

CASE STUDY

HOW THE GENDER DIMENSION OF ONE HEALTH HELPS COMBAT OUTBREAKS OF EMERGING AND REEMERGING ZOO NOTIC DISEASES: CASE STUDIES

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When outbreaks of emerging and reemerging zoonotic diseases are discussed, little attention is paid to differential gender impacts, or to gender involvement and roles in different settings during the outbreak. Gender roles shape how individuals' interactions with animals, wildlife, other people and the environment, which influences exposure to zoonotic pathogens. For example, in some rural communities, men may face risks of exposure to emerging pathogens during hunting whilst women who primarily take care of domestic animals may face prolonged exposure to other zoonotic diseases. In some settings, women (and men) lack access to health protection, education or communication with health officials (medical doctors or veterinarians). In some cultures, women are not allowed to speak directly with male service providers, further limiting their access to critical information and services. One Health is a holistic, inclusive approach which should be incorporating a gender lens when considering zoonoses. This includes thinking about the need to create appropriate gender sensitive policies that address disparities in surveillance, response, prevention, detection, and control of the disease (or health issue) being addressed. In this paper, we highlight these issues through several case

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studies that demonstrate the importance of including gender in zoonotic disease response and, ideally, when implementing prevention measures.

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INTRODUCTION

ONE HEALTH (OH) is marked by an emphasis on interdependency, recognizing that “the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.”¹ It goes beyond siloed approaches to offer a framework that emphasizes joint efforts across disciplines including medicine, veterinary science, ecology, and social sciences.^{2,3} Emphasizing this interdependency, the One Health High-Level Expert Panel (OHHLEP), which provides advice to the United Nations’ Quadripartite organizations (Food and Agriculture Organization of United Nations [FAO], United Nations Environment Programme [UNEP], World Health Organization [WHO], and World Organisation for Animal Health [WOAH]), recognizes that several societal challenges have a critical impact on the health and wellbeing of humans, animals, and ecosystems. Although gender inclusiveness is not yet formally listed as a core principle of One Health, the OHHLEP has clearly emphasized its importance in addressing structural inequities that hinder effective health outcomes. Moreover, the United Nations Sustainable Development Goal 5 explicitly calls for gender equality and the empowerment of all women and girls, reinforcing the relevance of gender considerations in health-related strategies. Therefore, given that gender equality is essential to the health of humans, animals, and the environment, there is a critical need to assess the gender dimension of One Health.

Despite the holistic goals of OH approaches, gender dimensions have historically been neglected in its

implementation.⁴ Yet gender is inseparable from how people experience health risks, access health services, and exist within communities, and this depends on the society and culture. Women and men have different roles and responsibilities in agriculture, caregiving, food handling, and natural resource management that influence their exposure to zoonotic pathogens, those that are transmissible between animals and humans, and their ability to respond and comply with health interventions.^{5,6} For instance, in many rural settings, in some parts of Africa (such as Uganda and Kenya, for example), women are responsible for managing poultry or preparing raw animal products, potentially exposing them to zoonotic pathogens including *Salmonella*, *Campylobacter*, variants of avian influenza or *Brucella*. In rapidly intensifying poultry systems, women are often tasked with feeding and cleaning, increasing their contact with antimicrobials and resistant pathogens.⁷ Additionally, in resource-limited communities, caregiving and water collection responsibilities expose women to zoonotic agents such as Rift Valley fever.⁸ In Uganda, practices such as handling raw meat and consuming unpasteurized milk have heightened women’s risk of contracting Rift Valley fever.⁹ While this study does not definitively prove higher incidence in woman, it highlights gendered exposure patterns that suggest increased vulnerability. Addressing these gender-specific vulnerabilities through targeted interventions can enhance disease prevention and promote equitable health outcomes. However, OH policies and research often lack sex-disaggregated data and rarely account for these gender-specific vulnerabilities.^{10,11}

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Gender disparities are also present in stakeholder groups tasked with the prevention and control of zoonotic diseases. Significant barriers to diversity, equity, and inclusion remain within OH programs and global health governance more broadly. Women professionals and professionals from low- and middle-income countries are underrepresented in OH decisionmaking structures despite playing critical roles in fieldwork, lab-based diagnostics, caregiving, and community engagement.^{12,13} These disparities are exacerbated by structural inequalities such as gender-specific barriers including lack of access to funding, limited leadership opportunities, and cultural or institutional biases that prevent meaningful participation in research, policymaking, and resource allocation.¹⁴ While such disparities persist in OH programs, so do drivers of zoonotic disease emergence, including land use change, wildlife trade, deforestation, livestock intensification, and climate change, creating more opportunities for spillover and disease spread.^{15,16} To more effectively prevent and respond to spillover and disease transmission, it is essential to incorporate the gender dimension into OH efforts. Furthermore, limited access to education, particularly among women and girls, undermines governmental disease control efforts by reducing community-level awareness and participation. Women who do not go to school or delay their studies, due to obligation to take care of family or household chores, or get married at early age, have reduced opportunities for higher positions or leading roles.

In this paper, we critically examine how integrating gender considerations into One Health approaches influences the prevention, surveillance, detection, and control of emerging and reemerging zoonotic diseases. Using targeted case studies across a range of zoonotic pathogens with varying transmission dynamics—including viral hemorrhagic fevers, vector-borne diseases, antimicrobial resistance, neglected parasitic infections, and diseases associated with livestock and wildlife—we summarize how gender-specific factors affect vulnerability, health outcomes, and responses, thereby informing more inclusive and effective public health strategies.

DEFINITIONS

One Health

One Health is an integrated, unifying approach that recognizes the interconnection between human health, animal health, and the environment. It promotes collaboration across multiple sectors to prevent and control diseases, ensure food safety, and address public health challenges. This approach is essential in tackling global health threats such as zoonotic diseases, antimicrobial resistance (AMRs), and environmental degradation. One Health is based on the understanding that human, animal, and environmental health are interconnected.¹⁷ The key principles include

interdisciplinary collaboration, disease prevention and control, environmental sustainability, food and water security, climate change. Emerging infectious diseases, climate change, population growth, and growing inequity have made OH more necessary than ever. One Health also plays a role in addressing antimicrobial resistance by promoting responsible antibiotic use in humans and animals.¹⁸

Although the OH concept in a broad sense encompasses the impact on health of agriculture, industries, cities, and societies as a whole, the global OH community—given its origin in the veterinary and medical professions—in the past it was more narrowly focused on infectious diseases, and today besides emerging and existing zoonotic diseases the focus is also on the AMR threat, food safety, biodiversity, climate change, and so on.^{19–21} This narrow focus is also forced by urgency. In emerging economies, where the demand for animal-sourced foods is rising and commercial livestock production is being promoted, there is a risk that historical patterns may repeat. New pathogens and epidemics have often accompanied habitat encroachment, economic development, urbanization, and the expansion of intensive livestock production systems—trends that have been closely linked to agriculture and industrial revolutions since the Neolithic era.^{22,23} Looking at the gender dynamics in the OH context is particularly timely, since the veterinary and medical professions have a long history of technical scientific orientation and male-dominated leadership and culture. However, over the years, the overall gender imbalance has shifted dramatically in healthcare professions.^{24–26}

Gender

Gender is a social construction that is culturally established, and shaped by livelihood challenges.^{27,28} Most societies evolved with agriculture providing a livelihood²⁹ and in different systems gender roles and norms can vary greatly, particularly within livestock systems. For instance, many pastoral systems on the African continent are in essence capitalist patriarchies meaning that men own and decide on assets, such as animals, and women have some control over the fruits of their labor, which usually comprise milk and manure (usufruct rights). This gender division, however, is not rigid and gets adapted to circumstances, such as loss of a spouse, loss of a herd, warfare, climate change, migration limitations, or development interventions.^{30–34} In other parts of the world or in other livestock systems, the meaning of livestock and associated gender roles may be very different. For example, in the Southern Highlands of Tanzania, it is traditionally a man's job to milk the cows. In societies that have urbanized, industrialized, and accumulated wealth, the livelihoods of many have changed and cultures have evolved with these changes, often including changes in gender norms. Since gender roles are part of a society's social structure, providing stability, changes to gender roles or norms are

commonly met with opposing forces that wish to conserve the existing social structure.³⁵ Powerful lessons from development projects show that ignoring or assuming gender roles and gender dynamics can jeopardize interventions or project impacts. This has moved scientists and organizations to compile and work with gender data, documenting good practices, gender mainstreaming and gender norms transformation tools, for example FAO,³⁶ WHO,³⁷ UNDP,³⁸ and The World Bank.³⁹

Zoonotic Diseases

Zoonotic diseases are transmitted between humans and nonhuman animals in both directions, either through direct contact, or indirectly via contaminated environments (such as water, soil), food or vectors. Several human behaviors are described as epidemiological risk factors that increase the probability of cross-species pathogen transmission. These risks relate to cultural practices, socioeconomic factors, population growth, urbanization, global travel, agricultural intensification, ecosystem transformations and biodiversity disruption or losses. Often highlighted is the preference in many cultures for buying food at wet markets, where live animals are sold and slaughtered, increasing potential for contact with zoonotic pathogens. Similarly, communities with indigenous farming practices or dietary preferences are often considered susceptible to new pathogen dynamics of infectious diseases. Very important are the socioeconomic factors such as limited access to healthcare and education, lack of financial capital, general poverty and vulnerability of circumstances, which constrain behaviors that could avoid risky activities and enhance health. With over 60% of known infectious diseases in humans originating from animals, strengthening surveillance and response mechanisms is critical. Accordingly, it is fundamental to recognize context-specific factors and develop OH strategies that take these into account.

CASE STUDY EXAMPLES ON ZOOZOTIC OUTBREAKS AND THE GENDER DIMENSION INFLUENCE

Applying a gender inclusive OH approach includes the creation of gender-sensitive policies to address disparities in surveillance, response, prevention, detection and control of disease (or health). In this section, we present several case studies that are examples of why this approach is a necessity for future measures to predict, prevent, and respond to zoonotic disease outbreaks.

Case Study 1: Analyzing Gender Dimensions to Influence Rabies Prevention

Rabies predominantly affects males due to their higher engagement in outdoor activities and consequent increased

probability of animal bites.⁴⁰ Rabies causes about 59,000 deaths globally each year with around half being children under 15 years of age, particularly boys.⁴¹ Although fatal once clinical signs appear, rabies can be prevented by vaccination (of people and canids) and death can be avoided if therapeutic treatment is given rapidly after a bite from an infected animal. Integrating gender analysis into rabies prevention strategies could address disparities⁴² with key points to be included:

1. Residence – in rural areas poverty and inadequate surveillance limit people's access to vaccines and treatment, leading to underreporting of rabies cases.^{43,44} Traditional gender roles often restrict women's access and involvement in health advice, highlighting a need for targeted educational programs.^{45,46}
2. Cultural practices and dog ownership – men often take the lead in decisions about livestock management and vaccination while women look after household pets, and are typically responsible for children, who are most vulnerable to dog bites.⁴²
3. Healthcare access – women often recognize health risks but face barriers to seeking care due to social and economic challenges. Gender sensitive health policies can improve access to postexposure prophylaxis.
4. Community education and awareness campaigns – gender roles influence participation in health initiatives. Limited education can reduce awareness of rabies prevention, and women often have less access to vital information.^{45,46} Educational campaigns involving men and women with tailored gender messages can enhance awareness and engagement.
5. Impact of socioeconomic status – economic factors intersect with gender, affecting affordability pet vaccination. Women, particularly in lower-income households, may prioritize household needs over pet care.⁴² Economic support programs for pet vaccinations can help mitigate this issue.

Analyzing gender dimensions reveals hidden barriers that hinder women's access and participation in rabies control programs and revealing these can improve health outcomes for all.

Case Study 2: Gender-Sensitive Approaches for Control of Highly Pathogenic Avian Influenza in Poultry

Poultry plays a vital role in livelihoods across many cultures,⁴⁷ but production systems and gender roles vary widely. Typically, women and children manage village poultry, while men dominate small-scale intensive systems.⁴⁸ These differences shape access to information, health-related resources and exposure to zoonotic disease

Additionally, exposure to health risks can be influenced by gender.^{49,50}

In Egypt, for example, women's responsibilities for poultry care and carcass handling were associated with higher rates of incidences of highly pathogenic avian influenza (HPAI) among women.⁵¹ While this suggests a link between gender roles and disease exposure, causality has not been fully established. Despite such evidence and findings, gender considerations were largely overlooked and absent from initial HPAI H5N1 outbreak response in Southeast Asia, where male-dominated health sectors prioritized technical solutions over social dynamics.⁵² Understanding how gender, culture, and education affect poultry, the ownership and access to services are crucial, for effective disease control.⁵³ Incorporating gender- and culturally sensitive dialogue can uncover key concerns, including disease transmission pathways, risk perception and livelihood priorities.⁵⁴

The revised *Global Strategy for the Prevention and Control of High Pathogenicity Avian Influenza (2024–2033)*, developed by FAO and WOA⁵⁵ emphasizes gender-sensitive approach. Objective No. 3 of the strategy focuses on transforming poultry value chains to enhance resilience against HPAI and other disease threats through:

- Establishing gender- and culturally sensitive poultry agrifood system transformation with inclusive, cross-sectorial working groups
- Offering interdisciplinary One Health training and research, and incorporating expertise in risk communication, gender, youth, poultry production, economics, ecology, and public policy
- Encouraging the generation and sharing of risk assessments, studies on avian influenza virus evolution, and gender-sensitive behavior change research within poultry value chains
- Supporting inclusive, gender-sensitive benefit–cost analyses to demonstrate the economic and food security advantages of a systems-based approach to HPAI prevention and control, including strengthening poultry health and production services across small-, medium-, and large-scale production systems
- Ensuring that poultry health and production services are both gender- and culturally sensitive, particularly in underserved areas

By integrating these gender-sensitive strategies, stakeholders can enhance disease prevention and resilience across poultry systems.

Case Study 3: Crimean–Congo Hemorrhagic Fever With Female Patients in Senegal

Crimean–Congo hemorrhagic fever (CCHF) reemerged in Senegal, following the COVID-19 pandemic. CCHF

manifests sporadically, particularly in rural areas where livestock are critical to the local community, notably among the Fulani people. The CCHF virus is primarily transmitted to people by ticks and from handling livestock, particularly at slaughter. Human-to-human transmission can also occur from close contact with blood, secretions, or other bodily fluids of infected persons. CCHF can cause severe hemorrhagic fever with a fatality rate up to 40%.⁵⁶ Historically, awareness of the disease was limited among local communities of livestock keepers in Senegal, with rural women facing increasing exposure risk.⁵⁷

Fulani pastoralist communities are patriarchal, with a culture centered around family livestock keeping in remote areas.⁵⁸ Women take care of the home, animals, and children. In these households, women and children are most exposed to CCHF since they do most of the animal handling and fetch water from sites infested with ticks.^{30,59,60} Women are also the carers of sick people. In these areas, women and girls have limited schooling and have little exchange with the outside world due to cultural norms and the male head of household is the spokesperson for the family. Lack of knowledge about CCHF has caused considerable anxiety, particularly among women.¹¹ Cases have been followed up and interventions for confirming and tracing suspected cases revealed challenges in the medical approach to communities, especially case management and follow-up of affected families.

During outbreak interventions, follow-up activities revealed challenges in engaging affected communities, especially in case management and tracing families. A follow-up study (Fatou Ndoye, personal communication) following interventions revealed that local healthcare staff observed psychological distress symptoms (panic, fear and stigmatization) among victims and their families who reported that isolation and visitation bans imposed during the period of infection exacerbated their distress, causing insomnia and anxiety. Visiting medical investigation teams were commonly accompanied by a high-level delegation, including representatives from the district, region, and Ministry of Health, along with the district doctor and local medical staff. This presence, perceived as excessive, fuels rumors and reinforces collective anxiety. Consequently, the patient's illness quickly becomes known to the entire community, leading to avoidance of the victim's family. This exposure generates negative experiences and leads to reluctance by other families to participate in contact tracing. During investigations, only men were typically called upon to answer questions, with the patient's caregiver (a woman) as his information source. In some cases, male relatives would not allow women to respond to questions or receive medical intervention, without a husband's, son's, or father's approval. These findings highlight the importance of involving female professionals in health investigations and interventions, particularly to facilitate communication with women.

The absence of support and medical follow-up often leaves families to cope on their own after diagnosis, further exacerbating their distress. In addition to medical expenses, there is the cessation of economic activities that generate a precarious daily income. The emergence of the disease frequently results in disruption of economic activities. When a family member falls ill and cannot generate income, resources to cover daily expenses quickly become insufficient. This underscores the need for follow up and could require social workers and livelihood support. From this case study, several lessons are learned:

- Gender and culture sensitivity during medical and veterinary investigations or interventions can be critical for cooperation and compliance. A One Health infrastructure without cooperation or compliance of the patients and people and animals at risk is severely hampered.
- The most vulnerable or most exposed, mostly women, are easily overlooked. Knowledge sharing, education and communication should be targeted at the people most at risk and in the best position to better the outcomes, by cooperating with or providing information, giving care, and so on.
- From a humanitarian perspective, the psychological impact of disease threat as well as medical interventions and measures deserve attention.
- To overcome the previous issues, involve female professionals during any health-related studies or interventions.

Case Study 4: *Tenia solium* Taeniasis/ Cysticercosis Cases Study in Zambia

This case study has been chosen to illustrate how gendered sanitation norms and the division of labor influence the implementation of zoonotic disease control measures such as improved latrine use, which is a sanitation measure that, combined with others, could potentially have implications for many other sanitation-related pathogens. Latrines are a key intervention in controlling *Taenia solium* transmission, which spreads through the fecal-oral route: humans acquire taeniasis by consuming undercooked pork infected with cysticerci, while pigs become infected by ingesting human feces containing *T. solium* eggs. Poor sanitation practices such as open defecation thus play a central role in sustaining the parasite's lifecycle and in human and animal reinfection cycles.⁶¹

This *T. solium* taeniasis/cysticercosis study was conducted in 2010 among the Nsenga ethnolinguistic group in a *T. solium* endemic rural area of the Eastern Province in Zambia.⁶² Embedded in a One Health approach, the objective was to identify possible barriers to control measures and adaptations of strategies to overcome cysticercosis locally. The key findings related to latrines reveal that

seeking privacy and taboos were hindering latrine use and construction. Men expressed reluctance to abandon the open air defecation practice mainly because of toilet-associated taboos with in-laws and grown-up children of the opposite gender.

In our review of sanitation frameworks, we found that shared taboos in the study area were largely shaped by the Nsenga's traditionally matrilineal system. When a couple marries, the husband moves into his in-laws' home. Because of this, men are expected to build their own latrines, as sharing one with their mother-in-law is considered highly disrespectful. This is because the mother-in-law is seen as the source of future descendants. Several norms and taboos must be observed to keep peace and respect in the family. The same taboos exist in patrilineal societies, such as latrine taboos between father and daughter-in-law.

These findings also indicate that in this local context, latrine promotion messages should not only focus on general health benefits. Since the gender division of tasks means that only men were responsible for building latrines, sanitation programs should also be directed to men and address related sanitary taboos to be effective.

From a participatory lens, Tough et al⁶³ recently questioned if sanitation programs, such as the Community-Led Total Sanitation (CLTS) program⁶⁴ also implemented in Zambia, may unintentionally reinforce existing gender inequalities.^{65,66} In such WASH programs the inclusion of women is essential, as they are typically responsible for maintaining domestic hygiene and procuring water at the household level.⁶⁷ However, the gendered outcomes of participatory approaches are often overlooked. Evaluations tend to rely on quantitative measures, failing to capture the depth of participants' motivations, the nature of their involvement, and whether their participation is genuinely meaningful across different groups.⁶³

Lessons learned from this study are the following: (1) sanitation strategies must be gender-responsive and culturally appropriate and sensitive to be effective in zoonotic disease control; (2) men should be directly engaged in programs addressing latrine construction, particularly in context where cultural norms assign them that role; and (3) participatory programs must be critically evaluated to avoid reinforcing gender inequalities and to ensure that women's engagement is meaningful and empowering.

Case Study 5: One Health Surveillance Systems and Gender in Guinea

The development of One Health surveillance systems has yet to be critically examined through a gender lens. While gender norms significantly shape exposure to zoonotic disease, gender also influences participation in health surveillance activities such as observing, monitoring, and reporting within community-based systems. For example, considering the sexual division of labor is essential to improving the

effectiveness and inclusivity of epidemiological surveillance. To address this issue, a study in Guinea under the AFRI-CAM project is examining gender dynamics.⁶⁸

In Guinea, a national One Health platform was created in 2017. One Health surveillance is implemented at the national level by 3 institutions under the supervision of the Ministry of Health, the Ministry of Livestock and Animal Production, and the Ministry for the Environment.⁶⁹ These institutions are represented at the regional, prefectural, and local levels. At the community level, various actors contribute to surveillance activities including community health agents (for human health), breeders, hunters, and conservation agents.

In February 2025, during a 2-week training course on One Health (DOPERAUS project), a session on integrating gender was delivered at the Centre de Recherche et de Formation en Infectiologie de Guinée. The training reached 24 regional and prefectural surveillance agents, including 6 women. Insights from the group discussions were collected by a CIRAD-affiliated anthropologist and are presented here as exploratory data, with participant consent. At the regional and national level, participants stated that women had less access to university, and, therefore, the fewer qualifications required for employment in surveillance roles. At the community level, the majority of agents involved in the surveillance activities were men.

Some barriers were highlighted, such as women's role in domestic work, which limited their ability to participate in disease surveillance activities. Coyle et al⁷⁰ also showed that women performed more tasks involving direct human contact tasks in addition to greater burden of household chores compared to men. Participants highlighted that husbands often prohibited their wives from engaging in surveillance activities at night, and that many women are unable to leave the household to join vaccination campaigns across regions. Women are more frequently assigned to work in Conakry (the capital). Furthermore, participants observed that women were often less informed and rarely invited to assemblies. Women are often less exposed to extension messages, even when these messages relate to activities they are primarily responsible for.⁵³ One participant, a young man of approximately 25 years of age noted that men tended to benefit more from development projects than women because they were more familiar with how to respond effectively to project criteria. Finally, participants made recommendations, such as involving women's associations and training women so that they can be a part of the surveillance.

Lessons learned from this case study were the following: (1) gender norms can seriously limit women's participation in community-level surveillance roles, (2) women's social roles restrict their mobility and access to information and lead to institutional exclusion, and (3) women's participation in One Health surveillance systems, involving women's associations and organization of trainings is needed.

Case Study 6: The Nipah Virus Outbreak in Kerala, India

In May 2018, fear gripped Kerala's Kozhikode district as a mysterious illness spread. Initially isolated, cases of high fever, confusion, and breathlessness soon turned deadly. Families watched in horror as their loved ones slipped into comas. The culprit was Nipah virus. The first patient, a young man caring for his sick family, developed acute encephalitis. His condition worsened rapidly, and soon his relatives showed the same symptoms. When test results arrived from the National Institute of Virology, Pune, Nipah was confirmed—a deadly virus with no vaccine or cure.^{71,72} Kerala had never encountered it before.

The Government acted swiftly, establishing containment zones and placing villages under lockdown. Over 2,000 people were placed under surveillance. Healthcare workers in protective gear traced every contact of infected patients. Despite the risks, doctors and nurses worked tirelessly. Public health investigators, including veterinarians, clinicians and epidemiologists found that the virus came from fruit bats, which thrived in Kerala's lush greenery. Fruits left half-eaten near patient homes were likely contaminated. As days passed, the number of cases declined. Isolation, strict hygiene, and public awareness campaigns helped contain the virus. Within a month, the crisis ended. Seventeen lives were lost, but a larger catastrophe was averted.⁷³ In the 2018 outbreak, women, particularly nurses and caregivers, bore the brunt of the crisis. The healthcare workforce in Kerala is predominantly female, placing them at high risk. The Accredited Social Health Activists, the large women workforce of community health workers in India plays a crucial role in disease outbreaks.⁷⁴ According to health authority data, more than 70% of frontline responders are women who provide care at home, further increasing their exposure.

At the household level, gender norms meant that women were primary caregivers, looking after sick relatives and performing domestic duties despite the dangers. This heightened their risk of infection. Additionally, not all patients receiving care at home were women, but most caregivers were. Many affected women were also breadwinners, and their deaths had long-term financial consequences for families. Psychological distress was another burden, as grieving mothers and widows faced stigma and economic instability. The crisis clearly highlighted the need for gender-sensitive policies in healthcare. Kerala's female healthcare workforce represented over 60% of patient-facing roles during the outbreak, yet access to personal protective equipment and mental health services was initially unequal. Kerala's government, learning from the outbreak, improved protective measures for female health workers and increased mental health support. Public health campaigns began addressing gendered caregiving responsibilities to ensure a more equitable response in future crises.^{38,74}

Nipah returned in 2019 and 2023, but Kerala was prepared. Rapid response, better surveillance, and public awareness ensured containment with minimal casualties. The 2018 outbreak remains a lesson in resilience, quick action, and the interconnectedness of human, animal, and environmental health.

Case Study 7: Integrating Gender-Sensitive Strategies in AMR Control in Ghana

While several interventions have been developed to combat AMR in Ghana, gender-sensitive approaches are often overlooked despite their critical role in ensuring effective implementation. Women, usually primary caregivers, frequently self-medicate or seek informal healthcare services for their children and families, potentially contributing to the misuse of antibiotics.⁷⁵ Social and economic barriers prevent women from accessing proper medical consultations, leading to higher dependence on unprescribed medications.⁷⁶ Men, on the other hand, are engaged in farming and animal husbandry in Ghana and may have a higher exposure to resistant pathogens due to the inappropriate use of antibiotics in farm animals.

To address this, a gender-sensitive approach to AMR control is essential to ensure the success of public health interventions in Ghana. The integration of gender inclusive healthcare policies that address gender-specific barriers is one of the key areas to explore. For instance, mobile health clinics could be deployed in rural areas to provide women with better access to proper medical consultations and prescribed antibiotics.⁷⁷ Since women in rural areas frequently rely on informal drug vendors, strengthening the regulation and monitoring of antibiotic sales is crucial. Providing training and certification for informal vendors can help mitigate the risks associated with the uncontrolled circulation of antibiotics. Furthermore, targeted education campaigns that focus on raising awareness about the correct use of antibiotics among population, including women are essential, like it was done in some previous studies.⁷⁸ Addressing the distinct needs and challenges faced by women can help reduce antibiotic misuse, slow the spread of resistance, and improve health outcomes.

Case Study 8: The Role of Brucellosis in Antenatal Outcomes: A Missing Link

Brucellosis is a bacterial disease which can be transmitted through direct contact or indirectly via raw milk or meat consumptions.⁷⁹ It is an endemic disease among livestock in developing countries, which account for one-third of livestock production in the world.⁸⁰ Brucellosis is a reproductive health threat. Studies show that women with Brucellosis experience significantly higher premenstrual syndrome severity and frequency. The prevalence of Brucellosis in pregnant women ranges from 1.5% to 12.2%, with a

cumulative incidence of 0.42 to 3.3 cases per 1000 deliveries in endemic regions. Among women diagnosed with Brucellosis, 1.5% to 16.9% are pregnant, facing a higher risk of adverse outcomes, including spontaneous abortion (2.5% to 54.5%), intrauterine fetal death (0% to 20.6%), and preterm delivery (1.2% to 28.6%). Pregnant women with Brucellosis have worse obstetric outcomes compared to healthy women.⁸¹

According to FAO data, women contribute approximately 43% of the total labor in the agricultural sector, play a crucial role in livestock management and engagement tasks include regular cleaning, milking, and grazing.⁸² This exposure increases the risk of infection, which can lead to antenatal outcomes.⁸³ The impact of Brucellosis on antenatal health remains largely underestimated, as most existing studies focus only on serological surveillance.

Women in developing countries have limited access to education, which affects their awareness and ability to make informed health decisions. Female livestock handlers often see themselves primarily as homemakers, which contributes to the underreporting of their exposure to livestock-related risks. Veterinary outreach often fails to recognize women as key stakeholders, and communication efforts tend to prioritize male livestock keepers. Moreover, coordination with local maternal health services is limited. To address this gap, it is essential to build the capacity of healthcare professionals, especially gynecologists and maternal and child health workers, to recognize the potential impacts of Brucellosis on women. It is also crucial to include livestock handling as part of the occupational history when registering women for antenatal services to improve outcomes.

CONCLUSION AND RECOMMENDATIONS

Integrating gender sensitivity into One Health approaches to zoonotic diseases is essential for comprehensive prevention, surveillance, control and decisionmaking. Gender inequalities range from disparities in exposure to zoonotic pathogens and access to healthcare, to underrepresentation in decision-making during outbreak response. One Health approaches have increasingly contributed to improving the integration of human, animal and environmental health efforts, and increasingly incorporate gender considerations to deliver more equitable and efficient outcomes.

As we face more emerging and reemerging zoonotic outbreaks and detrimental environmental changes, incorporating gender-sensitive approaches is critical to build a more resilient, inclusive and effective global health response. The case studies presented offer insights into gender dynamics within zoonotic disease management under the One Health framework. They reveal disparities that often go unnoticed in traditional approaches, emphasizing the importance of integrating gender analyses during surveillance, prevention, response and treatment.

These examples highlight the need to incorporate gender dimension into One Health strategies to ensure meaningful participant of all genders to efficiently prevent and control infectious disease outbreaks. Doing so will reduce existing barriers and lead to more effective and equitable public health outcomes.

Our key recommendations are:

1. Greater involvement of gender and culture experts in outbreak prevention and response teams.
2. Universal healthcare promotion, and the implementation of community-based One Health field initiative led and staffed by local actors, particularly in rural and underserved areas.
3. National and international funding prioritization to maintain accessible human and animal health services, ensuring that the most vulnerable—particularly women—can access care and participate in safeguarding public and animal health and preparing strategies with action plans.

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