

Awareness of zoonoses in Lao PDR: A call for targeted health education

Masahiro Sano^{1,*}, Chansay Pathammavong², Yoshiaki Kanno¹, Moe Moe Thandar¹, Yuta Yokobori¹, Yu Hagiwara¹, Phonethipsavanh Nouanthong², Mathida Thongseng², Kongxay Phounphenghack², Bouaphanh Khamphaphongphane², Bandith Soumphonphackdy², Masahiko Hachiya¹, Shinsuke Miyano¹

¹ Bureau of Global Health Cooperation, Japan Institute for Health Security, Tokyo, Japan;

² Ministry of Health, Vientiane Capital, Lao People's Democratic Republic, Vientiane, Lao People's Democratic Republic.

Abstract: Zoonoses pose serious public health challenges. In Lao People's Democratic Republic, where > 70% of population engages in agriculture and livestock farming, public awareness of zoonoses remains unclear. We conducted a nationwide population-based survey with 347 individuals aged 12–40 years across 40 villages in 20 districts. Logistic regression analysis was used to identify factors associated with zoonoses awareness. Awareness was approximately 42.9% and was significantly higher among females and livestock owners. Lower awareness was observed among individuals with primary or secondary education compared with those with higher education, whereas no significant difference was found for those with no formal education. These findings highlight the need for targeted health education programs for populations with limited access to formal education and health information. A One Health approach, integrating human, animal, and environmental health sectors, should be prioritized to improve zoonoses awareness and reduce transmission risks, especially in rural and marginalized communities.

Keywords: Laos, zoonotic diseases, livestock ownership, multilevel analysis, ethnic minority, One Health

1. Introduction

Zoonoses are infectious diseases that can be transmitted between animals and humans, posing substantial public health challenges, particularly in low-income and middle-income countries (1). In Southeast Asia, close human-animal interactions, traditional agricultural practices, and limited public health infrastructure increase the risk of zoonoses transmission (2).

Despite their public health importance, awareness and knowledge of zoonoses among populations in Lao People's Democratic Republic (Lao PDR) remain poorly documented. Lao PDR is a predominantly agricultural country, with approximately 70% engaged in farming and livestock production (3). This emphasizes the need to strengthen public awareness to prevent spillover events, particularly in rural communities that reside near forested areas or experience high livestock exposure.

A One Health approach integrating human, animal, and environmental health sectors is essential for managing zoonoses in resource-limited settings. Notably, understanding the level of zoonoses awareness is crucial for designing effective health education campaigns, improving surveillance systems, and

reducing transmission risks.

2. Nationwide population-based survey in Lao PDR

We conducted a nationwide, population-based survey across 40 villages in 20 districts of Lao PDR in September 2023 to evaluate the awareness and understanding of zoonoses among the general population through a brief face-to-face interview using a single yes/no question: "Are you aware of diseases from animals?" Participants were originally recruited as part of a seroepidemiological study targeting individuals aged 4–40 years, but those < 12 years were excluded owing to cognitive limitations. After this exclusion, a total of 347 participants aged 12–40 years were analyzed. Prior to this survey, we conducted a pre-survey to assess the feasibility of including younger participants, particularly those aged 12–16 years, and confirmed that they were able to understand and appropriately respond to the questionnaire. Participants were selected using multistage cluster sampling with probability proportional to size to ensure geographic representation and population-weighted sampling. Sociodemographic data were collected and analyzed

using logistic regression to identify associated factors. Variables with a p -value < 0.05 in bivariate analysis were included in the multivariable logistic regression model. Written informed consent was obtained from all participants, and the study was approved by the institutional review boards in Japan and Laos. Overall, weighted analysis estimated zoonoses awareness at 42.9% (37.9–48.1). In multivariable analysis, females (adjusted odds ratio [AOR] = 2.38, 95% confidence interval [CI]: 1.47–3.86) and livestock owners (AOR = 2.27, 95% CI: 1.23–4.20) were significantly more likely to be aware than others. Awareness was significantly lower among those with primary (AOR = 0.37, 95% CI: 0.20–0.68) and secondary education (AOR = 0.40, 95% CI: 0.23–0.70) than among those with higher education (Table 1).

3. Factors affecting awareness

To the best of our knowledge, this is the first report on zoonoses awareness in Lao PDR, as identified through a PubMed literature search. Public awareness of zoonoses varies significantly across different regions. These disparities in zoonoses awareness highlight the global need for enhanced public education on zoonoses risks and transmission pathways. This study provides valuable insights into the awareness of zoonoses among residents in Lao PDR. Our findings highlight significant disparities in knowledge based on sex, educational attainment, and livestock ownership. These disparities may stem from sociodemographic factors and structural barriers, such as limited access to health education, language differences, or rural infrastructure constraints.

i) Sex: In this study, females were significantly more likely to be aware of zoonoses than males. This may reflect their roles in caregiving, household management, and food preparation in Lao PDR, which may expose them to more health information. While studies on sex and zoonoses awareness have shown mixed results across different settings (4,5), our nationally representative sample suggests that sex-based differences in awareness exist in Lao PDR. Future studies should explore the underlying reasons for this disparity.

ii) Education: Individuals with primary or secondary school education were significantly less likely to recognize zoonoses than those with higher education, whereas no significant difference was observed for participants with no education. This highlights the critical role of formal education in enhancing health literacy. Limited awareness in these groups may contribute to delayed awareness of zoonoses symptoms, underutilization of healthcare resources, and increased transmission risks within communities. Community-based educational programs are instrumental in improving public awareness of zoonoses. Therefore, culturally and age-appropriate educational interventions

should be implemented. To achieve sustainable and comprehensive improvements in zoonoses awareness and prevention, it is essential to adopt a One Health approach (6). Considering that zoonoses account for 60% of new diseases (7), effective education of the appropriate populations will protect the population from emerging infectious disease crises.

iii) Livestock ownership: Past studies indicate that occupational context shapes zoonoses awareness. In Nepal and Ethiopia, 72.1% and 75.5% of livestock farmers were aware of zoonoses (8,9). In Laos, awareness among livestock owners was 46.4% — higher than among non-owners yet lower than in Nepal and Ethiopia, likely reflecting differences in production systems, education, and access to health information. Livestock owners' more frequent and direct animal contact may also increase exposure to guidance from veterinarians, extension workers, or agricultural programs, which could contribute to higher awareness, although our study could not fully clarify the mechanism.

This study has some limitations. First, the small sample size, particularly among some ethnic and educational groups, may have reduced statistical power and limited generalizability. Second, only participants aged 12–40 years were included, excluding older adults who may have different awareness levels. Third, the outcome was measured using a single binary question, which may not fully capture depth of understanding. Finally, certain populations, including urban residents, persons with disabilities, and older adults, were not represented in the sample, which may limit the applicability of findings to the broader population.

In conclusion, $< 50\%$ of surveyed individuals were aware of zoonoses in Lao PDR. Awareness was significantly higher among females and livestock owners, and significantly lower among those with primary and secondary education than among those with higher education. These findings highlight the need for targeted health education programs to reduce disparities. A One Health approach — integrating human, animal, and environmental sectors — should be prioritized to improve awareness and prevent zoonotic risks, particularly in underserved rural communities.

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Table 1. Factors associated with the awareness of zoonoses

Items	Absolute number	Estimated proportion of zoonoses awareness			Bivariate analysis			Multivariable analysis		
		Weighted %	95% CI		Crude odds ratio	95% CI	p-value	Adjusted odds ratio	95% CI	p-value
Age group, years, range										
12–15	68	38.2	26.6–49.8		Reference					
16–24	116	39.0	30.0–47.9		1.03	0.56–1.91	0.922			
25–40	163	47.8	40.1–55.5		1.48	0.83–2.65	0.181			
Sex										
Male	130	31.6	23.5–39.6		Reference					
Female	217	49.7	43.0–56.4		2.15	1.36–3.39	0.001	Reference	1.47–3.86	<0.001
Marriage status										
Married	193	43.0	35.9–50.0		Reference					
Not married	154	42.9	35.0–50.7		0.99	0.65–1.53	0.98			
Ethnicity										
Lao	207	46.8	40.0–53.6		Reference					
Khmu	51	41.3	27.7–54.9		0.80	0.43–1.49	0.483			
Ka tang	20	34.7	13.8–55.6		0.60	0.23–1.58	0.304			
Brao	17	29.1	7.4–50.7		0.47	0.16–1.38	0.167			
Phou noi	9	66.7	35.7–97.6		2.27	0.55–9.41	0.256			
Ta-oi	10	30.2	1.6–58.9		0.49	0.12–1.97	0.316			
Pray	7	14.6	-11.9–41.2		0.20	0.02–1.67	0.135			
Other	26	34.8	16.4–53.3		0.61	0.26–1.43	0.253			
House type										
Traditional	146	36.9	29.1–44.8		Reference					
Modern	201	47.3	40.3–54.2		0.65	0.42–1.01	0.057			
Air conditioning*										
Yes	265	53.6	42.7–64.5		53.6	42.7–64.5	0.027	1.51	0.88–2.60	0.135
No	82	39.6	33.7–45.5		Reference					
Education										
No education**	24	33.1	14.2–52.0		33.1	0.13–0.84	0.021	0.39	0.13–1.13	0.082
Primary school	91	36.0	24.2–43.8		34.0	24.2–43.8	<0.001	0.37	0.20–0.68	0.002
Secondary school	127	37.0	28.5–45.4		37.0	28.5–45.4	0.001	0.40	0.23–0.70	0.001
High school or higher	105				Reference			Reference		
Occupation										
Farmer	161	39.7	32.1–47.3		Reference					
Housewife	14	35.8	10.5–61.6		0.85	0.27–2.66	0.776			
Labor	28	35.6	17.8–53.4		0.84	0.36–1.94	0.680			
Officer	12	58.1	30.0–86.2		2.11	0.64–6.96	0.220			
Private/Company worker	28	49.8	31.2–68.5		1.51	0.67–3.39	0.319			
Unemployed***	103	47.5	37.8–57.2		1.37	0.83–2.27	0.216			
Other	1	0	Omitted		-	-	-			
Income										
< 2 million Lao Kip	179	37.4	29.5–45.2		Reference					
> 2 million Lao Kip	168	47.2	37.0–57.5		1.67	1.08–2.56	0.020	1.59	0.99–2.54	0.053
Livestock owners										
Yes	276	46.4	40.5–52.3		2.08	1.18–3.66	0.011	2.27	1.23–4.20	0.009
No	71	29.4	18.7–40.0		Reference			Reference		

*Presence of an air conditioner in the household. **Defined as never having attended formal schooling. ***Students are categorized as unemployed.

Conflict of Interest: The authors have no conflicts of interest to disclose.

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**Address correspondence to:*

Masahiro Sano, Bureau of Global Health Cooperation, Japan Institute for Health Security, 1-21-1 Toyama, Shinjuku, Tokyo 162-8655, Japan
E-mail: sano.m@jihs.go.jp