Assessing One Health Surveillance Systems at the Human-Animal-Wildlife Interface in a Biodiversity Hotspot: Findings from Stung Treng Province, Cambodia

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Summary
Designing an effective One Health (OH) surveillance system requires, as a first step, a clear understanding of how existing systems actually work — not as they are described in official documents, but as they are experienced by the people who operate them. This paper presents the findings of a participatory assessment of health surveillance systems conducted in Stung Treng province, Cambodia, covering three sectors: human health, animal health, and wildlife health. Using a combination of semi-structured interviews and focus group discussions involving 203 participants from community to provincial level, the study mapped information flows across sectors, identified the barriers that prevent timely reporting, and documented stakeholder perceptions of the system's effectiveness. The main findings point to a deeply fragmented surveillance landscape, where human health infrastructure is relatively functional, animal health is partially operational but eroding, and wildlife health is almost entirely absent as a formal system. Across all three sectors, the dominant barrier is not technical but relational: a lack of trust in the system, driven by repeated experiences of slow or absent response after reporting. These findings now serve as a foundation for co-constructing a community-based OH surveillance pilot in the province.

Introduction
Cambodia sits at a particularly active interface between human populations and wildlife. The country has experienced significant zoonotic disease pressure over the past two decades — avian influenza, COVID-19, African Swine Fever, Lumpy Skin Disease — and its rural landscapes, particularly in remote provinces, combine multispecies livestock farming, active wildlife trade, and close proximity to forested areas with high biodiversity. In this context, early detection of zoonotic events depends on a surveillance system that can capture signals across multiple sectors simultaneously and transmit them upward in a timely and coordinated way.

Stung Treng province, in the northeast of the country bordering Laos, represents an especially relevant setting for this kind of assessment. It covers 11,092 km² of sparsely populated, biodiversity-rich terrain within the Mekong basin, including six protected areas, 21 community forests, large colonies of flying foxes and cave bats, and rivers teeming with aquatic species. Stung Treng is also notable scientifically: it is one of the sites where bat coronaviruses closely related to SARS-CoV-2 have been detected. Several previous surveillance efforts have been implemented here — including a wildlife health surveillance network and an 18-month community respiratory surveillance project funded by the French National Agency for Research (ANR) — making it a site with some institutional history in OH surveillance (1).

The work presented here is part of the BCOMING project (Biodiversity Conservation to Mitigate the risks of Emerging Infectious Diseases), funded under the European Union's Horizon Europe programme (grant No. 101059483). A central premise of the project is that co-designing a better surveillance system with communities and authorities requires first understanding the existing one in depth — its actors, its communication flows, and critically, the reasons why it does or does not function as intended (2).

Materials and Methods
The assessment was conducted in Stung Treng province, with fieldwork focused on the Thalaborivat district, where six community forests cover 16,606 hectares and one community covers 1338.54 hectares across five communes and eleven villages. Data collection took place between January and March 2024.

The methodology combined two participatory approaches (3). In the first phase, 11 semi-structured interviews (SSIs) were conducted with key informants representing a range of sectors and administrative levels: animal health (Provincial Animal Health and Production Office), wildlife and environment (Provincial Department of Environment, Forestry Administration at both provincial and district level), human health (Provincial Department of Health, one health centre), district authorities, commune authorities, community forestry representatives, and one conservation NGO (Angkor Centre for Conservation of Biodiversity). Each interview lasted approximately two hours. During interviews, participants were asked to draw the communication flow within and between sectors — reporting channels, response pathways, and actors involved — which produced three distinct flow diagrams for wildlife health, animal health, and human health. Participants also rated their satisfaction with the system using a five-point scale.

In the second phase, nine focus group discussion (FGD) workshops were conducted in March 2024, involving 192 participants distributed across three levels: seven workshops at community forestry sites, one at district and commune level, and one at provincial level. The FGDs were used to validate and enrich the information collected during interviews, identify cross-sectoral communication gaps, and generate participant-led recommendations for improvement. All sessions were audio-recorded with informed consent and transcribed for qualitative analysis using the Quirkoos tool. The communication flow diagrams were compiled using Whimsical software.

Results

Mapping the three sectors

The three communication flow diagrams revealed a clear and consistent gradient across sectors in terms of institutional development and operational functionality (Figure 1).

Human health has the most developed infrastructure, from community to national level. At the community level, Village Health Support Groups (VHSGs) and Village Malaria Workers (VMWs) work closely with health posts and health centres to detect and report cases. Digital tools are in active use: the malaria programme uses a dedicated mobile application, while the CamEMS and CamEwarn platforms serve for broader health monitoring and zoonotic event reporting. Rapid Response Teams (RRTs) at operational district level are deployed within 48 hours of a reported event. Communication within the human health sector is generally functional and uses Telegram and phone calls routinely alongside formal reporting platforms.

Animal health sits at an intermediate level. The reporting chain nominally runs from Village Animal Health Workers (VAHWs) up to the Provincial Animal Health and Production Office and then to the General Directorate of Animal Health and Production (GDAHP) at national level. In practice, however, this chain is breaking down. Many VAHWs have stopped working — they are volunteers who receive no salary, must purchase medicines from their own pockets, and often see no useful response when they do escalate cases. The provincial animal health office has only four officers, who described being overwhelmed during outbreak events and unable to follow formal reporting procedures. Contracted farms and private service providers handle disease events internally, without notifying authorities. The CamEwarn platform, introduced to bridge human and animal health reporting, is underutilized: one provincial veterinarian reported having login credentials for the system but being unable to navigate it in practice.

Wildlife health is the most fragmented sector. A Wildlife Health Surveillance Network (WHSN) Telegram group exists at provincial level, with representatives from the animal health office, the Provincial Department of Environment (PDoE), wildlife rescue organisations, and conservation projects. But this group is known to few people and rarely active. Most community members — including forest rangers, hunters, and people who live inside or adjacent to protected areas — are unaware that any wildlife health reporting mechanism exists. When dead or sick wildlife is found, the default response is consumption, not reporting.

Barriers to surveillance performance

Ten challenges were identified through the combined SSI and FGD process. The two most frequently cited — raised in eight of nine FGDs — were delayed or reluctant disease reporting due to low trust in the system, and lack of data sharing and integration across sectors.

The trust problem is concrete and well-founded. Farmers describe reporting sick animals and waiting ten to fifteen days for any response, by which time the entire flock had already died. One participant said plainly: "I am afraid that when I report the case, they don't report to their upper level. That is why I don't want to report." Others described being told by village chiefs to slaughter and sell sick animals quickly rather than seek veterinary advice. The rational response to these experiences is to stop reporting — and that is what many communities have done. The same dynamic appears in wildlife health: villagers who fell ill after consuming wildlife meat

sought care at private clinics but did not report, partly from fear of legal consequences and partly because they expected no useful response from authorities.

The absence of feedback mechanisms reinforces this cycle. Participants who had contributed to surveillance activities — collecting tick and blood samples, submitting reports — described never receiving results or follow-up. A provincial veterinarian recounted asking for results from a sampling campaign and simply not receiving them. Without feedback, the system loses credibility, and people who might otherwise be willing to participate disengage.

Intersectoral data sharing is a separate but related problem. Within the human health sector, communication is relatively good. But between human health and animal health, information exchange is almost absent at the provincial level. Staff expressed concern that sharing data with another sector without authorisation from their superiors could result in disciplinary consequences. The result is that each sector operates with information the others would need in order to detect and respond to a potential zoonotic event.

Cultural and economic barriers compound the structural ones. When dead wildlife is found in fresh condition, consuming it is a food security strategy, not reckless behaviour — in contexts of genuine poverty, this makes sense. Selling sick poultry at a discount before the authorities intervene is economically rational when there is no compensation for mandatory culling. Training on zoonotic diseases alone is unlikely to be sufficient to change these behaviours.

What stakeholders want

Despite the frustrations documented above, all stakeholder groups expressed strong willingness to participate in a better-designed system. This came through clearly in the FGDs — many participants described the workshop itself as the first time they had seen how different actors were connected, and several expressed genuine enthusiasm for implementing a shared communication structure. The most consistent recommendation across groups was the establishment of a formal Provincial One Health Coordination Group, led by a deputy provincial governor, with representatives from all three sectors. A provincial-level Telegram platform for inter-sectoral alert sharing was widely supported, as was the designation of clear focal points for wildlife health at commune level. Participants also emphasised that any new system must include a mandatory feedback loop — test results and follow-up information returned to communities after a report is filed.

Discussion

The picture that emerges from Stung Treng is of a surveillance system that is structurally present but functionally inadequate — not because the actors lack motivation, but because the system as currently designed does not offer them anything in return for the effort and risk of reporting. Rebuilding this requires addressing trust before addressing technology.

Some elements are already in place and should be built upon rather than replaced. The Malaria Information System demonstrates that digital reporting works in this context when properly supported, simplified, and linked to a visible response. The COVID-19 experience showed that rapid, coordinated, multi-level communication is possible when there is perceived urgency and institutional commitment. Conservation NGOs already maintain informal wildlife health networks that could be formalised. These are real entry points, not just aspirational starting points.

The BCOMING project is now using these findings to facilitate a co-construction process with provincial authorities, community forestry groups, and health actors — designing a community-based OH surveillance pilot that takes the economic and relational barriers seriously, not as side constraints but as central design problems (4, 5). The assessment itself appears to have had some catalytic effect: several participants described the communication flow workshops as the first time they had discussed these issues across sectors, and the demand for a provincial OH coordination structure grew directly out of the FGD process.

Dimension	Human health	Animal health	Wildlife health
Key community actors	VHSG, VMW, health posts	VAHW, village chiefs	Rangers, hunters, NGO staff
Reporting tools in use	Telegram, CamEMS, CamEwarn, malaria app	Telegram, phone, CamEwarn (limited)	SMART patrol app (partial), Telegram (WHSN)
Frequency of cross-level reporting	Regular	Irregular	Rare to absent
Cross-sectoral information sharing	Rare	Rare	Absent
Main barrier	Preference for private clinics; fear of reporting illegal events	Low trust; economic loss; VAHW dropout	No awareness of reporting mechanism; consumption of carcasses
Response time (when it occurs)	Within 48h (RRT)	10–15 days (reported cases)	Within 2 days (if NGO involved)
Stakeholder motivation	High	Moderate, declining	High in principle, no formal outlet

Note: Data derived from 11 semi-structured interviews and 9 focus group discussions involving 192 participants, conducted January–March 2024, Thalaborivat district, Stung Treng province, Cambodia.

Figure 1. Comparative overview of health surveillance communication flows across three sectors in Stung Treng province, Cambodia (2024)

Keywords: Stakeholder mapping, zoonotic disease, early warning system, community-based surveillance, Cambodia.

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