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RESEARCH ARTICLE

Operationalizing One Health governance at the local level: Lessons from avian influenza coordination in Indonesia

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ABSTRACT

Background and Aim: Highly pathogenic avian influenza (HPAI) has persisted in Indonesia since 2003, causing repeated poultry outbreaks and sporadic human cases. Despite the national One Health framework established by Coordinating Ministerial Regulation No. 7/2022, evidence of its implementation at city and district levels, especially in high-risk urban and peri-urban areas, remains limited. This study explored barriers and facilitators to One Health governance for zoonoses control, using HPAI as a sentinel case in Bogor City and Bogor District, West Java.

Materials and Methods: An exploratory qualitative study was conducted in October 2025, supplemented by descriptive quantitative data. A multi-sectoral focus group discussion (FGD) involved 67 participants from human health, animal health, environmental, agriculture, market management, planning, legislative, and academic sectors. A structured pre-FGD questionnaire was completed by 20 participants. Quantitative data were analyzed descriptively using frequencies and percentages. Qualitative FGD data were analyzed thematically following Braun and Clarke's six-phase approach, with inductive coding and iterative team consensus. Ethical approval was obtained from the Faculty of Medicine, Universitas Indonesia – Dr. Cipto Mangunkusumo Hospital, and Wageningen University & Research.

Results: Questionnaire respondents mainly came from local government health and animal health sectors (85%), with 60% prioritizing zoonoses prevention over outbreak response. While 100% understood the One Health concept and 95% supported joint risk assessment, only 70% found joint surveillance effective, and 40% believed local policy and budget support were sufficient. Thematic analysis identified five key themes: (1) mostly reactive, event-driven coordination; (2) ongoing human and financial resource limitations; (3) underuse of the Sistem Informasi Zoonosis dan Emerging Infectious Diseases (SIZE) platform and fragmented data integration; (4) low community awareness and poor risk communication, especially in live bird markets; and (5) weak institutional integration and funding of national policies at local levels.

Conclusion: Local One Health implementation in Bogor remains fragmented, reactive, and resource-constrained, despite a supportive national policy framework. Key actionable recommendations include developing joint cross-sectoral operational guidelines and standard operating procedures, institutionalizing routine multisectoral forums, strengthening SIZE platform use through training and interoperability, embedding zoonoses prevention into regional development and risk planning, enhancing community-focused risk communication, and exploring sustainable financing models (e.g., pentahelix collaboration and corporate social responsibility). These strategies can turn policy intent into proactive, preventive governance, improving HPAI control and broader zoonotic and pandemic preparedness in similar high-risk settings across Indonesia.

Keywords: avian influenza, Bogor, Indonesia, highly pathogenic avian influenza, intersectoral coordination, One Health governance, One Health implementation, zoonoses control, zoonotic disease prevention.

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INTRODUCTION

Since 2003, highly pathogenic avian influenza (HPAI), mainly subtype H5N1, has circulated endemically in Indonesia, causing recurring poultry outbreaks and occasional human infections [1]. As of late 2025, Indonesia has reported a total of 200 confirmed human cases of A(H5N1) with 168 deaths since 2003, although no new human cases were documented in 2025 according to WHO surveillance data up to December 2025. Due to its significant socio-economic impacts and pandemic potential, HPAI has become a benchmark for assessing Indonesia's zoonoses management [2].

Effective control requires multisectoral coordination among animal health, public health, agriculture, environmental sectors, and local authorities, as success depends on their collaborative response [3]. From a One Health perspective, zoonotic disease management demands governance processes that integrate and balance health, environmental, social, and economic considerations across sectors and governance levels [4].

As one of the world's largest poultry producers, Indonesia faces significant challenges in reducing viral spread in live bird markets, commercial farms, backyard holdings, and households [5]. These issues are worsened by close human–animal contact, informal trading networks, and limited laboratory diagnostic capacity [6, 7]. Bogor City and Bogor District are examples of high-risk areas for transmission, marked by intensive poultry farming, widespread live poultry markets, and frequent human–animal interactions at livestock–market interfaces. This highlights the crucial role of local governance in preventing and controlling zoonoses. As a result, HPAI goes beyond just veterinary or public health concerns, becoming a broader governance and systemic issue that requires ongoing multisectoral coordination and commitment.

To address these complex challenges, Indonesia officially adopted the One Health approach through Permenko PMK No. 7/2022 concerning the Prevention and Control of Zoonoses and Emerging Infectious Diseases. This regulation requires the creation of local coordination teams (Tim Koordinasi Daerah/TIKORDA) and integrated surveillance via the Sistem Informasi Zoonosis dan Emerging Infectious Diseases (SIZE) platform [8]. The framework aims to institutionalize cross-sector collaboration among human, animal, and environmental health sectors through improved data sharing, joint risk assessments, and coordinated response strategies.

Nevertheless, One Health governance research shows that formal policy adoption alone does not ensure effective implementation without specific mechanisms to assess policy consistency, manage trade-offs, and develop local operational capacity [9]. Evidence on how these national One Health policies are practically applied at city and district levels, especially in routine coordination, preventive efforts, and data sharing, remains limited [10]. Ongoing problems such as divided institutional responsibilities, resource shortages, and poor data sharing hinder quick detection and response. In reality, interactions among health offices, livestock services, and environmental agencies are largely reactive, triggered only by outbreaks, while preventive and proactive cooperation remains limited [11–13]. These issues reflect common challenges in many low- and middle-income countries trying to go beyond strategic One Health plans toward real, coordinated action [14].

While Indonesia has made progress in national level commitments to One Health through institutional mechanisms and surveillance tools, significant gaps remain in turning these into effective, local actions, especially in urban–peri-urban areas vulnerable to disease, such as Bogor City and Bogor District, where intensive poultry systems and live bird markets increase HPAI transmission risks. Most existing literature focuses on epidemiological surveillance of HPAI, national policy frameworks, or broad regional issues in Southeast Asia, with less emphasis on governance processes that involve multiple levels, national, provincial, city, and district [10, 11]. There is a critical lack of research on daily operational realities at sub-national levels, including how routine multisectoral engagement extends beyond emergency responses, how economic and market sectors, often overlooked in zoonoses studies, are integrated, and how digital platforms mandated for cross-sectoral data sharing and joint decision-making perform in real-world settings [12].

A major oversight in previous work is the failure to systematically distinguish between mostly reactive, event-based interactions among health, livestock, and environmental agencies and the clear lack of proactive, preventive collaboration that could enable early risk mitigation and sustained capacity development [13, 14]. This reactive focus leads to delays in detection, inefficient resource mobilization, and poor community level risk communication, issues made worse by ongoing challenges in staffing, budgeting, inter-agency cooperation, and the institutional embedding of national directives at the local level. These patterns align with common barriers seen in low- and middle-income settings, where One Health efforts often struggle due to isolated operations, inadequate assessment of policy coherence, unresolved sectoral trade-offs, and limited mechanisms for

expanding preventive strategies [9]. Therefore, there is an urgent need for detailed, multisectoral empirical research that sheds light on these local implementation gaps, assesses platform usability in context, and provides specific recommendations to promote proactive, integrated governance for better zoonoses control and pandemic preparedness.

The main goal of this study is to identify the barriers and facilitators for implementing One Health governance at the local level in Indonesia, focusing on HPAI as a key zoonotic disease in the high-risk settings of Bogor City and Bogor District, West Java. Specifically, the research aims to:

1. Assess the nature, frequency, and effectiveness of multisectoral coordination mechanisms across human health, animal health, environmental, agricultural, market management, planning, and legislative sectors at city and district levels.
2. Evaluate the practical use and effectiveness of integrated surveillance systems, focusing on the adoption, performance, and limitations of the SIZE platform for real-time data sharing, joint risk assessment, and coordinated response planning.
3. Identify systemic operational gaps, including reactive versus preventive coordination patterns, human and financial resource limitations, data fragmentation, weak community risk communication, and insufficient institutional integration of national policies like Permenko PMK No. 7/2022, in daily zoonoses control efforts.
4. Suggest evidence-based, contextually suitable strategies to improve proactive multisectoral governance, including creating joint operational guidelines, standardized protocols, routine coordination meetings, improved SIZE platform training and interoperability, integrating zoonoses prevention into regional development and disaster risk planning, and establishing sustainable financing models.

By combining qualitative thematic analysis of a multi-stakeholder focus group discussion (FGD) with descriptive quantitative insights from a pre-discussion questionnaire, this study integrates perspectives from various governance levels and sectors to develop a conceptual framework that distinguishes reactive, event-driven coordination from sustained, preventive action. The findings aim to guide targeted policy improvements, capacity building efforts, and institutional reforms that strengthen local zoonoses management and support resilient pandemic preparedness in similar high-risk, resource-limited settings across Indonesia and Southeast Asia.

MATERIALS AND METHODS

Ethical approval

Ethical approval for this study was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia – Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia (Approval No.: KET-XXX/UN2.F1/ETIK/2025). The study complied with national regulations for research involving human participants and followed the ethical principles outlined in the Declaration of Helsinki.

Because this research involved human participants through a FGD and a structured questionnaire, all participants were informed about the objectives, procedures, potential risks, and benefits of the study before participation. Written informed consent was obtained from all respondents prior to data collection. Participation was voluntary, and participants were allowed to withdraw at any time without any consequences.

To ensure confidentiality, personal identifiers were not recorded in the dataset, and all responses were anonymized during analysis. Data were stored securely and used only for research purposes.

The study did not involve experimental manipulation of animals or biological sampling. However, the research addressed zoonotic disease governance and multisectoral coordination related to avian influenza (AI) control; therefore, institutional permission was also obtained from the School of Veterinary Medicine and Biomedical Sciences, IPB University, Bogor, Indonesia, and relevant local government authorities in Bogor City and Bogor District before conducting the field activities.

All procedures were conducted in accordance with applicable ethical guidelines for public health, veterinary, and social research involving multisectoral stakeholders under the One Health framework.

Study period and location

The research was conducted in October 2025 in Bogor City and Bogor District, West Java, Indonesia. These locations were deliberately chosen because of their high relevance to HPAI and zoonoses governance, characterized by dense poultry populations, widespread live poultry markets, and frequent human–animal–

environment interactions that increase zoonotic disease risks. Bogor City and District provide representative urban–peri-urban governance settings with significant multisectoral involvement in health, animal health, and food systems, making them ideal for studying operational One Health implementation.

Study design

This study used an exploratory qualitative design, combined with a descriptive quantitative survey to gather multisectoral perceptions on the implementation of One Health. A FGD was selected for its ability to promote interactive dialogue, providing deeper insights into intersectoral coordination, multilevel governance, and institutional dynamics compared to a survey alone. A pre-FGD questionnaire collected participant characteristics and initial views on institutional support and coordination, serving as background information to guide and enhance the FGD discussions.

Participant selection and sampling

Purposive sampling ensured representation from institutions and sectors key to zoonoses prevention, surveillance, and control. Inclusion criteria required: (1) affiliation with government, academic, technical, or service organizations involved in zoonoses governance or policy implementation; (2) active participation at the national, provincial, city, or district levels; and (3) direct involvement in policy development, surveillance, outbreak response, coordination, or program delivery related to AI or other zoonotic diseases.

Participants included representatives from IPB University (lead institution), the Faculty of Medicine Universitas Indonesia, and Wageningen University & Research (WUR, the Netherlands), as academic partners. At the national level, participants included representatives from the Ministry of Health, the Directorate of Animal Health, Ministry of Agriculture, and the Coordinating Ministry for Human Development and Cultural Affairs.

Local institutions include the Food Security and Agriculture Office of Bogor City (Dinas Ketahanan Pangan dan Pertanian/DKPP of Bogor City), the Fisheries and Livestock Office of Bogor District (Dinas Perikanan dan Peternakan/Diskanak of Bogor District), the Bogor City Health Office (Dinas Kesehatan/Dinkes of Bogor City), the Bogor District Health Office (Dinkes of Bogor District), the Regional Development Planning, Research and Innovation Agency of Bogor City (Badan Perencanaan Pembangunan Riset dan Inovasi/BAPPERIDA of Bogor City), the Regional Planning, Research and Development Agency of Bogor District (Badan Perencanaan Pembangunan, Penelitian dan Pengembangan Daerah/Bappedalitbang of Bogor District), the Environmental Agency of Bogor City (Dinas Lingkungan Hidup/DLH of Bogor City), the Department of Cooperatives, Small and Medium Enterprises, Trade and Industry of Bogor City (Dinas Koperasi Usaha Kecil Menengah Perdagangan dan Perindustrian/ DinKUKMDagin of Bogor City), and the Public Market Management Unit of Bogor City, and representative from Bogor District Market Management Unit.

Additional participants included representatives from the Bogor Regional House of Representatives (Dewan Perwakilan Rakyat Daerah/DPRD of Bogor City), regional hospitals (Rumah Sakit Umum Daerah/RSUD of Bogor City and Bogor District), the Bogor City Slaughterhouse (Rumah Potong Hewan/RPH of Bogor City), and Subang Diseases Investigation Center, a regional reference laboratory and diagnostic for veterinary.

A total of 67 participants from academia, national ministries, local governments, hospitals, technical laboratories, slaughterhouses, market authorities, and legislative bodies attended the FGD. Invitations were issued through institutional channels under the Indonesian-Dutch collaborative project “A Whole-of-Society Approach to Health System Resiliency and Pandemic Preparedness” (IPB, UI, WUR, and UU; 2024-2029), ensuring broad multisectoral participation across One Health domains.

Data collection procedures

Pre-FGD questionnaire

A structured pre-FGD questionnaire collected quantitative data to support qualitative discussions. It included categorical and Likert-scale questions on participant demographics (such as sector, institutional level, and role), understanding of One Health, perceived institutional capacity, coordination effectiveness, surveillance implementation, and policy/budget support. These questions were developed specifically for this study, based on established One Health assessment tools and governance literature, and reviewed internally for clarity, relevance, and multisectoral appropriateness. The full questionnaire is included in the appendix. Out of 67 participants, 20 completed it. Because of the small sample size, analysis was limited to descriptive statistics (frequencies and percentages) for triangulating with qualitative data rather than inferential analysis.

FGD procedures

A single multisectoral FGD was held on October 10, 2025, at IPB University in Bogor, lasting about 2 h in a

neutral academic venue to encourage open exchange. Trained facilitators (MB, HY), experienced in qualitative methods and One Health governance, moderated the session, supported by note-takers capturing key points and non-verbal cues. An FGD guide, based on study objectives and responses from the pre-FGD questionnaire, covered topics such as coordination mechanisms, surveillance systems, regulatory enforcement, resource allocation, and community engagement. Discussions were audio-recorded with consent, and facilitators ensured equal participation across sectors.

Data management and transcription

Audio recordings were transcribed verbatim, cross-checked against originals and field notes for accuracy. Transcripts were anonymized using codes to protect confidentiality, with identifying details removed. All digital files (recordings, transcripts, questionnaires) were stored securely on password-protected devices accessible only to the research team, following ethical and institutional data protection standards, including compliance with the General Data Protection Regulation (EU2016/679).

Statistical analysis

Quantitative analysis of questionnaire data involved descriptive methods (frequencies and percentages) using spreadsheet software to summarize stakeholder representation, priorities, and institutional perceptions, thereby providing context and triangulation for qualitative insights.

Thematic analysis followed Braun and Clarke's six-phase approach: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. An inductive approach allowed themes to emerge from the data without preconceived categories. Initial coding was performed manually by the research team (ES, DI, HY, ZM). Codes were iteratively compared, refined, and grouped into overarching themes through team discussions to ensure consistency and consensus. Triangulation combined FGD and questionnaire findings. Data saturation was considered reached when no new themes emerged. Preliminary interpretations underwent internal team review and reflexive refinement to improve validity and credibility.

Researcher reflexivity

The research team considered their positionalities in relation to participants and took steps to reduce bias, such as neutral facilitation, iterative member checks, and triangulation of data sources. They recognized professional backgrounds and held reflexive team discussions during analysis to examine assumptions, improve interpretations, and make sure that the findings accurately reflected participant views.

RESULTS

Quantitative findings: stakeholder profile and perceived implementation

Out of the 67 FGD participants, 20 (29.9%) completed the pre-FGD questionnaire. Due to the exploratory, governance-focused design, this subsample offers descriptive insights into sectoral representation, institutional roles, and perceived implementation gaps to complement and cross-verify the qualitative data rather than for statistical inference.

Sectoral and institutional representation

Seventeen respondents (85%) were affiliated with district or city government institutions, mainly from health and animal health sectors. Sixty percent (12/20) prioritized zoonoses prevention over outbreak response. Table 1 summarizes stakeholder distribution by institutional level, field of work, and prevention priority (all percentages are based on n = 20).

Multisectoral involvement in zoonoses policymaking was reported, but participation was uneven. Agriculture and animal health sectors were most frequently involved (17/20), followed by public health (16/20), while environmental sector engagement was minimal (1/20) (Figure 1). Veterinary medicine (18/20), public health (16/20), and agriculture/animal science (15/20) dominated disciplinary representation in zoonoses-related research for policy, with environmental disciplines being the the least represented (1/20) (Figure 2).

Implementation of zoonoses regulations and surveillance systems

Perceived implementation of national zoonoses regulations varied across governance levels (Table 2). The Sistem Informasi Zoonosis dan Emerging Infectious Diseases (SIZE) platform achieved the highest reported complete implementation (60%; 12/20). Participatory integrated risk mapping, community-based surveillance by volunteers in Disaster Risk Reduction Forums, synchronized data systems, and routine training and technical guidance were mostly rated as partly implemented.

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Table 1: Distribution of stakeholders by institutional affiliation, field of work, and priority in zoonotic disease prevention (n = 20).

Variable	Category	n	%
Work affiliation	Central government	3	15
	District/City government	17	85
Field of work	Agriculture, livestock, and animal health	4	20
	Health	8	40
	Environment, forestry	1	5
	Public service	4	20
	Regional Planning/Research and Development Agency	1	5
	Legislative member	2	10
Priority in zoonoses prevention vs. outbreak control	High	12	60
	Moderate	7	35
	Low	1	5

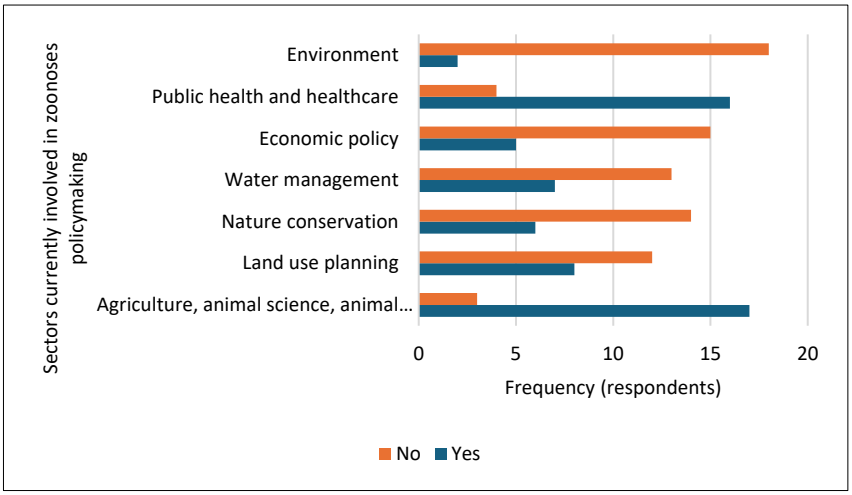

Figure 1: Sectors involved in zoonose policymaking. Bars represent the number of respondents indicating sectoral participation; multiple responses are permitted.

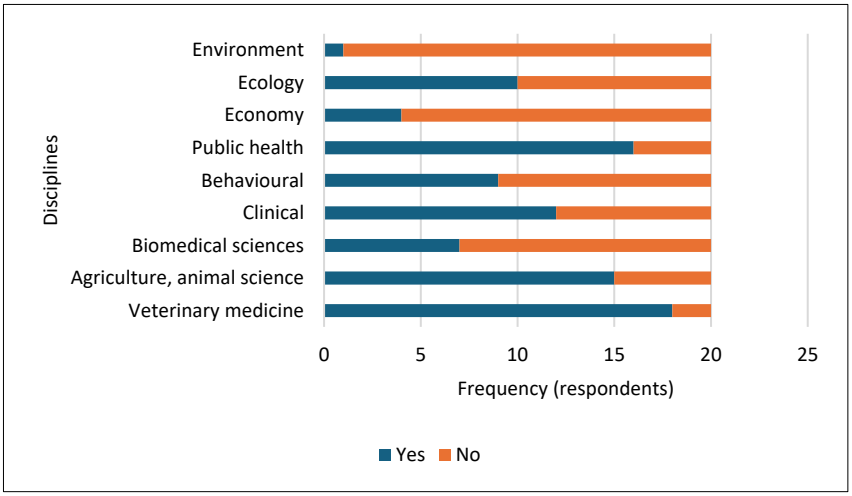

Figure 2: Knowledge disciplines involved in zoonoses research for policy, based on stakeholder responses in Bogor.

Table 2: Perceived implementation of zoonoses-related regulations and guidelines across national, regional, and local levels (n = 20).

Program/System	Completely implemented n (%)	Partly implemented n (%)	Not yet implemented n (%)
Information System for Zoonoses and Emerging Infectious Diseases (SIZE)	12 (60)	7 (35)	1 (5)
Participatory Integrated Risk Mapping System	6 (30)	10 (50)	4 (20)
Community-based risk surveillance by volunteers	6 (30)	10 (50)	4 (20)
Training and Technical Guidance	5 (25)	12 (60)	3 (15)
Synchronized Data	5 (25)	12 (60)	3 (15)
Reporting Channel	8 (40)	10 (50)	2 (10)

Perceived support and operational barriers

Support for One Health was strong: 100% of respondents understood the concept, and 95% supported joint risk assessment and cross-sectoral outbreak investigations. However, only 70% found joint surveillance systems

effective, and just 40% believed local policy and budget support were adequate (Table 3). While 75% reported sufficient institutional human and technical capacity for joint surveillance, 60% highlighted coordination challenges, incomplete data sharing mechanisms, and a lack of standardized SOPs for joint investigations.

Table 3: Stakeholder responses on One Health perception, coordination, and implementation (n = 20).

Statement	Strongly agree (%)	Disagree (%)
I understand the One Health concept, which integrates the human, animal, and environmental sectors.	100	0
The joint zoonotic disease surveillance program across sectors in our area has been running effectively.	70	30
Joint risk assessment is important for the control of zoonotic diseases in our area.	95	5
The implementation of joint investigations across sectors during zoonotic outbreaks must be strengthened.	95	5
The current data sharing mechanisms among zoonoses-related institutions are adequate.	60	40
My institution has sufficient human and technical capacity to participate in joint surveillance of zoonoses.	75	25
Coordination among institutions (health, livestock, environment, and trade/market) is functioning well in controlling zoonoses.	70	30
Clear SOPs exist for conducting joint risk assessments and joint investigations in our area.	65	35
Regional policy and budget support for One Health collaborative activities are adequate.	40	60
I am willing to support and strengthen inter-institutional data sharing mechanisms for the early detection and control of zoonoses.	100	0

Qualitative findings: thematic analysis of FGD data

Theme 1: Reactive coordination

Coordination was consistently described as reactive and event-driven, activated mainly during outbreaks rather than through routine preventive planning. “Coordination becomes active only when there is a case alert; otherwise, each sector runs independently.” (City livestock sector) Formal One Health teams exist via local decrees, but participants noted they lack operational guidance and rely heavily on informal channels such as WhatsApp groups.

Theme 2: Resource constraints

Chronic shortages of human resources and funding were significant barriers to ongoing prevention efforts. “We only have one paramedic and no funds to conduct community training.” (City livestock sector) These limitations forced agencies to focus on outbreak response instead of routine surveillance, disinfection, and community engagement, leading to reactive governance.

Theme 3: Data integration gaps and SIZE underutilization

Although the SIZE platform was available, its use was inconsistent due to poor integration between human and animal health reporting systems. Discrepancies between Dinkes and DKP/Diskanak channels caused delays in analysis and response. Participants emphasized the need for regular training, user-friendly interfaces, and institutional mandates to ensure consistent data entry and support evidence-based decision-making.

Theme 4: Community awareness and barriers to communication

Low awareness of zoonotic risks among market workers, poultry traders, and sanitation staff was a recurring issue. “We need flyers written in simple language so that people in markets can easily understand the risks.” (City Market Officer) Participants pointed out a lack of accessible, culturally tailored educational materials and limited outreach of existing programs.

Theme 5: Governance, financing, and policy adoption

National regulations offer a strong framework, but weak local institutional support and limited funding hinder implementation. “Zoonoses should appear in our regional risk maps so that funding can be mobilized quickly without waiting for central approval.” (District planning agency) Proposed solutions include integrating zoonoses into regional development and risk planning, exploring corporate social responsibility (CSR) financing, and adopting pentahelix collaboration involving government, academia, the private sector, communities, and media.

DISCUSSION

Strengthening intersectoral coordination through institutionalized One Health mechanisms

The findings show that multisectoral coordination in Bogor City and Bogor District mostly reacts to outbreaks rather than engaging in routine preventive planning. Although formal structures like the One Health Team

(created through the Regent's Decree) are in place, operational collaboration still depends on informal channels, especially WhatsApp groups. This pattern is similar to what is seen in other low- and middle-income countries, where policy-driven multisectoral frameworks often lack structured operational mechanisms, leading to ongoing structural and behavioral vulnerabilities despite currently low human health risk from HPAI [15–17]. A significant operational gap is the lack of harmonized SOPs for routine intersectoral activities, a point recognized in national policy but not effectively implemented at the local level.

The near-total lack of representation from the environmental sector (only one participant from environmental agencies) is not just a sampling artifact but a sign of fragmentation in local One Health governance. Environmental institutions are often excluded from key zoonoses surveillance and response, even though they play vital roles in waste management, sanitation, and ecosystem-based risk pathways, including climate-related wild bird migration. This narrow human–animal focus weakens the holistic goals of One Health and hampers comprehensive risk assessment and preventive measures.

Participants consistently called for a formal cross-sectoral guideline that clearly defines roles, responsibilities, and communication pathways among key agencies (DKPP/Diskanak, Dinkes, DLH, and BAPPERIDA/ Bappedalitbang). Such a joint operational framework would institutionalize coordination beyond emergencies, establish accountability across administrative levels, and promote continuity. Comparable multisectoral action plans in Japan, Thailand, Singapore, and Vietnam have demonstrably improved early warning systems and outbreak response effectiveness [18]. Establishing regular coordination forums and adopting joint action plans with shared objectives and task divisions at city and district levels would reduce duplication, maintain preventive focus, and make zoonoses control a routine local priority.

Mapping gaps to established One Health frameworks

The identified barriers were mapped against the Tripartite/Quadripartite One Health pillars to place local findings within global governance models [19]. Coordination gaps relate to the coordination pillar, emphasizing the need for structured intersectoral mechanisms and SOPs. Human and financial resource constraints align with the capacity pillar, highlighting the need for workforce development and sustainable funding. Data integration issues, including SIZE underutilization and delayed laboratory feedback, relate to the information and surveillance pillar. Weak policy embedding and lack of operational manuals reflect shortcomings in the governance and financing pillar. This alignment shows that Bogor's challenges are not just isolated practical issues but systemic misalignments with established One Health principles, providing a structured basis for targeted interventions.

Building human and financial capacity for sustained zoonoses control

Persistent shortages of trained personnel, especially veterinarians and paramedics in DKPP Bogor City and Diskanak Bogor District, along with insufficient funding, severely restrict preventive field activities. These challenges reflect workforce limitations widely recognized as major barriers to implementing One Health in resource-limited areas [14]. Overcoming these issues requires sustained political commitment and systematic investment [20, 21]. Incorporating zoonoses control into local budget cycles and regional medium-term development plans (RPJMD) could ensure more reliable funding [12]. Decentralized financing models, backed by national grants or public–private partnerships, may support routine activities like community training and surveillance [3, 22]. Collaborating with academic institutions such as IPB University provides a practical route for ongoing technical capacity building and workforce development.

Enhancing community engagement and risk communication

Limited community awareness of zoonotic risks among market workers, poultry traders, and sanitation staff highlights a significant gap between policy and practice. Similar low awareness levels have been noted across Southeast Asia, where they hinder prevention efforts [23]. Culturally appropriate, visually engaging materials such as simple illustrated flyers and posters can enhance understanding and encourage compliance [24]. Reviving successful local initiatives like the Ayam Asuh program, which involved market facilitators in HPAI control, would boost grassroots participation. Participatory models and community champion approaches have proven effective in improving preventive behaviors and encouraging early reporting in other contexts [25]. Incorporating these efforts into DKPP and Diskukmdagin programs in Bogor City would create a direct link between risk communication and existing governance structures.

Integrating data systems for evidence-based decision-making

Fragmented data flows between Dinkes and DKPP/ Diskanak offices hinder timely, evidence-based decisions. Despite its mandate, SIZE platform adoption remains inconsistent at the local level. Delays in sample submission

to Subang Diseases Investigation Center (BVET Subang), slow laboratory feedback, and poor integration of results into surveillance discussions worsen these issues, a pattern common in decentralized systems with digital tools but limited interoperability and human resource support [26]. Formalizing coordination and mutual accountability among DKPP/Diskanak, Dinkes, and BVET Subang through regular data validation meetings and joint reporting templates could improve consistency [27]. Shared dashboards and harmonized reporting have reduced detection delays and strengthened responses in other settings [28]. Improving SIZE functionality and routinely using laboratory data in local policy discussions would strengthen the evidence base for HPAI surveillance and resource allocation.

Institutionalizing One Health governance and sustainable financing

National frameworks like Permenko PMK No. 7/2022 provide a strong foundation, but local implementation in Bogor City and District faces structural and funding challenges. Integrating zoonoses prevention into regional development plans, risk assessments, and disaster risk management systems (led by BAPPERIDA/Bappedalitbang) could improve budget justification, ensure policy continuity, and increase access to multisectoral resources [3, 29]. Participants called for a joint cross-sectoral operational manual to ensure consistent interpretation and application of national regulations, along with shared data dashboards, inclusion of zoonoses in regional risk maps, and adoption of the pentahelix model (government, academia, private sector, communities, media). Exploring new financing options, such as public–private partnerships and CSR contributions, provides pathways to sustain intersectoral efforts [30]. Overall, these recommendations shift the focus from emergency response to proactive, routine governance, strengthening operational capacity and pandemic preparedness at the local level.

Limitations

This study has several limitations. Purposive sampling was used to capture key stakeholders within established governance and institutional networks in Bogor City and Bogor District; however, this approach excluded direct representation from community members, backyard poultry farmers, and poultry traders. As a result, the findings mainly reflect institutional and governmental perspectives and may not fully capture grassroots experiences or barriers faced at the community level, thus limiting generalizability beyond similar urban–peri-urban administrative settings in West Java.

Second, the single multisectoral FGD format, while effective at encouraging interactive and in-depth dialogue across sectors, may have introduced social desirability bias. Participants from government institutions, in particular, might have been inclined to provide more positive or coordinated views of their efforts to maintain institutional harmony in a group setting.

Third, the quantitative component was limited by the low response rate to the pre-FGD questionnaire (20 of 67 participants, 29.9%). This small sample size prevented any inferential statistical analysis and restricted the use of survey data to descriptive purposes, specifically, to provide contextual background on sectoral representation, priorities, and perceived implementation gaps, as well as to triangulate qualitative themes. Therefore, the descriptive nature of these findings should be interpreted with caution.

Finally, the study examined HPAI as a sentinel zoonotic disease within a specific high-risk urban–peri-urban area in Bogor. As a result, the observed governance patterns, operational barriers, and proposed strategies might not be directly applicable to other provinces with different epidemiological profiles, poultry production systems, or administrative structures, nor to other zoonotic pathogens with different transmission dynamics.

Despite these limitations, combining multisectoral qualitative insights, descriptive quantitative contextualization, and mapping to established One Health frameworks offers a solid, empirically based analysis of local level implementation challenges and opportunities. The findings provide valuable, context-specific evidence to guide targeted improvements in One Health governance in comparable resource-limited settings across Indonesia and similar low- and middle-income countries.

CONCLUSION

This study offers essential insights into implementing One Health governance at the local level in Bogor City and Bogor District, Indonesia, using HPAI as a sentinel zoonotic disease. Key findings from the multisectoral FGD with 67 participants and the analysis of 20 pre-FGD questionnaires highlighted ongoing barriers, including primarily reactive, event-driven coordination (Theme 1), longstanding human and financial resource limitations (Theme 2), underuse of the Sistem Informasi Zoonosis dan Emerging Infectious Diseases (SIZE) platform with disjointed data integration (Theme 3), low community awareness and insufficient risk communication (Theme 4), and weak institutional integration and funding of national policies (Theme 5). Quantitative data showed that while

all respondents understood the concept of One Health and 95% supported joint risk assessments, only 70% found joint surveillance effective, and just 40% felt local policy and budget support was sufficient. Sectoral representation was heavily weighted toward health and animal health (85% of respondents), with limited involvement from environmental sectors, highlighting structural gaps in governance.

Practically, these results highlight actionable strategies to bridge policy-to-practice gaps, such as developing joint cross-sectoral operational guidelines and standard operating procedures (SOPs), institutionalizing routine multisectoral forums for proactive collaboration, enhancing SIZE platform training and interoperability, integrating zoonoses prevention into regional development and disaster risk management plans, and adopting sustainable financing models like pentahelix collaborations (involving government, academia, private sector, communities, and media) and CSR initiatives. Implementing these could transform reactive systems into preventive ones, improving early detection, resource allocation, and community engagement—crucial for HPAI control and broader zoonotic pandemic preparedness in high-risk urban–peri-urban settings.

A key strength of this study is its multisectoral approach, incorporating views from national, provincial, and local stakeholders across human health, animal health, environmental, agricultural, market management, planning, and legislative sectors. The combination of qualitative thematic analysis with descriptive quantitative triangulation, aligned with Tripartite/Quadripartite One Health pillars, provides a thorough, evidence-based framework that differentiates reactive from preventive governance and offers practical recommendations suited for resource-limited settings.

Future research should include community level stakeholders through mixed-methods approaches, such as surveys or interviews with farmers and market vendors, to gather end-user perspectives on risk awareness and behavior. Longitudinal studies assessing the impact of proposed interventions, like joint SOPs or improved SIZE integration, across multiple Indonesian districts could evaluate scalability and long-term sustainability. Comparative analyses with other Southeast Asian countries experiencing similar HPAI endemicity would help refine One Health frameworks by incorporating emerging factors like climate change and antimicrobial resistance.

In conclusion, while Indonesia's national One Health policies establish a strong foundation, local implementation remains fragmented and reactive, which hampers effective control of zoonoses. By addressing identified gaps through proactive multisectoral strategies and institutional reforms, this study advocates for a shift toward resilient, preventive governance. Ultimately, implementing One Health at the community level not only reduces HPAI risks but also enhances global pandemic preparedness, highlighting the importance of sustained investment in collaborative systems that protect human, animal, and environmental health.

DATA AVAILABILITY

All the generated data are included in the manuscript.

AUTHORS' CONTRIBUTIONS

ES, MB, DWL, FND, and SA: Conceptualization, methodology, supervision and reviewed and edited the manuscript. DI, HP, HY, and ZM: Field data collection and stakeholder engagement. ES, HY, ZM, and DI: Data analysis and interpretation. ES and DI: Original draft preparation. All authors have read and approved the final manuscript.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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