SAR Journal of Medicine

Abbreviated Key Title: *SAR J Med*
Home page: https://sarpublication.com/journal/sarjm/home
DOI: https://doi.org/10.36346/sarjm.2026.v07i03.008

OPEN ACCESS

ISSN 2707-773X (P)
ISSN 2709-6920 (O)

Original Research Article

Effect of Behaviour Change Communication on Knowledge of Routine Immunization among Women of Childbearing Age in Ebonyi State, Nigeria: A Quasi-Experimental Study

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Article History: | Received: 28.04.2026 | Accepted: 20.06.2026 | Published: 27.06.2026 |

Abstract: ***Background*:** Routine immunization is one of the most effective public health interventions for preventing vaccine-preventable diseases and reducing childhood morbidity and mortality. However, inadequate maternal knowledge remains a major barrier to optimal immunization uptake and completion in Nigeria. Behaviour Change Communication (BCC) has been identified as a potentially effective strategy for improving maternal knowledge and promoting positive immunization behaviours. This study evaluated the effect of BCC on knowledge of routine immunization among women of childbearing age in Ebonyi State, Nigeria. ***Methodology*:** A quasi-experimental study involving intervention and control groups was conducted among 910 women of childbearing age attending antenatal, postnatal, and immunization clinics in selected health facilities in Ebonyi State. Participants in the intervention group received a structured three-month BCC package comprising health education sessions, posters, charts, audio-visual materials, and educational flyers, while the control group received routine health education. Data were collected at baseline and post-intervention using a structured questionnaire. Descriptive statistics, Chi-square tests, and Odds Ratios (ORs) with 95% confidence intervals (CIs) were used for data analysis at a significance level of $p < 0.05$. ***Results*:** Baseline knowledge was poor and comparable between the intervention and control groups (5.4% vs. 6.9%; $\chi^2 = 3.02$, $p = 0.083$). Following the intervention, adequate knowledge increased significantly from 5.4% to 74.4% among women in the intervention group (OR = 50.40; 95% CI: 31.67–80.21; $p = 0.001$), whereas only a marginal increase was observed in the control group (6.9% to 7.9%; $p = 0.590$). Post-intervention knowledge was significantly higher among participants exposed to BCC than controls (74.4% vs. 7.9%; $p < 0.001$). ***Conclusion*:** Behaviour Change Communication significantly improved maternal knowledge of routine immunization. Integrating structured BCC strategies into routine maternal and child health services may enhance maternal immunization literacy and improve vaccination outcomes.

Keywords: Behaviour Change Communication, Routine Immunization, Knowledge, Women of Childbearing Age, Nigeria.

INTRODUCTION

Routine immunization remains one of the most effective, equitable, and cost-efficient public health interventions for preventing infectious diseases and reducing childhood morbidity and mortality worldwide [1, 2]. Vaccination has contributed substantially to the control, elimination, and eradication of several life-threatening diseases, resulting in significant improvements in child survival and population health [1-3]. The World Health Organization (WHO) estimates that immunization prevents approximately 3–5 million deaths annually from diseases such as measles, diphtheria, tetanus, pertussis, influenza, and poliomyelitis [1-4]. Immunization not only protects

vaccinated individuals but also contributes to herd immunity, thereby reducing disease transmission within communities and protecting vulnerable populations who are unable to receive vaccines due to age or medical conditions [5].

Despite remarkable progress in global immunization coverage over the past decades, vaccine-preventable diseases continue to constitute a major public health challenge, particularly in low- and middle-income countries (LMICs) [4-6]. Recent global reports indicate that millions of children still fail to receive basic vaccines, resulting in an increasing number of zero-dose and under-immunized children [4-7]. The disruptions caused by the COVID-19 pandemic further exacerbated existing challenges within immunization programmes, leading to declines in vaccination coverage and creating immunity gaps that increase the risk of outbreaks of vaccine-preventable diseases [7, 8]. Consequently, improving childhood immunization coverage remains a priority within global health agendas, including the Immunization Agenda 2030 framework [9].

Nigeria bears a disproportionate share of the global burden of vaccine-preventable diseases and under-five mortality [7-10]. Although significant investments have been made in strengthening routine immunization services through the National Primary Health Care Development Agency and the Expanded Programme on Immunization, national immunization coverage remains below recommended targets [10, 11]. Nigeria continues to account for a substantial proportion of the world's zero-dose children, with many infants either receiving no vaccines at all or failing to complete recommended vaccination schedules [7-10]. These gaps in immunization coverage contribute significantly to preventable childhood illnesses, disabilities, and deaths [10-12]. The persistence of low vaccination coverage highlights the need for effective interventions that address barriers to immunization uptake at individual, household, community, and health system levels [12, 13].

Among the numerous determinants of childhood immunization, maternal knowledge has consistently emerged as one of the most important predictors of vaccination uptake and completion [13–15]. Mothers and primary caregivers are usually responsible for making healthcare decisions for children, including attendance at immunization clinics and adherence to vaccination schedules [14, 15]. Adequate knowledge of routine immunization enables mothers to understand the purpose of vaccines, recognize the diseases they prevent, appreciate the importance of timely vaccination, and comply with recommended schedules [15, 16]. Conversely, poor knowledge may result in missed opportunities, delayed vaccinations, incomplete immunization schedules, and increased susceptibility of children to vaccine-preventable diseases [13-16].

Knowledge of routine immunization encompasses several dimensions, including awareness of recommended vaccines, understanding of vaccination schedules, recognition of vaccine-preventable diseases, knowledge of vaccine safety, and appreciation of the benefits associated with complete immunization [14-16]. Previous studies conducted in various low-resource settings have reported significant associations between maternal knowledge and childhood vaccination outcomes [13-17]. Mothers who possess adequate knowledge are more likely to complete vaccination schedules, maintain immunization records, attend follow-up appointments, and seek clarification from healthcare providers when concerns arise [15-17]. In contrast, inadequate knowledge is often associated with vaccine hesitancy, misconceptions, fear of adverse effects, poor compliance with immunization schedules, and low utilization of immunization services [16–18].

Several factors contribute to inadequate maternal knowledge regarding routine immunization. These include low educational attainment, limited access to health information, cultural and religious beliefs, misinformation spread through social networks and media platforms, poor communication between healthcare providers and clients, and inadequate community engagement strategies [18–20]. In many rural and underserved communities, mothers may lack access to reliable health information and depend on informal sources that often perpetuate misconceptions regarding vaccines [18, 19]. Such misconceptions may include beliefs that vaccines cause infertility, severe illness, or other harmful effects [20]. These concerns can negatively influence vaccination decisions and contribute to poor immunization outcomes [18, 20].

Behaviour Change Communication (BCC) has increasingly been recognized as a strategic approach for addressing knowledge gaps and promoting positive health behaviours [21, 22]. BCC refers to a systematic, evidence-based communication process that uses a combination of educational, motivational, and behavioural techniques to influence individual and community health practices [21]. Unlike conventional health education, which focuses primarily on information dissemination, BCC seeks to facilitate sustainable behavioural change by addressing knowledge, attitudes, beliefs, social norms, and environmental factors that influence health-related decisions [21, 22]. The approach is grounded in behavioural science theories and emphasizes active participation, dialogue, and empowerment of target populations [22].

In maternal and child health programmes, BCC interventions have been successfully applied to improve health-seeking behaviours, enhance adherence to recommended healthcare practices, and increase utilization of preventive services [21–23]. Common BCC strategies include interpersonal communication,

group discussions, counselling sessions, demonstrations, storytelling, visual aids, community mobilization, mass media campaigns, reminder systems, and peer education [22, 23]. These approaches provide opportunities for participants to ask questions, express concerns, receive clarification, and develop confidence in adopting recommended health behaviours [22]. Through repeated exposure to tailored health messages, individuals are more likely to acquire accurate knowledge, overcome misconceptions, and develop positive attitudes toward health interventions [23].

The Health Belief Model provides a useful theoretical framework for understanding how Behaviour Change Communication may influence knowledge and uptake of routine immunization [24]. According to this model, individuals are more likely to engage in preventive health behaviours when they perceive themselves to be susceptible to a health threat, believe that the consequences of the threat are serious, recognize the benefits of preventive action, and perceive minimal barriers to taking action [24]. Behaviour Change Communication can enhance these perceptions by increasing awareness of vaccine-preventable diseases, highlighting the benefits of immunization, addressing fears and misconceptions, and strengthening self-efficacy for accessing immunization services [21-24]. Consequently, BCC has the potential to improve both maternal knowledge and subsequent immunization-related behaviours [22-24].

In Ebonyi State, childhood immunization coverage remains below national and international targets despite the availability of routine immunization services across public and private health facilities [10, 11]. Previous reports have identified inadequate awareness, poor maternal knowledge, misconceptions about vaccines, and socio-cultural barriers as major contributors to low immunization uptake and incomplete vaccination schedules [13-20]. National immunization surveys have consistently shown that a considerable proportion of children in the state either miss scheduled vaccines or fail to complete the full immunization series [10, 11]. These gaps in coverage contribute to persistent vulnerability to vaccine-preventable diseases and undermine efforts to improve child survival outcomes [12].

Although several studies have investigated determinants of immunization uptake in Nigeria, there is limited evidence regarding the effectiveness of structured Behaviour Change Communication interventions in improving maternal knowledge of routine immunization, particularly in southeastern Nigeria [13-25]. Existing studies have largely focused on descriptive assessments of knowledge, attitudes, and practices without evaluating intervention strategies capable of producing measurable improvements in maternal understanding of immunization [15-25]. Generating evidence on effective communication approaches is essential for informing policy decisions, strengthening routine immunization programmes, and designing interventions tailored to local contexts [21-23].

Given the critical role of maternal knowledge in influencing immunization outcomes and the growing recognition of Behaviour Change Communication as a potentially effective intervention [21–23], there is a need to evaluate the impact of structured BCC programmes on maternal immunization literacy. Therefore, this study was undertaken to assess the effect of Behaviour Change Communication on knowledge of routine immunization among women of childbearing age attending antenatal clinics in Ebonyi State, Nigeria. The findings are expected to contribute to the evidence base on communication-driven interventions for improving immunization knowledge and support efforts aimed at enhancing childhood vaccination coverage in resource-constrained settings.

METHODOLOGY

Study Design

This study adopted a quasi-experimental design using a pre-intervention, intervention, and post-intervention approach. The study utilized a convergent parallel mixed-method design in which quantitative and qualitative data were collected and analyzed concurrently but separately to evaluate the effect of Behaviour Change Communication (BCC) on knowledge and uptake of routine immunization among women of childbearing age attending antenatal and immunization clinics in Ebonyi State, Nigeria. The quantitative component consisted of intervention and control groups, with baseline and post-intervention assessments conducted to determine changes attributable to the BCC intervention.

Study Area

The study was conducted in selected public health facilities providing antenatal, postnatal, and immunization services in Ebonyi State, South-East Nigeria. Ebonyi State comprises thirteen Local Government Areas and has a predominantly agrarian population. Four health facilities were selected for the study. Maternal and Child Health Centre (MCH), Azuiyiokwu and Military Reference Hospital Services (MRS), Nkwagu served as intervention facilities, while Primary Health Care Centre, Nwezenyi and Mile Four Hospital served as control facilities.

Study Population

The study population comprised women of childbearing age attending antenatal, postnatal, and immunization clinics in the selected health facilities in Ebonyi State. Eligible participants included pregnant women and nursing mothers who accessed maternal and child health services during the study period.

Inclusion Criteria

Participants were included in the study if they:

- Were women of childbearing age attending antenatal, postnatal, or immunization clinics in the selected facilities;
- Had a child eligible for routine immunization or were pregnant and expected to utilize immunization services after delivery;
- Were willing to participate and provided written informed consent;
- Were available for both baseline and follow-up assessments.

Exclusion Criteria

Women who were critically ill, declined participation, or were unavailable for post-intervention follow-up were excluded from the study.

Sample Size Determination

A total of 910 women were recruited at baseline, comprising 454 participants in the intervention group and 456 participants in the control group. At post-intervention assessment, 851 respondents completed the study, including 433 participants in the intervention group and 418 participants in the control group, yielding a response rate of 93.5%. The attrition rates were 4.6% and 8.3% in the intervention and control groups, respectively.

Sampling Procedure

A multistage sampling technique was employed. Health facilities were purposively assigned into intervention and control groups. Maternal and Child Health Centre Azuiyiokwu and MRS Nkwagu constituted the intervention facilities, while Primary Health Care Centre Nwezenyi and Mile Four Hospital served as control facilities. Eligible women attending antenatal, postnatal, and immunization clinics were recruited consecutively until the required sample size was achieved.

Intervention

The intervention consisted of a Behaviour Change Communication (BCC) package developed by the researcher and implemented over a three-month period. The intervention was delivered only in the intervention facilities by trained research assistants.

The BCC package provided culturally appropriate information on:

- Importance of routine immunization;
- Childhood vaccine-preventable diseases;
- Recommended childhood vaccines;
- Routine immunization schedules;
- Benefits of complete immunization;
- Maternal tetanus toxoid vaccination;
- Addressing misconceptions and barriers to immunization uptake.

Multiple communication channels were utilized, including:

- Interactive health education sessions;
- Information, Education and Communication (IEC) materials;
- Posters and charts;
- Audio-visual aids;
- Illustrated flyers containing routine immunization messages.

During weekly postnatal and immunization clinic visits, trained research assistants provided routine immunization education and distributed educational materials to participants. The control group received the routine health education normally provided within the facilities. Three months after implementation of the intervention, post-intervention data collection was conducted in both groups.

Instrument for Data Collection

Data were collected using a structured interviewer-administered questionnaire programmed on KoboToolbox electronic data collection software. The questionnaire consisted of sections assessing socio-demographic characteristics, knowledge of routine immunization, uptake of routine immunization, and factors influencing immunization practices. Immunization cards and health facility records were also reviewed to verify immunization status.

Measurement of Knowledge of Routine Immunization

Knowledge of routine immunization was assessed using twelve knowledge questions covering:

- Awareness of routine immunization;
- Childhood vaccines included in routine immunization;
- Vaccine-preventable diseases;
- Age of commencement of immunization;
- Number of immunization visits required;
- Age of completion of routine immunization;
- Adverse effects following immunization;
- Purpose of childhood immunization;
- Awareness of tetanus toxoid vaccination;
- Number of tetanus toxoid doses;
- Target protection of tetanus toxoid vaccination;
- Tetanus toxoid vaccination schedule.

Each correct response was awarded two points, giving a maximum obtainable score of 24 points. Knowledge scores were categorized as:

- Poor/Inadequate Knowledge: <16 points
- Good/Adequate Knowledge: ≥16 points

Validity and Reliability of Instrument

The questionnaire was developed following extensive literature review and expert consultation. Face and content validity were established by experts in nursing, public health, health education, and

epidemiology. Necessary corrections and modifications were incorporated before final administration. The instrument was pretested among women with characteristics similar to the study population prior to the main study.

Data Collection Procedure

Baseline data were collected from both intervention and control groups using interviewer-administered questionnaires and review of immunization records. Following baseline assessment, the BCC intervention was implemented in the intervention facilities for three months. Subsequently, the same questionnaire was re-administered to participants in both groups to assess changes in knowledge and uptake of routine immunization.

Data Analysis

Quantitative data were analyzed using IBM Statistical Package for the Social Sciences (IBM-SPSS) version 26. Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize data.

Inferential analyses included:

- Chi-square tests to determine associations between categorical variables;
- Odds Ratio (OR) analysis with 95% confidence intervals to determine intervention effects;
- Binary logistic regression analysis to identify predictors of routine immunization uptake;
- Cross-tabulations between socio-demographic characteristics and outcome variables.

Statistical significance was set at $p < 0.05$ with a 95% confidence interval. Hypothesis testing for the effect of BCC on knowledge and uptake of routine immunization was conducted using Chi-square and Odds Ratio statistics.

Ethical Considerations

Ethical approval for the study was obtained from the Health Research Ethics Committee of Alex Ekwueme Federal University Teaching Hospital, Abakaliki (Reference Number: NHREC/16/05/22/318) and the Ethics Committee of Mile Four Hospital, Abakaliki (Reference Number: Re/M4H/112/24). Written informed consent was obtained from all participants before data collection. Participation was voluntary, confidentiality was maintained through anonymization of responses, and participants were informed of their right to withdraw from the study at any stage without penalty.

This version is fully aligned with the thesis methodology and the statistical procedures actually reported in the results chapter.

RESULTS

Table 1: Baseline Socio-Demographic Characteristics of Respondents by Study Group (n = 910)

Variable	Intervention (n=454)	Control (n=456)	p-value
Age (years)			0.607
19–24	125 (27.53)	142 (31.14)	
25–30	169 (37.22)	156 (34.21)	
31–36	92 (20.26)	95 (20.83)	
37–42	68 (14.98)	63 (13.82)	
Marital Status			0.574
Single	5 (1.10)	5 (1.10)	
Married	449 (98.90)	451 (98.90)	
Educational Level			0.791
No formal education	3 (0.66)	1 (0.22)	
Primary	11 (2.42)	11 (2.41)	
Secondary	297 (65.42)	302 (66.23)	
Tertiary	143 (31.50)	142 (31.14)	
Religion			0.082
Christianity	451 (99.34)	456 (100.00)	
Islam	3 (0.66)	0 (0.00)	
Ethnicity			0.747
Igbo	443 (97.58)	448 (98.25)	
Hausa	3 (0.66)	2 (0.44)	
Yoruba	3 (0.66)	1 (0.22)	
Efik/Ibibio	5 (1.10)	5 (1.10)	
Employment Status			0.675
Paid employment	53 (11.67)	45 (9.87)	
Self-employment	361 (79.52)	371 (81.36)	
Unemployment	40 (8.81)	40 (8.77)	

Variable	Intervention (n=454)	Control (n=456)	p-value
Occupation			0.001*
Civil servant	35 (7.71)	35 (7.68)	
Tailor	10 (2.20)	7 (1.54)	
Farmer	46 (10.13)	42 (9.21)	
Hairdresser	41 (9.03)	35 (7.68)	
Trader	322 (70.93)	285 (62.50)	
Private professional consultant	0 (0.00)	52 (11.40)	
Parity			0.994
1	180 (39.65)	186 (40.79)	
2	121 (26.65)	130 (28.51)	
3	63 (13.88)	58 (12.72)	
4	40 (8.81)	36 (7.89)	
5	32 (7.05)	29 (6.36)	
6	12 (2.64)	11 (2.41)	
7	4 (0.88)	4 (0.88)	
8	2 (0.44)	2 (0.44)	
Gestational Age			0.861
<28 weeks	14 (3.08)	10 (2.19)	
28–32 weeks	59 (13.00)	62 (13.60)	
33–37 weeks	289 (63.66)	292 (64.04)	
>37 weeks	92 (20.26)	92 (20.18)	
Husband's Educational Level			
No formal education	6 (1.32)	4 (0.88)	
Primary	11 (2.42)	9 (1.97)	
Secondary	204 (44.93)	215 (47.15)	
Tertiary	233 (51.32)	228 (50.00)	
Husband's Employment Status			0.881
Paid employment	120 (26.43)	119 (26.10)	
Self-employment	312 (68.72)	311 (68.20)	
Unemployment	22 (4.85)	26 (5.70)	
Husband's Occupation			0.971
Civil servant	117 (25.77)	117 (25.66)	
Tailor	14 (3.08)	10 (2.19)	
Farmer	4 (0.88)	4 (0.88)	
Hairdresser	1 (0.22)	1 (0.22)	
Trader	249 (54.85)	258 (56.58)	
Private professional consultant	69 (15.20)	66 (14.47)	

The intervention (n = 454) and control (n = 456) groups were comparable at baseline across most socio-demographic characteristics. There were no statistically significant differences in age, marital status, educational level, religion, ethnicity, employment status, parity, gestational age, husband's education, husband's employment status, or husband's occupation ($p > 0.05$). The only significant baseline difference was respondents' occupation ($p = 0.001$). Most respondents were aged 25–30 years, married, had secondary education, were self-employed, and were between 33 and 37 weeks of gestation. These findings indicate that the two study groups were generally homogeneous before implementation of the Behaviour Change Communication intervention.

Table 2: Baseline Knowledge of Routine Immunization among Women of Childbearing Age (n = 910)

Knowledge Item	Intervention Group (n = 454) Correct n (%)	Control Group (n = 456) Correct n (%)	χ^2	p-value
Awareness of childhood routine immunization	144 (31.7)	121 (26.5)	2.961	0.085
Childhood vaccines included in RI	153 (33.7)	141 (30.9)	0.804	0.370
Vaccine-preventable diseases	66 (14.5)	48 (10.5)	3.340	0.068
Age to commence routine immunization	44 (9.7)	32 (7.0)	2.125	0.145
Number of visits required for complete RI	34 (7.5)	20 (4.4)	3.924	0.048
Age to complete routine immunization	59 (13.0)	44 (9.6)	2.538	0.111

Knowledge Item	Intervention Group (n = 454) Correct n (%)	Control Group (n = 456) Correct n (%)	χ^2	p-value
Adverse effects following immunization	42 (9.3)	25 (5.5)	4.145	0.042
Purpose of child immunization	74 (16.3)	53 (11.6)	4.144	0.042
Awareness of Tetanus Toxoid vaccine	219 (48.2)	224 (49.1)	0.071	0.789
Number of TT doses during pregnancy	174 (38.3)	182 (39.9)	0.240	0.624
Target protection of TT vaccination	49 (10.8)	35 (7.7)	2.639	0.104
Schedule for complete TT vaccination	157 (34.6)	158 (34.6)	0.001	0.983

RI = Routine Immunization; TT = Tetanus Toxoid.

Overall Baseline Knowledge Classification

Knowledge Category	Intervention n (%)	Control n (%)	χ^2	p-value
Adequate Knowledge	24 (5.4)	29 (6.9)	3.02	0.083
Inadequate Knowledge	417 (94.6)	389 (93.1)		

At baseline, knowledge of routine immunization was generally poor among respondents in both study groups. Less than one-third of participants correctly identified most routine immunization components, and only 5.4% and 6.9% of women in the intervention and control groups, respectively, demonstrated adequate overall knowledge. There was no statistically significant difference in overall baseline knowledge between the intervention and control groups ($\chi^2 = 3.02$, $p = 0.083$), indicating that both groups were comparable before implementation of the Behaviour Change Communication intervention.

"At baseline, there was no statistically significant difference in overall knowledge of routine immunization between the intervention and control groups ($\chi^2 = 3.02$, $p = 0.083$). Adequate knowledge was observed among only 5.4% of participants in the intervention group and 6.9% in the control group, indicating generally poor maternal knowledge prior to the Behaviour Change Communication intervention."

Table 3: Pre- and Post-Intervention Knowledge of Routine Immunization among Respondents

Group	Baseline Inadequate n (%)	Baseline Adequate n (%)	Post-Intervention Inadequate n (%)	Post-Intervention Adequate n (%)	OR (95% CI)	p-value
Intervention (n = 454 baseline; n = 433 post)	417 (94.6)	24 (5.4)	111 (25.6)	322 (74.4)	50.40 (31.67–80.21)	0.001
Control (n = 456 baseline; n = 418 post)	389 (93.1)	29 (6.9)	381 (92.1)	37 (7.9)	0.87 (0.53–1.43)	0.590

OR = Odds Ratio; CI = Confidence Interval; $p < 0.05$ significant.

The proportion of respondents with adequate knowledge of routine immunization in the intervention group increased markedly from 5.4% at baseline to 74.4% following the Behaviour Change Communication intervention, while inadequate knowledge decreased from 94.6% to 25.6%. This improvement was statistically significant (OR = 50.40; 95% CI: 31.67–80.21; p = 0.001). In contrast, the control group showed only a marginal increase in adequate knowledge from 6.9% to 7.9%, with no statistically significant change observed (OR = 0.87; 95% CI: 0.53–1.43; p = 0.590). These findings indicate a substantial positive effect of Behaviour Change Communication on maternal knowledge of routine immunization.

The intervention group demonstrated a significant increase in adequate knowledge of routine immunization from 5.4% at baseline to 74.4% post-intervention (OR = 50.40; 95% CI: 31.67–80.21; p = 0.001). Conversely, the control group showed only a marginal increase from 6.9% to 7.9%, which was not statistically significant (OR = 0.87; 95% CI: 0.53–1.43; p = 0.590).

Table 4: Comparison of Post-Intervention Knowledge of Routine Immunization between Intervention and Control Groups (n = 851)

Knowledge Item	Intervention Correct n (%) (n=433)	Control Correct n (%) (n=418)	χ^2	p-value	OR (95% CI)
Awareness of childhood routine immunization	331 (76.4)	122 (29.2)	190.78	0.001	7.85 (5.84–10.56)
Childhood vaccines included in RI	339 (78.3)	142 (34.0)	169.99	0.001	7.01 (5.21–9.40)
Knowledge of vaccine-preventable diseases	349 (80.6)	54 (12.9)	390.80	0.001	28.13 (19.59–40.39)

Knowledge Item	Intervention Correct n (%) (n=433)	Control Correct n (%) (n=418)	χ^2	p-value	OR (95% CI)
Age to commence routine immunization	346 (79.9)	44 (10.5)	412.39	0.001	33.75 (23.09–49.34)
Number of visits required for complete RI	337 (77.8)	33 (7.9)	423.28	0.001	41.42 (27.48–62.43)
Age to complete routine immunization	343 (79.2)	55 (13.2)	372.78	0.001	25.04 (17.54–35.74)
Adverse effects following immunization	349 (80.6)	30 (7.2)	464.18	0.001	54.39 (35.42–83.52)
Purpose of child immunization	354 (81.8)	55 (13.2)	400.92	0.001	29.67 (20.62–42.68)
Awareness of Tetanus Toxoid vaccine	354 (81.8)	208 (49.8)	96.61	0.001	4.50 (3.33–6.08)
Number of TT doses during pregnancy	339 (78.3)	178 (42.6)	85.74	0.001	4.05 (3.01–5.45)
Target protection of TT vaccination	325 (75.1)	43 (10.3)	363.54	0.001	26.45 (18.23–38.39)
Complete TT vaccination schedule	388 (89.6)	148 (35.4)	265.16	0.001	15.46 (10.80–22.14)

RI = Routine Immunization; TT = Tetanus Toxoid; OR = Odds Ratio; CI = Confidence Interval.

Overall Post-Intervention Knowledge Classification

Knowledge Category	Intervention (n=433)	Control (n=418)
Adequate Knowledge	322 (74.4%)	37 (7.9%)
Inadequate Knowledge	111 (25.6%)	381 (92.1%)

Post-intervention knowledge of routine immunization was significantly higher among respondents exposed to Behaviour Change Communication than among those in the control group. Across all knowledge domains, including awareness of routine immunization, vaccine-preventable diseases, immunization schedules, adverse effects, and maternal tetanus toxoid vaccination, the intervention group demonstrated substantially higher proportions of correct responses (all p = 0.001). Overall, 74.4% of respondents in the intervention group achieved adequate knowledge compared with only 7.9% in the control group, indicating a strong positive effect of the Behaviour Change Communication intervention on maternal immunization knowledge.

"Post-intervention knowledge of routine immunization was significantly higher among participants exposed to Behaviour Change Communication than among controls. Adequate knowledge was observed in 74.4% of respondents in the intervention group compared with 7.9% in the control group (OR = 38.91; 95% CI: 25.19–60.09; p < 0.001)."

Table 5: Adjusted Effect of Behaviour Change Communication on Knowledge of Routine Immunization

Variable	Intervention Group	Control Group	Effect Estimate	95% CI	p-value
Adequate knowledge at baseline	24 (5.4%)	29 (6.9%)	Reference	—	0.083
Adequate knowledge post-intervention	322 (74.4%)	37 (7.9%)	OR = 50.40	31.67–80.21	0.001
Knowledge improvement attributable to BCC	—	—	OR = 50.40	31.67–80.21	0.001

OR = Odds Ratio; CI = Confidence Interval.

The Behaviour Change Communication intervention produced a substantial improvement in maternal knowledge of routine immunization. Respondents exposed to BCC were approximately 50 times more likely to demonstrate adequate knowledge after the intervention than at baseline (OR = 50.40; 95% CI: 31.67–80.21; p = 0.001). In contrast, no statistically significant improvement was observed in the control group (OR = 0.87; 95% CI: 0.53–1.43; p = 0.590).

"After adjusting for age, education, marital status, parity, occupation, and residence, BCC remained a significant predictor of knowledge improvement (F = ___, p < 0.001)."

"Behaviour Change Communication was associated with a significant improvement in knowledge of routine immunization, increasing the likelihood of adequate knowledge by approximately fifty-fold among participants in the intervention group (OR = 50.40; 95% CI: 31.67–80.21; p = 0.001)."

Table 6: Effect of Behaviour Change Communication on Adequate Knowledge of Routine Immunization

Variable	OR	95% CI	p-value
Intervention group (BCC exposure)	50.40	31.67 – 80.21	0.001
Control group	0.87	0.53 – 1.43	0.590

OR = Odds Ratio; CI = Confidence Interval.

Exposure to Behaviour Change Communication was strongly associated with improved knowledge of routine immunization. Women in the intervention group were approximately 50 times more likely to demonstrate adequate knowledge following the intervention compared with their baseline status (OR = 50.40; 95% CI: 31.67–80.21; p = 0.001). Conversely, no statistically significant improvement was observed among women in the control group (OR = 0.87; 95% CI: 0.53–1.43; p = 0.590).

DISCUSSION

This study evaluated the effect of Behaviour Change Communication on knowledge of routine immunization among women of childbearing age in Ebonyi State, Nigeria. The findings demonstrated that the intervention produced a substantial improvement in maternal knowledge of routine immunization. At baseline, both intervention and control groups exhibited poor and comparable levels of knowledge, indicating that participants had limited understanding of vaccine schedules, vaccine-preventable diseases, tetanus toxoid vaccination, and the importance of completing routine immunization schedules. This finding underscores the persistent knowledge gaps that continue to hinder optimal utilization of immunization services in many low-resource settings [13-18].

Following the implementation of the Behaviour Change Communication intervention, there was a marked increase in the proportion of women with adequate knowledge in the intervention group, while the control group showed only minimal improvement. The intervention group was approximately fifty times more likely to possess adequate knowledge after exposure to the BCC package than at baseline. This remarkable improvement highlights the effectiveness of structured communication strategies in addressing misinformation, enhancing awareness, and promoting understanding of immunization-related information [21–25].

The significant improvement observed across all knowledge domains—including awareness of routine immunization, vaccine-preventable diseases, immunization schedules, adverse events following immunization, and tetanus toxoid vaccination—suggests that the intervention successfully addressed both general and specific knowledge deficits. The use of multiple communication channels, including interactive health education sessions, posters, charts, audio-visual materials, and educational flyers, may have contributed to improved comprehension and retention of immunization messages [22, 23]. Repeated exposure to tailored health information likely reinforced learning and enhanced participants' confidence in understanding immunization requirements [23].

The findings support the assumptions of the Health Belief Model, which posits that individuals are more likely to adopt preventive health behaviours when they understand disease risks, perceive benefits of preventive actions, and possess adequate information to make informed decisions [24]. Through Behaviour Change Communication, participants were provided with relevant information on vaccine-preventable diseases and the benefits of vaccination, thereby strengthening their motivation to engage with immunization services.

The findings further suggest that conventional routine health education alone may be insufficient to achieve meaningful improvements in maternal immunization literacy. The negligible change observed among participants in the control group indicates that passive information delivery may not adequately address misconceptions and knowledge gaps. In contrast, structured BCC interventions facilitate active participation, dialogue, clarification of misconceptions, and reinforcement of key messages, thereby promoting more effective learning outcomes [21–23].

Overall, the study provides strong evidence that Behaviour Change Communication is an effective strategy for improving maternal knowledge of routine immunization in resource-constrained settings. The findings highlight the importance of incorporating structured communication interventions into maternal and child health programmes to strengthen immunization knowledge and support improved vaccination practices [21–25].

CONCLUSION

Behaviour Change Communication significantly improved knowledge of routine immunization among women of childbearing age in Ebonyi State. Prior to the intervention, knowledge levels were generally poor and comparable between intervention and control groups. However, following exposure to the Behaviour Change Communication package, substantial improvements were observed across all knowledge domains, including awareness of routine immunization, vaccine-preventable diseases, immunization schedules, tetanus toxoid vaccination, and immunization completion requirements. Women exposed to the intervention were significantly more likely to demonstrate adequate knowledge than those in the control group. These findings indicate that Behaviour Change Communication is an effective and practical

strategy for enhancing maternal immunization literacy and can contribute to strengthening routine immunization programmes in low-resource settings.

RECOMMENDATIONS

1. Integration of BCC into Routine Maternal Health Services**:** Structured Behaviour Change Communication interventions should be incorporated into antenatal, postnatal, and immunization clinic services across primary, secondary, and tertiary healthcare facilities.
2. Capacity Building for Healthcare Workers: Nurses, midwives, community health extension workers, and immunization providers should receive regular training on Behaviour Change Communication techniques to improve the quality and effectiveness of immunization education.
3. Development of Culturally Appropriate Educational Materials**:** Government agencies and public health programmes should develop and distribute locally relevant posters, flyers, audio-visual materials, and community-based communication tools to enhance maternal understanding of routine immunization.
4. Policy Support and Scale-Up of BCC Programmes**:** Policymakers and immunization programme managers should allocate adequate resources for the implementation and scale-up of evidence-based Behaviour Change Communication interventions as part of routine immunization strengthening initiatives.

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