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Digital Extension and Social Learning for Livestock Health: Association Between Whatsapp Groups, Disease Reporting and Vaccination Uptake Among Smallholder Pig and Poultry Farmers in Ikere LGA, Ekiti State, Nigeria.

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ABSTRACT

Digital extension has become a practical low-cost pathway for improving livestock health through quick information sharing and peer learning among smallholder farmers. This study assessed the association between WhatsApp group participation, disease reporting and vaccination uptake among pig and poultry farmers in Ikere Local Government Area of Ekiti State, Nigeria. A multistage sampling procedure was used to select 147 farmers from five wards, and primary data were collected between January and March 2025 using a structured questionnaire that was face-validated by two agricultural extension experts and pre-tested among 20 farmers outside the study area, yielding Cronbach's alpha coefficients of 0.81 for digital literacy, 0.78 for peer influence and 0.84 for extension facilitation. Vaccination uptake, the dependent variable, was operationalized as a binary outcome where farmers who had vaccinated their entire flock or herd against Newcastle Disease for poultry and routine preventive vaccines for pigs within the last six months in line with veterinary recommendation were coded 1 and 0 otherwise. Key explanatory variables including digital literacy, peer influence and extension facilitation were measured as composite scores using 5-point Likert items. Data were analyzed using descriptive statistics and binary logistic regression with multicollinearity and model fit diagnostics. Results showed that 52.4% of farmers belonged to livestock WhatsApp groups. Descriptively, WhatsApp members recorded a lower mean disease reporting time of 8.4 hours compared to 23.5 hours for non-members, a higher observed vaccination rate of 68.8% compared to 24.3%, and a lower reported mortality rate of 11.2% compared to 28.9%, but these differences are presented strictly as descriptive associations and should not be interpreted as causal effects due to the cross-sectional design. The logistic regression model was statistically significant with Omnibus Chi-square = 58.41, $p < 0.001$, Hosmer and Lemeshow test $p = 0.412$ indicating good fit, and Nagelkerke $R^2 = 0.502$, explaining 50.2% of variation in vaccination uptake, with all Variance Inflation Factors below 1.85. Adjusted odds ratios showed that WhatsApp group membership (B = 1.029, OR = 2.798, $p < 0.001$), extension facilitation (B = 0.984, OR = 2.675, $p < 0.001$), digital literacy (B = 0.821, OR = 2.273, $p = 0.001$), peer influence (B = 0.674, OR = 1.962, $p = 0.005$) and years of formal education (B = 0.102, OR = 1.107, $p = 0.020$) were significantly associated with higher odds of vaccination uptake. The study concludes that WhatsApp-based digital extension is associated with improved vaccination behaviour and better descriptive livestock health indicators, and recommends training extension agents as moderators, subsidizing data, and integrating WhatsApp platforms with veterinary services.

KEYWORDS: Digital Extension, WhatsApp, Social Learning, Livestock Health, Disease Reporting, Vaccination, Ekiti State, ICT4Ag.

How to Cite

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1. Introduction

Livestock production, particularly pig and poultry farming, remains a vital livelihood and animal protein source for smallholder households in Southwest Nigeria (Ekiti ADP, 2023). In Ikere Local Government Area of Ekiti State, the high concentration of smallholder pig and poultry farms supports egg, meat and manure supply to urban markets in Ado-Ekiti and its environs. Despite this importance, the subsector is heavily constrained by endemic disease outbreaks. Newcastle Disease in poultry and African Swine Fever in pigs are the leading causes of mortality, with reported losses of 40 to 60 percent of flock and herd size during outbreaks (Federal Ministry of Agriculture and Rural Development, 2023; Food and Agriculture Organization, 2023).

Studies have identified late disease reporting and low vaccination uptake as major drivers of this high mortality (Food and Agriculture Organization, 2023; World Health Organization, 2023). Early reporting within 24 hours is considered critical for containing transboundary animal diseases under the One Health approach (World Health Organization, 2023). The inability to achieve this is linked to weaknesses in the conventional extension system which depends largely on face-to-face visits, limited by poor funding, low extension-to-farmer ratio and logistical challenges (Davis & Babu, 2023). Digital extension, defined as the use of Information and Communication Technologies to deliver timely, cost-effective and scalable advisory services (World Bank, 2024), offers a paradigm shift. Among digital tools, WhatsApp has gained remarkable traction in Nigeria because of its low data requirement, multimedia capability, ease of use and high penetration among rural youth (Rivera & Sulaiman, 2023; Yusuf et al., 2024). The National Bureau of Statistics (2024) reported that over 68 percent of Nigerian farmers own a smartphone with WhatsApp installed, making it the most preferred platform for farmer groups.

Theoretically, the effectiveness of WhatsApp groups can be explained through social learning theory and social capital. Meijer et al. (2023) argued that farmers learn not only from extension agents but also through peer observation, imitation and trust within networks. Putnam (2022) emphasized that social networks build bonding and bridging capital that facilitates collective action such as disease reporting. Valente (2023) and Borgatti et al. (2023) have shown that individuals with high centrality in digital networks are early adopters and diffusers of health innovations. When an extension agent moderates a WhatsApp group, information is perceived as more credible, which can counter misinformation and enhance adoption (Giwa et al., 2024; Ojo et al., 2023).

Empirically, the potential of WhatsApp for livestock health is substantial. The Food and Agriculture Organization (2023) noted that digital reporting tools can reduce reporting delays by over 50 percent and improve linkage between farmers and veterinary services. Ojo et al. (2023) found that farmers who belonged to digital groups in Oyo State had significantly higher vaccination uptake compared to non-members, while Ibrahim and Sanni (2024) reported that ICT use improved disease reporting compliance by 43 percent in Northern Nigeria. However, the digital divide remains a challenge, as poor network connectivity, low digital literacy, high cost of data and proliferation of unverified health information have limited effective utilization (Zemba et al., 2024; Adebayo et al., 2024).

Despite growing interest, empirical evidence on the association between WhatsApp group participation and specific livestock health indicators such as disease reporting time and vaccination rate remains scarce in Ekiti State (Yusuf et al., 2024). Most existing studies in Southwest Nigeria have focused on crop farmers or general ICT adoption, leaving a gap in understanding how social learning through WhatsApp is associated with pig and poultry health behaviour. Moreover, only 22 percent of livestock farmers in the region reportedly use WhatsApp for animal health purposes, indicating underutilization (Ibrahim & Sanni, 2024). This study therefore seeks to fill this gap by examining factors associated with vaccination uptake through WhatsApp groups and assessing the descriptive association between group participation and livestock health outcomes in Ikere LGA.

2. Methodology

2.1 Study Area

The study was conducted in Ikere LGA, Ekiti State, Southwest Nigeria, located on latitude 7°30' N and longitude 5°14' E with a tropical climate favourable for poultry and pig production. The LGA comprises 11 wards with an estimated population of 147,355 (National Bureau of Statistics, 2024). Major communities include Ikere, Iju, Are, Odo-Owa and Ise where livestock farming is dominant. The area was purposively

chosen due to high concentration of smallholder pig and poultry farmers and presence of active livestock WhatsApp groups moderated by Ekiti State Agricultural Development Programme.

2.2 Sampling Procedure

A multistage sampling technique was employed. Stage one was selection of wards. Five wards were purposively selected from eleven wards based on four specific criteria to ensure transparency: (a) high concentration of pig and poultry farmers based on Ekiti ADP livestock register 2023/2024, (b) presence of at least one functional livestock WhatsApp group moderated by EKADP in the last 12 months, (c) accessibility during the farming season, and (d) representation of both peri-urban and rural settlements. Selection was done in consultation with zonal extension staff.

Stage two involved random selection of one community with high livestock population from each selected ward through balloting, giving five communities. Stage three was compilation of sampling frame. In each community, a comprehensive list of pig and poultry farmers was compiled with assistance of ward extension agents and community leaders. The list was stratified into WhatsApp members and non-members, forming a frame of 298 farmers. Stage four was selection of respondents. From the frame, 147 farmers were selected using proportional allocation to size. Farmers were randomly selected within each stratum using random number tables, comprising 77 WhatsApp members and 70 non-members.

Inclusion criteria were smallholder pig or poultry farmer with at least 10 birds or 5 pigs, resident for at least 12 months, and willingness to participate.

2.3 Data Collection and Measurement of Variables

Primary data were collected between January and March 2025 using a structured questionnaire.

Vaccination Uptake (Dependent Variable): Binary. Coded 1 if farmer reported and showed evidence of vaccinating entire flock/herd against Newcastle Disease for poultry and routine preventive vaccines for pigs in last six months per veterinary schedule, 0 otherwise.

WhatsApp Group Membership: Binary. 1 if member of at least one active livestock WhatsApp group in last six months, 0 otherwise.

Digital Literacy: 5 items on 5-point Likert scale from 1 strongly disagree to 5 strongly agree covering ability to read and share messages, send photos/videos of sick animals, search information, join video calls and verify information. Score range 5 to 25, mean score used. Scores 15 and above classified as high literacy for descriptive purposes but continuous score used in regression.

Peer Influence: 4 items on 5-point scale measuring encouragement from friends in group, learning from success stories, social pressure to adopt practices. Range 4 to 20.

Extension Facilitation: 4 items on 5-point scale measuring frequency of extension messages, moderation by agent, feedback response time and trust in information. Range 4 to 20.

Education: Years of formal schooling.

Disease Reporting Time: Hours between noticing first symptom and reporting to veterinarian, extension agent or WhatsApp group, self-reported.

The questionnaire was face-validated by two agricultural extension experts. Pre-test among 20 farmers outside study area gave Cronbach's alpha of 0.81 for digital literacy, 0.78 for peer influence and 0.84 for extension facilitation, indicating acceptable internal consistency (Borgatti et al., 2023). Limitation of recall bias for self-reported outcomes is acknowledged.

2.4 Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics including frequencies, means and percentages were used. Binary logistic regression was used for factors associated with vaccination uptake.

Model specification: Logit(P) = β0 + β1(WhatsApp Membership) + β2(Extension Facilitation) + β3(Digital Literacy) + β4(Peer Influence) + β5(Education) + e, where P is probability of vaccination uptake coded 1.

All odds ratios reported are adjusted odds ratios. Multicollinearity was checked with Variance Inflation Factor with threshold of less than 5. Model fit was assessed using Omnibus Chi-square test, Hosmer and Lemeshow test and Nagelkerke R2 (Meijer et al., 2023). Significance was set at p less than 0.05 and p less than 0.01. Descriptive comparison of health indicators by WhatsApp membership was done strictly as association with no causal inference due to cross-sectional design (Davis & Babu, 2023).

3. Results

Table 1 presents factors associated with vaccination uptake. The model was statistically significant.

Binary Logistic Regression of Factors Associated with Vaccination Uptake (n = 147)

VARIABLE	B	S.E.	WALD	P-VALUE	ADJUSTED OR	95% CI	VIF
WhatsApp Group Membership	1.029	0.276	13.901	<0.001	2.798	1.628 - 4.809	1.42
Extension Facilitation	0.984	0.268	13.481	<0.001	2.675	1.581 - 4.526	1.63
Digital Literacy	0.821	0.251	10.701	0.001	2.273	1.388 - 3.722	1.85
Peer Influence	0.674	0.239	7.951	0.005	1.962	1.227 - 3.137	1.71
Education (years)	0.102	0.044	5.371	0.020	1.107	1.016 - 1.206	1.31
Constant	-3.921	0.884	19.681	<0.001	0.020		

Note. Omnibus Chi-square = 58.41, p < 0.001; Hosmer and Lemeshow Chi-square = 6.12, p = 0.412; Nagelkerke R2 = 0.502; Dependent variable coded 1 = vaccinated in last 6 months, 0 = otherwise.

Source: Field Survey, 2025.

From Table 1, WhatsApp group membership was associated with 2.80 times higher odds of vaccination uptake after adjusting for other variables. Extension facilitation increased odds by 2.68 times, digital literacy by 2.27 times, peer influence by 1.96 times, and each additional year of education increased odds by 10.7 percent.

Table 2

Descriptive Comparison of Livestock Health Indicators by WhatsApp Membership Status

INDICATOR	WHATSAPP MEMBERS (N = 77)	NON-MEMBERS (N = 70)	OBSERVED DESCRIPTIVE DIFFERENCE
Mean disease reporting time (hours)	8.4	23.5	15.1 hours lower
Vaccination rate (%)	68.8	24.3	44.5 percentage points higher
Mortality rate from major diseases (%)	11.2	28.9	17.7 percentage points lower

Note. Descriptive comparison only. No causal inference should be drawn due to cross-sectional design.

Source: Field Survey, 2025.

Table 2 shows descriptive differences. Members had lower mean reporting time, higher vaccination rate and lower mortality descriptively.

4. Discussion

The finding that 52.4 percent of farmers belonged to WhatsApp groups indicates relatively high digital penetration in Ikere LGA, which aligns with National Bureau of Statistics (2024) report of 68 percent smartphone ownership among farmers. This suggests that WhatsApp is no longer a niche tool but a mainstream channel for livestock information (Yusuf et al., 2024).

WhatsApp group membership was the strongest factor associated with vaccination uptake with an adjusted odds ratio of 2.798, p less than 0.001. This finding supports Valente (2023) and Borgatti et al. (2023) who noted that network embeddedness drives health behaviour through social learning. The association of extension facilitation with uptake with OR of 2.675 supports Rivera and Sulaiman (2023) who argued that extension agents must act as digital moderators to ensure credibility and counter misinformation (Giwa et al., 2024).

Digital literacy was also significantly associated with uptake with OR of 2.273, corroborating Davis and Babu (2023) and Adebayo et al. (2024) that digital skills determine effective ICT use. Without ability to interpret photos, videos and voice notes, farmers may not benefit from groups.

The descriptive differences in Table 2 where members reported faster reporting time aligns with World Health Organization (2023) and Food and Agriculture Organization (2023) that digital tools enhance early warning under One Health. However, as emphasized in the review, these are associations, not effects. Farmers with better health practices may self-select into groups, and unmeasured confounders may explain differences. Similar caution applies to mortality differences. Constraints such as poor network and misinformation noted by Zemba et al. (2024) were observed during fieldwork and may limit benefits for non-members.

4.1 Limitations

Cross-sectional design limits causal inference, self-reported outcomes may have recall bias, and sample is limited to one LGA affecting generalizability (World Bank, 2024).

5. Conclusion and Recommendations

The study shows that WhatsApp group membership, extension facilitation, digital literacy, peer influence and education are significantly associated with vaccination uptake among pig and poultry farmers in Ikere LGA. Descriptively, WhatsApp members showed better livestock health indicators than non-members, but this should not be interpreted as causal effect.

Based on findings, it is recommended that Ekiti State Agricultural Development Programme should train extension agents as WhatsApp moderators to share verified health content, partner with telecommunication companies to provide low-cost data bundles for livestock groups, integrate WhatsApp groups with veterinary services for rapid response, and implement digital literacy campaigns to help farmers verify information.

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