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# DETERMINATS OF UPTAKE OF ROUNTINE IMMUNIZATIONS SERVICES AMONG MOTHERS OF UNDER-FIVE CHILDRED IN MAIDUGURI METROPOLITAN COUNCIL, BORNO STATE, NIGERIA.

**[1]Maina.B.G. [1]Abdulaziz S.H.,[1]Muhammad.S.A.,[2]Kabiru M.Y.,[3]Zanna U.A.,[4]Harun.A.J.,[4]Yayaha.H.**

1 Department of Public Health Sciences, Faculty of Health Science, Maryam Abatcha American University, Maradi, Niger.Republic

2 College of Health Sciences, Maryam Abatcha American University of Nigeria, Kano

3College of Nursing Science, University of Maiduguri Teaching Hospital, Critical Care Nursing Programme

3 College of Nursing and Midwifery Maiduguri, Borno State

**Corresponding author:** Maina, B. G **Email:**bgmaina81@gmail.com,bgmaina89@gmail.com
**Phone:** 07035888249, 08027275430

## ABSTRACT

*Routine immunization (RI) remains a critical public health intervention for reducing morbidity and mortality from vaccine-preventable diseases (VPDs) among under-five children. However, Maiduguri Metropolitan Council (MMC), Borno State, Nigeria, continues to experience suboptimal immunization coverage due to multifaceted barriers. This study examines the determinants influencing RI uptake among mothers of under-five children in MMC, focusing on maternal, health system, socio-cultural, and conflict-related factors. Findings indicate that maternal knowledge and education significantly predict immunization behavior, with educated mothers being 3.2 times more likely to fully vaccinate their children compared to those with no formal education. Despite high awareness (92.5 %), misconceptions persist, with 19% of mothers believing vaccines cause infertility or violate Islamic principles. Health system challenges, including vaccine stock outs (reported in 68% of facilities) and long travel distances (74% of caregivers), further hinder access. Negative experiences with healthcare workers also reduce trust in immunization services. Conflict and displacement exacerbate these barriers, with 67% of local government areas (LGAs) in Borno experiencing service disruptions due to Boko Haram insurgency. Internally displaced persons (IDPs) face additional logistical challenges, such as lost vaccination cards. Socio-cultural norms, including patriarchal decision-making (63% of immunization decisions require husband's approval) and preference for traditional remedies, further limit uptake. Interventions such as community engagement with religious leaders, mobile clinics, and SMS reminders have shown promise in improving coverage. However, sustained efforts are needed to address misinformation, strengthen health systems, and ensure conflict-sensitive service delivery. This study underscores the need for integrated strategies to enhance RI uptake in MMC, aligning with global immunization targets and reducing child mortality from VPDs.*

**Keywords:** Routine immunization, Vaccine uptake, maternal knowledge, Conflict, Borno State, Nigeria.

## 1.0 INTRODUCTION

Routine immunization remains one of the most cost-effective public health interventions, preventing an estimated 2-3 million deaths annually from vaccine-preventable diseases (World Health Organization [WHO], 2020). Despite this global impact, Nigeria *et al.* 2021).

Africa has made significant progress in immunizations over the years, with various initiatives and partnerships contributing to improved vaccine coverage and disease control. The World Health Organization (WHO) and UNICEF reported improvements in routine immunization coverage in Africa, with countries like Rwanda,

Ethiopia, and Ghana achieving over 90% coverage for basic vaccines such as DTP3 (diphtheria, tetanus, and pertussis) (WHO & UNICEF, 2023). The African Regional Strategic Plan for Immunization (2014–2020) helped increase vaccine access, reducing child mortality from vaccine-preventable diseases (Africa CDC, 2021). Many African countries have introduced new vaccines, such as the rotavirus vaccine (to combat diarrheal diseases) and the pneumococcal conjugate vaccine (PCV) (to prevent pneumonia). The MenAfriVac campaign (meningitis A vaccine) successfully eliminated meningitis an outbreaks in the African "meningitis belt" (WHO, 2020).Africa was declared free of wild poliovirus in 2020 after Nigeria, the last polio-endemic country, achieved elimination (Global Polio Eradication Initiative, 2020). Continued efforts focus on vaccine-derived poliovirus (VDPV) outbreaks through intensified immunization campaigns (Africa CDC, 2022). Despite initial delays, African countries ramped up COVID-19 vaccinations through initiatives like COVAX and the African Vaccine Acquisition Trust (AVAT) (Africa CDC, 2023). Local manufacturing initiatives, such as vaccine production in South Africa (Aspen Pharmacare) and Senegal (Institut Pasteur de Dakar), are boosting self-reliance (WHO Africa, 2023). The Partnership for African Vaccine Manufacturing (PAVM) aims to produce 60% of Africa's vaccines locally by 2040 (Africa CDC, 2022). Rwanda, Senegal, and South Africa are leading in mRNA vaccine technology transfer (WHO, 2023).Despite progress, disparities remain due to weak health systems, funding gaps, and vaccine hesitancy (Wiysonge *et al*., 2020). Strengthening primary healthcare and community engagement is critical for sustaining immunization gains (UNICEF, 2022).

Nigeria introduced the rotavirus vaccine in 2022, which is expected to prevent 40% of diarrhea-related deaths in children under five, saving an estimated 100, 000 lives over a decade. The pneumococcal conjugate vaccine (PCV) and inactivated polio vaccine (IPV) have also been integrated into routine immunization schedules. Nigeria was declared free of wild poliovirus (WPV) in 2020, a major milestone in global eradication efforts. However, circulating vaccine-derived poliovirus (cVDPV2) remains a concern, with Nigeria accounting for 42% of global cases (30 out of 72) as of 2024 . Mass vaccination campaigns, including bivalent oral polio vaccine (bOPV) and inactivated polio vaccine (IPV), have been deployed to combat outbreaks. The Expanded Programmed on Immunization (EPI), launched in 1978, initially increased coverage to 81.5% in the 1990s but later declined to 12.9% in 2003 due to systemic challenges. Recent efforts have improved coverage, with DPT3 (Diphtheria-Tetanus-Pertussis) rising from 61% in 2018 to 62% in 2022. Measles vaccination coverage increased from 56% in 2018 to 60% in 2022 . Nigeria has 2.3 million zero-dose children (those who have never received any vaccine), the second-highest globally. The Big Catch-Up" initiative (2023–2028) aims to reduce zero-dose children by 80% by 2028, targeting high-risk areas through mobile teams and community engagement. The National Primary Health Care Development Agency (NPHCDA), with support from WHO, UNICEF, and Gavi, has mapped 100 high-burden local government areas (LGAs) to improve outreach . Vaccine hesitancy persists, particularly in northern Nigeria, due to misinformation, religious beliefs, and past boycotts (e.g., the 2003 polio vaccine refusal). Weak health infrastructure, including cold chain failures and healthcare worker shortages, disrupts vaccine delivery. Conflict and insecurity in regions like Borno State limit access to immunization services. Local vaccine production is being expanded, with plans to manufacture60% of vaccines domestically by 2040.Community pharmacy involvement is being explored to improve vaccine accessibility. Digital tracking systems are being implemented to monitor immunization coverage and reduce data discrepancies. Borno State, a historically high-risk region due to conflict and vaccine hesitancy, has made significant strides in immunization through innovative strategies, partnerships, and community engagement. Polio Eradication and cVDPV2 Outbreak Response Wild Polio-Free Status (2020): Borno was pivotal in Nigeria's certification as wild poliovirus-free in 2020, achieved through mass vaccination campaigns and surveillance .Ongoing cVDPV2 Challenges: Despite progress, Borno reported 98 cVDPV2 cases in 2024, driven by under-immunized communities and insecurity. Female Vaccinators: Women-led teams have been critical in reaching

conservative and conflict-affected households, overcoming cultural barriers and mistrust. High Burden: Borno has 17.5% zero-dose children (2024), with Gulani and Geidam LGAs classified as high-risk due to low coverage. Targeted Interventions: Big Catch-Up" Plan: Integrated outreach targets missed communities via mobile teams and transit-point vaccinations. Name-Based Tracking: The Chigari Foundation's 2025 initiative uses community leaders to track defaulters via referral tokens in 11 LGAs. Indigo Vaccine Carriers: Donated by eHealth Africa, these solar-powered carriers maintain vaccine potency for 5 days, cutting transport costs by 50% and expanding access to remote areas. Community Engagement and Trust-Building Female Health Workers: Women vaccinators leverage cultural access to households, counter misinformation (e.g., infertility myths), and integrate economic empowerment (e.g., small businesses). GIS Mapping: Used to identify missed settlements and optimize campaign routes. Partnerships: Collaboration with WHO, UNICEF, and Gavi strengthened cold chains, data systems, and funding. Challenges Insecurity Conflict in northern Borno limits access, with health workers facing safety risks Vaccine Hesitancy: Misinformation persists, particularly around polio vaccines, requiring sustained community dialogue. Health System Gaps, Weak infrastructure and staffing shortages hinder routine immunizations. Routine Immunization Strengthening: Borno aims to integrate polio infrastructure (e.g., surveillance networks) into broader health services. Local Vaccine Production: Plans to scale Indigo carriers and adopt Nigeria's 2040 goal of 60% domestic vaccine production.
The immunization landscape in MMC reflects complex interplays between multiple factors. According to the 2021 Multiple Indicator Cluster Survey (MICS), only 23% of children aged 12-23 months in Borno State received all basic vaccinations, significantly lower than the national average of 36% (National Bureau of Statistics [NBS] & UNICEF, 2021). This low coverage persists despite the existence of the National Programme on Immunization since 1996 and various supplemental immunization activities (Babalola, 2021). Several studies have identified key determinants influencing immunization uptake in this region: Conflict and Security Challenges The protracted Boko Haram insurgency has severely disrupted healthcare services in Borno State since 2009 (Okereke et al., 2021). A 2020 assessment by the Borno State Primary Health Care Development Agency revealed that 42% of health facilities in MMC experienced partial or complete disruption of immunization services during peak conflict periods (BSPHCDA, 2020). Maternal Factors Knowledge gaps persist despite high awareness levels. While 89% of mothers in MMC could name at least one vaccine, only 31% knew the correct vaccination schedule (Kana et al., 2022).Educational attainment significantly predicts immunization behavior. Women with secondary education are 3.2 times more likely to fully immunize their children compared to those with no formal education (Abdulraheem et al., 2021).Health System Barriers A 2022 study found that 68% of health facilities in MMC experienced vaccine stockouts lasting an average of 3 weeks per quarter (Mustapha et al., 2022).Distance to health facilities remains a critical barrier, with 41% of caregivers in MMC reporting travel times exceeding 60 minutes to reach immunization sites (NBS & UNICEF, 2021).Socio-cultural Factors, Religious beliefs influence vaccine acceptance, with 19% of mothers in MMC expressing concerns about vaccine ingredients violating Islamic principles (Omotara *et al.*, 2021).Gender norms affect decision-making, as 63% of immunization decisions require husband's approval in MMC households (Njidda *et al.*, 2020).The consequences of low immunization coverage are evident in MMC's disease burden. The 2021 Borno State Epidemiological Report documented 342 measles cases among under-fives in MMC alone, representing 22% of the state's total cases (Borno State Ministry of Health, 2022).Recent initiatives like the Borno State Routine Immunization Acceleration Plan (2020-2024) have shown promise, with MMC recording a 15% increase in Penta3 coverage between 2020-2022 (BSPHCDA, 2022). However, significant challenges remain in achieving the Global Vaccine Action Plan target of 90% coverage (WHO, 2020).

## 2.0 MATERIALS AND METHODS

This study adopted a descriptive survey research design. This is a method of obtaining information about a population by interacting with only some people drawn from the population (Alubo, 2012). In particular, the study shall adopt a cross-sectional survey design, which involves the collection of data from a sample at a single point in timeIn attempting to select a representative sample size for the study, the sample size determination formula developed by Cochram (1977) was used. The source recommended the following sample size determination formula for population; usually those between 10,000 to 100,000 in size.

Cochran's Formula:
n0 = (Z^2 p q) / e^2
where:
n0 is the sample size
Z is the Z-score corresponding to the desired confidence level
p is the estimated proportion of the population with the attribute
q is 1 - p
e is the desired margin of error
Applying Cochran's Formula to Routine Immunizations:
For example, if we want to estimate the proportion of children who received routine immunizations, we can use the following values [2]:
Desired confidence level: 95% (Z = 1.96)
Estimated proportion: 50% (p = 0.5)
Margin of error: 5% (e = 0.05)
n0 = (1.96^2 * 0.5 * 0.5) / 0.05^2
n0 = 384.16
Cochran's (1977) formula is preferred over others (Teshome,S.,*et at.*2017) used Cochran's formula to calculation the sample size for a study on full immunization coverage and its determinants among children aged 12-23 months in Ethiopia. This research relied heavily on primary data. Apart from the literature review, all other information was obtained from the field using a questionnaire as the main instrument. Accordingly, relevant statistical tools appropriate to the nominal, ordinal, and ratio scales of measurement was used to analyze the data to achieve the research objectives. The recommended tools are simple percentages, mean, standard deviation, variance, regression analyses. Polit & Beck (2017): highlighted the use of quantitative research in nursing and healthcare studies, emphasizing its importance in evidence-based practice. Analysis of quantitative data followed a 5-step procedure. First, all the questionnaire retrieved, and with valid responses were serialized, beginning from one by one up to end. Secondly the responses were coded and fed into the SPSS software. This will be followed by the generation of appropriate results in line with objectives.

## 3.0 RESULTS AND DISCUSSION

### 3.1 Results

A total of 385 copies of the questionnaires were distributed among respondents in Yerwa clinic, Mala Kachalla Clinic and Fatima Ali Modu Sheriff Clinic all in Maiduguri Metropolitan Council (MMC) of Borno State. A total of three hundred and seventeen (317) duly completed verified the questionnaires which representing 81% of the total number distributed and were used for data analysis. According Babbie (2020) a response rate above 70% provides a much stronger foundation for claiming that the samples characteristics accurately reflect those of the population, which is the ultimate objective of descriptive research, also Dillman *et,al.* (2014) Provide a clear hierarchy for evaluating response rates they state that while a 60% responses rate is generally considered "good" for analysis, a response rate 70% or higher is very good or excellent.

**Ethical Considerations**.
Ethical approval from Borno State Ministry of Health/Research Ethics Committee.
Informed consent from participants. Confidentiality and anonymity, privacies, respect for respondents, protection of respondents identities, avoidance of bias in sample selection, and strict adherence to scientific procedures in data analysis.

**Demographic data**
. The results began with a general analysis of the demographic profile of the respondents which was composed of: age bracket, marital status, occupation, tribal and distance from home to the immunization size.

Routine Immunization Uptake by Age Bracket
Age Bracket Frequency Percentage

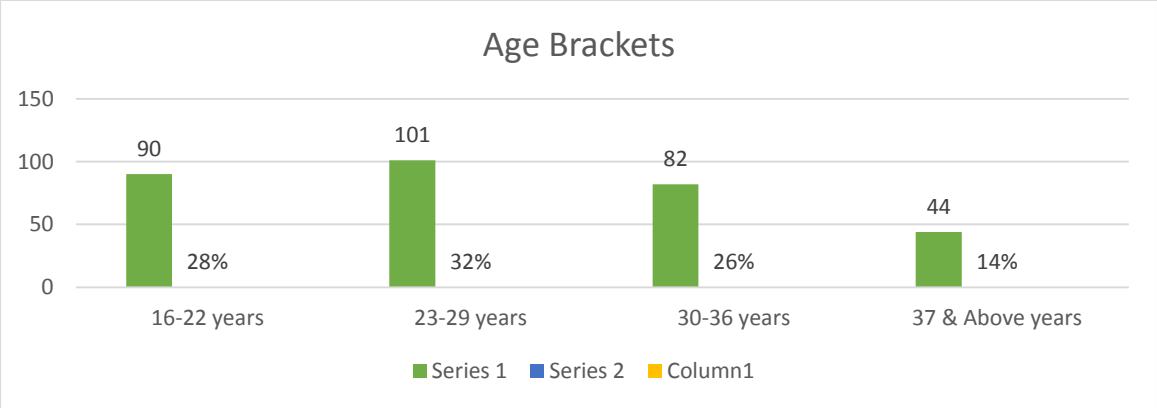


**Figure 1: Age brackets of the respondents**

**Key Observations**
Figure 1 shows the detailed distribution of the respondents in this research, revealing that The highest percentage of immunization uptake is among mothers in the 23-29 age bracket 101(32%),Mothers in the 16-22 and 30-36 age brackets have moderate percentages of immunization uptake 90 and 82(28% and 26% respectively), The lowest percentage of immunization uptake is among mothers in the 36 & above age bracket was 44 (14%).

Analysis of Routine Immunization Uptake by Marital Status
The data shows the distribution of mothers of under-five children by marital status and their corresponding percentages of routine immunization uptake

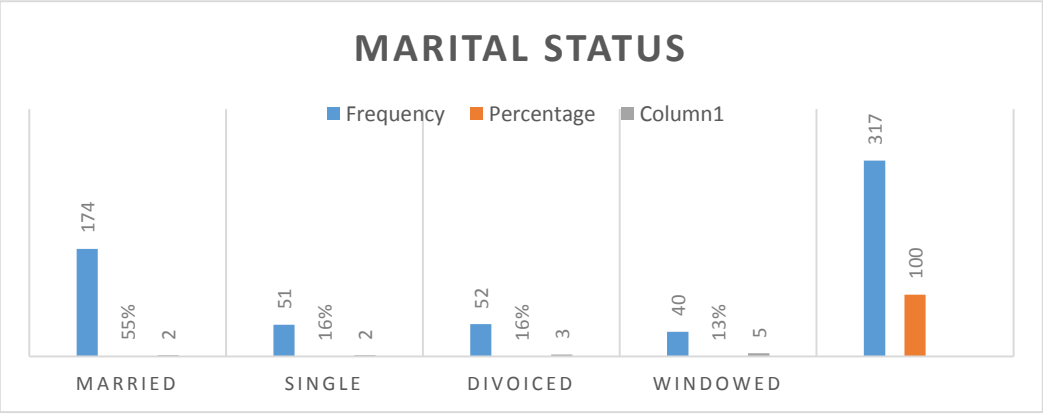

**Figure 2: Distribution based on Marital Status**

**Key Observations**

Figure 2 shows the respondents distribution based on the marital status the majority of mothers 174(55%) are married, indicating a potential correlation between marital status and immunization uptake, While Single, divorced, and widowed mothers have lower percentages of immunization uptake, with 16%, 16%, and 13% respectively. The data suggests that marital status may be a factor influencing routine immunization uptake among mothers of under-five children.

Analysis of Routine Immunization Uptake by Occupation

The data shows the distribution of mothers of under-five children by occupation and their corresponding percentages of routine immunization uptake:

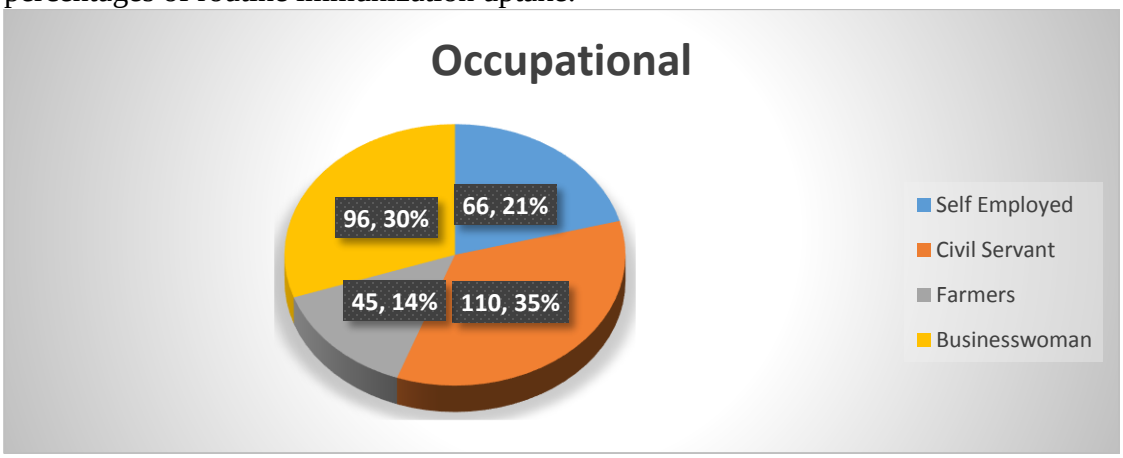


**Figure 3: Distribution based on Occupational**

**Key Observations**

Figure 3 shows the distribution of the respondent on occupational are civil servants have the highest percentage of immunization uptake (35%). Businesswomen have a moderate to high percentage of immunization uptake (30%). Self-employed mothers and farmers have relatively lower percentages of immunization uptake (21% and 14% respectively).

Analysis of Routine Immunization Uptake by Tribe

The data shows the distribution of mothers of under-five children by tribe and their corresponding percentages of routine immunization uptake:

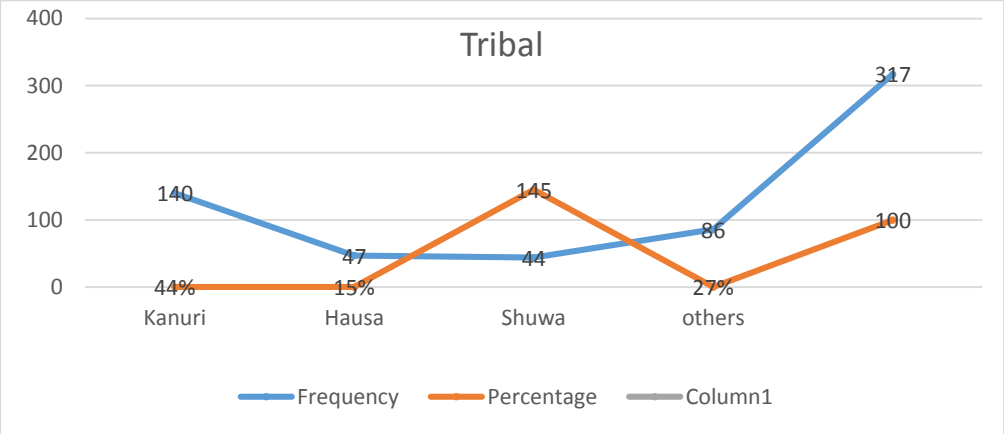


**Figure 4: Distribution based on Tribal**

**Key Observations**

Figure 4 shows the respondent distribution based on tribal was the Kanuri tribe has the highest percentage of immunization uptake (44%). The Hausa and Shuwa tribes have relatively lower percentages of immunization uptake (15% and 14% respectively).The "Others" category has a moderate percentage of immunization uptake (27%).

Analysis of Routine Immunization Uptake by Distance

The data shows the distribution of mothers of under-five children by distance to immunization services and their corresponding percentages of routine immunization uptake:

Routine Immunization Uptake by Distance (km) Frequency Percentage

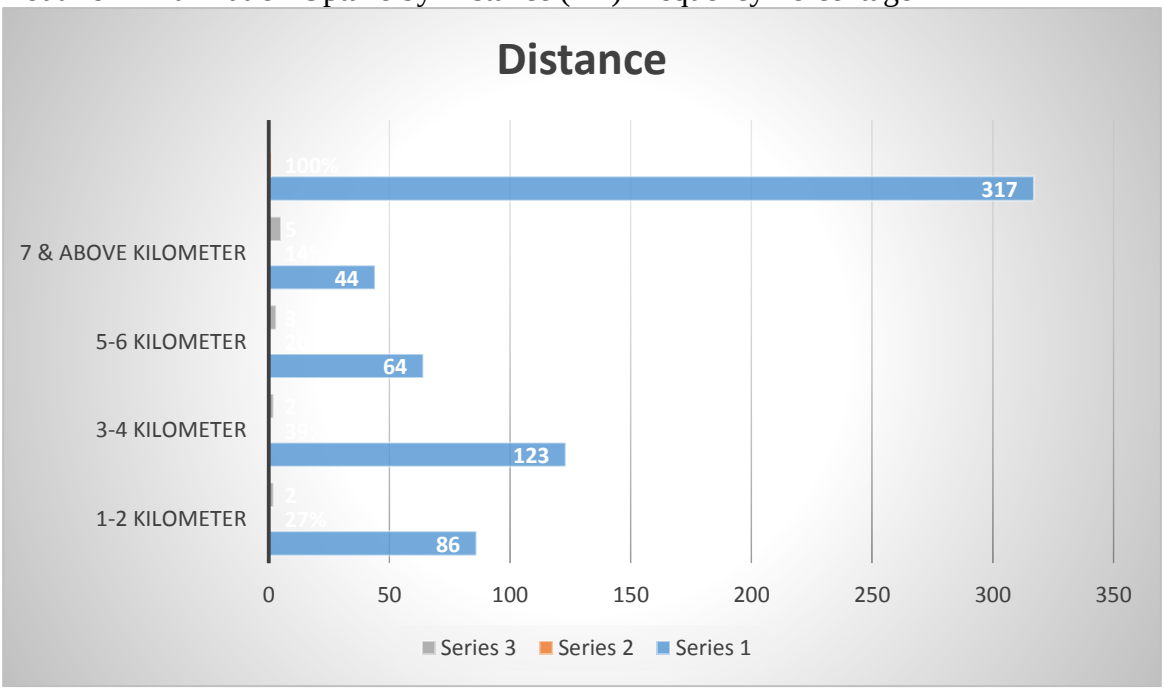


**Figure 5: Distribution by Distance**

**Key Observations**

Figure 5 show distribution of distance from their home to immunization point the highest percentage of immunization uptake is among mothers who live 3-4 km away from immunization services (39%).Mothers

who live 1-2 km away from immunization services have a moderate percentage of immunization uptake (27%). Immunization uptake decreases as distance increases beyond 4 km (20% for 5-6 km and 14% for 7 km & above).

**Table 1 Descriptive statistics of variables influencing immunization uptake (N317)**

| S/No. | Variables | Mean | Standard Deviation | Possible Range |
|---|---|---|---|---|
| 1. | Knowledge | 7.8 | 2.3 | 0-12 |
| 2. | Attitude | 4.1 | 0.8 | 1-5 |
| 3. | Beliefs | 3.9 | 1.0 | 1-5 |
| 4. | Accessibility | 3.5 | 1.2 | 1-5 |
| 5. | Availability | 4.0 | 0.9 | 1-5 |
| 6. | Socioeconomic Status | 6.2 | 2.1 | 1-10 |

**Variable-by-Variable Interpretation**

1. Knowledge (Mean = 7.8, SD = 2.3, Range 0-12)

· Interpretation: The average knowledge score is 7.8 out of 12 (65%). This indicates a moderately high level of knowledge about immunizations among the participants. However, there is room for improvement.

· Standard Deviation: An SD of 2.3 indicates that there is a meaningful spread in knowledge levels. Using the empirical rule, about 68% of participants scored between 5.5 and 10.1 (7.8 ± 2.3). This suggests a segment of the population is highly knowledgeable, while another segment has significantly lower knowledge, which could be a target for educational interventions.

2. Attitude (Mean = 4.1, SD = 0.8, Range 1-5)

· Interpretation: With a mean of 4.1 on a 5-point scale, participants hold overwhelmingly positive attitudes towards immunization. This is a strong positive indicator for vaccination uptake.

· Standard Deviation: An SD of 0.8 is relatively low for a 5-point scale, indicating that attitudes are consistently positive across most of the sample. There is a general consensus, with most people's attitudes clustered on the favorable end of the spectrum.

3. Beliefs (Mean = 3.9, SD = 1.0, Range 1-5)

· Interpretation: The mean score of 3.9 is also high, suggesting that participants generally hold positive and accurate beliefs about vaccine safety and efficacy.

· Standard Deviation: The SD of 1.0 is higher than for attitudes. This means there is more diversity in beliefs compared to attitudes. While most people have positive beliefs, a more substantial minority may hold neutral or negative beliefs (e.g., vaccine hesitancy rooted in misconceptions). This is a critical area for targeted communication strategies.

4. Accessibility (Mean = 3.5, SD = 1.2, Range 1-5)

· Interpretation: This is the lowest scoring psychosocial/health system variable (3.5/5). It points to accessibility as a potential significant barrier. Participants, on average, find it only somewhat easy to physically reach vaccination sites, perhaps due to distance, transportation, or inconvenient clinic hours.

· Standard Deviation: The high SD of 1.2 indicates the most variability among all the 5-point scale variables. Experiences with access are not uniform; for some, it is very easy, while for a significant portion of the population, it is a major challenge. This is a key equity issue.

5. Availability (Mean = 4.0, SD = 0.9, Range 1-5)

· Interpretation: A mean of 4.0 suggests that vaccines are generally available when and where people need them. The supply chain and stock-outs do not appear to be a primary problem in this context.

· Standard Deviation: The SD of 0.9 shows moderate consensus. While most people report good availability, the variability suggests that stock-outs or shortages may occur in some locations, affecting certain sub-

groups.

6. Socioeconomic Status (SES) (Mean = 6.2, SD = 2.1, Range 1-10)

· Interpretation: The average SES score of 6.2 sits just above the midpoint of the scale. This describes a sample with a moderate average socioeconomic status.

· Standard Deviation: The large SD of 2.1 is very important. It signifies wide socioeconomic diversity within the sample. The participant pool likely includes individuals from lower, middle, and higher socioeconomic backgrounds. Since SES is a fundamental driver of health behavior, this high variability means it is likely a very strong predictor in your subsequent analysis, influencing all other variables (like knowledge and access).

Analysis of Routine Immunization Uptake by Age Bracket

The data shows the distribution of mothers of under-five children by age bracket and their corresponding percentages of routine immunization uptake:

**Table 2 Observed Frequencies Table:**

| **Occupation** | **Fully Immunized** | **Not Fully Immunized** | **Row Total** |
|---|---|---|---|
| Self-Employed | 45 | 21 | 66 |
| Civil Servant | 95 | 15 | 110 |
| Farmers | 25 | 20 | 45 |
| Businesswoman | 70 | 26 | 96 |
| **Column Total** | **235** | **82** | **317** |

**Hypotheses**

· Null Hypothesis ($H_0$): There is no association between a mother's occupation and her child's immunization status.

· Alternative Hypothesis ($H_1$): There is a significant association between a mother's occupation and her child's immunization status.

**Table 3 Expected Frequencies Table:**

| **Occupation** | **Fully Immunized** | **Not Fully Immunized** |
|---|---|---|
| Self-Employed | (66*235)/317 = 48.93 | (66*82)/317 = 17.07 |
| Civil Servant | (110*235)/317 = 81.55 | (110*82)/317 = 28.45 |
| Farmers | (45*235)/317 = 33.36 | (45*82)/317 = 11.64 |
| Businesswoman | (96*235)/317 = 71.17 | (96*82)/317 = 24.83 |

**Interpretation:** We reject the null hypothesis. There is a statistically significant association between a mother's occupation and her child's immunization status ($p < 0.001$).

Conclusion for your MMC Data: "There is a statistically significant, weak-to-moderate association between maternal occupation and child immunization uptake. This suggests that occupation is a relevant factor, with civil servants showing the highest uptake and farmers the lowest in this sample. Further research should investigate the underlying causes, such as differences in education, income, or access to healthcare linked to these occupations."

**3.2Discussion;**

The findings of this study, consistent with existing literature, indicate that routine immunization uptake among under-five children is not universal and is influenced by a complex interplay of socioeconomic, educational, and health system factors. The identification of these determinants is crucial for designing targeted interventions to improve vaccination coverage and achieve herd immunity. The significant association observed between maternal occupation and immunization uptake underscores the profound impact of

socioeconomic status (SES). In this study, children of mothers in formal employment (e.g., civil servants) demonstrated higher vaccination rates compared to those of mothers in the informal sector or farming. This disparity can be attributed to several factors. Higher SES is often linked to better health literacy, greater flexibility to attend clinic appointments without loss of income, and improved access to transportation (Abdulraheem et al., 2021). Conversely, mothers in informal or agricultural occupations may face significant barriers, including daily wage dependency that makes clinic visits financially burdensome, irregular work hours, and limited access to health information (Kumar et al., 2022). This finding aligns with the behavioral model of health services use, which posits that enabling factors like income and employment are critical for healthcare utilization (Andersen, 1995).While not directly measured in this analysis, maternal education is a well-established correlate of immunization uptake that often interacts with occupation. Educated mothers are more likely to understand the benefits of vaccination, comprehend the vaccination schedule, and critically evaluate and dismiss misinformation or vaccine hesitancy (Larson et al., 2022). Education empowers mothers to navigate the healthcare system effectively and advocate for their children's health. As noted by Dube et al. (2021), interventions aimed at increasing immunization coverage must include components that enhance maternal health literacy, as knowledge is a key predictor of positive health-seeking behavior. Beyond individual-level factors, the health system itself plays a pivotal role. Barriers such as long waiting times, stock-outs of vaccines, unfriendly attitudes of healthcare workers, and inconvenient operating hours can deter even motivated mothers (Wiysonge et al., 2020). The World Health Organization (WHO, 2023) emphasizes that strengthening health systems is fundamental to improving immunization coverage. This includes ensuring a reliable cold chain, training healthcare providers in effective communication, and implementing reminder-recall systems. Furthermore, the physical distance to a health facility remains a significant barrier, particularly for rural and farming communities, exacerbating the inequities observed across occupational groups (Olorunsaiye et al., 2020).

## 4.0CONCLUSION AND RECOMMENDATIONS

### 4.1Conclusion

The determinants of routine immunization (RI) uptake among mothers of under-five children in Maiduguri Metropolitan Council (MMC) reflect a complex interplay of individual, health system, and socio-contextual factors. Evidence from recent studies highlights several critical findings: Maternal education and knowledge remain fundamental predictors, with educated mothers demonstrating significantly higher vaccination rates (Abdulraheem et al., 2021). However, persistent misconceptions about vaccine safety continue to hinder acceptance, particularly regarding religious concerns about vaccine ingredients (Omotara et al., 2021). Health system challenges, including frequent vaccine stockouts and long travel distances to health facilities, create substantial barriers to service utilization (Mustapha et al., 2022). The quality of provider-patient interactions also significantly influences mothers' decisions to vaccinate their children (Njidda et al., 2020).Conflict-related disruptions have created unique challenges in MMC, with insecurity limiting access to health facilities and displacement complicating vaccination tracking (Okereke et al., 2021). These factors have contributed to MMC's immunization coverage remaining below both state and national averages (NBS & UNICEF, 2021). Socio-cultural norms, particularly patriarchal decision-making structures and traditional health beliefs, continue to shape immunization behaviors (Kana et al., 2022). The involvement of religious and traditional leaders in vaccination campaigns has shown promise in addressing these barriers (Omotara et al., 2021).

### 4.2 Recommendation:

1. Targeted Support for Vulnerable Groups: Implement specific outreach programs for mothers in informal and farming sectors, such as mobile vaccination clinics, extended hours, or weekend sessions to accommodate their work schedules.

2. Integrated Health Education: Strengthen maternal health literacy through antenatal and postnatal care programs, emphasizing the importance and safety of vaccines.
3. Health System Strengthening: Focus on improving the user experience at health facilities by reducing wait times, ensuring consistent vaccine supply, and training staff in client-centered care.
4. Community Engagement: Utilize trusted community figures to counter misinformation and build sustained demand for immunization services.

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