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Bridging the Gap: Aligning Animal Welfare Ethics with One Health Responsibilities Among Exotic Pet Owners in Indonesia

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Abstract

The One Health framework emphasizes interdependence among human, animal, and environmental health, yet exotic pet ownership can create practical tensions between animal welfare ethics and public health responsibility. This mixed methods study examines those tensions among exotic pet owners in Indonesia. A convergent parallel design combined qualitative interviews with 30 owners and a cross-sectional survey. Of 60 survey submissions, eight were excluded because respondents reported cat-only ownership or no current exotic pet, producing a final analytic sample of 52. The Five Domains Model was used as an interview sensitizing guide rather than as a direct welfare scoring framework. Qualitative data were analyzed thematically, while survey data were analyzed using Fisher's exact tests as the primary inferential method, with Yates-corrected chi-square tests disclosed for comparability, Cramer's V for effect size, and Holm and Benjamini-Hochberg corrections for multiple testing. Survey results showed high declarative zoonosis knowledge (47/52, 90.4%), strong vaccination support (41/52, 78.8%), low regular veterinary utilization (16/52, 30.8%), and high zoonosis concern in half of respondents (26/52, 50.0%). Unadjusted Fisher tests suggested associations for veterinary use with vaccination support ($p = 0.012$) and vaccination support with zoonosis concern ($p = 0.038$), but no association remained statistically significant after Holm correction. Qualitative findings identified domestic-pet analogy, cleanliness-as-safety beliefs, fragmented zoonosis understanding, inconsistent vaccination practices, community-based knowledge networks, injury normalization, and welfare-focused ethics with limited public-health framing. The integrated findings suggest a value tension within this sample rather than a definitive population-level conflict. One Health interventions should connect public health responsibility to owners' existing welfare commitments while using veterinarians and community networks as complementary communication channels.

Keywords: One Health; exotic pets; zoonosis; animal welfare; Five Domains Model; mixed methods

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INTRODUCTION

One Health recognizes the interdependence of human, animal, and environmental health. This framework is especially relevant at interfaces where close human-animal contact occurs outside formal livestock or conventional companion-animal systems. Exotic pet ownership is one such interface because it combines intimate household contact, variable species-specific veterinary care, and potential exposure to pathogens associated with wildlife, non-traditional companion animals, and informal animal trade networks (Souza, 2011; Varela et al., 2022).

Indonesia provides an important context for examining these issues. Wildlife markets and the keeping of non-traditional animals have been associated with zoonotic risk and with regulatory, veterinary, and conservation challenges (Adnyana et al., 2023; Morcatty et al., 2022). However, risk is not determined only by pathogen presence. It is also shaped by how owners understand responsibility, animal care, cleanliness, vaccination, veterinary expertise, and community knowledge.

The Five Domains Model offers a useful welfare framework for thinking about nutrition, physical environment, health, behavioral interactions, and mental state (Mellor et al., 2020). In this manuscript, the model is not treated as a direct welfare assessment tool because the study did not conduct independent clinical or behavioral welfare scoring. Instead, the Five Domains served as a sensitizing framework for interview design and interpretation. This framing avoids overstating what the data can support while retaining the value of the model for understanding owners' welfare-oriented reasoning.

The central question is not whether animal welfare and public health are inherently opposed. A more defensible framing is that exotic pet ownership may generate value tensions when owners interpret ethical responsibility primarily through individual animal care while giving less explicit attention to community-level disease prevention. This study therefore aims to: (1) explore exotic pet owners' perceptions of animal welfare and zoonosis risk; (2) describe patterns of vaccination support and veterinary service use; and (3) examine whether and how owners' ethical reasoning incorporates public health responsibility within a One Health frame.

METHODS

Study Design and Reporting Orientation

This study used a convergent parallel mixed methods design. Qualitative and quantitative data were collected during the same study period, analyzed separately, and integrated during interpretation through joint displays (Creswell & Plano Clark, 2018; Fetters et al., 2013). Reporting follows STROBE for the cross-sectional survey component, COREQ for qualitative interview reporting, and GRAMMS for mixed methods transparency (O'Cathain et al., 2008; Tong et al., 2007; von Elm et al., 2007).

The qualitative component was prioritized for conceptual explanation, while the quantitative component was used to describe the distribution of selected awareness and behavior variables and to explore associations. Because the survey sample was small and non-probabilistic, inferential statistics are interpreted as exploratory rather than confirmatory.

Study Population, Sampling, and Data Inclusion

The study population comprised owners of exotic or non-traditional companion animals in Indonesia. Qualitative participants (n = 30) were recruited purposively to capture diversity in animal types, ownership experience, acquisition pathways, and community involvement. Survey data were collected through an online questionnaire distributed via exotic pet communities and social media platforms between 19 and 26 August 2025.

The raw survey contained 60 submissions. Responses were included when the respondent reported current ownership of at least one non-traditional companion animal, including reptiles, amphibians, non-domestic birds, small or other non-traditional mammals, arachnids, or locally reported exotic species. Eight responses were excluded: six cat-only ownership responses and two responses reporting no current exotic pet. Rabbit-containing responses were retained because rabbits and small non-traditional mammals are commonly grouped within non-traditional pet contexts in veterinary public health literature. One response with species marked '-' was retained because other screening fields indicated current ownership. A sensitivity analysis excluding this record did not change the inferential interpretation. The final quantitative analytic sample was n = 52.

Data Collection

Semi-structured interviews explored animal acquisition, feeding and husbandry, environmental management, health perceptions, veterinary care, behavioral interactions, owner-animal relationships, injury experiences, zoonosis awareness, vaccination, and ethical reasoning. The interview guide was informed by the Five Domains Model, but the analysis did not assign welfare scores. Interviews were audio-recorded, transcribed, translated into English for reporting, when necessary, anonymized using respondent codes, and analyzed at the thematic level.

The survey contained 56 items on demographics, ownership characteristics, zoonosis knowledge, vaccination knowledge, hygiene practices, veterinary use, and attitudes toward zoonosis prevention and vaccination. Personal identifiers collected in the raw questionnaire were removed from the analytic dataset before analysis. The de-identified dataset excluded names, telephone numbers, email addresses, and social media handles.

Variable Recoding and Decision Rules

Recoding rules were defined before statistical analysis. The main recoded variables and binary decision rules are shown in Table 1. These rules were also implemented in the accompanying R script.

Table 1. Recoding Decision Rules for Quantitative Analysis

Variable	Positive or focal category	Decision rule
Zoonosis knowledge	Correct	Correct only if the respondent defined zoonosis as disease transmissible between animals and humans or vice versa.
Vaccination support	Supportive	Supportive if the respondent selected 'Setuju, demi kesehatan bersama' or 'Sangat setuju, harus diwajibkan' for vaccination obligation.
Zoonosis concern	High concern	High concern if the respondent selected 'Khawatir' or 'Sangat khawatir'. 'Cukup khawatir', 'Sedikit khawatir', and 'Tidak khawatir sama sekali' were coded as not high concern.
Regular veterinary use	Regular vet	Regular if the respondent reported routine veterinary examination at least once per year.
Community membership	Member	Member if the respondent was active in one community, active in several communities, or belonged to a community but was not very active.
Survey inclusion	Included	Included if the current animal type was not cat-only and not explicit no-pet/no-exotic ownership.

Quantitative Analysis

Descriptive statistics are reported as counts and percentages. Because all planned association tests were 2 by 2 tables and some expected counts were below 5, Fisher's exact test was used as the primary inferential test. Yates-corrected chi-square statistics and p-values are also disclosed, while Cramer's V was calculated from the uncorrected Pearson chi-square statistic as an effect size.

Six association tests were treated as one family of exploratory tests. Fisher p-values were adjusted using the Holm method for family-wise error control and the Benjamini-Hochberg procedure as a false discovery rate sensitivity check. Statistical significance was assessed at alpha = 0.05 after Holm correction. Results with unadjusted $p < 0.05$ but Holm-adjusted $p >= 0.05$ were interpreted as exploratory signals, not confirmatory findings.

Qualitative Analysis

Thematic analysis followed Braun and Clarke's six-phase approach: familiarization, initial coding, theme development, theme review, theme definition, and report production (Braun & Clarke, 2006). NVivo 12 was used to organize the coding structure. The codebook distinguishes between the Five Domains as an interview guide and the final inductive themes.

The primary coding was conducted by the research team using anonymized transcripts. Theme definitions and illustrative extracts were reviewed against the coded data, and selected interpretations were checked with participants where possible. Because an independent inter-coder reliability statistic was not calculated, analytic rigor is reported through a transparent codebook, theme definitions, illustrative quotations, selected member checking, and an audit trail. The researchers also considered reflexivity because some authors have experience in biodiversity, conservation, and exotic animal contexts, which may shape interpretation of owner ethics and risk perception.

Mixed Methods Integration

Integration used joint display logic to classify meta-inferences as convergence, divergence, or expansion. Convergence was defined as qualitative and quantitative findings pointing to a similar interpretation. Divergence was defined as a mismatch between survey patterns and interview narratives. Expansion was defined as one data stream identifying a dimension that was not captured by the other.

RESULTS

Inclusion Flow and Participant Characteristics

Of 60 submitted surveys, 52 met the analytic inclusion criteria and were retained. Eight responses were excluded because they did not meet the analytic definition of current exotic or non-traditional pet ownership. Table 2 summarizes the inclusion and exclusion decisions.

Table 2. Survey Inclusion and Exclusion Flow

Step	n	Decision
Raw survey submissions	60	Initial online questionnaire responses.
Excluded cat-only ownership	6	Excluded because cats were treated as traditional companion animals.
Excluded no current exotic pet	2	Excluded because respondents reported no current exotic pet.
Final analytic sample	52	Used in descriptive and association analyses.

In the analytic sample, 25 of 52 respondents (48.1%) were aged 36-45 years, 28 (53.8%) had a bachelor's degree, and 15 (28.8%) had kept exotic or non-traditional pets for 1-3 years. Community membership was reported by 17 respondents (32.7%). Multi-response animal categories included reptiles (21 mentions), birds (18), small or other mammals (15), amphibians (5), arachnids (1), and one unspecified but retained case.

Table 3. Interview Participant Characteristics Summarized from The Qualitative Dataset (n = 30)

Characteristic	Distribution
Animal types represented	Otter (7), civet/musang (6), sugar glider (4), iguana (2), lizard/kadal (2), otter and civet (1), hedgehog (1), sulcata tortoise (1), parrot (1), rabbit (1), owl (1), gecko (1), slow loris/kukang (1), tarantula (1).
Acquisition pathways	Not specified (9), purchase (3), gift (3), breeder or legal breeder (4), wild or nature-sourced (2), hunter (1), mixed wild and breeding sources (2), community barter or community source (2), official breeder or captivity source (2), pet shop (1), adoption from friend (1).
Initial zoonosis knowledge	No prior knowledge (22), reported knowledge (4), disease-specific or partial knowledge including rabies, scabies, salmonella, or psittacosis (4).
Community involvement	Active (15), active as resource persons (3), active in events (2), inactive (6), not specified (4).
Vaccination practice	No vaccination (10), routine annual or repeated vaccination (10), cat-like vaccine logic (3), check-up without vaccination or no vaccination (3), not yet vaccinated (2), bird vaccine (1), one-time vaccination (1).

Qualitative Findings

Thematic analysis identified six interrelated themes. Figure 1 presents the thematic structure, which reflects an account informed by the Five Domains interview guide rather than a direct welfare-scoring analysis.

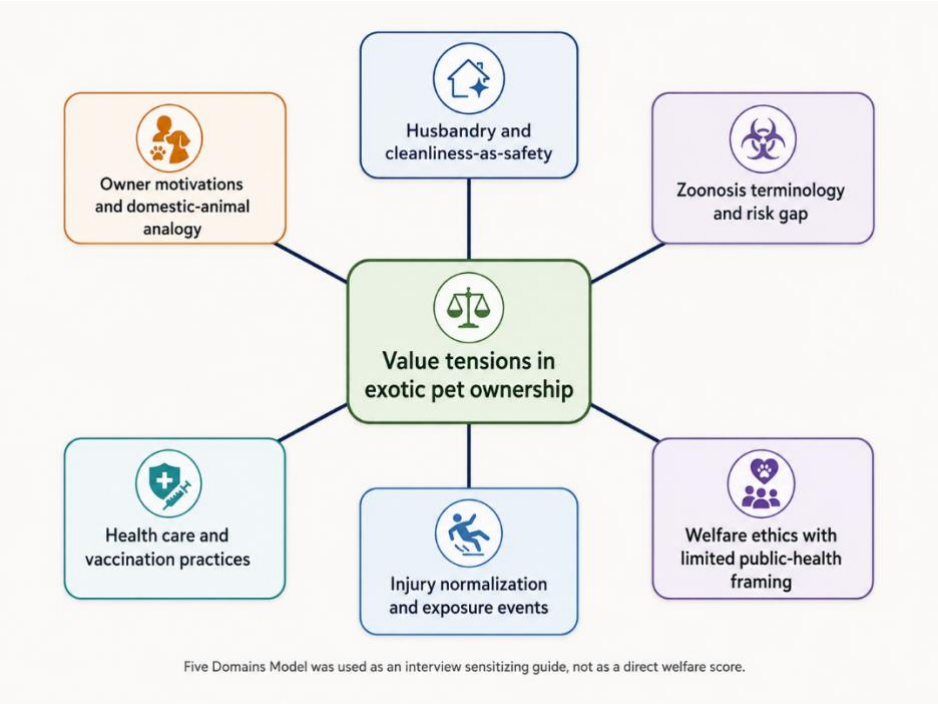


Figure 1. Thematic Structure from Qualitative Interview Analysis (NVivo)

Table 4. Qualitative themes, definitions, illustrative quotations, and One Health relevance.

Theme	Definition	Illustrative quote	One Health relevance
Owner motivations and domestic-pet analogy	Exotic animals were made familiar through comparisons with cats or dogs.	"The character is the same as cats. The care is also less complicated than cats." (R001)	Domestic analogies can lead to inappropriate transfer of care and vaccination assumptions.
Husbandry and cleanliness-as-safety	Visible cleanliness was treated as equivalent to biological safety.	"If it is a cared-for civet, it is definitely clean." (R002, translated); "I am not afraid because it depends on our cleanliness toward the animal." (R004, translated)	Hygiene is reduced to visible cleanliness, while asymptomatic carriage is under-recognized.
Zoonosis terminology and risk gap	Some owners knew disease examples but did not recognize zoonosis as an integrated concept.	"Zoonosis?" (R001); "What is zoonosis?" (R002, R004, R005, translated)	Public health messages may fail if they rely on technical vocabulary without practical framing.
Health care and vaccination practices	Vaccination and veterinary contact were uneven and often shaped by species analogies or community advice.	"Just once, all of them. After one vaccine, never vaccinated again." (R001, translated); "The vaccine is the same as a dog vaccine." (R005, translated)	Support for vaccination does not guarantee species-appropriate preventive care.
Injury normalization and exposure events	Bites, scratches, and puncture wounds were normalized as ordinary handling events.	"Puncture wounds on the hands are already normal... scratches and wounds are already usual." (R003, translated)	Physical injuries are not consistently interpreted as zoonotic exposure events.
Welfare ethics with limited public-health framing	Responsibility was articulated as commitment to individual animal care, with weaker attention to community health.	"The main key is commitment." (R005, translated); "In terms of cost and injury, that is the risk. We have to be ready." (R003, translated)	Owner ethics can be expanded to include public health responsibility as part of good care.

Owner Motivations and Domestic-Pet Analogy

Owners often described a trajectory from conventional pet ownership to more unusual species. Exotic animals were valued for uniqueness, challenge, and identity. At the same time, owners made them understandable through domestic-pet analogies. These analogies lowered perceived difficulty but also shaped medical assumptions, including the reported use of cat or dog vaccine logic for non-cat and non-dog species.

"The character is the same as cats. The care is also less complicated than cats." (R001, translated)

Cleanliness-as-Safety Belief System

A recurring belief equated visible cleanliness with biological safety. Owners often reasoned that a well-cared-for animal was not a disease risk. This theme is important because

it transforms hygiene from one layer of risk reduction into a perceived complete shield. The qualitative evidence explains why declarative knowledge about zoonosis can coexist with low concern about asymptomatic transmission.

"If it is a cared-for civet, it is definitely clean." (R002, translated)
"I am not afraid because it depends on our cleanliness toward the animal." (R004, translated)

Zoonosis Terminology Barrier

Several interviewees did not recognize the term zoonosis until it was explained. Some knew disease examples such as rabies, salmonella, psittacosis, or scabies, but this knowledge was fragmented rather than integrated into a general interspecies transmission framework. This theme diverges from the survey's high correct-definition rate and suggests that survey recognition may overestimate usable risk literacy.

"Zoonosis?" (R001)
"What is zoonosis?" (R002, R004, R005, translated)

Inconsistent Vaccination Practices

Vaccination narratives ranged from one-time vaccination to annual protocols. The key qualitative issue was not simply support or opposition. Rather, owners differed in how they interpreted vaccine relevance across species, who should administer vaccines, and whether repeated boosters were necessary. Species-specific veterinary guidance appeared uneven.

"Just once, all of them. After one vaccine, never vaccinated again." (R001, translated)
"The vaccine is the same as a dog vaccine." (R005, translated)

Community-Based Knowledge Networks

Community networks were repeatedly described as primary information channels. Owners used communities to exchange care knowledge, identify veterinarians, obtain animals, and normalize handling practices. These networks can disseminate preventive knowledge, but they can also reproduce non-professional assumptions when not linked to veterinary guidance.

"Just the communities." (R001, translated)
"From fellow friends... fellow community members." (R002, translated)

Injury Normalization

Bites, scratches, and puncture wounds were often described as ordinary parts of handling. These events were not consistently interpreted as exposure events. This finding expands the survey results because the questionnaire did not directly measure injury normalization, yet the theme is highly relevant to zoonotic disease prevention.

"Puncture wounds on the hands are already normal... scratches and wounds are already usual." (R003, translated)

Welfare-Focused Ethics with Limited Public-Health Framing

Owners articulated strong ethical commitments to feeding, housing, enrichment, emotional bonding, and long-term commitment. These commitments align with the concerns reflected in the Five Domains Model. However, public health responsibility toward people outside the owner-household was rarely articulated spontaneously. The finding suggests a value tension, not a necessary opposition, between animal welfare ethics and population health responsibility.

"The main key is commitment." (R005, translated)
"In terms of cost and injury, that is the risk. We have to be ready." (R003, translated)

Quantitative Findings

Key recoded variables are shown in Figure 2 and Table 5. Zoonosis knowledge was high by the survey definition, with 47 of 52 respondents (90.4%) answering the definition item correctly. Vaccination support was also high (41/52, 78.8%). However, regular veterinary use was reported by only 16 respondents (30.8%), and high zoonosis concern was present in 26 respondents (50.0%).

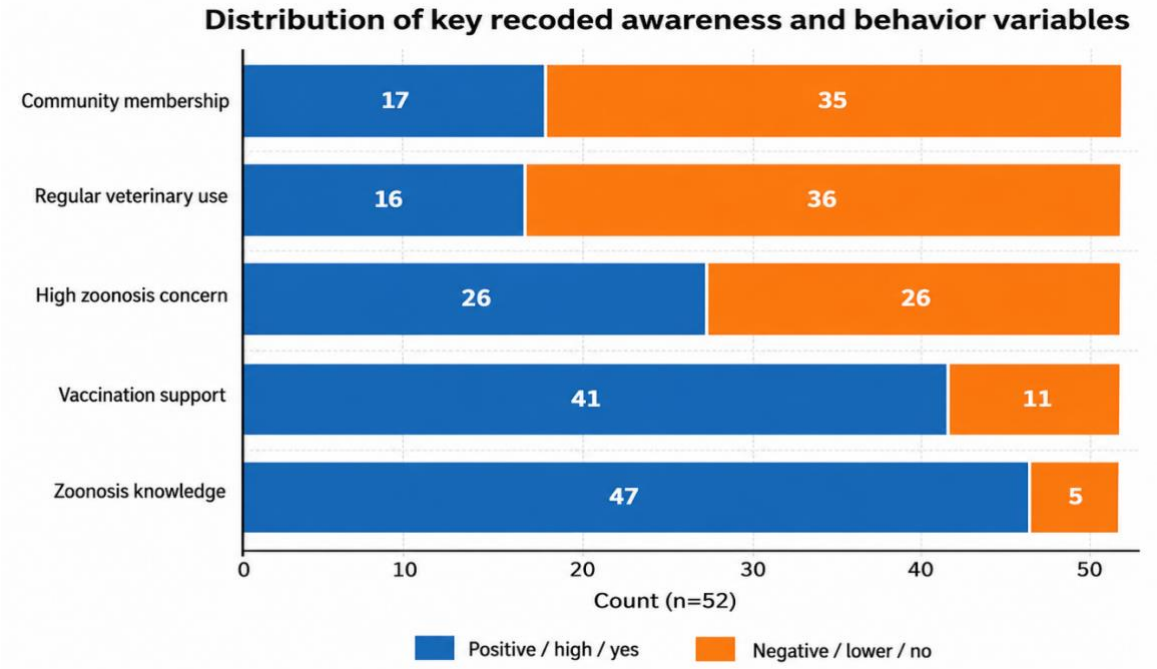


Figure 2. Distribution of Key Awareness and Behavior Variables in The Analytic Sample (n = 52)

Table 5. Descriptive Distribution of Key Recoded Variables

Variable	Positive or focal n (%)	Comparison n (%)
Zoonosis knowledge	47 (90.4)	5 (9.6)
Vaccination support	41 (78.8)	11 (21.2)
High zoonosis concern	26 (50.0)	26 (50.0)
Regular veterinary use	16 (30.8)	36 (69.2)
Community membership	17 (32.7)	35 (67.3)

Association Testing

Table 6 presents the association tests. Fisher's exact tests were used as the primary tests. Unadjusted Fisher tests suggested two associations: veterinary use with vaccination support (p = 0.012) and vaccination support with zoonosis concern (p = 0.038). However, after Holm correction for six tests, neither association remained statistically significant at alpha = 0.05. The strongest signal was veterinary use with vaccination support (Holm-adjusted p = 0.070; Benjamini-Hochberg adjusted p = 0.070). Therefore, the interpretation is exploratory: regular veterinary contact may be related to vaccination support, but this dataset does not provide confirmatory statistical evidence after multiple testing correction.

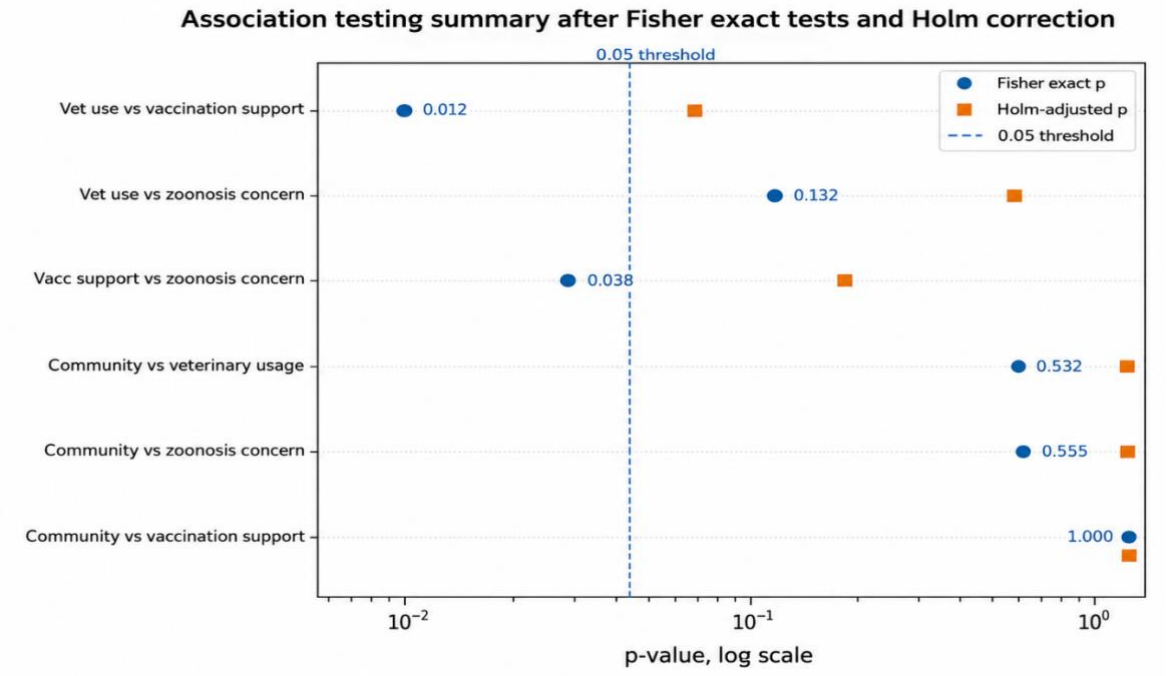


Figure 3. Fisher exact p-values and Holm-adjusted p-values for the six planned association tests

Table 6. Association testing using Fisher's exact test, Yates-corrected chi-square disclosure, Holm correction, and Benjamini-Hochberg sensitivity adjustment

Association	Group	Outcome yes/high/supportive/regular	Outcome no/lower	Fisher p	Holm p	BH p	Yates chi-square, p	Cramer's V
Community membership vs vaccination support	Member	13 supportive	4 not supportive/neutral	1.000	1.000	1.000	0.000, p = 1.000	0.041
	Non-member	28 supportive	7 not supportive/neutral					
Community membership vs zoonosis concern	Member	7 high concern	10 not high concern	0.555	1.000	0.666	0.350, p = 0.554	0.123
	Non-member	19 high concern	16 not high concern					
Community membership vs veterinary usage	Member	4 regular vet	13 no regular vet	0.532	1.000	0.666	0.219, p = 0.640	0.109
	Non-member	12 regular vet	23 no regular vet					
Vaccination support vs zoonosis concern	Supportive	24 high concern	17 not high concern	0.038	0.192	0.115	4.151, p = 0.042	0.330
	Not supportive/neutral	2 high concern	9 not high concern					
Veterinary usage vs zoonosis concern	Regular vet	11 high concern	5 not high concern	0.132	0.527	0.264	2.257, p = 0.133	0.250
	No regular vet	15 high concern	21 not high concern					
Veterinary usage vs vaccination support	Regular vet	16 supportive	0 not supportive/neutral	0.012	0.070	0.070	4.504, p = 0.034	0.345
	No regular vet	25 supportive	11 not supportive/neutral					

Note. Fisher p-values are the primary inferential results. Holm-adjusted p-values define statistical significance for the six-test family. Benjamini-Hochberg adjusted p-values are reported as a false discovery rate sensitivity check. Cramer's V was calculated from the uncorrected Pearson chi-square statistic.

Mixed Methods Integration

The integration emphasizes what each data stream adds to the interpretation. High survey knowledge converged only partially with qualitative evidence, because interviewees often lacked a practical vocabulary for zoonotic risk. Survey evidence of low regular veterinary use converged with interviews describing reliance on community networks. Injury normalization was an expansion finding because it was visible in interviews but not directly measured in the survey.

Table 7. Joint Display of Mixed Methods Integration

Qualitative finding	Quantitative finding	Mixed-methods inference
Zoonosis term unfamiliar; risk known only fragmentarily	Correct zoonosis definition: 47/52 (90.4%)	Divergence: survey recognition did not fully translate into interview-level conceptual fluency.
Cleanliness treated as safety; asymptomatic carriage absent	High concern: 26/52 (50.0%)	Expansion: concern was present but often framed through visible hygiene rather than pathogen risk.
Veterinarians used reactively; communities remain key sources	Regular veterinary use: 16/52 (30.8%)	Convergence: low regular veterinary use supports interview accounts of informal knowledge networks.
Vaccination considered useful, but protocols inconsistent	Vaccination support: 41/52 (78.8%)	Divergence: positive attitudes did not guarantee species-appropriate or repeated vaccination practices.
Bites and scratches normalized as part of handling	Not directly measured in survey	Expansion: qualitative data identified an exposure pathway absent from the survey.

DISCUSSION

This study suggests a value tension within the sample between welfare-centered ownership ethics and public health responsibility. Many owners expressed strong concern for the care, comfort, and emotional well-being of their animals. However, responsibility toward broader public health, particularly the prevention of zoonotic transmission beyond the owner-household relationship, was less consistently articulated.

The qualitative findings provide the strongest basis for the article's contribution by explaining why knowledge and behavior may diverge. Some owners were able to identify zoonosis correctly in the survey, yet interview narratives showed that practical risk understanding remained fragmented. Visible cleanliness was often treated as sufficient protection, bites and scratches were normalized as routine handling experiences, and peer-based knowledge frequently substituted for professional veterinary guidance. This pattern is consistent with wider pet-related zoonosis literature showing that knowledge alone does not necessarily translate into preventive behavior.

The quantitative findings should be interpreted cautiously. Fisher's exact tests were appropriate because several contingency tables contained small expected counts and one zero cell. The association between regular veterinary use and vaccination support showed the strongest exploratory signal, but it did not remain statistically significant after Holm correction. Therefore, veterinary engagement should be understood as a plausible intervention point supported by qualitative convergence and exploratory quantitative evidence, rather than as a statistically confirmed determinant.

The Five Domains Model contributed to the study by sensitizing the interviews to owners' reasoning about nutrition, physical environment, health, behavioral interactions, and emotional relationships. However, the study did not directly measure animal welfare outcomes through clinical, behavioral, or physiological assessment. For this reason, the model is best understood as an interpretive guide for examining owner ethics rather than as a direct welfare scoring framework.

For One Health practice, these findings suggest that public health responsibility should not be framed as competing with animal welfare. Instead, zoonotic disease prevention can be communicated as an extension of responsible care that protects animals, owners, households, and the wider community. Community networks should also be engaged because they function as trusted sources of information and often mediate access to veterinary advice. However, community-based dissemination needs professional support to avoid reinforcing cross-species vaccine assumptions, incomplete risk knowledge, and cleanliness-as-safety misconceptions.

Limitations

This study has several limitations. First, the survey used a small non-probability sample, which limits the generalizability of the findings. Second, the cross-sectional design does not allow causal inference between veterinary engagement, vaccination support, zoonosis concern, and other behavioral variables. Third, eight survey responses were excluded from the quantitative analysis because they did not meet the analytic definition of current exotic or non-traditional pet ownership. One retained response had an unspecified species entry, although sensitivity analysis excluding this record did not materially change the interpretation. Fourth, survey responses were self-reported and may be affected by recall bias or social desirability bias. Fifth, the qualitative analysis did not include an independently calculated inter-coder reliability statistic. However, analytic transparency was strengthened through codebook development, theme definition, illustrative quotations, selected member checking, and audit trail documentation. Sixth, the study did not include clinical examination, pathogen testing, or direct animal welfare scoring; therefore, the findings should be interpreted as owner-reported perceptions and practices rather than direct evidence of animal welfare status or zoonotic infection risk. Finally, the Indonesian context may limit transferability to settings with different exotic pet regulations, veterinary service availability, and cultural understandings of non-traditional animal ownership.

CONCLUSION

This mixed methods study suggests that exotic pet owners in this Indonesian sample often articulate strong welfare-oriented commitments while giving less explicit attention to public health responsibility. Survey findings showed high declarative zoonosis knowledge and strong vaccination support, but regular veterinary use remained low. After adjustment for multiple testing, no association remained statistically significant at the Holm-adjusted alpha = 0.05 level, so the quantitative findings should be interpreted as exploratory. The qualitative findings provide the primary explanatory contribution by showing how domestic-pet analogy, cleanliness-as-safety reasoning, community-based knowledge networks, inconsistent vaccination practices, and injury normalization can weaken the integration of public health responsibility into exotic pet ownership. One Health interventions should therefore frame zoonotic disease prevention as an extension of responsible animal care, while engaging both veterinary professionals and trusted community networks. Future research should use larger and more diverse samples, prospective designs, validated measures of One Health responsibility, and strengthened qualitative rigor procedures.

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