Correlation between Exposure to Immunisation Communication and Perceived Effectiveness among Caregivers in Jalingo Local Government Area, Nigeria

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DOI: https://doi.org/10.51244/IJRSI.2026.1311000114

Received: 05 November 2026; Accepted: 10 November 2026; Published: 25 November 2026

ABSTRACT

Caregivers in northern Nigeria are reached by many channels of routine immunisation communication, but it is unclear whether those reached by more of them judge the communication to be more effective. This paper examines the correlation between caregivers' exposure to communication by the Taraba State Primary Health Care Development Agency (TSPHCDA) and their perceived effectiveness of it in Jalingo Local Government Area. A cross-sectional survey of 435 women who were mothers or primary caregivers of children aged 0 to 23 months (87 in each of five wards) provided an eight-item exposure index (Cronbach's alpha 0.82) and a seven-item effectiveness index (alpha 0.89), each scored from 1 to 5. Spearman's rank correlation was the primary measure. Mean exposure was 3.64 (SD 0.54) and mean effectiveness was 4.11 (SD 0.45). The indices were positively correlated ($\rho = 0.35$, 95% CI 0.27 to 0.43, $p < 0.001$), and the correlation remained after controlling for ward, age and education (partial $\rho = 0.32$). Of 56 item pairs, 52 were significant before correction for multiple testing, but only 39 remained significant after Bonferroni correction. Correlations by channel group were 0.38 for broadcast, 0.31 for print, 0.22 for digital and 0.19 for interpersonal channels, and these overlap because the groups are inter-correlated ($r = 0.35$ to 0.57). The correlation differed between wards ($Q = 11.8$, $p = 0.019$) and was absent in Sintali B, where variation in effectiveness was smallest. The design was cross-sectional and self-reported, and ratings clustered near the top of the scale, so the results show association only. Greater exposure is associated with higher perceived effectiveness, but whether it causes it requires longitudinal or experimental testing.

Keywords*:* routine immunisation, communication exposure, perceived effectiveness, correlation analysis, Nigeria

INTRODUCTION

Communication interventions help to create and sustain demand for vaccination, but how much they achieve depends on whether messages reach caregivers and whether caregivers find them credible and useful (Brewer et al., 2017; Oku et al., 2017). In northern Nigeria, routine immunisation messages travel through many channels at once, and the channel matters: only about half of Nigerian women aged 15 to 49 years were literate and fewer than one in five had used the internet (National Population Commission [NPC] & ICF, 2019), so print, SMS and social media may not reach many caregivers, whereas locally trusted people such as lay health workers can improve uptake (Lewin et al., 2010) and opinion leaders can speed the spread of a health practice (Valente & Davis, 1999).

Recent evidence supports the importance of how caregivers are reached. A systematic review of 33 studies found that communication interventions can reduce parental vaccine hesitancy and raise childhood coverage, and that in-person, interactive approaches featured prominently among the effective ones (Jwa et al., 2025). A

Cochrane review of strategies in low- and middle-income countries likewise concludes that intervention packages are needed to sustain childhood immunisation coverage (Oyo-Ita et al., 2023), and a meta-analysis of African trials reported higher vaccination rates with mHealth messaging (odds ratio 2.15; Gilano et al., 2024). Survey and qualitative studies add that knowledge, trust and the sources of information shape caregivers' views of vaccination. In Rwanda, mothers' knowledge and trust were high and health care professionals were the commonest information source (Mbonigaba et al., 2024), while in Malawi, inadequate awareness of the schedule and weak engagement of caregivers were among the drivers of hesitancy (Adeyanju et al., 2022). These studies mostly examine whether communication changes uptake or hesitancy. Fewer ask whether caregivers who are reached by more channels also judge the communication to be more effective, which is the question addressed here.

A descriptive survey of caregivers in Jalingo Local Government Area (LGA), Taraba State, found that exposure to the communication of the Taraba State Primary Health Care Development Agency (TSPHCDA) was high for community health workers, leaders, print and radio, and that perceived effectiveness was very high. Reporting the two separately leaves a question unanswered. If caregivers who are reached by more channels do not judge the communication to be more effective, the high ratings may reflect general goodwill or the way the survey was conducted and not anything the communication did. If they do, the pattern is at least consistent with the communication contributing to those judgments, and the channels that carry the association become useful to know.

Conceptual framework and hypotheses

The study used the Health Belief Model (Rosenstock et al., 1988) and the Theory of Planned Behaviour (Ajzen, 1991) as interpretive lenses. In both, exposure to cues and to the views of important others is the entry point to beliefs and intentions. Perceived effectiveness, as measured here, captures caregivers' beliefs that the communication informed them, was trustworthy and helped them to act. The questionnaire did not measure the theoretical constructs separately and no behaviour was tested.

Three hypotheses were derived from this framework and the literature. They were formulated for this secondary analysis after the descriptive results were known. They are therefore not pre-registered. **H1:** Exposure to TSPHCDA communication is positively correlated with perceived effectiveness. **H2:** The correlation persists after controlling for ward, age and education. **H3:** Exposure to interpersonal channels (community health workers, leaders and meetings) is more strongly correlated with perceived effectiveness than exposure to broadcast, print or digital channels, because trusted messengers work largely through social norms (Lewin et al., 2010; Valente & Davis, 1999). The paper also asked how the correlation varies across wards, education levels and awareness of the programme.

METHODOLOGY

Study design, setting and sample

This is a secondary analysis of the caregiver survey conducted as the first phase of an explanatory sequential mixed-methods evaluation in five wards of Jalingo LGA (Turaki A, Sintali A, Sintali B, Barade and Kona). Eligible respondents were women who were mothers or primary caregivers of children aged 0 to 23 months and who lived in the ward and could give informed consent. The sample size, 435, was calculated with Yamane's (1967) formula ($N = 31{,}885$, $e = 0.05$, giving about 395) and checked against Cochran's (1977) formula (about 385), with 10% added for non-response. The population figure of 31,885 is an estimate of the caregivers of children aged 0 to 23 months in the five wards. No register of eligible caregivers exists, so it was derived from the agency's projected 2021–2025 population of Jalingo LGA, taking the five wards as about half of the LGA population and applying the 5.5% share of the population aged 0 to 5 years reported for the North-East in the 2018 Nigeria Demographic and Health Survey (NPC & ICF, 2019). Without a register there was no formal sampling frame, so the sample is a quota (convenience) sample and not a probability sample. Each ward contributed 87 respondents, recruited by five community-based “mama-to-mama” communicators at women's group meetings, community spaces and health facility waiting areas, and the questionnaire was

administered face to face in Hausa or the caregiver's preferred language. Ethical clearance was obtained from the American University of Nigeria Research Ethics Committee and the Taraba State Ministry of Health Research Ethics Committee, and consent was obtained from all respondents. Recruitment in each ward continued until 87 consenting women had completed the questionnaire. The communicators approached 440 eligible women and 435 completed the questionnaire, a response rate of 98.9%; five women declined. Because so few declined, non-response is unlikely to have biased the results much, but the rate applies only to women who were approached at gathering points, and it says nothing about eligible women who were not reached; the characteristics of the five who declined were not recorded.

Measures

Exposure was measured with eight statements scored from 1 (strongly disagree) to 5 (strongly agree) on whether the respondent had heard messages on radio (C1), seen information on television (C2), spoken to a community health worker (C3), attended a community meeting where immunisation was discussed (C4), been reached by a religious or traditional leader (C5), seen posters, flyers or printed materials (C6), received SMS messages (C7) and seen information on social media (C8). The exposure index was the mean of the eight items (Cronbach's alpha = 0.82). For channel-group analysis, the items were combined into interpersonal channels (C3 to C5), broadcast media (C1 and C2), print (C6) and digital channels (C7 and C8).

Perceived effectiveness was measured with seven statements on the same scale: that the communication made the respondent aware of the vaccines the child needs (D9), helped them understand when to vaccinate (D10), addressed concerns about side effects (D11), could be trusted (D12), influenced the decision to vaccinate (D13), made the community more accepting (D14) and helped them complete the schedule (D15). The effectiveness index was the mean of the seven items (Cronbach's alpha = 0.89; Nunnally, 1978). Ward, age group, education and awareness of the immunisation programme were taken from the questionnaire.

Correlation analysis

Both indices were skewed towards the top of the scale (skewness −0.82 for exposure and −1.30 for effectiveness; Shapiro-Wilk $p < 0.001$ for both), and the items were five-point ordinal ratings. Spearman's rank correlation (ρ) was therefore the primary measure, with a 95% confidence interval from the Fisher transformation, checked with a bootstrap interval from 5,000 resamples. Pearson's r and Kendall's τ-b were reported for comparison, and the Pearson coefficient was squared to give the shared variance. To test H2, a partial correlation was obtained by correlating the ranks of the two indices after removing the linear effects of ward, age group and education from each. Item-level correlations were calculated for each of the 56 pairs of an exposure item and an effectiveness item, and channel-group correlations were calculated between each group score and the effectiveness index. Correlations were then calculated within each ward, education level and awareness group. Interpretation followed common benchmarks, with coefficients of about 0.10 to 0.29 taken as weak, 0.30 to 0.49 as moderate and 0.50 or above as strong. As a sensitivity check, the effectiveness index was regressed on the exposure index with heteroscedasticity-consistent (HC3) standard errors, alone and adjusted for ward, age group and education. Several further checks were added after the first version of this paper in response to peer review. To test whether the correlation differed between wards, the ward correlations were converted with Fisher's z transformation and compared with a heterogeneity test (Q, on 4 degrees of freedom); Sintali B was also compared with the pooled correlation of the other four wards. Ward standard deviations were calculated to judge whether restriction of range could explain a weaker correlation, and the Sintali B coefficient was adjusted for restriction on the effectiveness index with the standard univariate correction (Thorndike's Case II), using the standard deviation of the whole sample as the reference. Because the channel groups are correlated with each other, their inter-correlations and variance inflation factors (VIF) were computed. As a check on acquiescence, the main correlation was recalculated after excluding respondents who gave the same answer to all 15 items. The precision of the study was described by the smallest correlation detectable with 80% power at a two-sided α of 0.05. Two-sided p values below 0.05 were considered significant. No adjustment for multiple testing was made for the secondary correlations other than the Bonferroni correction applied to the 56 item pairs (threshold $p < 0.0009$). Analyses were done in

Python (pandas, SciPy and statsmodels). The hypotheses and analysis plan were registered retrospectively, and any difference between the registered plan and the analysis reported here is stated in the registration.

RESULTS

Descriptive statistics

The mean exposure index was 3.64 (SD 0.54, median 3.75) and the mean effectiveness index was 4.11 (SD 0.45, median 4.00) (Table 1). Effectiveness was close to the ceiling: 88.0% of respondents scored 4.0 or above and 17.9% scored 4.5 or above. Exposure was more spread, with 30.6% scoring 4.0 or above.

Table 1: Descriptive statistics for the exposure and perceived-effectiveness indices (N = 435)

Index	Items	Cronbach's α	Mean (SD)	Median	Scoring 4.0 or above, %
Exposure	8	0.82	3.64 (0.54)	3.75	30.6
Perceived effectiveness	7	0.89	4.11 (0.45)	4	88

Note. Indices are the mean of items scored from 1 (strongly disagree) to 5 (strongly agree).

Correlation between the two indices (H1 and H2)

Exposure and perceived effectiveness were positively correlated (Table 2). The primary coefficient was moderate (Spearman $\rho = 0.35$, 95% CI 0.27 to 0.43, $p < 0.001$; bootstrap interval 0.26 to 0.44), and Pearson's r (0.46) and Kendall's τ-b (0.27) were also significant (both $p < 0.001$). The Pearson r^2 of 0.21 means that exposure shares about one-fifth of its variation with perceived effectiveness. H1 was therefore supported. With 435 respondents, the study had 80% power to detect a correlation as small as $\rho = 0.13$, so the observed coefficient was well above the smallest detectable effect. The Pearson coefficient is higher than the Spearman coefficient, which probably reflects a minority of respondents with low scores on both indices, since the rank-based measure gives such extreme values less weight.

After controlling for ward, age group and education, the partial rank correlation was 0.32 (95% CI 0.23 to 0.40, $p < 0.001$), which is slightly lower than the zero-order coefficient, so some of the association is shared with these characteristics, but most of it remains (H2 supported). The regression check gave the same picture: each one-point increase in the exposure index was associated with a 0.37-point higher effectiveness index (95% CI 0.25 to 0.50, $p < 0.001$; $R^2 = 0.21$), and the coefficient was unchanged after adjustment ($b = 0.37$, 95% CI 0.21 to 0.54, $p < 0.001$; $R^2 = 0.32$).

Table 2: Correlation between the exposure index and the perceived-effectiveness index (N = 435)

Coefficient	Value	95% CI	p
Spearman ρ (primary)	**0.35**	**0.27 to 0.43**	**<0.001**
Pearson r	0.46	0.38 to 0.53	<0.001
Kendall τ-b	0.27	–	<0.001
Pearson r^2 (shared variance)	0.21	–	–
Partial Spearman ρ, controlling for ward, age and education	0.32	0.23 to 0.40	<0.001

Note. CI = confidence interval. The Kendall coefficient is reported without an interval.

Item-level correlations

Of the 56 pairs of an exposure item and an effectiveness item, 52 were significantly positive at $p < 0.05$ without correction, and 39 remained significant after a Bonferroni correction for 56 tests ($p < 0.0009$), so 13

pairs were significant only before correction and the uncorrected count should be treated as the upper bound. Coefficients ranged from −0.05 to 0.40. The strongest were between spoken contact with a community health worker and the sense that side-effect concerns had been addressed (ρ = 0.40), and between a community health worker or print materials and awareness of the vaccines the child needs (ρ = 0.38 for each). Attendance at community meetings was the exception, with weak or no correlations: it was not significantly correlated with trust (ρ = −0.05), influence on the decision to vaccinate (0.01) or help in completing the schedule (0.00), and was only weakly correlated with the other items. Contact with leaders was not significantly correlated with the community becoming more accepting (ρ = 0.09, p = 0.06). SMS had weak correlations of 0.12 to 0.16 with every effectiveness item.

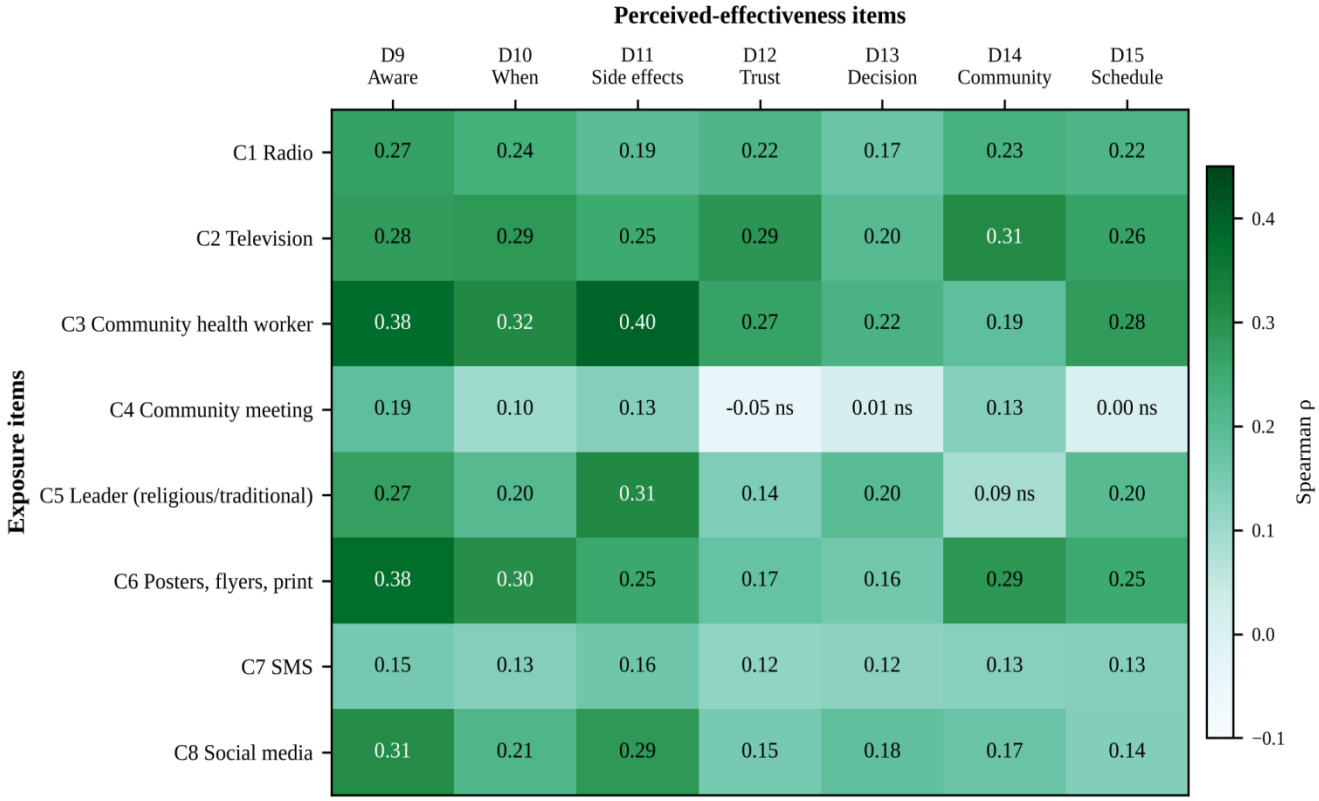

Figure 1: Spearman correlations between exposure items (rows) and perceived-effectiveness items (columns); ns = not significant at p ≥ 0.05

Channel-group correlations (H3)

Every channel group was positively correlated with the effectiveness index (Table 3). Broadcast media had the strongest correlation (ρ = 0.38, 95% CI 0.29 to 0.46), followed by print (0.31) and digital channels (0.22), and interpersonal channels had the weakest (0.19, 95% CI 0.10 to 0.28). H3 was therefore not supported at the level of simple correlations: the interpersonal group was less strongly correlated with effectiveness than broadcast and print. This is partly because the group includes community meetings, which had almost no correlation with the effectiveness items, whereas contact with a community health worker alone had a correlation of 0.33 with the index. In the regression sensitivity check with all four groups entered together and adjusted for ward, age and education, interpersonal channels had the largest independent coefficient (b = 0.21, 95% CI 0.08 to 0.35), followed by print (0.12, 95% CI 0.03 to 0.20) and broadcast media (0.08, 95% CI 0.00 to 0.17), and digital channels had none (−0.02, 95% CI −0.09 to 0.05). The groups overlap, since respondents reached by one channel tend to be reached by others: the Spearman correlations between the group scores ranged from 0.35 (interpersonal with broadcast and with print) to 0.57 (interpersonal with digital), and the variance inflation factors were 1.5 to 1.7, which indicates moderate and not serious collinearity. Because of this overlap, the group correlations, and the differences between them, cannot be read as the separate contribution of each channel. The 95% confidence intervals for broadcast (0.29 to 0.46) and interpersonal channels (0.10 to 0.28) do not overlap, but the group scores contain different numbers of items (two, three,

one and two), which also affects their reliability and therefore the size of the correlations, so the comparison is offered with caution. In standardised terms the adjusted coefficients were 0.26 for interpersonal, 0.19 for broadcast, 0.18 for print and −0.02 for digital channels.

Table 3: Correlation of channel-group exposure with the perceived-effectiveness index (N = 435)

Channel group	Mean (SD)	Spearman ρ	95% CI	p
Broadcast media (C1, C2)	3.69 (0.76)	0.38	0.29 to 0.46	<0.001
Print (C6)	3.88 (0.67)	0.31	0.22 to 0.39	<0.001
Digital channels (C7, C8)	3.35 (0.83)	0.22	0.13 to 0.31	<0.001
Interpersonal channels (C3 to C5)	3.71 (0.57)	0.19	0.10 to 0.28	<0.001

Correlations within subgroups

The correlation was significant in four of the five wards, ranging from ρ = 0.31 in Sintali A to 0.52 in Kona, but it was weak and not significant in Sintali B (ρ = 0.11, 95% CI −0.10 to 0.31, p = 0.31) (Table 4; Figure 2). The ward-level means also differed: exposure was highest in Sintali A (4.02) and lowest in Kona (3.30), whereas effectiveness was highest in Turaki A (4.39), so the overall correlation is not simply a result of differences between wards. It was also significant in every education group except respondents with no formal education (ρ = 0.23, p = 0.14), and it was strongest among those with primary education (0.63) and university education (0.55), although these groups are small (n = 41 and n = 35) and their intervals wide. Among the 407 respondents who were aware of the programme the correlation was ρ = 0.32 (p < 0.001), whereas among the 28 who were not it was 0.15 (p = 0.44), which cannot be distinguished from no correlation with so few respondents.

The ward correlations were not homogeneous (Q = 11.8 on 4 degrees of freedom, p = 0.019). Sintali B differed significantly from the pooled correlation of the other four wards (ρ = 0.44; z = −2.93, p = 0.003), and pairwise from Barade (z = −2.15, p = 0.032), Kona (z = −3.05, p = 0.002) and Turaki A (z = −2.71, p = 0.007), but not from Sintali A (z = −1.35, p = 0.18). Effectiveness varied least in Sintali B (SD 0.19, against 0.45 in the whole sample and 0.28 to 0.66 in the other wards), which is consistent with restriction of range. Correcting the Sintali B coefficient for this restriction raised it from 0.11 to about 0.25, which is closer to the other wards but still smaller than the pooled value. Restriction of range therefore appears to explain part, but not all, of the weaker correlation, and the corrected figure is indicative only because the sample-wide standard deviation includes differences between wards. The ward with the weakest correlation was not the ward with the smallest variation in exposure (SD 0.37 in Sintali B against 0.20 in Turaki A), and Turaki A, which had a narrow exposure range, still showed a correlation of 0.48. With 87 respondents per ward, a correlation had to be at least 0.30 to be detected with 80% power, so smaller ward-level correlations may have been missed.

As a check on acquiescence, 40 respondents (9.2%) gave the same answer to all 15 items. When they were excluded, the correlation was ρ = 0.42 (n = 395), higher and not lower than the full-sample value, and excluding the 108 respondents who agreed or strongly agreed with every item gave ρ = 0.45 (n = 327). Acquiescent responding therefore does not appear to account for the correlation, although these checks cannot remove a general tendency to agree, which would affect both indices, and 80.5% of all answers were agree or strongly agree. A comparison of facility-based and community-based interviews, which would have been a further test, was not possible because the place of recruitment was not recorded for each respondent.

Table 4: Correlation between exposure and perceived effectiveness within subgroups

Subgroup	n	Spearman ρ	95% CI	p
Ward				
Barade	87	0.41	0.22 to 0.57	<0.001
Kona	87	0.52	0.35 to 0.66	<0.001
Sintali A	87	0.31	0.10 to 0.49	0.004

Sintali B	87	0.11	−0.10 to 0.31	0.31
Turaki A	87	0.48	0.30 to 0.63	<0.001
Education				
No formal education	41	0.23	−0.08 to 0.50	0.14
Primary	41	0.63	0.40 to 0.78	<0.001
Secondary	201	0.33	0.20 to 0.44	<0.001
College/diploma	117	0.28	0.10 to 0.44	0.002
University	35	0.55	0.26 to 0.75	<0.001
Aware of the programme				
Yes	407	0.32	0.23 to 0.41	<0.001
No	28	0.15	−0.23 to 0.50	0.44

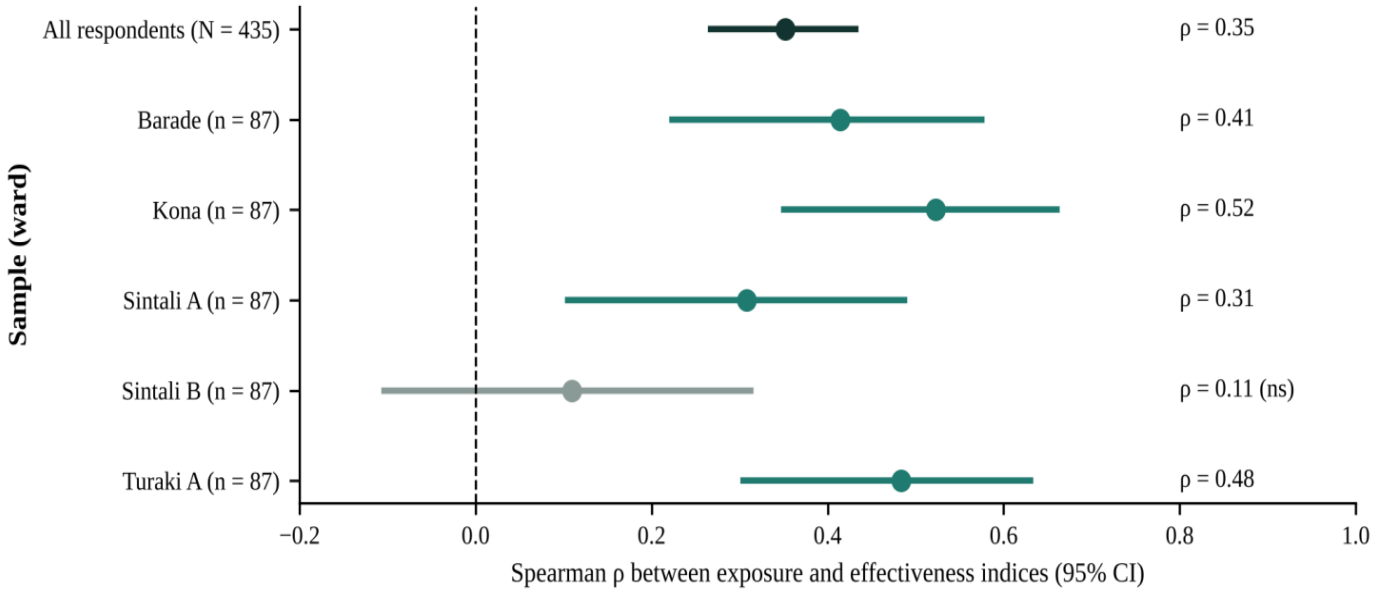

Figure 2: Spearman correlation between the exposure index and the perceived-effectiveness index, overall and by ward (points are ρ; horizontal lines are 95% confidence intervals; grey = not significant)

DISCUSSION

Caregivers who reported greater exposure to the agency's communication rated it as more effective, with a moderate correlation (ρ = 0.35) that held after controlling for ward, age and education (partial ρ = 0.32). This is consistent with the idea that cues and messages reaching caregivers feed beliefs about the usefulness and credibility of the communication (Rosenstock et al., 1988; Ajzen, 1991), and it is not what would be expected if the high ratings were only general goodwill, because caregivers who reported less exposure gave lower ratings. The direction agrees with studies that link caregivers' knowledge, trust and hesitancy to the sources of information available to them (Mbonigaba et al., 2024; Adeyanju et al., 2022), and it suggests that caregivers reached by more channels tend to find the communication more useful. A correlation is not evidence of cause. Caregivers who already trusted the programme may have noticed and reported more of its communication, and caregivers who were more engaged with the health system would be both more exposed and more favourable.

Two features of the data affect how strong the correlation should be judged to be. First, effectiveness was close to the ceiling, so the range of the variable was restricted, which tends to lower correlations and could mean the underlying relationship is stronger than 0.35. Second, both indices came from the same respondents in the same interview, so common-method effects could raise the correlation. The two pressures work in

opposite directions, and the net effect cannot be estimated from these data, although excluding respondents who gave the same answer to every item did not reduce the correlation. The absence of a correlation in Sintali B, the ward with the lowest variation in effectiveness (SD 0.19 on the index), is consistent with the restriction of range, and the formal tests show that restriction of range explains only part of it: the correlation differed significantly between wards, and after correction for restriction Sintali B was still weaker than the pooled value. Other ward-specific factors, such as how the communication is delivered there, cannot be excluded.

The channel results did not support the prediction that interpersonal channels would correlate most strongly. Broadcast media and print correlated more strongly with effectiveness than interpersonal channels did, even though community health workers correlated well on their own ($\rho = 0.33$) and gave the highest item-level correlations. Community meetings, the least reached interpersonal channel, were barely correlated with the ratings, which may be because meetings reach caregivers who are already supportive, or because they differ in quality, and the questionnaire could not tell these explanations apart. When all channel groups were considered together, interpersonal channels had the largest independent association, which agrees with evidence on lay health workers and opinion leaders (Lewin et al., 2010; Valente & Davis, 1999), and so the simple correlations should not be read as a ranking of channels, particularly because the groups are inter-correlated and have different numbers of items. Digital channels were weakly correlated and had no independent association, which is unsurprising given limited literacy and internet use among Nigerian women (NPC & ICF, 2019) and the modest effect of SMS reminders on completion of routine immunisation (Oladepo et al., 2021).

Correlations were highest for items on awareness of the vaccines needed and addressing side-effect concerns, and lower for trust and for influence on the decision to vaccinate. This ordering is consistent with the idea that communication acts first on knowledge and reassurance, while the decision to vaccinate also depends on access and other things (Brewer et al., 2017; Omoniyi & Williams, 2020).

STRENGTHS AND LIMITATIONS

The study uses a large sample with equal numbers from five wards, reliable scales, and several correlation measures and checks that gave consistent results. Its limitations are important. The design is cross-sectional, so the direction of the correlation cannot be established. Both indices were self-reported by the same respondents, in the same interview. The questionnaire was administered by community communicators known to respondents, so acquiescence or social desirability may have raised ratings at both ends; the check on same-answer responses reduces but does not remove this concern, and a comparison of facility and community interviews was not possible. The sample was a quota sample with no sampling frame, and the high response rate (98.9%) applies only to women who were approached, so the results cannot be generalised with confidence beyond the five wards. Effectiveness was measured as perception and not as knowledge, intention or verified vaccination. Ratings were concentrated at the top of the scale, which restricts variation. Exposure was measured as agreement with statements and not as the frequency or recency of contact. Respondents were recruited at gathering points and health facilities and may over-represent attenders. Subgroup correlations rest on small groups in places, and the analyses were not planned in the original protocol and several tests were made without adjustment, so the secondary findings should be treated as hypotheses for further work.

CONCLUSION

In Jalingo LGA, exposure to routine immunisation communication was moderately and positively correlated with perceived effectiveness, and the correlation remained after controlling for ward, age and education. Simple correlations were strongest for broadcast media and print and weakest for interpersonal channels, whereas the adjusted regression gave interpersonal channels the largest independent contribution, and digital channels contributed little in either analysis. The correlation was weaker in one ward and the channel comparisons are limited by overlap between groups. The findings show association and not cause, they rest on self-reports clustered near the top of the scale, and whether greater exposure leads to higher perceived effectiveness, or to better vaccination outcomes, needs longitudinal or experimental testing.

RECOMMENDATIONS

1. Because each channel group was positively associated with perceived effectiveness, a mix of interpersonal, broadcast and print channels appears worth maintaining, and the agency may wish to consider extending reach to caregivers who report the least exposure.

2. The quality and reach of community meetings merit review, since attendance was commonly reported but was barely associated with the effectiveness items.

3. SMS and social media were weakly associated with effectiveness, and the agency may wish to treat them as supplements and to monitor their reach.

4. Programme managers could examine wards and groups where exposure and ratings are low, such as Kona and caregivers with primary education only, and look into why the association was weaker in Sintali B.

5. Future surveys should add measures that discriminate at the top of the scale, frequency and recency of exposure, knowledge and intention items, the place of interview, the reasons for refusal, and vaccination status verified against cards.

6. Because these data are correlational, longitudinal or quasi-experimental studies should test whether greater exposure to community-based communication changes perceived effectiveness and vaccination behaviour before any channel is prioritised on the strength of these results.

ACKNOWLEDGEMENTS

The authors thank the caregivers, officials, leaders and frontline communicators who took part, the five “mama-to-mama” communicators who administered the survey, and the research assistants.

Conflict of interest

The authors declare no conflict of interest.

Funding

This research received no specific grant from any funding agency.

Data availability statement

The anonymised survey dataset (435 caregiver records with item responses, ward, age group and education) and the Python analysis scripts that produced every table and figure in this paper are available from the corresponding author on reasonable request. The dataset contains no names or contact details.

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