
No	260	61.3
4. Distance to health facility		
Less than 2km	138	32.5
Between 2km to 5km	282	66.5
More than 5km	4	0.9
5. Travel time for immunization services		
Less than 30 minutes	304	71.7
30 minutes to 1 hour	114	26.9
1 to 3 hours	6	1.4
6. Cost implication for immunization		
Yes	133	31.4
No	291	68.6
7. Amount involve		
No cost	291	68.6
Less than Ghc 5	95	22.4
Ghc 5 Ghc 10	38	9

Note: Data presented as frequency and percentages.

Univariate Analysis of Availability of Reminder Systems to Immunization Services

Findings from table 3 show that, almost all respondents (95.0%) normally receive reminders to attend immunization sessions with the media of delivery of such information being community volunteers, SMS, phone

calls or visit by health workers and other sources. Majority (72.6%) cited phone calls or visit by health workers while 23.8% cited community volunteers. Use of SMS was affirmed by only 10.8% of respondents while 16% cited written on card and 7.1% through verbal information at session. In terms of re-scheduling immunization sessions, almost all respondents (99%) indicated that they

normally receive information about rescheduled sessions. Similarly, 98% of respondents affirmed that they always receive information about common side reactions that may accompany immunizations and how to

manage the common side reactions. Furthermore, 28.3% have ever forgotten about an immunization with about 90.8% of those who forgot to attend a session were due to pressure or busy work schedules.

Table 3. Univariate Analysis of Availability of Reminder Systems to Immunization Services from Caregivers

Variable	Number (n=424)	Percentage (%)
1. Received reminders always		
Yes	403	95.0
No	21	5.0
2. Medium of delivery		
CBSV		
Yes	101	23.8
No	323	76.2
Verbal at session		
Yes	30	7.1
No	394	92.9
Health workers (phone call/visit)		
Yes	308	72.6
No	116	27.4
Written on Card		
Yes	68	16
No	356	84
SMS		
Yes	46	10.8
No	378	89.2
3. Reschedule session information		
Yes	420	99.1
No	4	0.9
4. Information about side effects		
Yes	416	98.1
No	8	1.9
5. Management of Side effects		
Yes	417	98.3
No	7	1.7
6. Forgotten immunization session		
Yes	120	28.3
No	304	71.7
7. Reason for forgetfulness of session		
Child was sick	2	1.7
Busy/Pressure of work	109	90.8

Mere forgetfulness	5	4.2
Others	4	3.3

Note: Data presented as frequency and percentages.

Multivariate Analysis of Significant Variables Based on the Caregiver Demographic Information, Accessibility to Immunization Services and Availability of Reminder Systems

After the bivariate analysis, Multivariate logistics regression was further run on the significant variables to account for other predictor variables in the model to estimate

their adjusted odds ratio. The following variables were significant; Unemployment, AOR = 0.56 (C.I = 0.21 - 0.80), frequency of immunization services, weekly AOR = 3.69 (C.I = 1.47 - 9.23), monthly AOR = 7.89 (CI = 2.94 - 21.20), and forgetfulness of immunization session 28.3% (C.I = 0.27 - 0.81) as displayed in table 4 below.

Table 4. Multivariate Analysis of Significant Variables Based on the Caregiver Demographic Information, Accessibility to Immunization Services and Availability of Reminder System

Variable	No (n=260)	Yes (n=164)	AOR	CI
1. Occupation				
Civil service	23	12	Ref	
Farming	75	43	0.92	0.36 - 2.36
Trading	94	68	0.67	0.28 - 1.62
Unemployed	34	36	0.56	0.21 - 0.80
Others (specify)	34	5	1.22	0.32 - 4.71
2. Frequency of immunization services				
Daily	9	28	Ref	
Twice a week	2	1	2.67	0.12 - 57.96
Weekly	126	90	3.69	1.47 - 9.23
Monthly	123	45	7.89	2.94 - 21.20
3. Forgetfulness of immunization session				
Yes	57	63	Ref	
No	203	101	0.47	0.27 - 0.81

Note: Data Presented as Bivariate and p-Values.

Discussion

Accessibility of Caregivers to Immunization Services

From the study results, almost (97.9%) all respondents had access to health facility in their communities. Also, according to the study results, 32.5% of the respondents indicated that they lived less than 2km from the nearest health facility whiles 66.5 lived between 2-5km and only about 1% lived beyond 5km. The result is similar to Vann *et*

al [5] who reported that more than half (56.5%) of caretakers lived in less than 2km distance and could reach the vaccination site within 30 minutes on foot [10]. The finding was also similar to study in Ethiopia, which found a strong association between travel distance and immunization coverage [16]. Geographical accessibility does not only relate to distance but also mean travel time since this translates into the consumption of more resources especially if motorized vehicles are

used. The findings from this study indicated that, majority (71.7%) of respondents travelled less than 30 minutes to the nearest health facility while only 1.4% said their travel time was 1-3 hours. Due to the shorter travel time for caregivers to reach the health facility, they are motivated to send their children for immunization compared to caregivers who travel longer hours. This finding is similar to findings by [4] who stated that; caregivers who travel less than an hour to the nearest immunization location are more likely to have fully immunized children than those who travel longer distance [4]. In the Eastern Region of Ghana, Kenu and Sally carried out a similar study in 2017, and found that, 18.8% children surveyed were not fully vaccinated largely because the immunization centres were too far [14]. Again, the practice of immunization outreach to various communities by nurses which is usually influenced by transportation availability at the facility has facilitated the high accessibility to immunization services. The finding of work done in Sudan, Kenya, Eastern and Southern Ethiopia [11], [12], [13] had similar study results. In areas of low level of education and or poor socioeconomic development, caregivers are likely to opt for economic activities ahead of immunization therefore any little hindrance to easy access to immunization services may lead to neglect of childhood immunization [15]. However, The findings of this study contradicts findings from a study in Kenya where the median travelling time was above 41 minutes and 28.6% of children who lived more than one hour away from the facility were a worry for both caregivers and health staff since it was a barrier to children getting fully immunized. A travel time above one hour to a vaccination time significantly reduces the likelihood of Pentavalent vaccination by about 16% after adjusting for other factors [17]. Again this current finding contradicted the study by Favin et al who reviewed grey literature and found the

following, about 43% of caregivers in Siaya, Kenya claimed that access to immunization was a problem, and same did 30% in Liberia [18].

From the study findings, Immunization services were ran weekly for 50.9% (p-value = 0.0000, AOR = 3.69 C.I = 1.47 - 9.23) and monthly for 39.6% (p-value=0.001, AOR = 7.89 CI = 2.94 - 21.20) in the facilities. Only 8.7% of facilities ran immunization services on daily basis. The immunization sessions which were organised on weekly and monthly basis affected immunization uptake because, over 50% of the caregivers interviewed had busy work scheduled, therefore if the mother squeeze time out to visit a facility and the services were not available on the particular day, the child misses the vaccine or when a session falls on a market day, the mother is likely to miss the session and for that matter the vaccine leading to less coverage and more non-fully immunize children in the Municipality. From the data analysed, if the immunization session becomes daily the Municipality will increase the chances of immunization uptake by about four times compared to the weekly sessions (weekly AOR = 3.69) and about 8 times compared to the monthly sessions. This finding is similar to a study by [22] who stated that hindrance to immunization uptake are several including timing of vaccination.

Availability of Reminder Systems

From the study results, most (95.0%) respondents normally received reminders to attend immunization sessions through specific media of delivery. Majority (72.6%) mentioned phone calls or visit by health workers, 23.8% receive from community-based volunteers, 16% saw it written on the card, and only 7.1% heard verbally during a session. Immunization coverage for children has been shown to be greatly impacted by parent forgetting their immunization appointments. Even though

sometimes mothers might have been informed when the next vaccination session would take place, the busy pattern of their work can lead to forgetfulness of the session; this was evident in this study for both univariate and bivariate analysis as about 28.3% of caregivers forgot their next immunization session. (*C.I*= 95%, *P-value* = 0.0002). The institution of a reminder system has shown improved uptake in several interventions. The US Task Force on Community Preventive Services adopted reminder system to improve on their appointment attendance [11]. Reminder system has several medium of delivery but in the univariate analysis only about 10% of caregivers receive reminders through mobile messaging (SMS or voice messages) with the reason that health staffs do not see the feasibility of this medium. This is similar to a study by [12] who found that health workers find it difficult to comprehend to the fact that reminder system is feasible in their setting and therefore find it difficult to incorporate it especially the use of mobile phone messaging. Meanwhile, a study done in Nigeria showed that majority 92.7% of caregivers possessed a mobile phone and more than half (69%) of them were more willing to receive reminders on immunization through mobile phone [19]. Another study in Cote-Devoir revealed that the use of mobile phone for reminder was feasible as 84.6% of the mothers in the intervention group prefer mobile voice messages as compared to 15.4% that preferred SMS text [20]. Although only 15.4% preferred SMS text, it can translate to greater numbers in a populated area. It is therefore necessary for health workers to explore the medium that works best for them and use it to improve immunization coverage in their setting. The world is reaching a level where usage of mobile phone is becoming universal, it is therefore imperative for programme planners to find means of instituting messaging (SMS or voice) reminder systems in place to improve on immunization uptake and coverage.

Despite the high receipt of reminders, 28.3% have ever forgotten about an immunization session. This indicates that if we improve upon our medium of delivery of immunization reminders, we will cover this 28.3% of caregivers. Similarly, reminders for vaccination have been shown to improve healthcare-seeking behaviours' and have been recommended for application in routine and supplemental measles immunization activities [4]. From the results of the study, reminder system in health facilities was not statistically significant to the low immunization coverage, however some media of delivery were statistically significant SMS (*C.I* = 95%, *p-value* = 0.0003), Verbal information during session, (*C.I* = 95%, *p-value* = 0.0040), and information written on card (*C.I* = 95%, *p-value* = 0.0000). This finding is similar to the results found a review of 47 studies on vaccine reminders in developed countries, it was found that, reminder systems increased the number of people vaccinated from at least 1% to 20% and from that same study, facilities with reminder systems in place had an 89.3% chance of achieving high coverage for targeted children compared to facilities without reminder systems [21].

Equations

The sample size was the proportion of the population studied (i.e. caregivers of children 12-23 months and selected health staff). Population proportion sample size formula with a 95% confidence level, 5% margin of error, and 50% sample proportion in the study area and 10% non-response rate was used to calculate for the number of caregivers.

By formula,

$$X = Z_{\alpha/2}^2 * p * (1-p) / MOE^2,$$

Where,

$Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), MOE is the margin of error (0.05) p is

the sample proportion, and N is the population size.

Substituting in the values into the formula gives:

$$X = \frac{(1.962)^2 \times 0.50 \times 0.50}{0.0025}$$

$$X = 384.9 \cong 385$$

$$10\% \text{ non-response rate} = 10/100 \times 385 \cong 39$$

$$n = 385 + 39 = 424.$$

Conclusion

From the data analysis, the findings indicated that most of the caregivers had both geographical and financial access to immunization services. Most Immunization services were ran weekly and monthly. The only challenge with access was the frequency with which most vaccination sessions were ran. The study concludes that caregivers' accessibility to immunization services is not a major contributing factor to the Municipality's low immunization coverage. The recommendation is that; the sessions should be run daily.

Again, the study's findings revealed that most caregivers were given reminders for immunization, and this was done mostly through phone calls or visit from the health

care workers. Media of reminder systems in the health facilities for caregivers were a predictor of immunization uptake in the Municipality. Therefore, establishing a formal reminder system in the health facilities using various medium such as mobile phone messaging (voice or SMS) and CBSV's etc. will help improve the Municipality's immunization coverage.

Conflict of Interest

There was no conflict of interest.

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