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Review Article

Bridging Theory and Practice: A Critical Review of One Health Implementation for Zoonotic Disease Prevention

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Abstract

Zoonotic diseases represent a growing global health threat, with approximately 60% of human infectious diseases originating from animals. While the One Health approach recognizes the interconnectedness of human, animal, and environmental health and has been widely promoted as a framework for addressing these threats, its real-world implementation remains inconsistent and under-theorized. This critical narrative review synthesized peer-reviewed articles and policy documents from PubMed, Scopus, Web of Science, and Google Scholar (2004–2026) using a political economy framework to analyze One Health implementation barriers for zoonotic disease prevention. This critical review evaluates the conceptual and practical limitations of One Health, moving beyond descriptive summaries to analyze why sectoral approaches persist despite decades of advocacy. We systematically examine the structural, political, and resource-related barriers that hinder effective integration, including fragmented governance, insufficient funding mechanisms, and lack of standardized metrics for evaluating success. Through critical analysis of case studies (rabies, avian influenza, brucellosis, and antimicrobial resistance), conditions under which One Health interventions succeed or fail is identified. Key gaps in the literature are highlighted, including the need for rigorous economic evaluations, equity-focused implementation research, and integration of climate adaptation strategies. This review concludes that while One Health remains conceptually valuable, its transformative potential will only be realized through fundamental restructuring of institutional incentives, sustained political commitment, and context-sensitive strategies that address underlying social determinants of disease.

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INTRODUCTION

Zoonotic diseases, defined as infections naturally transmitted from vertebrates to humans, constitute approximately 60% of all human infectious diseases and impose substantial health and economic burdens worldwide (Stufano *et al.,* 2025). The emergence of these diseases is driven by complex interactions among human activities, animal populations (both domestic and wildlife), and environmental changes, including deforestation, climate change, urbanization, and intensive agricultural practices (Ghai *et al.,* 2022). While the One Health framework has been advanced as an integrated solution to these challenges, its formalization over a decade ago raises a critical question: why have traditional sectoral isolationist approaches persisted despite widespread recognition of their inadequacy?

While One Health principles formally advocate for balanced integration of human, animal, and environmental health, practice often reveals an anthropocentric drift. Surveillance, funding, and intervention efforts are typically triggered by human health threats, such as spillover events or pandemic potential, rather than by ecological degradation or animal welfare concerns in their own right (Plowright *et al.,* 2024). Consequently, animal health surveillance remains largely instrumental, valued primarily for its utility as an early warning system for human outbreaks rather than for intrinsic livestock or wildlife disease control. Environmental health, the most under-resourced pillar, is frequently reduced to a risk factor mapping exercise for zoonotic spillover. This practical hierarchy means that once a human health crisis recedes, integrated surveillance networks often lose funding and political support, leaving animal and environmental components to operate in siloed, underfunded isolation once again (Strupat *et al*., 2025).

The problem this review addresses is twofold. First, despite more than a decade of investment in One Health advocacy, policy frameworks, and institutional coordination efforts at both

global and national levels, the actual implementation of One Health principles on the ground remains inconsistent and fragmented (Shedeed, 2024). Ministries of health, agriculture, and environment largely continue to operate within their own silos, guided by separate budgets, competing mandates, and disconnected accountability structures. Surveillance systems that track diseases in humans rarely communicate with those monitoring livestock, and neither routinely incorporates environmental data. The result is a persistent gap between what One Health promises and what it actually delivers. Second, and perhaps more troubling, the evidence base supporting One Health effectiveness remains remarkably thin. As Baum and colleagues (2017) documented in their systematic review, fewer than 20% of One Health evaluations employ rigorous economic or epidemiological outcome measures that would allow meaningful comparison across settings. Claims that One Health interventions are cost effective frequently rest on modeling assumptions rather than empirical verification. The practical consequence is straightforward: policymakers and practitioners who wish to invest in One Health approaches lack clear, evidence based guidance on which specific interventions actually work, under what conditions they succeed, and whether the returns justify the required investment.

This review departs from existing literature in three specific ways. First, rather than reiterating well-documented conceptual benefits of One Health, we critically examine the gap between its theoretical promise and practical implementation. Second, we apply a political economy framework to systematically analyze the structural, institutional, and resource related barriers that have limited the transformative impact of One Health. Third, we evaluate the quality of evidence underlying common cost effectiveness claims and identify conditions under which One Health interventions succeed or fail. The central research question guiding this review is the following: What structural, political, and methodological factors explain the persistent gap between One Health advocacy and effective implementation, and what priority actions are required to bridge this divide? Through critical analysis of four case studies on rabies, avian influenza, brucellosis, and antimicrobial resistance, we assess implementation outcomes and distill lessons for future policy and research priorities.

METHODS

Searching Strategy

This study employed a critical narrative review methodology, selected as the most appropriate approach for synthesizing and interrogating literature with the explicit purpose of identifying conceptual limitations, theoretical gaps, and persistent implementation barriers rather than providing exhaustive coverage of all available evidence (Grant and Booth, 2009). A comprehensive literature search was conducted across PubMed/MEDLINE, Scopus, Web of Science Core Collection, and Google Scholar for publications between January 2004 (following the Manhattan Principles formalization) and February 2026. Search strategies combined terms in three conceptual clusters using Boolean operators: (i) "One Health" OR "One Health approach" OR "One Health framework" OR "multisectoral collaboration"; (ii) "zoonotic disease" OR "zoonoses" OR "zoonotic emerging infectious disease" OR "spillover" OR "animal-human interface"; and (iii) "implementation" OR "barriers" OR "governance" OR "evaluation" OR "effectiveness" OR "cost-effectiveness." Inclusion criteria encompassed peer-reviewed articles, systematic reviews, policy documents from multilateral organizations (WHO, FAO, WOAH, UNEP, World Bank), and empirical evaluations of One Health interventions or analyses of implementation barriers published in English, purely descriptive articles extolling One Health benefits without critical analysis, laboratory studies lacking policy dimensions, conference abstracts without full text, and opinion pieces without supporting evidence were excluded. Case studies (rabies, avian influenza, brucellosis, antimicrobial resistance) were purposively selected to represent diverse geographic contexts, pathogen types, and implementation histories, enabling comparative analysis of conditions influencing intervention success or failure. Limitations include the English-language restriction, potential publication bias against unsuccessful initiatives, and the rapidly evolving policy landscape that may outpace full literature capture.

REVIEW LITERATURE

Conceptual Evolution and Persistent Gaps in One Health Implementation

The One Health approach emerged from recognition that human, animal, and environmental health are inextricably linked. However, despite its conceptual appeal, implementation remains fragmented. Institutional arrangements have evolved significantly over the past two decades. The Tripartite collaboration, established in 2010 between the Food and Agriculture Organization (FAO), World Health Organization (WHO), and World Organisation for Animal Health (WOAH, formerly OIE), provided the initial multilateral framework for coordinating zoonotic disease prevention and control (WHO, 2019).

A critical institutional shift occurred in 2022 with the formal inclusion of the United Nations Environment Programme (UNEP), transforming the Tripartite into the Quadripartite alliance. This structural change explicitly acknowledges the environmental dimension of health threats, a domain previously underrepresented in One Health governance despite its fundamental importance to disease emergence drivers such as deforestation, climate change, and biodiversity loss. The Quadripartite subsequently launched the One Health Joint Plan of Action (OH JPA) 2022–2026, which provides a comprehensive implementation framework across six interdependent action tracks: (1) health systems capacity strengthening, (2) emerging and re-emerging zoonotic diseases, (3) neglected tropical and vector-borne diseases, (4) food safety, (5) antimicrobial resistance, and (6) environmental integration (WHO ,UNEP and WOAH, 2022).

Despite these institutional advances at the global level, critical implementation gaps persist at regional and national scales:

Lack of Standardized Operational Frameworks

While numerous organizations endorse One Health principles, there is no universally accepted and consistently implemented operational framework. The launch of the One Health Joint Plan of Action (2022–2026) by the Quadripartite represents a landmark effort to provide such a structure. However, this framework remains relatively new, and its adoption is not yet universal. Consequently, inconsistent application across

contexts persists, making cross-study comparison and meta-analysis difficult (Ghai *et al.,* 2022). Most initiatives remain project based or pilot driven rather than fully institutionalized within national surveillance systems, a gap that the OH JPA explicitly aims to address over the long term.

Kenya and Uganda, both East African nations with similar zoonotic disease burdens, have pursued markedly different institutional arrangements (Kemunto *et al .,* 2018). Kenya established the Zoonotic Disease Unit in 2011, a jointly staffed office within the ministries of health and agriculture that coordinates surveillance and outbreak response for priority zoonoses including Rift Valley fever and brucellosis (Munyua *et al.,* 2019). This co-located model has enabled joint outbreak investigations and shared data systems. In contrast, Uganda's One Health platform, established in 2016, operates as a coordination committee without dedicated staff or budget, relying on voluntary participation from ministry officials who retain primary allegiance to their home institutions (Buregyeya *et al.,* 2020). A comparative evaluation found that Kenya's embedded model responded to zoonotic events 40 percent faster than Uganda's committee based approach, though both countries continue to struggle with sustainable financing (Killewo *et al.,* 2021).

Inadequate Metrics for Success

Existing evaluations of One Health interventions rarely employ standardized metrics. Cost-effectiveness claims, such as those for rabies control (Lavan *et al.,* 2017), are often based on modeling rather than empirical data. A systematic review by Baum *et al*. (2017) found that fewer than 20% of One Health evaluations used rigorous economic or epidemiological outcome measures. The Quadripartite has initiated development of a Monitoring and Evaluation Framework to accompany the OH JPA; however, this framework remains under development and has not yet been widely operationalized at national levels. Without agreed-upon indicators for measuring success, claims of One Health effectiveness remain difficult to substantiate or compare across diverse settings.

Tanzania's rabies elimination program in the Serengeti ecosystem tracked clear metrics including dog vaccination coverage, human post exposure prophylaxis delivery, and confirmed rabies cases in both dogs and humans (Cleaveland *et al.,* 2018). This metric driven approach enabled the program to demonstrate a 90 percent reduction in human rabies deaths over a decade. In contrast, the Philippines' National Rabies Prevention and Control Program, despite legislative mandate since 2007, has struggled to maintain consistent metrics across its more than 1,600 municipalities. A 2021 assessment found that only 38 percent of local government units submitted complete vaccination coverage data, and human death reporting remained inconsistent across provinces (Amparo *et al.,* 2021). Without reliable metrics, program managers cannot identify performance gaps or allocate resources efficiently.

Governance and Institutional Fragmentation

Despite calls for cross-sectoral collaboration, ministries of health, agriculture, and environment typically operate under separate budgets, mandates, and accountability structures. This fragmentation creates perverse incentives: the benefits of One Health interventions often accrue to sectors different from those bearing implementation costs (Häsler *et al.,* 2012). For instance, livestock vaccination programs that prevent human brucellosis require expenditure by agricultural ministries while generating savings for health ministries, a misalignment that discourages investment absent compensatory mechanisms. The Quadripartite structure, while symbolically important, lacks authority to compel national-level integration and cannot directly address domestic budgetary fragmentation.

Mongolia and Azerbaijan are countries with endemic brucellosis transmitted from livestock to humans, yet their governance arrangements have produced divergent outcomes. Mongolia's brucellosis control program operates through the State Central Veterinary Laboratory, which coordinates with the National Center for Communicable Diseases under a formal intersectoral agreement signed in 2010 (Zinsstag *et al.,* 2015). Mass livestock vaccination campaigns reduced human brucellosis incidence from 25 to 8 cases per 100,000 population between 2010 and 2018 (World Bank, 2021). Azerbaijan, by comparison, maintains separate veterinary and human health surveillance systems that do not routinely share data. A 2020 assessment found that human brucellosis cases were reported to the Ministry of Health while livestock vaccination coverage was tracked by the State Veterinary Service, with no mechanism linking the two datasets (FAO, 2020). Consequently, hotspots of human infection could not be traced to specific livestock populations, undermining targeted interventions.

Environmental Drivers of Zoonotic Emergence: A Critical Gap in One Health Implementation

Despite the formal inclusion of UNEP in the Quadripartite alliance and the explicit environmental integration track within the OH JPA, environmental dimensions remain the least operationalized component of One Health frameworks (WHO, UNEP, WOAH, 2022). This is not for lack of evidence. Research published between 2023 and 2026 has substantially advanced our understanding of how anthropogenic environmental change drives zoonotic spillover risk. Yet this growing evidence base remains inadequately translated into concrete surveillance and prevention strategies, a disconnect that undermines the "One" in One Health.

Land use change and habitat fragmentation: Rulli et al. (2025) identified land use change, particularly tropical deforestation for agricultural expansion and urbanization, as the single strongest predictor of zoonotic emerging infectious disease events globally. The analysis found that such changes mediate over 40% of spillover events documented since 1960. Forest fragmentation creates extensive edge habitats where human-wildlife contact intensifies, while simultaneously reducing biodiversity in ways that disproportionately favor competent reservoir hosts (Gibb *et al.,* 2024). Perhaps most critically, these landscape-level drivers operate across administrative boundaries and sectoral jurisdictions, rendering conventional single-sector surveillance approaches structurally inadequate.

Biodiversity loss and the dilution effect debate: The relationship between biodiversity and zoonotic disease risk remains contested, with recent studies refining and in some cases challenging earlier dilution effect hypotheses. Keesing and Ostfeld (2024) synthesized available evidence to demonstrate that biodiversity loss does not uniformly increase disease risk in a predictable manner. Instead, outcomes depend critically on which species are lost from a system and which species persist

or thrive in modified landscapes. Generalist reservoir species, including certain rodent genera like Peromyscus and specific bat families, often flourish in human altered environments, while specialist species with lower reservoir competence decline. This nuanced understanding carries important implications for One Health interventions: conservation strategies must be designed with disease ecology in mind, and conversely, disease control strategies must account for biodiversity impacts. Simplistic assumptions that "more biodiversity always reduces disease risk" are no longer tenable.

Climate change and shifting disease geography: Climate-driven shifts in vector and reservoir distributions are already reshaping the geography of zoonotic disease. Carlson *et al*. (2020) projected that under moderate warming scenarios, climate change will drive over 15,000 novel viral sharing events among mammal species by 2070. Spillover risk is expected to concentrate in high-elevation and high-latitude regions where species assemblages are reorganizing most rapidly as temperatures shift. These are not abstract future scenarios. The 2023-2024 surge in Oropouche virus activity across South America, linked directly to interacting pressures of deforestation and climate anomalies, offers a real-time illustration of how environmental drivers combine to produce unexpected emergence patterns (Pan American Health Organization, 2024).

The implementation gap: Despite this robust and growing evidence base, environmental monitoring remains conspicuously absent from most zoonotic disease surveillance systems. A systematic assessment by White and Razgour (2025) found that fewer than 12% of national One Health strategies include explicit environmental indicators, whether land-cover change metrics, biodiversity indices, or climate projections. Even when environmental data are collected, they typically reside within environment ministries on platforms with limited or no interoperability with health and agriculture surveillance systems. This represents a fundamental failure to operationalize the environmental pillar of One Health. In practice, the Quadripartite's inclusion of UNEP has not yet translated into meaningful environmental integration at the national level.

Emerging frameworks with unrealized potential: Promising approaches for environmental integration do exist. These include Earth observation-based early warning systems that leverage satellite data to monitor land-use change in near real-time (Pettinotti *et al.,* 2024), integrated wildlife health surveillance networks that systematically sample at high-risk interfaces (Watsa *et al.,* 2023), and ecological counterfactual analysis for attributing specific spillover events to antecedent environmental changes (Plowright *et al.,* 2024). However, these approaches remain predominantly research-stage initiatives rather than operational public health tools. Bridging this research-to-practice gap by moving environmental surveillance from academic proof-of-concept to routine public health infrastructure represents one of the most urgent priorities for the next phase of One Health implementation.

CRITICAL ANALYSIS OF EVIDENCE FOR ONE HEALTH EFFECTIVENESS

The existing literature on One Health effectiveness presents a mixed picture, with notable successes in specific contexts alongside persistent implementation failures in others. This section moves beyond cataloging interventions to provide a comparative analysis of four case studies: rabies control, avian influenza surveillance, brucellosis control, and antimicrobial resistance surveillance. For each case, we examine measurable outcomes, identify conditions associated with success or failure, and draw comparative lessons across contexts.

Successes with Caveats

Rabies Control: Beginning in 2003, the Serengeti rabies elimination program implemented annual mass dog vaccination campaigns across 180 villages surrounding Serengeti National Park, achieving mean vaccination coverage of 64 percent (range 53 to 76 percent) across the intervention zone (Cleaveland *et al.,* 2018). The program tracked four core metrics consistently: dog vaccination coverage by village, human post exposure prophylaxis administration, laboratory confirmed rabies cases in dogs, and human rabies deaths. Between 2003 and 2015, confirmed human rabies deaths declined from 4.9 to 0.5 cases per 100,000 population annually, representing a 90 percent reduction (Cleaveland *et al.,* 2018). Economic analysis demonstrated a cost of approximately USD 1,800 per death averted and a benefit cost ratio of 3.2 to 1 when accounting for livestock losses prevented (Fitzpatrick *et al.,* 2016). Integrated programs combining mass dog vaccination, post-exposure prophylaxis, and public education have reduced human rabies in Latin America and parts of Asia (WHO, 2018). However, sustained success requires continuous political and financial commitment; where funding lapses, incidence rebounds. Moreover, these successes occur primarily in middle-income countries with existing veterinary infrastructure; lessons are not directly transferable to low-income settings (Lavan *et al.,* 2017).

Tanzania's success occurred in a geographically bounded, ecologically coherent ecosystem with a manageable dog population and centralized implementation (Mungure, 2017). The Philippines' devolved governance model, while appropriate for an archipelagic nation, created metric blind spots and implementation variability across local government units. This comparison underscores that governance structure, and scale must align with intervention design. Centralized metrics without centralized implementation authority create accountability gaps.

Avian Influenza Surveillance: One Health surveillance network has enabled early detection of highly pathogenic avian influenza strains (FAO, 2017). Yet, surveillance gaps persist in regions with limited laboratory capacity, and control measures such as culling often face social and economic resistance from affected communities. The H5N1 outbreak in U.S. dairy cattle reveals a critical, ongoing failure: surveillance and data remain siloed between animal agriculture and human health sectors (Kamel *et al.,* 2025). This gap persists even in countries with high laboratory capacity, not just in resource limited regions. Consequently, a novel pathway for influenza adaptation and spillover, spreading via asymptomatic or atypically presenting livestock, went initially undetected. This recent challenge dramatically underscores that control measures such as culling are insufficient if they do not address transspecies transmission routes, for example through milking equipment, and face new forms of economic resistance, including from the

dairy industry concerned about milk supply or disclosure (Neumann and Kawaoka, 2024).

Following the establishment of coordinated FAO-WHO-WOAH surveillance networks in 2005, the median time from HPAI outbreak detection to international reporting decreased from 23 days in 2004 to 6 days in 2018 (FAO, 2019). Laboratory diagnostic capacity expanded substantially: the number of national laboratories capable of H5N1 confirmation increased from 60 in 2005 to over 200 by 2020 (OIE, 2021). These metrics demonstrate tangible improvements in global detection capacity.

Despite global progress, surveillance remains geographically and sectorally uneven. A 2022 assessment of HPAI surveillance coverage found that 73 percent of reported outbreaks originated from high income and upper middle income countries, despite lower middle income countries harboring approximately 60 percent of global poultry production (Lai *et al.,* 2022). Within countries, surveillance is heavily weighted toward commercial poultry operations. A systematic review of environmental surveillance studies found that fewer than 15 percent of published investigations included wild bird sampling, and only 8 percent incorporated environmental water sources despite evidence that wetland contamination represents a significant transmission pathway (Ahmed *et al.,* 2023; Hill *et al.,* 2024). Avian influenza surveillance demonstrates that technical capacity building alone is insufficient without aligned economic incentives. Farmers and producers respond rationally to the incentives created by compensation policies. When reporting disease imposes financial losses, underreporting becomes predictable regardless of surveillance infrastructure. This case illustrates the political economy barriers identified in our analytical framework: benefits of early detection accrue to public health and trade authorities, while costs of reporting fall disproportionately on producers.

Control measures centered on mass culling of infected and at risk poultry have faced persistent implementation barriers (Gupta *et al .,* 2021). A comparative study across six countries (Egypt, Indonesia, Thailand, Vietnam, China, Nigeria) found that culling compensation payments averaged only 38 percent of market value, with payments delayed by a median of 67 days after culling. This compensation gap created strong disincentives for reporting: farmers who reported sick birds received delayed partial compensation, while those who sold birds rapidly recovered near full market value. Modeling estimates suggest that underreporting due to inadequate compensation reduced outbreak detection sensitivity by approximately 40 to 60 percent in the countries studied (Moreno and Sulasula, 2024).

Brucellosis Control: Integrated vaccination and surveillance programs have reduced brucellosis in livestock in several countries (Zhang *et al.,* 2018). However, programs frequently fail due to inconsistent vaccine supply, inadequate compensation for culled animals, and weak enforcement of movement restrictions. Mongolia's brucellosis control program operates through a formal intersectoral agreement signed in 2010 between the State Central Veterinary Laboratory and the National Center for Communicable Diseases (Zinsstag *et al.,* 2015). Mass livestock vaccination campaigns using Brucella melitensis Rev.1 vaccine achieved coverage of over 80 percent of small ruminants in targeted provinces. Human brucellosis incidence declined from 25 to 8 cases per 100,000 population between 2010 and 2018, representing a 68 percent reduction (Tsolmon *et al.,* 2020). Economic analysis estimated a benefit cost ratio of 2.7 to 1 over a ten year horizon, with benefits accruing from averted human treatment costs and livestock productivity gains (World Bank, 2021).

Failures and Implementation Gaps

Despite the rhetoric of multisectoral collaboration, numerous One Health initiatives have failed due to:

Non-integrated funding: Siloed funding represents a structural barrier to One Health implementation. Projects funded through single sector agencies, such as agriculture ministries, health departments, or environmental agencies, default to sector specific priorities by design (Strupat, *et al.,* 2025). Consequently, even when projects nominally endorse One Health principles, resources flow toward measurable outcomes within a single sector's mandate, such as livestock productivity or disease treatment, rather than toward cross-sectoral activities like joint human animal surveillance or ecosystem monitoring. The World Bank (2022) report Putting Pandemics Behind Us explicitly identifies this chronic underinvestment in prevention oriented, cross sectoral activities as a key driver of the "panic and neglect" cycle, where emergency response consistently outcompetes prevention for scarce funding. By estimating that annual One Health prevention costs would range from US$10.3 billion to US$11.5 billion, compared to approximately US$30.1 billion per year for pandemic management, the report makes a powerful economic argument that siloed funding is not only operationally inefficient but also fiscally irrational (World Bank, 2022).

Data-sharing barriers: Data sharing barriers represent a persistent operational challenge for One Health surveillance (Meidenbauer *et al.,* 2025). Privacy regulations governing human health data, particularly under frameworks such as GDPR or HIPAA, create legitimate but often inflexible restrictions that conflict with the open data principles needed for cross-sectoral surveillance. Incompatible data systems across agriculture, wildlife, and human health sectors compound this problem, as legacy platforms were never designed to interoperate. Even where technical solutions exist, institutional reluctance to share data, driven by concerns over liability, reputational risk, or loss of control over intellectual property, impedes integration (Redman-White *et al.,* 2023). Consequently, surveillance data that could reveal early spillover signals remain fragmented across sector specific databases, accessible only through informal relationships rather than systematic, institutionalized mechanisms.

Community resistance: Community resistance represents a frequently underestimated barrier to effective One Health surveillance and control(Uchtmann *et al.,* 2015). Top down interventions that fail to meaningfully engage local stakeholders, including farmers, market workers, and community health volunteers, often face non-compliance (Degeling *et al.,* 2015). This resistance may take passive forms, such as underreporting sick animals or delaying notification of unusual deaths, or active forms, including concealment of outbreaks or refusal to participate in culling campaigns. The underlying drivers are often rational responses

to perceived risks: fear of economic loss without adequate compensation, distrust of government authorities based on past coercive experiences, and exclusion from decision making processes that directly affect livelihoods. Degeling and colleagues argue that ethical, participatory approaches that recognize local knowledge and address structural vulnerabilities are not merely adjuncts to technical surveillance but are essential conditions for its success(Weber, 2017).

Antimicrobial Resistance (AMR): A Case Study in Unrealized Potential

AMR requires a One Health response due to antibiotic use across human medicine, animal health and production, and environmental contamination (Ahmad *et al.,* 2023). However, surveillance systems remain largely non-integrated across human, animal, and environmental sectors, and efforts to restrict agricultural antibiotic use face powerful industry opposition. This underscores that technical solutions alone are insufficient without addressing political economy factors. A 2023 assessment of 142 national AMR surveillance systems found that only 23 percent integrated data from human, animal, and environmental sectors into a common platform (Ahmad *et al.,* 2023). Among systems that included animal surveillance, 71 percent sampled only food producing animals at slaughter, with minimal surveillance of antimicrobial use or resistance in live animal populations, companion animals, or wildlife (Ahmad *et al.,* 2023). Environmental surveillance for AMR genes in water sources, soil, or wastewater was included in fewer than 8 percent of national systems (Redman-White *et al.,* 2023).

Political economy of agricultural antibiotic restrictions: Efforts to restrict antibiotic use in animal agriculture face powerful structural barriers. Globally, an estimated 73 percent of all antimicrobials sold are used in food producing animals, with use projected to increase by 11.5 percent between 2017 and 2030 under current trajectories (Van Boeckel *et al.,* 2021). The European Union's ban on antibiotic growth promoters (implemented 2006) demonstrated that regulatory action can reduce agricultural use: total veterinary antibiotic sales in EU member states declined by 43 percent between 2011 and 2020 (European Medicines Agency, 2022).

STRUCTURAL AND POLITICAL BARRIERS TO ONE HEALTH ADOPTION

A fundamental barrier is the mismatch between who invests and who benefits. Vaccinating livestock against brucellosis benefits public health but imposes costs on farmers and veterinary services; without compensation mechanisms, adoption remains low (Horton & Rushton, 2025). Most countries lack formal mechanisms for cross ministerial coordination, and even where One Health committees exist, they often lack decision making authority or dedicated budgets. Zoonotic diseases compete with other priorities, and prevention investments are politically unattractive because benefits are delayed and difficult to attribute, resulting in chronic underfunding of surveillance and preparedness. Resources are mobilized only during emergencies (Yopa *et al.,* 2023).

At the global political level, negotiations for the WHO Pandemic Treaty have exposed North South fractures over benefit sharing. Developing nations argue that sharing viral sequences depends on equitable access to vaccines, while high income countries resist commitments that might delay response or infringe on intellectual property. This asymmetry creates structural disincentives for rapid data sharing, directly undermining global early warning systems. At the local level, top down interventions that fail to engage stakeholders face non-compliance (Degeling *et al.,* 2015), reflecting rational fears of economic loss, distrust of authorities, and exclusion from decision making. Taken together, these barriers reveal that obstacles to One Health adoption are fundamentally political, rooted in asymmetries of power, resources, and trust. Until global benefit sharing mechanisms are resolved and local communities treated as partners, One Health will remain aspirational rather than operational.

Pastoralist communities in northern Kenya rely on livestock for livelihood and nutrition, with close human-animal contact and limited access to pasteurized dairy products creating elevated brucellosis risk. A 2023 serosurvey found human brucellosis seroprevalence of 14 percent among pastoralist households compared to 2 percent in neighboring settled agricultural communities (Ngugi *et al.,* 2023). Despite this elevated burden, national brucellosis control programs prioritize commercial dairy farms that supply urban markets, with pastoralist communities receiving less than 10 percent of veterinary extension services and vaccination resources (Ngugi *et al.,* 2023). This disparity reflects the political marginalization of mobile populations whose electoral influence is limited relative to sedentary agricultural constituencies.

DISCUSSION

This review aimed to explore why the One Health approach, even though it is widely accepted in theory, keeps running into the same practical obstacles when it comes to implementation. Looking across case studies and policy analyses, the evidence points to a recurring pattern, the main challenges facing One Health are not technical in nature; they are rooted in structures and politics. In various settings, what matters most for success isn't scientific expertise or whether interventions are available, but whether governance systems, incentives, and accountability structures are properly aligned between different sectors. This review concludes that institutional design plays a critical role. Looking at comparative examples, One Health approaches tend to succeed when authority, funding, and operational responsibility are embedded within formal organizations. For instance, Mongolia's intersectoral brucellosis program and Kenya's co-located zoonotic disease unit both achieved measurable outcomes largely because collaboration was built into the system rather than left to voluntary cooperation. In contrast, advisory or committee-based models, such as those in Azerbaijan and Uganda, consistently underperform due to a lack of resources and decision-making power. This suggests that the often-praised "multisectoral collaboration" model falls short when it relies more on goodwill than on legally enforceable mandates.

Incentive alignment is a second important realization. The reviewed evidence confirms a continuous imbalance between who pays for interventions and who benefits from them. This disparity is demonstrated by disease reporting systems, livestock immunisation programs, and antimicrobial management. The main advantages go to public health systems or the avoidance of global illness, but farmers, veterinary services, or agricultural ministries are frequently obliged to commit resources. Underinvestment and non-compliance are logical reactions rather than ignorance in the

absence of shared funding models or compensation systems. The avian influenza surveillance instance further demonstrates how reporting is directly undermined by insufficient remuneration regulations, which lowers the efficacy of even highly built surveillance infrastructure. The review also identifies measurement and evidence gaps as a critical constraint. While One Health is frequently described as cost-effective, the supporting evidence remains limited and often based on modeling rather than empirical data. The absence of standardized metrics prevents meaningful comparison across settings and weakens the case for sustained investment. Programs such as the Serengeti rabies control initiative demonstrate that when clear indicators are defined and consistently tracked, both epidemiological and economic benefits can be demonstrated. However, such examples remain the exception rather than the norm. Without rigorous evaluation frameworks, One Health risks remaining a normative concept rather than an evidence-driven strategy.

Another major finding is the continued marginalization of the environmental dimension. Despite formal recognition through the Quadripartite alliance, environmental drivers of zoonotic disease, including land-use change, biodiversity loss, and climate variability, remain poorly integrated into surveillance and policy systems. The evidence shows that these drivers are not peripheral but central to disease emergence. However, institutional separation between environmental, agricultural, and health data systems prevents their effective use in early warning and prevention. This gap represents a fundamental limitation in current One Health implementation, where the "One" remains incomplete in practice. The review further highlights the importance of scale and governance context. Interventions that succeed in geographically bounded and administratively centralized settings do not automatically translate to decentralized or resource-constrained environments. The contrast between Tanzania and the Philippines in rabies control illustrates how governance structure influences data quality, accountability, and program consistency. This finding challenges the assumption that One Health models are universally transferable and underscores the need for context-specific design rather than replication of best practices.

Equity considerations emerge as another critical but under-addressed dimension. The evidence shows that zoonotic disease burden is disproportionately concentrated among marginalized populations, including pastoralist communities and smallholder farmers. However, resource allocation and intervention strategies often prioritize commercially important sectors or politically influential populations. This imbalance reflects broader structural inequities and limits the overall effectiveness of disease control efforts. Addressing zoonotic diseases without addressing underlying social and economic vulnerabilities is unlikely to produce sustainable outcomes. Taken together, these findings point to a clear conclusion: the primary barriers to One Health implementation are rooted in political economy rather than technical capacity. Institutional fragmentation, misaligned incentives, weak accountability structures, and inequitable resource distribution consistently undermine implementation across contexts. Technical solutions alone, including improved diagnostics, surveillance tools, or digital platforms, are insufficient without corresponding changes in governance and financing structures. This review contributes to the existing literature by moving beyond descriptive accounts of One Health benefits to identify the conditions under which it succeeds or fails. It also highlights the need to reframe One Health from a coordination problem to a problem of institutional reform. Future research should prioritize rigorous economic evaluations, comparative analyses of governance models, and implementation studies that explicitly address incentive structures and equity outcomes. However, this review has limitations. The reliance on English-language sources may exclude relevant regional evidence, and publication bias may over represent successful interventions. Additionally, the rapidly evolving nature of One Health policy means that some recent developments may not yet be fully captured in the literature. Despite these limitations, the consistency of patterns observed across multiple case studies strengthens the validity of the conclusions. In practical terms, the implications are direct. Efforts to advance One Health must move beyond advocacy toward structural change. This includes establishing formal intersectoral institutions with authority over budgets, developing shared financing mechanisms that align costs and benefits, implementing standardized metrics for evaluation, and integrating environmental data into routine surveillance systems. Without these changes, One Health will continue to function as an aspirational framework rather than an operational strategy.

FUTURE DIRECTIONS: MOVING BEYOND ASPIRATION TO ACTION

The preceding analysis has documented persistent gaps between One Health advocacy and effective implementation, driven by structural barriers in governance, financing, political prioritization, and equity. This section moves beyond generic calls for "more collaboration" to propose specific, prioritized recommendations with explicit consideration of financial and political feasibility. Recommendations are organized by implementation horizon: short-term actions achievable within existing institutional structures (one to three years) and long-term reforms requiring fundamental institutional change (five to ten years).

Develop and Implement Standardized Metrics: We need agreed-upon indicators for evaluating One Health interventions, including economic, epidemiological, and equity outcomes. Funding should be conditional on using such metrics.

Establish Sustainable Financing Mechanisms: Innovative financing models including cross-sectoral budget pooling, international development assistance targeted to One Health, and results-based financing are needed to address cost-allocation mismatches.

Strengthen Governance Structures: Countries should establish statutory One Health coordination bodies with mandated cross-sectoral membership, dedicated budgets, and accountability mechanisms.

Integrate Equity and Social Determinants: Zoonotic disease risk is concentrated in low-income and marginalized communities (Grace and Cook, 2023). Interventions must address underlying drivers including inadequate housing, limited healthcare access, and reliance on livestock rather than focusing solely on biological vectors.

Incorporate Climate Adaptation: Climate change is altering vector distributions and disease dynamics (Kilpatrick & Randolph, 2012). One Health frameworks must explicitly incorporate climate projections into risk assessments and adaptation planning.

Leverage Digital Technologies: Digital surveillance platforms, artificial intelligence, and integrated data systems offer opportunities to overcome data-sharing barriers, but require investment in interoperability standards and data governance frameworks.

CONCLUSION

The One Health approach represents a conceptually necessary response to the complex drivers of zoonotic disease emergence. However, after more than a decade of advocacy, the gap between collaboration and reality remains substantial. This review has critically examined why: fragmented governance, misaligned incentives, inadequate metrics, and insufficient attention to political economy and equity dimensions. Our analysis of four case studies reveals that interventions succeed under specific conditions (bounded geographic scope, centralized implementation, formal intersectoral agreements, aligned incentives, and sustained domestic funding) yet fail when these conditions are absent. The barriers are not technical but structural and political: cost-benefit misalignment, institutional fragmentation, political invisibility of prevention, and persistent neglect of equity. The prioritized recommendations provide a pragmatic roadmap for translating rhetoric into measurable outcomes. Ultimately, the gap between One Health theory and practice is a political problem requiring political solutions. Until the global health community confronts this political economy dimension with the same rigor devoted to technical interventions, One Health will remain an appealing concept with limited practical impact. The question is whether the global community possesses the political will to operationalize One Health principles before the next pandemic makes the cost of inaction undeniable once again.

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