

Supplementary file 2:

Additional Methods

Supplement to:

Bracing for the next pandemic: Stakeholders and communities' perspectives on infectious disease risks and prevention on Aruba

Authors

Debby Pluimert¹, Kimberly M. Gréaux², Judelca Briceno³, Wilmer Salazar³, Verenuska Rincon³, Riem van den Berg³, Nathalie Maduro⁴, Anselmo Mathew³, Eugene Maduro³, Luis Chong³, Clariene Croes³, Esther Vermeulen³, Natalie V.S. Vinkeles Melchers¹

Affiliations:

1. Health & Society, Social Sciences Department, Wageningen University & Research, Hollandseweg 1, 6706 KN Wageningen, the Netherlands.
2. Faculty of Hospitality and Tourism Management Studies, University of Aruba, J. Irausquinplein 4, Oranjestad, Aruba.
3. Department of Public Health (DVG) Aruba, Caya Ing. R.H. Lacle 4, Oranjestad, Aruba.
4. Santa Rosa, Department of Agriculture, Livestock and Fishery, Piedra Plat 114-A, Paradera, Aruba.

Correspondence to:

Natalie V.S. Vinkeles Melchers, PhD. MSc. MPH.

Health & Society, Social Sciences Department, Wageningen University & Research, Wageningen, The Netherlands

Email: natalie.vinkelesmelchers@wur.nl

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1. Data analysis

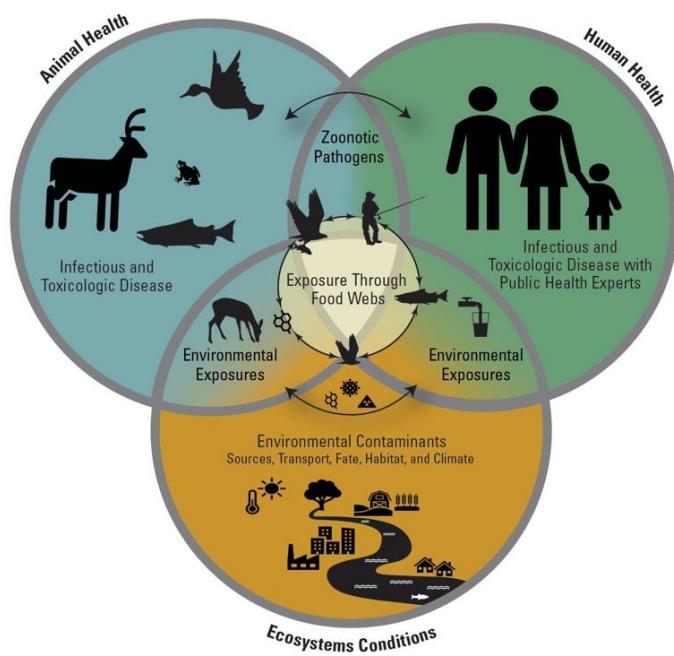
All data were stored at a secured and protected drive of the Wageningen University & Research (WUR) to prevent unauthorised access. All data will be deleted after five years in accordance with data protection protocols of the WUR ethics. To protect participant privacy, pseudo-anonymisation was implemented, ensuring that any identifying information was not accessible during the analyses (Abu Attieh et al., 2025).

For the analyses, we followed Braun and Clarke's six-phase process of thematic content analyses (Braun & Clarke, 2006). These steps involve familiarisation with the data, initial coding, searching for themes, reviewing themes, defining themes, and reporting. After familiarisation, a codebook with important themes and sub-topics was developed using the One Health framework as overarching structure for the codebook (chapter 6). In total, 117 codes were identified, organised into 24 subcategories, and grouped under the three One Health domains: human, animal, and environmental health. Coding of the data itself was conducted collaboratively in Atlas.ti (Flick, 2018).

2. One Health framework

The One Health framework (Figure S1) is an integrated approach that aims to balance and optimise the health of people, animals, and ecosystems. It recognises the deep interconnections between human health, animal health, and the environment (Brown et al., 2024; Destoumieux-Garzón et al., 2018; Rüegg et al., 2017). These linkages mean that the emergence and spread of infectious diseases are influenced by human behaviours, animal populations, and environmental conditions (Rüegg et al., 2017). This approach is particularly relevant for addressing threats related to novel infections, zoonoses, and broader environmental health problems. Close contact between humans and animals facilitates the transmission of pathogens, while factors such as pollution, climate change, and biodiversity decline further shape these risks (Cianconi et al., 2022; Deiana et al., 2024; Marselle et al., 2021). By examining complex problems through the perspectives of One Health, researchers and policymakers can identify factors that otherwise might have been overlooked (Lebov et al., 2017).

Figure S1. One Health framework showing the importance of intersectoral collaboration between human and animal health sectors, and ecosystems. Source: United States Geological Survey (2023) (USGS, 2023). The diagram features three overlapping circles representing human, animal, and environmental health. Each circle includes annotations detailing how challenges in that sector can lead to infectious or toxicologic diseases. The overlapping regions visually emphasise shared risks and interconnections among the sectors, while directional elements indicate the bi-directional influence between them.



Organisations such as the World Health Organisation (WHO) and the European Centre for Disease Prevention and Control (ECDC) actively promoted the One Health framework in recent years. Their efforts focus on reinforcing disease prevention, preparedness, and emergency response to improve global health security (ECDC, 2024; World Health Organisation, 2025).

Key stakeholders within the One Health framework include public health authorities, veterinary services, agricultural agencies, environmental organisations, and community groups (Adisasmto et al., 2022). These groups bring complementary knowledge and resources, strengthening prevention and response strategies to make them more effective and equitable. The engagement of the community groups is essential to promote risk-reducing habits and attitudes, but also to timely detect and contain disease

outbreaks (Adisasmitho et al., 2022; Hayman et al., 2023). Altogether, by mapping the relations and interactions between community members and stakeholders, the framework can reveal weaknesses in surveillance, communication, and collaboration across disciplines (Brown et al., 2024; Hayman et al., 2023; Lebov et al., 2017; Lerner & Berg, 2015).

3. Informed Consent

Risk assessment of infectious diseases with a pandemic potential in the Caribbean (RiCa)

This research will help to control and prevent a range of infectious diseases on Aruba and the Caribbean as a large. This project is implemented in collaboration with the Wageningen University & Research (NL), the University of Aruba, and the Department of Public Health (DVG) Aruba. The Advisory Board of this project consists of the Caribbean Prevention Center (Fundashon Prevenshon), CARMABI foundation, and the Ministry of Public Health, Well-being, and Health of the Netherlands.

Explanation of written consent

For research with human participants, it is important to obtain informed consent in advance. We would like to receive – preferably - written consent prior to participation in this study. Before you can give consent, we would like to provide you with additional information about the objectives of the study, and any advantages and disadvantages. The study will take approximately one hour, including an explanation of the study and Informed Consent.

Background and objectives of the study

As experienced during the corona pandemic, the risk of an outbreak by an infectious disease is present. Aruba has also been affected by the pandemic. In addition, there are local outbreaks of dengue fever on the Caribbean islands. Everyone is therefore at risk of contracting infectious diseases, which can lead to outbreaks with serious consequences. It is therefore important to evaluate the risks of transmission due to groups of infectious diseases, so that targeted prevention strategies can be applied in collaboration with local policy makers. This study is intended to inventory the risks that certain individuals, households, and communities encounter with certain groups of infectious diseases across Aruba. We would like to perform the inventory by means of a survey and/or a focus group. With your permission, we would like to link the survey to an observation of your house

premises (incl. garden) to see if there are any environmental risk factors present (e.g. stagnant water in plant pots).

This study is commissioned by Wageningen University & Research (WUR, The Netherlands), in collaboration with the University of Aruba, the Caribbean Prevention Center (Organization Fundashon Prevension), and Carmabi Fundation. The study is funded by ZonMW Netherlands in the context of pandemic preparedness. This study has received approval from the WUR Ethical Review Committee for non-medical research involving human subjects and meets the requirements of the Dutch Ethical Code for research in the social and behavioural sciences involving human participants.

What is expected of you as a participant?

You have been approached because we would like to invite you for an interview that will last approximately 45 minutes. We will start the interview with some demographic information, such as year of birth, your family situation, and some questions concerning your economic status. We would like to continue the survey questions by asking about clinical symptoms that you or your family members may recently have experienced. Furthermore, we will ask questions about risk factors for contracting infectious diseases, including hygiene measures, drinking water use, food preparation, the presence and use of natural water sources, your living situation and environment, and your contact or proximity with (wild) animals. For most questions, you can give the best fitting answer. There is usually space for additional explanation if you wish (under 'other'). We would like to emphasize that participation in this study is voluntary, and that you can stop the interview at any time during the study. If you find certain questions inappropriate, you are free to indicate that you would rather skip the question, without having to provide an argument. If you would like to withdraw your survey after consideration, please contact the Principal Investigator of the project (see below).

Are there any benefits to participating?

We will share an infographic with all participants, if desired, by email at the end of the study. The infographic shows the most important results of the study and will also discuss which group of infectious diseases individuals, households and communities are most at

risk for due to environmental factors or individual risk factors. The infographic will briefly discuss how the most important group of infectious diseases can best be prevented by yourself and your household. This knowledge can be used by you and your family to take the appropriate measures against contracting the infectious diseases mentioned. In addition, the aim is to share the results of this study with local policy makers in Aruba. Your participation in this study therefore also helps the local government and health services by focusing more specifically on certain prevention strategies in certain communities, and by strengthening surveillance, if possible and where necessary.

Are there any risks associated with participating?

There are no risks associated with your participation in this study. A disadvantage for you may be that the interview will take some of your time. You may experience some discomfort if we ask about your financial situation, or you may experience some stress or anxiety as you are made aware of the possible risks of transmission of infectious diseases. How is your information handled? As researchers from the Wageningen University & Research (WUR) and the University of Aruba, we make sure your data is safe. We will store data that can identify you, such as your email address, date of birth, gender, zip code or residential location, family situation, and salary scale, separately from the other data (not relevant for stakeholder interviews and focus group discussions). All your information will be given a unique identity (ID) number. When we work with your information, we will only use that ID number. We will store all data in a secure environment at WUR for a duration of max. 5 years. We will pseudonymize your data prior to analyses. This Informed Consent will also be stored in a secure environment and will not be shared with anyone else outside WUR. The data obtained from the University of Aruba will be handed over to WUR, and the University of Aruba will use pseudonymized data for training purposes up till December 2024. After this, only the principal investigator will have access to the traceable information. Any other researchers who will work with the data will not be able to link the research data to participants. In short, during the further processing of the interviews, such as the analysis or sharing of the results, no information that can be traced back to the participant will be used.

Disclosure

Pseudonymized and aggregated results of this research will be processed in an infographic, in a scientific publication, and possibly shared at meetings. Possibly quotes from the interview could be used in publications, but these quotes will not make the participants recognizable, for example by using fictitious names.

What should I do if I have questions about the study or change my mind?

If you have any questions after reading this information or at any time after the interview, you can contact the principal investigator of the study. Participants can withdraw from the study during or after participation. You may request that your data be removed from the study during the interview or afterwards if you so desire.

BEFORE YOU FILL IN....

Thank you for participating in the RiCa study. You are participating in a Focus Group discussion with other community members. We are interested in your common ideas, knowledge, perceptions, and opinions. We would therefore encourage you to enter the group discussion with your peers. The Focus Group discussion will take between 60 to 90 minutes.

SOME POINTS TO NOTE:

- › We will need to receive your explicit oral or written approval to participate in this Focus Group Discussion, stating your name and approval.
- › If interested, you can receive a document with the full Informed Consent to read at a later stage.
- › The interview may only be conducted by the person who provided the Informed Consent or gave verbal approval (with recording).
- › Your name will not be used for the analysis of your answers.
- › We are interested in YOUR opinion and experiences. There are no right or wrong opinions or perceptions.
- › This Focus Group discussion will be audio recorded in order to transcribe into written text at a later stage.

Informed Consent provided by:

1. Candidate I
 - a. Name:.....
.....
 - b. Date:
.....
 - c. Signature:.....
.....
2. Candidate I
 - a. Name:.....
.....
 - b. Date:
.....
 - c. Signature:.....
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3. Candidate I
 - a. Name:.....
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 - b. Date:.....
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 - c. Signature:.....
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4. Candidate I
 - a. Name:.....
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 - b. Date:.....
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 - c. Signature:.....
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5. Candidate I
 - a. Name:.....
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 - b. Date:.....
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 - c. Signature:.....
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4. In-depth interview (IDI) guide for stakeholders

Definitions

Infectious diseases are caused by microorganisms such as bacteria, viruses, parasites, and fungi. These microbiological pathogens are spread through contact with other people, contact with animals, insect bites, or via food.

Groups of infectious diseases: this research is primarily interested in groups of diseases that may lead to local or emerging outbreaks of pandemic potential. We consider primarily the following groups of infectious diseases in the RiCa study: airborne, water-borne, vector-borne, and zoonotic disease pathogens.

Sample questions

Professional position

- What is your current role within this organisation?
- Could you explain how you are involved in infectious disease control, prevention, or hygiene?
- Are you specialised in the management and disease control of a group of diseases? If so, which?

Perceived community risk

- In your opinion, what are the primary drivers of the health-related problems for the population of Aruba?
- Are there underlying causes that are not being sufficiently addressed?
- If you think back about this past year, which (group of) infectious diseases has been most common on Aruba?
- What about the infectious diseases that caused highest disease burden?
- Is there an infectious disease that you would consider that could cause a local, or even a pandemic or outbreak?
 - If yes, which one?
 - Why do you think of this infection?
 - What about viral infections that may mutate and cause epidemics?

- Are there certain districts in Aruba that may be at highest risk of infectious disease outbreaks, in your opinion?
 - If so, which districts? Why?
- Are there certain demographic populations in Aruba that may be at highest risk of infectious disease outbreaks, in your opinion?
 - If so, which populations? Why?
- Are there certain social determinants of health that are most important in sustaining disease transmission risks in the population?
- On other Caribbean islands, there have been reports of cholera. Is that something you have heard of on Aruba?
 - What about leprosy?
 - Spread of the kissing bug, triatominae?
 - Zoonotic diseases, such as bovine TBC?
 - Schistosomiasis or Bilharzia?
 - Avian Flu?
 - Swine Flu?
- Are there any risks or fears of zoonotic disease outbreaks caused by for example:
 - Stray dogs?
 - Rats or other rodents?
 - African snail?
- Do you feel like there is general awareness of the population of Aruba to take individual actions to prevent themselves from attracting an infectious disease?
- Are there other kinds of challenges the population of Aruba face in accessing needed health-care services? Are there other barriers preventing people from getting needed care? (e.g. not knowing where to go, waiting lists, services not available, people not being tested)

Perceived environmental risk

- Are there any environmental settings on Aruba that make communities living close by at increased risks of infectious disease outbreaks? (e.g., salinas (salt-water lakes), mangrove parcs, nature reserves with swamps)

- If yes, which settings are they? Which infectious diseases do you think of?
- Do you think that bird farms, such as ostrich or chicken farms, pose a risk to the public health of the population of Aruba?
- Is there a problem on Aruba of stray trash or (illegal) trashing dump sites?
- Is there a fear within your health institute/organisation for infectious disease spread through stray trash or trashing dump sites?
 - If yes, which infectious diseases?
 - If yes, where are there dump sites located on the island? Can you name districts or specific locations?
 - If yes, what should be changed to reduce waste dumping and prevent potential disease spread?
- Are sewage systems kept clean? On other Caribbean islands, issues related to overgrown sewage systems, or clogged gutters are reported. What is the situation on Aruba?
- Do you think this sewage system can support a future hurricane, without floodings?
- Which infectious disease could cause a local outbreak in the absence of a good sewage system; do you think?
- Is there dumping of sewage in nature reserves on Aruba?
- Could this be an origin of an infectious disease outbreak? Does this pose a public health risk?

Governance and national policy

- What is the current national policy to prevent infectious diseases among the Aruban communities?
- If you think about the COVID-19 pandemic, are you afraid that a new pandemic will arise due to a new or existing infectious disease?
- What type of infectious disease would you be most afraid of and may cause an outbreak, in the context of Aruba? Water-borne, air-borne, vector-borne, sexually transmitted infections, or zoonotic (transmission of an infectious disease due to contact with an infected animal)?

- Do you think health actors on Aruba handled the COVID-19 pandemic well and accordingly?
 - If yes, why?
 - If not, please explain what could be done differently?
- Is there an action, service, programme, or resource, you would like to see initiated to help make Aruba a healthier community? Is there a particular approach that you would like to see implemented to achieve this goal?
- What do you think are the primary strengths of prevention efforts in Aruba? What is working well? (e.g. health care services, public health initiatives and services, programmes addressing social determinants of health)
- Is there a Public Health Law that is being followed in Aruba? Are there elements that could be improved?
- Does your organisation encounter difficulties in the reporting, testing, syndromic surveillance, data sharing of infectious diseases? What about communication and partnership with other health actors on the island?
- What is the biggest challenge - from your perspective - on the prevention and control of infectious diseases transmission on Aruba?
- How would you propose to tackle this challenge?
- What is the biggest challenge - from your perspective - on the diagnosis and treatment of patient presenting with symptoms of an infectious disease?
- How would you propose to tackle this challenge?
- Are there services or programmes that your organisation would like to be able to provide to inhabitants of Aruba, but you are not able to?
 - What are they?
 - Why are you not able to implement these programmes or services?
- Are there any other points you wish to raise concerning risks of infectious diseases on Aruba that we have not yet discussed?

5. Focus Group Discussion (FGD) with community members

Definitions

Infectious diseases are caused by microorganisms such as bacteria, viruses, parasites, and fungi. These microbiological pathogens are spread through contact with other people, contact with animals, insect bites, or via food.

Sample questions

Demographics

- What is your age?
- Do you have children?
- In which neighbourhood do you live?

Perceived individual risk

- Are you afraid of getting an infection in the community where you live?
- Which infectious diseases do you fear will affect you or your family members the most?
 - Why?
- Do you use specific preventive measures in your household?
- Think of sterilising your meat, or milk, or window screens against insects.
- Did you have any family members or friends who became seriously ill in the past year?
 - If so, do you know why they became very sick? Were they diagnosed?
- Are you afraid of infectious diseases transmitted through stray dogs?
- Are stray dogs in Aruba generally aggressive and do you risk a dog bite?
- What type of infectious diseases do you think dogs can transmit?

Perceived environmental risk

- Are there reasons in the environment why you think you or your family members are at risk of certain infectious diseases?
 - If yes, what infectious diseases were they, do you think?
- Do you encounter annoyance of the ostrich or chicken farms in your neighbourhood?
 - If so, do you think that these chicken farms also pose a risk for the transmission of infectious diseases?
- Do you encounter nuisance of stray trash or trashing dump sites?
 - If so, what nuisance do you encounter?
 - Are they close to your house?
 - Do you think this trash sites are an origin for infectious diseases?
 - What should be changed to make this better and prevent disease spread?
- Is there also dumping of sewage in nature reserves or close to your homes on Aruba?
- Would this be an origin of an infectious disease outbreak? Does this pose a risk of infection for you and your family?
 - If so, which infectious diseases do you think of in particular? Which infectious diseases are you particularly afraid of?
 - Does this contribute in some other way to a reduced well-being of you or your family?
- Are you bothered by certain nature reserves in the vicinity of your community, which cause you to suffer from certain insects? For example, saltwater pools? Mangrove forests? o If yes, do you think that these insects can also bring certain infectious diseases?
 - If yes, which infectious diseases do you think of in particular?
 - Which infectious diseases are you particularly afraid of?
 - Do you think that more should be done by the municipality/local policy makers to reduce this risk?
 - If yes, how do you think the risk of disease can be reduced?

- Are there certain plants or trees that you feel attract more insects (e.g., bugs) or wildlife (e.g., rats, mice, possums), which may pose a risk to you of transmission of infectious diseases?
 - If so, which plants or trees are they?
 - Why do you feel these plants/trees are a risk factor?

Perceived governance and national prevention policy

- Do you ever see people from the government helping your community to try to protect you and/or your family from infectious diseases?
 - For example, by spraying insecticides in your village? Or by distributing covers for wells?
- Do you feel that sufficient prevention strategies are being practiced at the community level to limit these risks of transmission of infectious diseases?
- Do you think there is a national policy to prevent infectious diseases among Aruban communities?
 - If yes, what does that look like, in your opinion?
 - If not, what should happen in your opinion?
- Would you like to see more active actions taken by local policy makers or NGOs to protect you and/or your family from a possible risk of contracting infectious diseases?
 - If yes, which infectious diseases do you have in mind?
 - If yes, in what way, in your opinion?
 - If not, why not?
- If you think about the COVID-19 pandemic, are you afraid a new pandemic will arise due to a new or existing infectious disease?
- What type of infectious disease would you be most afraid of and may cause an outbreak, in the context of Aruba? Water-borne, air-borne, vector-borne, or zoonotic (transmission of an infectious disease due to contact with an infected animal)?
- Are there any other risks or certain infectious diseases that we have not yet discussed with you?

6. Codebook

The codebook was constructed through an iterative process that combined both inductive and deductive elements. Initial coding was conducted directly from the data, allowing themes to emerge without imposing a predefined structure. As coding progressed, connections between themes were identified and organised in relation to the three domains of the One Health framework: human health, animal health, and environmental health. This process enabled the integration of diverse perspectives while maintaining coherence within a recognised conceptual structure. In doing so, the codebook provided a systematic yet flexible tool for analysing the interconnected dimensions of infectious disease risks within a One Health context.

Human health

Code ID	Subcategory	Code name	Definition / Description	Example quote
HUM1	Risk perception	Outbreak risk perception	Perceived likelihood and drivers of infectious disease outbreaks.	"So the chance is very high that we will get these dengue viruses imported..."
HUM1	Risk perception	Community risk perception	Community members' understanding of general infectious disease risks.	"Dengue and other diseases are inevitable..."
HUM1	Risk perception	Human disease risk	Specific disease risks related to food, travel, or contact.	"Hotels feed tourists mostly imported food..."
HUM1	Risk perception	Surveillance risk	Gaps or issues in disease monitoring systems.	"We haven't come up with a proper system yet..."
HUM1	Risk perception	Communication barrier	Language, cultural or social barriers affecting information flow.	"I don't know if our communication department has materials in all these languages..."
HUM2	Prevention	Community prevention (human)	Personal or household actions to prevent illness.	"We always take off our shoes, shower, wash hands..."
HUM2	Prevention	Community prevention improvement	Ideas from participants to improve public prevention and awareness.	"Workshops, lectures... sex is still a taboo."

HUM2	Prevention	Vaccination (human)	Views and practices around vaccination for disease prevention.	“You have to vaccinate before you come to Aruba...”
HUM2	Prevention	Prevention barriers	Challenges or gaps that prevent effective public health measures.	“There are signs, but no control if people wash their hands.”
HUM3	Health	Health care access	Experiences and barriers in accessing healthcare services.	
HUM3	Health	General health community	General health conditions affecting susceptibility or response.	
HUM4	Disease	Dengue, Zika, Chikungunya, etc.	Specific infectious diseases categorised by transmission route.	

Animal health

Code ID	Subcategory	Code name	Definition / Description	Example quote
ANI1	Risk perception	Animal disease risk perception	Stakeholder views on zoonotic risks from wildlife, poultry, or imported animals.	“Migrating birds might bring bird flu...”
ANI1	Risk perception	Community risk perception	Community mentions of animal-related risks.	“I avoid contact with stray animals. Our dog is treated by a vet.”
ANI2	Prevention	Pet vaccination	Use of vaccines for pets to reduce zoonotic transmission.	
ANI2	Prevention	Pest control	Measures taken to manage pests linked to disease.	“We change chemicals every few years for pest control.”
ANI2	Prevention	Community prevention (animal)	Community actions related to animal health and disease risk.	“We take our dog to the vet regularly.”
ANI4	Disease	Zoonoses	Diseases of animal origin including bird flu, rabies, etc.	

Environmental health

Code ID	Subcategory	Code name	Definition / Description	Example quote
ENV1	Risk perception	Mosquitoes, ticks, etc.	Recognition of vector-borne risk linked to environment.	"Illegal dumping collects water... these areas harbor mosquitoes."
ENV2	Prevention	Vector management	Strategies to control mosquito and other vector populations.	
ENV2	Prevention	Community prevention (environment)	Household efforts to maintain cleanliness and reduce breeding sites.	"I throw away water, turn over buckets..."
ENV4	Disease	Vector/waterborne diseases	Diseases linked to environmental factors.	

Systems and governance

Code ID	Subcategory	Code name	Definition / Description	Example quote
SYS1	System barriers	Manpower/resources	Lack of trained personnel, budget, or operational capacity.	"Limited manpower and funding is a constant challenge."
SYS2	System coordination	Collaboration	Challenges or strengths in inter-agency and intersectoral collaboration.	"We have good relationships but communication is infrequent."
SYS3	Law and regulation	Notifiable diseases	Legal frameworks around disease reporting and control.	"Adding anything legislative-wise is a huge struggle."
SYS4	Communication	Public communication	Media use, language, trust, and access to health messaging.	"It's difficult to reach certain groups due to education and language gaps."
SYS5	Surveillance & response	Surveillance systems	Monitoring, testing, diagnostics, and outbreak preparedness capacity.	"We only have biosafety level 2 labs... not sufficient for major threats."

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