



Agricultural Extension Services and Disease Outbreak Readiness among Smallholder Poultry Farmers in Nasarawa State, Nigeria

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Abstract

Agricultural extension services (AES) are widely regarded as critical for strengthening smallholder poultry farmers' capacity to prevent, detect, and manage disease outbreaks, yet the extent to which these services translate into actual outbreak readiness in Nasarawa State, Nigeria, remains under-documented. This study examined AES and disease outbreak readiness among smallholder poultry farmers in the State, describing farmers' socio-economic characteristics, examining their awareness of and access to extension services relevant to disease outbreak readiness and the factors influencing such access, ascertaining their level of readiness, and investigating the barriers to effective readiness. A multi-stage sampling technique was used to select 300 poultry farmers from twelve communities across six Local Government Areas. Data were collected with a structured, validated questionnaire (Cronbach's alpha = 0.748) and analysed using descriptive statistics, binary logistic regression, and principal component analysis. Results showed that farmers were predominantly male (65.33%), married (80.33%), and highly literate, with 93.00% aware of extension services as sources of disease-prevention information and 93.67% reporting access to such services. Years of formal education, poultry management system, and marital status significantly influenced access to extension services. About 50.67% of farmers demonstrated high disease outbreak readiness, while 48.33% showed moderate readiness. Principal component analysis identified institutional, informational/financial, and technical constraints, which jointly explained 74.69% of the variance in barriers to readiness. The study concludes that strengthening extension delivery, veterinary support, and farmer education is essential for improving disease outbreak preparedness among smallholder poultry farmers.

Keywords:

Agricultural extension services; Disease outbreak readiness; Risk perception; Smallholder poultry farmers; Biosecurity; Nasarawa State.

1.0 INTRODUCTION

Poultry farming, whether practised in backyards, small family units, or larger commercial operations, plays a vital role in the livelihoods and food security of households across Nigeria. As demand for poultry products continues to rise, the sub-sector has become increasingly central to the agricultural economy, yet this progress remains constantly at risk. Disease

outbreaks can spread quickly, wiping out entire flocks, cutting off household incomes, and disrupting local markets (Abudulahi, et al., 2023). Globally, livestock diseases cause economic losses of more than US\$300 billion each year, with the hardest impacts felt in developing regions where veterinary services and disease control systems are limited (Food and Agriculture Organization [FAO], 2020).

Agricultural extension services (AES) are designed to bridge the gap between scientific research and grassroots farming practices by equipping farmers with timely, relevant, and actionable information, and should in theory play a pivotal role in enhancing poultry farmers' readiness for disease outbreaks (Sennuga & Fadiji, 2020; Abudulahi, et al., 2026). In practice, however, the delivery of extension services in Nasarawa State remains inconsistent and under-resourced. Alfa, Ajah, Onjewu and Iwegbu (2024) found that access to extension services varies significantly across states, reflecting poor coordination among government agencies, insufficient funding, and a lack of targeted outreach strategies. Moreover, the content of extension services often fails to address the specific needs of poultry farmers: while information on drug administration and feed formulation is commonly disseminated, critical areas such as early disease detection, vaccination protocols, and biosecurity measures are frequently overlooked (Alfa et al., 2024; Matanmi, Omotosho, Obaniyi, Adisa & Ogunsola, 2012).

Extension officers serve as key intermediaries between research institutions, veterinary services, and farmers, transferring technical knowledge while fostering trust and adapting information to local contexts, though their effectiveness is often constrained by underfunding, outdated training, and logistical barriers to reaching remote communities (World Health Organization [WHO], 2022; Hernandez, Mendes & Tunde, 2021; Greenfield, Ramirez & Lee, 2020). Fewer than 30% of rural farmers in Nigeria have regular access to extension officers, with poultry farmers being especially underserved (Ayoade, Akinniyi & Bello, 2019), a gap compounded by low literacy levels, cultural beliefs, and the high cost of veterinary care and vaccines (Ogunlela & Mukhtar, 2020; WHO, 2020).

The poultry sub-sector plays a critical role in enhancing food security, income generation, and employment in Nasarawa State, contributing significantly to the supply of affordable animal protein and supporting livelihoods along the value chain, yet it remains highly vulnerable to frequent disease outbreaks such as Avian Influenza and Newcastle Disease, which often result in high mortality rates, reduced productivity, market disruptions, and substantial economic losses (Ebisike, Sennuga & Maimunatu, 2021). Effective extension services are expected to equip farmers with up-to-date information on biosecurity measures, vaccination schedules, early disease detection, and emergency response strategies; however, access in many parts of the State is limited by inadequate staffing, poor funding, weak farmer-extension linkages, and logistical constraints, leaving many farmers reliant on informal sources of information that may be inconsistent or technically inadequate (Sennuga & Oyewole, 2020). There remains limited empirical evidence on the extent to which extension access shapes farmers' actual readiness to prevent, detect, and manage disease outbreaks, a gap that limits evidence-based policy formulation and targeted intervention.

It is against this background that this study examined agricultural extension services and disease outbreak readiness among smallholder poultry farmers in Nasarawa State, Nigeria. Specifically, the study sought to:

- i. describe the socio-economic characteristics of poultry farmers in the study area;

- ii. examine the level of awareness of extension services aimed at promoting disease outbreak readiness and response among poultry farmers;
- iii. determine poultry farmers' access to extension services that help them prepare for disease outbreaks and the factors influencing such access;
- iv. ascertain the level of disease outbreak readiness among poultry farmers; and
- v. investigates the barriers to effective disease outbreak readiness among poultry farmers in the study area.

2.0 LITERATURE REVIEW

Agricultural extension services have evolved substantially, shaping how farmers access and utilise new knowledge and how rural communities adapt to changing agricultural conditions, becoming instrumental in bridging the gap between research institutions and farming communities, facilitating the adoption of improved practices, and contributing to rural development objectives (Anderson & Feder, 2024). Within the poultry sub-sector, extension officers provide guidance on disease diagnosis, vaccination, and biosecurity, complementing veterinary services in disease control and awareness campaigns.

Empirical evidence indicates that poultry disease awareness is shaped by a complex mix of structural, socio-economic, and cultural factors. Many extension officers lack specialised training in poultry health, limiting their ability to communicate disease-prevention strategies effectively, while low literacy levels and cultural beliefs further reduce farmers' receptiveness to scientific advice (Ogunlela & Mukhtar, 2020). A farmer's level of awareness is often shaped by education, income, and access to extension support, and when farmers are well informed, they are better able to act quickly to protect their flocks (Oluwaseun & Patel, 2019).

Access to extension services remains uneven across Nigeria's poultry sub-sector. Education, marital status, farm management practices, and institutional factors significantly influence farmers' access to and utilisation of extension advice (Midamba et al., 2022; Bakari, Jatbong & Paul, 2019). Where access exists, farm visits, training sessions, and group meetings remain the dominant modes of service delivery, while the absence of extension agents, poor transportation infrastructure, and cost continue to constrain outreach to remote poultry-producing communities (Njenga, Oduor & Musyoka, 2021; Udoh, Vihi, Dalla, Binuyo & Mbah, 2024).

Beyond awareness and access, farmers' actual readiness for disease outbreaks reflects the interaction of institutional support, resource availability, and behavioural factors, typically measured through indicators such as adherence to vaccination schedules, maintenance of biosecurity protocols, availability of isolation facilities, access to veterinary support, and participation in disease surveillance and reporting systems. Even where awareness is high, structural constraints such as limited financial resources, inadequate veterinary supplies, weak surveillance systems, and poor extension coverage continue to undermine effective preparedness in many smallholder poultry systems (Njuki & Kaaria, 2019).

3.0 THEORETICAL FRAMEWORK

3.1 Risk Perception Theory

This study is anchored on Risk Perception Theory (RPT), which explains how individuals and communities interpret and respond to risks associated with environmental and health threats. The theory holds that risk perception is a subjective process shaped not only by the objective characteristics of a hazard but also by psychological, social, cultural, and institutional factors (Slovic, 1987). In the context of poultry farming, RPT offers a framework for examining how farmers assess the likelihood and severity of disease threats, how they prioritise these risks relative to other livelihood concerns, and how such perceptions influence their engagement with extension-recommended practices.

Central to RPT is the interplay between perceived likelihood and perceived severity, which together form the basis of farmers' risk assessments. Farmers who perceive a high likelihood of disease occurrence and severe consequences are generally more inclined to take proactive steps, such as vaccinating their birds or adopting biosecurity measures, whereas farmers with limited exposure to veterinary services or extension information may underestimate both likelihood and severity, leading to complacency (Renn, 2008). The availability heuristic, a related concept within RPT, further explains how farmers form risk perceptions based on the ease with which they recall similar events; recent or vivid memories of disease outbreaks within their communities can shape their sense of susceptibility, even where such recollections do not accurately represent actual probabilities (Kahneman, Slovic & Tversky, 1982), underscoring the critical role of timely, context-specific risk communication, of the kind extension services are positioned to provide, in shaping realistic risk assessment (Renn, 1992).

The social amplification of risk framework, an extension of RPT, further clarifies how risk perceptions are transmitted and reshaped through communication networks, institutional interactions, and peer discussion (Kasperson et al., 1988). Within farming communities, formal channels such as extension training can raise awareness and motivate preventive action, while informal channels, including peer discussion, may either reinforce or distort risk perceptions depending on the accuracy of information exchanged (Pidgeon, Kasperson & Slovic, 2003). Cultural framing also shapes how farmers interpret disease threats and the measures they consider appropriate, with some communities relying on centralised institutions such as extension and veterinary services for guidance, and others emphasising personal responsibility or collective, cooperative-based action (Douglas & Wildavsky, 1982).

Risk Perception Theory is therefore well suited to this study because it links farmers' awareness of extension information, their access to advisory and veterinary support, and the institutional and resource barriers they face, to their ultimate level of disease outbreak readiness. Extension services function within this framework as key institutional actors that shape farmers' risk assessments, calibrate the availability heuristic through accurate and timely communication, and help offset the structural constraints that would otherwise leave farmers under-prepared for disease threats.

4.0 MATERIALS AND METHODS

4.1 Study Area

The study was conducted in Nasarawa State, located between latitudes 7°45'N and 9°25'N and longitudes 7°00'E and 9°37'E, and covering an area of 27,117 square kilometres (National Bureau of Statistics [NBS], 2023). The State has a projected 2023 population of 3.07 million and a predominantly agrarian economy (National Population Commission [NPC], 2023). It is characterised by tropical Guinea savannah vegetation that supports both crop and livestock farming, with annual rainfall ranging between 1,000 mm and 1,500 mm. The State's livestock sector includes cattle, goat, and poultry production, with extension services playing a vital role in disease control and awareness campaigns. Its strategic location, significant contribution to Nigeria's livestock industry, and periodic vulnerability to disease outbreaks make it suitable for studying the relationship between extension services and poultry farmers' readiness for disease outbreaks.

4.2 Population, Sampling Technique and Sample Size

The population for the study comprised poultry farmers in Nasarawa State. A multi-stage sampling technique was employed to ensure a comprehensive and representative selection of respondents. In the first stage, six (6) Local Government Areas (LGAs) known for poultry farming were purposively selected. In the second stage, two (2) communities were purposively selected from each of the six LGAs, giving a total of twelve (12) communities, in consultation with the State's Agricultural Development Programme office. In the final stage, twenty-five (25) poultry farmers were randomly selected from each of the twelve communities, yielding a total sample size of 300 respondents (Table 1).

Table 1: Distribution of Sample Frame and Sample Size for the Study

Local Government Area	Community	No. of Poultry Farmers
Nasarawa Eggon	Nasarawa Eggon	25
	Kagbu	25
Karu	New Karu	25
	Ado	25
Keffi	Keffi	25
	Angwan Tiv	25
Lafia	Lafia	25
	Shabu	25
Obi	Obi	25
	Tudun Adabu	25
Akwanga	Akwanga	25
	Andaha	25

Local Government Area	Community	No. of Poultry Farmers
Total (6 LGAs)	12 Communities	300

Source: Field Survey Data (2026)

4.3 Method of Data Collection, Validation and Reliability

Primary data were collected using a well-structured questionnaire administered with the support of trained local enumerators. The instrument was structured into sections addressing poultry farmers' socio-economic characteristics, awareness of and access to extension services, perceived effects of extension services, disease outbreak readiness, coping strategies, and barriers to effective readiness. The instrument was validated by supervisors and experts from the Department of Agricultural Extension, University of Abuja, to ensure it was appropriately designed to collect the required data. Reliability was assessed through a pilot study involving 30 questionnaires (10% of the total sample), and responses were analysed using Cronbach's alpha, which yielded a coefficient of 0.748, indicating acceptable internal consistency (Ozigbo, 2000).

4.4 Method of Data Analysis

Both descriptive and inferential statistics were used to address the objectives of the study. Objectives on farmers' socio-economic characteristics, level of awareness of extension services, and access to extension services were achieved using descriptive statistics, namely percentages, frequencies, means, and standard deviations. The factors influencing access to extension services were further examined using a binary logistic regression model. The level of disease outbreak readiness was assessed descriptively through percentage distribution across readiness categories, while the barriers to effective disease outbreak readiness were analysed using principal component analysis (PCA) with varimax rotation.

5.0 RESULTS AND DISCUSSION

5.1 Socio-Economic Characteristics of Poultry Farmers

Table 2 presents the socio-economic characteristics of the poultry farmers in the study area. The gender distribution shows a strong male dominance, with males constituting 65.33% of the sample compared to 34.67% females. This imbalance may reflect gendered participation patterns in poultry farming, potentially indicating barriers to female inclusion or differing socio-cultural roles that limit women's engagement in poultry production. This finding conforms with Oluwaseun and Patel (2019) and Nnadi, Azibator, Nnadi and Ebibi (2025), who posited that women frequently face systemic barriers that limit their access to resources, training, and decision-making power within livestock farming systems.

Regarding household leadership, only 30.33% of farmers identified as household heads, while the majority (69.67%) were not, suggesting that decision-making power and economic responsibility within poultry households may be concentrated among a smaller subset of individuals. On marital status, 80.33% of farmers were married, with low proportions of single (13.33%), widowed (5.67%), and separated/divorced (0.67%) respondents, indicating a largely stable, family-oriented farming population; this aligns with Nnadi et al. (2025), who reported that most poultry farmers in their study were married.

Household size data show that most farmers belong to medium-sized households, with 47.00% having 6–10 members and 38.33% having 0–5 members; the average household size was 7 persons, similar to the finding of Nnadi et al. (2025). Age distribution indicates a relatively youthful and economically active farming population, with 86.67% of farmers below 50 years and a mean age of 42 years, consistent with Ogunyemi and Orowole (2020) and Nnadi et al. (2025), who reported that most poultry farmers in their studies were below 50 years old.

On education, 99.33% of farmers possessed formal education, with 48.00% holding HSC/OND/NCE certificates and 23.67% holding B.Sc/HND degrees; only 0.67% had no formal education. This relatively high literacy level may positively influence the adoption of improved farming practices and responsiveness to extension services, consistent with Abebe and Tilahun (2021) and Nnadi et al. (2025). Similarly, 35.33% of farmers had attained 17 years or more of formal education, comparable to the finding of Idowu, Ajah, Fadiji and Paul (2024) and Nnadi et al. (2025) that poultry farmers in their study had spent an average of 15 years in school.

Results show that 67.33% of farmers belonged to a cooperative or association, compared with 32.67% who were non-members, suggesting a relatively high level of social and institutional participation. Cooperative membership is often associated with improved access to credit, information, inputs, and extension services, in line with Ogunyemi and Orowole (2020), Idowu et al. (2024) and Nnadi et al. (2025), who found that most poultry farmers in their studies belonged to a cooperative society.

Table 2: Socio-Economic Characteristics of Poultry Farmers in the Study Area

Variable	Category	Freq.	%
Sex	Male	196	65.33
	Female	104	34.67
Household Headship	Yes	91	30.33
	No	209	69.67
Marital Status	Single	40	13.33
	Married	241	80.33
	Separated/Divorced	2	0.67
	Widow/Widower	17	5.67
Household Size	0–5	115	38.33
	6–10	141	47.00
	11–15	39	13.00
	16–20	5	1.67
Age (years)	0–30	61	20.33
	31–40	106	35.33

Variable	Category	Freq.	%
Level of Formal Education	41–50	70	23.33
	51–60	40	13.33
	61 and above	23	7.67
	Non-formal	2	0.67
	Primary	12	4.00
	Secondary	53	17.67
	HSC/OND/NCE	144	48.00
	B.Sc/HND	71	23.67
	MSc	12	4.00
Years of Formal Education	PhD	6	2.00
	1–6	41	13.67
	7–12	80	26.67
	13–16	73	24.33
Membership Status	17 and above	106	35.33
	Non-member	98	32.67
	Member	202	67.33
Total		300	100

Source: Field Survey Data (2026)

5.2 Awareness of Agricultural Extension Services on Disease Outbreak Readiness

Table 3 shows the level of awareness of agricultural extension services as a source of information on poultry disease prevention and outbreak readiness. Results indicate a high level of awareness, with 93.00% of farmers reporting that they are aware of extension services providing such information, while only 7.00% indicated a lack of awareness. This suggests that extension systems are well-established and visible within the study area, reflecting the effectiveness of outreach programmes in disseminating information and engaging farmers, and conforms with the findings of Greenfield, Ramirez and Lee (2020), Ipara, Otieno, Nyikal and Makokha (2021), and Abdulrahman, Gafaru, Kayode, Busari and Koloche (2022).

Table 3: Awareness of Extension Services as a Source of Information on Poultry Disease Prevention (n = 300)

Category	Freq.	%
Aware	279	93.00

Category	Freq.	%
Not Aware	21	7.00
Total	300	100

Source: Field Survey Data (2026)

Table 4 shows farmers' main sources of information on poultry disease prevention and outbreak readiness. Extension agents constituted the primary source of information, accounting for 24.6% of responses, underscoring the central role of agricultural extension in disseminating knowledge on disease prevention and preparedness. Mobile phones/WhatsApp (13.8%) and fellow poultry farmers (13.3%) were the next most common sources, reflecting the growing importance of digital platforms and peer-to-peer learning in agricultural information dissemination, a pattern consistent with Ipara et al. (2021). Veterinarians and animal health workers (12.7%) and radio/television (12.6%) contributed moderately, while cooperative societies (11.5%) and NGOs involved in poultry production (11.5%) played a complementary role. The distribution highlights a multi-channel communication system combining formal, informal, and digital pathways, consistent with the findings of Abdulrahman et al. (2022).

Table 4: Main Sources of Information on Poultry Disease Prevention and Outbreak Readiness

Source	%
Extension Agents	24.6
Mobile Phone/WhatsApp	13.8
Fellow Poultry Farmers	13.3
Veterinarians/Animal Health Workers	12.7
Radio/Television	12.6
Cooperative Societies	11.5
NGOs in Poultry Production	11.5

Source: Field Survey Data (2026)

Table 5 presents the rate of awareness of specific extension information items on poultry disease prevention. Awareness levels exceeded 99% across most indicators, including biosecurity measures, waste disposal advisory, clean water supply, mobile alerts/SMS, surveillance programmes, government assistance programmes, avoidance of unverified bird sources, and financial assistance/subsidy awareness. This demonstrates the effectiveness of extension services in communicating fundamental knowledge required to prevent and manage poultry diseases, aligning with the position of Clarkson and Ahmed (2020) and Anderson and Feder (2024) that extension services have become instrumental in bridging the gap between research and practice. Awareness of collaboration with veterinary officers and disease reporting procedures stood at 99.00%, while awareness of early detection importance and climate

influence on disease risks reached 99.67%. The lowest awareness recorded was for cross-livestock disease transmission (91.00%), a comparatively lower figure suggesting a potential knowledge gap in farmers' understanding of cross-species disease dynamics, with implications for integrated farm management in mixed farming systems.

Table 5: Rate of Awareness of Extension Information on Poultry Disease Prevention (n = 300)

Item	Aware (%)	Not Aware (%)
Biosecurity Measures Awareness	99.33	0.67
Waste Disposal Advisory	99.33	0.67
Clean Water Supply Awareness	99.33	0.67
Collaboration with Veterinary Officers	99.00	1.00
Mobile Alerts/SMS Awareness	99.33	0.67
Surveillance Programme Awareness	99.33	0.67
Government Assistance Programmes	99.33	0.67
Avoidance of Unverified Bird Sources	99.33	0.67
Disease Reporting Procedures	99.00	1.00
Early Detection & Reporting Importance	99.67	0.33
Climate Influence on Disease Risks	99.67	0.33
Financial Assistance/Subsidy Awareness	99.67	0.33
Cross-Livestock Disease Transmission	91.00	9.00

Source: Field Survey Data (2026)

5.3 Poultry Farmers' Access to Extension Services and Factors Influencing Access

Table 6 shows the level of access to agricultural extension services among poultry farmers and related service characteristics. Results indicate that 93.67% of farmers had access to agricultural extension services, suggesting a relatively well-established extension system in the study area, while 6.33% still lacked access, highlighting existing gaps in service delivery. This finding conforms with Njenga, Oduor and Musyoka (2021), who reported that the majority of farmers in their study had access to extension services, but disagrees with Udoh, Vihi, Dalla, Binuyo and Mbah (2024). Among farmers without access, 68.42% attributed this to the absence of extension agents in their locality, underscoring structural and institutional limitations in extension coverage, while distance and transportation challenges (26.32%) further indicate

infrastructural barriers; cost was a minimal constraint (5.26%), suggesting that accessibility issues are more geographic than financial.

Regarding the forms of extension services received, farm visits were the most prevalent (70.11%), indicating a strong reliance on direct, on-site advisory methods, followed by training/workshops (17.08%), group meetings (12.46%), and demonstrations (0.36%), the last of which suggests limited use of practical, hands-on learning approaches that are often critical for technology adoption. On frequency of contact, most farmers received extension visits monthly (41.28%) or weekly (35.94%), reflecting relatively consistent engagement, while 14.23% experienced quarterly visits and a further 8.54% experienced only twice-yearly or yearly contact, which may limit the effectiveness of advisory services.

Table 6: Access to Agricultural Extension Services and Related Characteristics

Variable	Category	Freq.	%
Access to Extension Services (n = 300)	Yes	281	93.67
	No	19	6.33
Reasons for Non-Access (n = 19)	No Extension Agent in Area	13	68.42
	Distance/Transport Challenges	5	26.32
	Cost of Services	1	5.26
Forms of Extension Services (n = 281)	Farm Visit	197	70.11
	Training/Workshop	48	17.08
	Group Meetings	35	12.46
	Demonstrations	1	0.36
Frequency of Extension Visits (n = 281)	Weekly	101	35.94
	Monthly	116	41.28
	Quarterly	40	14.23
	Twice a Year	10	3.56
	Yearly	14	4.98

Source: Field Survey Data (2026)

Table 7 presents the binary logistic regression results of the factors affecting poultry farmers' access to agricultural extension services. The model was statistically significant (LR $\chi^2 = 23.01$, $p < 0.01$), indicating that the explanatory variables jointly influence access to extension

services, with a pseudo- R^2 of 0.1625 (16.25%), an acceptable level of model fit for maximum likelihood estimation (Gujarati & Porter, 2009; Hosmer, Lemeshow & Sturdivant, 2013).

Years of formal education, poultry management system, and marital status were the significant variables influencing access to extension services, consistent with Bakari, Jatbong and Paul (2019) and Midamba et al. (2022), who found that education and marital status influenced poultry farmers' access to extension services. Years of formal education had a positive and statistically significant coefficient at 5%, with a marginal effect indicating that incremental increases in education raised the probability of accessing extension services by 0.0069, in line with the position of Gebremedhin, Alemayehu and Tesfaye (2020), Makau and Kamau (2020), and Ochieng, Onyango and Wambua (2021) that education is a key driver of technology adoption and institutional engagement.

Management system used by the farmer had a negative and significant coefficient at 5%, such that a unit increase in the use of the deep litter system was associated with a 0.0501 reduction in the probability of accessing extension services, suggesting that farmers operating under more traditional or extensive systems may be less integrated into formal advisory networks. Marital status had a positive and significant coefficient at 5%, with married farmers 0.0602 more likely to access extension services, consistent with Midamba et al. (2022), possibly reflecting greater household responsibility and stronger social networks among married farmers. Sex, stock size, and annual income were not statistically significant, suggesting that access to extension services in the study area is not strongly differentiated along gender or income lines.

Table 7: Factors Affecting Access to Extension Services by Poultry Farmers

Variable	Coeff.	S.E.	z	Marg. Eff.
Sex	0.630	0.609	1.04	0.0337
Years of Formal Education	0.128**	0.054	2.38	0.0069
Stock Size	0.277	0.200	1.38	0.0148
Annual Income	0.335	0.353	0.95	0.0179
Management System	-0.937**	0.457	-2.05	-0.0501
Marital Status	1.128**	0.537	2.10	0.0602
Constant	-5.743	4.309	-1.33	—

Model Summary: $n = 300$; LR χ^2 (6) = 23.01; Prob > χ^2 = 0.0008; Pseudo R^2 = 0.1625.

**Significant at 5%.

Source: Field Survey Data (2026)

5.4 Level of Disease Outbreak Readiness among Poultry Farmers

Table 8 shows the distribution of poultry farmers' readiness for disease outbreaks. Results indicate a generally high level of preparedness in the study area, with 50.67% of farmers falling within the highest readiness category (76–100%), suggesting that a substantial proportion of farmers are well-equipped to prevent, detect, and respond to disease outbreaks. About 48.33%

fell within the moderate readiness category (51–75%), indicating that while these farmers possess a reasonable level of preparedness, there remains room for improvement, while only 1.00% fell within the low readiness category (below 50%), showing that inadequate preparedness was relatively uncommon among the sampled farmers. The high concentration of farmers in the upper readiness categories may be attributed to increased access to agricultural extension services, improved knowledge of biosecurity practices, and greater awareness of disease prevention strategies, consistent with the levels of awareness and access reported in Tables 3 and 6.

Table 8: Level of Disease Outbreak Readiness among Poultry Farmers (n = 300)

Readiness Category	Freq.	%
High Readiness (76–100%)	152	50.67
Moderate Readiness (51–75%)	145	48.33
Low Readiness (below 50%)	3	1.00
Total	300	100

Source: Field Survey Data (2026)

5.5 Barriers to Effective Disease Outbreak Readiness among Poultry Farmers

Principal component analysis (PCA) was used to examine the multidimensional constraints affecting poultry farmers' readiness for disease outbreaks. Table 9 presents the factorability tests confirming the appropriateness of the dataset for PCA. The determinant of the correlation matrix (0.002) indicates the presence of intercorrelations among the constraint variables without severe multicollinearity. Bartlett's Test of Sphericity was highly significant ($\chi^2 = 1912.380$, $df = 45$, $p < 0.001$), confirming that the variables were sufficiently correlated to justify factor extraction, while the Kaiser-Meyer-Olkin (KMO) value of 0.724 indicated good sampling adequacy for dimensionality reduction.

Table 9: Factorability Tests for Principal Component Analysis

Test	Statistic	Value
Determinant of Correlation Matrix	Det	0.002
Bartlett's Test of Sphericity	χ^2 (df = 45)	1912.380***
Significance (p-value)	p	0.000
Kaiser-Meyer-Olkin (KMO)	KMO	0.724

Note. KMO values above 0.70 indicate good sampling adequacy. ***Significant at 1%.

Source: Field Survey Data (2026)

Table 10 shows the eigenvalues and explained variance from the PCA. Three principal components had eigenvalues greater than one, jointly explaining a cumulative variance of

74.69%, indicating that the majority of the variation in the constraint dataset was captured by these three components: Component 1 (42.76%), Component 2 (21.22%), and Component 3 (10.71%).

Table 10: Eigenvalues and Explained Variance from Principal Component Analysis

Component	Eigenvalue	% Variance	Cumulative %
1	4.276	42.76	42.76
2	2.122	21.22	63.98
3	1.071	10.71	74.69
4	0.882	8.82	83.51
5	0.473	4.73	88.24
6	0.372	3.72	91.96
7	0.312	3.12	95.09
8	0.268	2.68	97.76
9	0.132	1.32	99.09
10	0.091	0.91	100.00

Note. Components with eigenvalues > 1 are retained.

Source: Field Survey Data (2026)

Table 11 presents the rotated component loadings (varimax rotation) for the identified constraints. The first component was strongly associated with cultural/traditional beliefs (0.446), poor transportation (0.484), poor awareness of government programmes (0.429), and poor extension coverage (0.396), and is interpreted as representing institutional and systemic constraints, reflecting weaknesses in regulatory systems, infrastructure, and extension delivery mechanisms. The second component was characterised by high loadings on the absence of community-based disease surveillance systems (0.603) and limited financial resources (0.636), with a moderate contribution from limited access to timely information (0.356), representing information and capacity constraints that limit farmers' ability to anticipate and respond to disease outbreaks. The third component was dominated by high loadings on inadequate trained poultry staff (0.763) and insufficient vaccines and veterinary supplies (0.570), representing technical and resource constraints that reflect shortages in skilled personnel and essential inputs for disease prevention and control.

Table 11: Rotated Component Loadings for Constraints to Disease Outbreak Readiness (Varimax Rotation)

Constraint	Comp. 1	Comp. 2	Comp. 3
Limited access to timely information	0.228	0.356	0.005
Insufficient vaccines and supplies	0.152	-0.051	0.570
Absence of surveillance systems	-0.045	0.603	0.098
Cultural/traditional beliefs	0.446	-0.127	0.013
Adulterated drugs/vaccines	0.378	-0.109	0.128
Limited financial resources	0.001	0.636	-0.006
Poor transportation	0.484	0.183	-0.232
Poor awareness of gov't programmes	0.429	-0.164	0.107
Inadequate trained staff	-0.076	0.067	0.763
Poor extension coverage	0.396	0.096	-0.033

Note. Loadings $\geq |0.40|$ are considered significant.

Source: Field Survey Data (2026)

Overall, the PCA results indicate that poultry farmers' readiness is constrained by a combination of institutional weaknesses, limited access to information and financial resources, and shortages of technical inputs and expertise. The dominance of institutional constraints (Component 1) suggests that improving governance structures, strengthening extension services, and enhancing regulatory frameworks are critical for improving disease preparedness, consistent with the position of Njuki and Kaaria (2019) that such barriers affect poultry production activities.

6.0 CONCLUSION AND RECOMMENDATIONS

The study examined agricultural extension services and disease outbreak readiness among smallholder poultry farmers in Nasarawa State, Nigeria. Findings show that poultry farmers were predominantly male, married, relatively youthful, and highly literate, with a majority participating in cooperative societies. Awareness of agricultural extension services as a source of disease-prevention information was high, and access to extension services was similarly widespread, though years of formal education, poultry management system, and marital status significantly shaped the extent of that access. More than half of the farmers demonstrated a high level of disease outbreak readiness, with the remainder mostly in the moderate category, indicating that extension awareness and access have translated into meaningful, though not yet universal, preparedness. However, institutional, informational/financial, and technical constraints, particularly weak extension coverage, poor transportation, inadequate community-

based surveillance, limited financial resources, and shortages of trained staff and veterinary supplies, continue to limit optimal readiness.

Within the framework of Risk Perception Theory, these findings suggest that extension services function as a critical institutional channel for calibrating farmers' risk perceptions and translating awareness into concrete preparedness behaviour; where this channel is weak or inconsistent, as reflected in the identified institutional and resource constraints, farmers' readiness is correspondingly constrained. Based on these findings, the following recommendations are made:

- i. Government and agricultural development agencies should strengthen institutional support for extension delivery through improved rural infrastructure and increased recruitment and training of extension personnel, particularly in disease surveillance, early detection, biosecurity, and emergency response.
- ii. Extension agencies should strengthen the frequency and coverage of extension visits, including farm visits, training programmes, and digital communication platforms, to ensure timely dissemination of disease outbreak information, especially to farmers currently outside extension coverage.
- iii. Government and relevant stakeholders should improve the availability and accessibility of veterinary and animal health services, given the importance of technical and veterinary support to farmers' disease outbreak readiness.
- iv. Extension organisations should promote improved poultry management systems and encourage sound record-keeping and biosecurity practices, particularly among farmers using more traditional management systems who were less likely to access extension services.
- v. Community-based disease surveillance and early-warning systems should be strengthened by leveraging existing farmer cooperative structures, given the central role of information and financial constraints identified in the barriers to readiness.

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