Integrative Zoology

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Putting Rodents at the Center of One Health Programs: A Narrative Synthesis

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ABSTRACT

Rodents occupy a pivotal position at the interface of humans, animals, and the environment, making them a fundamental component of One Health frameworks. Both commensal and sylvatic rodent species act as reservoirs, amplifiers, and sentinels for a wide diversity of zoonotic pathogens, while simultaneously delivering key ecosystem services that influence biodiversity, nutrient cycling, and landscape structure. Spillover of pathogens between rodents, humans, livestock, and other wildlife occurs bidirectionally, enabling pathogen persistence, evolution, and emergence, particularly in rapidly changing socio-ecological systems. Invasive and synanthropic rodent species can profoundly disrupt ecosystems, contribute to biodiversity loss, and erode dilution effects that otherwise reduce disease transmission. At the same time, rodents serve as sensitive bioindicators of environmental contamination, antimicrobial resistance, and ecosystem degradation due to their close association with agriculture, waste streams, and human settlement. This narrative synthesis argues that rodents should be explicitly placed at the center of One Health programs, particularly within the scope of integrative zoology, which seeks to unify ecological, evolutionary, and health-related perspectives. Drawing on more than two decades of multidisciplinary research, largely from sub-Saharan Africa, this paper synthesizes current understanding of rodent ecology, pathogen diversity, and environmental change, while highlighting the RatZooMan project as an early exemplar of a rodent-focused One Health approach. We expand existing concepts, remove disciplinary silos, and identify future research directions that reconcile zoonotic disease prevention with ecosystem integrity and sustainable development.

1 | Introduction

Much like the paradigm of Ecologically Based Rodent Management (EBRM; Singleton et al. 1999), the practices of One Health have been around for decades, where many communities have inherently applied their core values using an ecosystem approach to health. Since at least the 1980s, scientific publications have referred to human and animal health being influenced by the environment, but the use of One Health as a conceptual framework only started to appear in the early 2000s, bringing together growing discussions around One Medicine, Planetary Health, and EcoHealth (Atlas 2012; Evans and Leighton 2014; Destoumieux-Garzón et al. 2018; Bresalier et al. 2021; Pettan-Brewer et al. 2024). It is around this time that one of the first fundamental research projects on rodents was funded by the European Union, which explicitly aimed to bring together multidisciplinary teams to look at the interactions of rodents across agriculture, health, and the growing connectivity between rural, peri-urban, and urban communities in sub-Saharan Africa (RatZooMan 2003). Starting in 2003, the RatZooMan project did not explicitly refer to One Health but did set out to integrate social anthropological case studies with eco-epidemiological surveys of rodent populations and empirical implementation of EBRM. RatZooMan is arguably one of the first One Health research projects focused on rodents, where earlier applied research on rodents in low-resource communities tended to focus on smallholder agriculture (Stenseth et al. 2003; Swanepoel et al. 2017; Dalecky et al. 2024). With RatZooMan encompassing four European and four African countries and 12 institutions, including government agencies, universities, research institutes, and the private sector, the benefits of working together across such different institutions had to overcome many challenges. RatZooMan achieved many of its scientific goals by the end of its 3-year duration, but one important lesson was that building and integrating diverse skills and perspectives across multidisciplinary teams and countries takes time and is a necessary goal in itself. Through concerted efforts and a degree of good luck, the RatZooMan experience helped build new multidisciplinary rodent research projects in Africa (EcoRat 2009; StopRats 2017; EcoRodMan 2020; RedRoz 2024; OHRatSA 2025). This continuity of funding in parts of sub-Saharan Africa over the past 20+ years has meant that many elements of the rodent One Health nexus are now much better understood. More importantly, new ways of thinking about rodent pest management have been identified through how rodent population management intersects with the drivers of disease spillover, public health, human behavior, and biodiversity conservation.

Despite their centrality, rodents have rarely been treated as focal organisms within One Health policy and research agendas. Instead, they are often addressed within disease-specific or agricultural pest management frameworks (Singleton et al. 2021; Mariën et al. 2024). Furthermore, One Health agendas are often biased in their emphasis on epidemiology of human and livestock health, with relatively little emphasis on environmental or wildlife health, and generally ignore integration of social sciences (Kuhn et al. 2024). This review aims to address these gaps by synthesizing existing knowledge and expanding conceptual integration, with particular attention to African research programs that have explicitly linked rodent ecology, zoonotic disease, and human behavior. Several good reviews are already available on the interactions of rodents and disease (Meerburg et al. 2009; Han et al. 2015; Asante et al. 2019; Dahmana et al. 2020; Hardgrove et al. 2021; Zeppelini et al. 2022; Banda et al. 2023; Basiouni et al. 2025; Duong et al. 2025; Rodriguez-Morales et al. 2025; Shehata et al. 2025), and this narrative synthesis is not attempting to carry out another review. Instead, the objectives of this synthesis are to help the rodent research community put their own work into a One Health context. The direction of both old and new research fields that can put rodents at the center of One Health is discussed.

2 | Methodology, Scope, and Approach

This paper employs a narrative synthesis to examine the role of rodents within One Health frameworks (Figure 1). A narrative approach was selected to enable conceptual integration across disciplines that are rarely combined within a single analytical framework. Rather than addressing narrowly defined questions through formal inclusion and exclusion criteria, this synthesis aims to connect bodies of evidence, identify cross-cutting patterns, and expand conceptual understanding of rodents as organisms linking human, animal, and environmental health. The scope of the synthesis considers commensal, synanthropic, and sylvatic rodent species across rural, peri-urban, and urban environments. Emphasis is placed on low- and middle-income country contexts, especially sub-Saharan Africa, where multidisciplinary research programs have explicitly examined rodents at the intersection of agriculture, zoonotic disease, biodiversity, and human behavior, notably referencing the RatZooMan project and outputs from its successor initiatives. Existing systematic reviews and meta-analyses are used to contextualize findings and situate this synthesis within the broader literature. The analytical structure is organized around several interlinked thematic domains: (i) rodents at the human–animal–environment interface; (ii) rodent diversity and ecosystem function; (iii) rodents as reservoirs, amplifiers, and sentinels of zoonotic pathogens; (iv) the influence of land-use change, urbanization, and climate variability on rodent population dynamics and disease risk; and (v) integrative management approaches including EBRM within One Health systems. These themes are treated as interconnected rather than discrete categories, reflecting the coupled socio-ecological nature of rodent-mediated health processes. Finally, this paper is intended as a conceptual and reflective contribution rather than a prescriptive policy analysis guide. Its primary aim is to support researchers, practitioners, and policymakers in situating rodent-focused work within a coherent One Health framework, highlighting under-recognized linkages and future research directions. By explicitly foregrounding rodents as focal organisms rather than peripheral risk factors, the paper advances integrative zoology as a unifying lens for understanding and managing rodent-associated risks and ecosystem functions in rapidly changing socio-ecological systems. After describing One Health principles as they relate to rodents, the RatZooMan research project is used as an example of how these principles can be put into practice.

3 | Results and Discussion

3.1 | Rodents at the One Health Interface

Rodents (order Rodentia) represent approximately 43% of extant mammalian species, making them the most species-rich mammalian order (Solari and Baker 2007). Their taxonomic, ecological, and functional diversity positions them at the center of interactions between humans, domestic animals, wildlife, and the environment. One Health paradigms that explicitly recognize that human health is inseparable from animal health and shared ecosystems (Queenan et al. 2017; Zinsstag et al. 2023) should exemplify rodents as a key taxon through which these linkages are most evidently expressed.

More than 60% of emerging infectious diseases affecting humans are zoonotic, and rodents contribute disproportionately to this burden as reservoirs of viruses, bacteria, protozoa, and helminths (Keesing et al. 2024). Rodent-borne diseases often emerge under conditions characterized by uncertainty, rapid environmental change, and socio-political complexity, features that typify the current global polycrisis of climate change, biodiversity loss, urbanization, and food insecurity (García-Peña et al. 2021; Duong et al. 2025). An integrative zoological approach is therefore required, combining population ecology, disease ecology, evolutionary biology, landscape ecology, and social sciences to

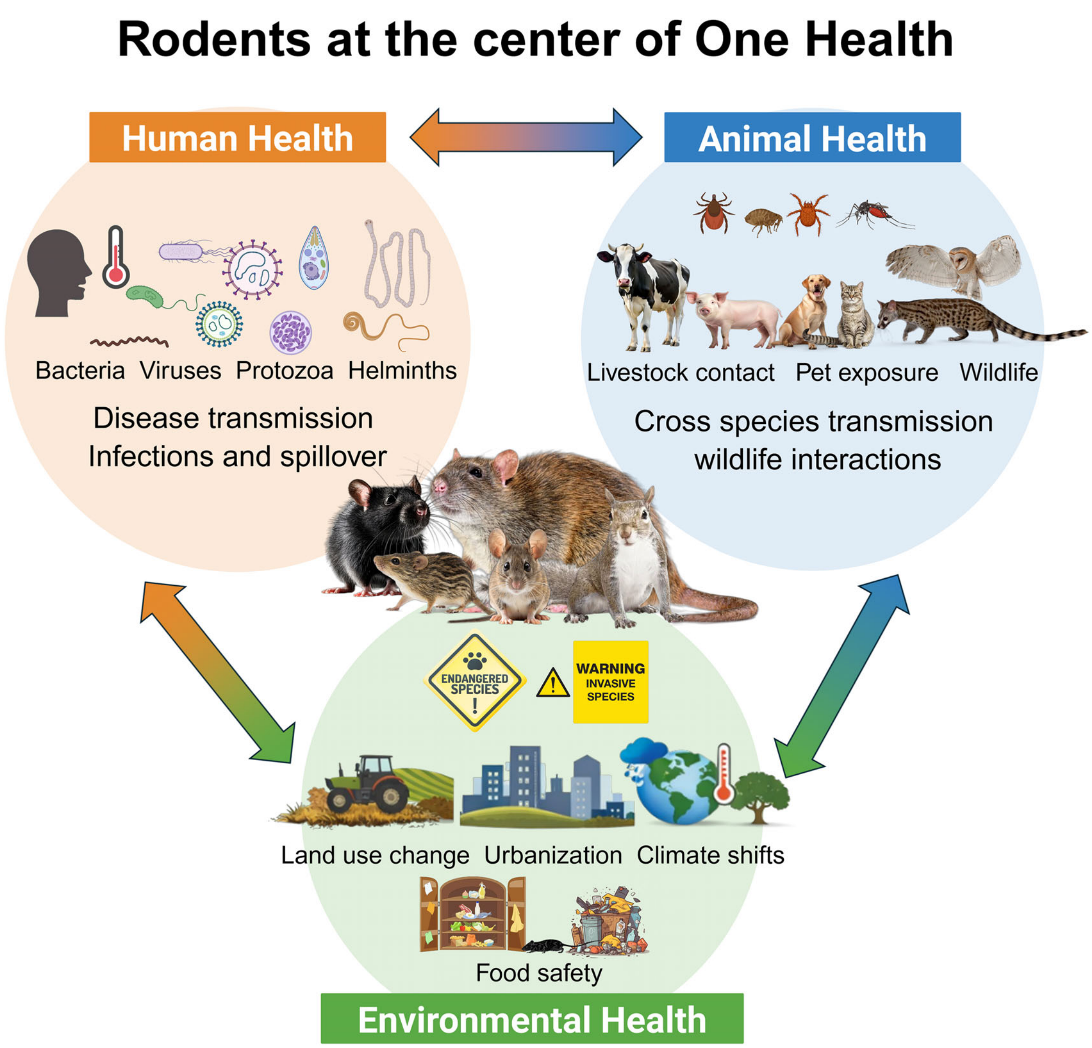

FIGURE 1 | Most One Health programs have constructed Venn diagrams showing overlapping spheres of human, animal, and environmental health. Here, we illustrate how rodents directly impact these spheres, acting as an integrative link at the center of the One Health paradigm.

better understand rodent-mediated health risks and potential management approaches.

Rodents occur across virtually all terrestrial ecosystems, from relatively undisturbed forests and savannas to highly anthropogenic agricultural systems and dense urban centers. This ubiquity allows rodents to act as ecological connectors across habitats and sectors (Morand et al. 2019). While many species provide essential ecosystem services, such as seed dispersal, soil aeration, and trophic support (Dickman 1999), other species, particularly synanthropic rodents such as *Rattus norvegicus*, *Rattus rattus*, and *Mus musculus*, thrive in close association with humans. These species often reach high population densities, increasing contact rates and facilitating pathogen transmission between wildlife, livestock, and people (Ecke et al. 2022).

3.2 | Rodent Diversity and Ecological Significance

Rodents comprise more than 2500 recognized species across 33 families, occupying habitats ranging from deserts and tundra to tropical forests and megacities (Kay and Hoekstra 2008). Their ecological roles are highly context-dependent. Many granivorous and frugivorous species contribute to seed dispersal and vegetation dynamics, while fossorial rodents modify soil structure, water infiltration, and nutrient cycling through burrowing. Larger-bodied rodents such as beavers (*Castor* spp.) are classic ecosystem engineers, altering hydrological regimes, creating wetlands, and reshaping landscapes with cascading effects on biodiversity and disease dynamics.

These ecological functions are tightly linked to disease ecology. Habitat modification by rodents can influence vector abundance, alter microclimates, and change contact rates among hosts (Benedek et al. 2024). Conversely, anthropogenic disturbances that simplify habitats often favor a subset of generalist rodent species that are often highly competent reservoirs for zoonotic pathogens (Morand et al. 2019). The resulting reduction in species diversity may weaken dilution effects, whereby increased biodiversity reduces disease transmission by diverting pathogens away from highly competent hosts (Keesing et al. 2006; Keesing and Ostfeld 2021). Integrative zoology and One Health provide a framework for understanding these dual roles of rodents as both ecosystem service providers and disease reservoirs. Recognizing this duality is essential for developing management strategies that reduce health risks without undermining ecological resilience.

Studies of rodent diversity are extensive, and yet new species are still being discovered, particularly in Africa and other regions of the global south (Monadjem et al. 2015; Krásová et al. 2022; Rowsey et al. 2022). Many conservationists and taxonomists focusing their research on rodents may not realize how their work fits within One Health, and yet this fundamental work is essential to understand the complex interactions between species and how changing landscapes may increase or decrease diversity, bringing together species that may otherwise not normally share resources (Castel et al. 2023). Several studies have particularly looked at how anthropogenic change through transportation, agricultural expansion, deforestation, habitat fragmentation, urbanization, land abandonment, rewilding, and climate mitigation can result in changes in species composition and abundance (Wan et al. 2022; Adamjy et al. 2024; Ventura-Rojas et al. 2025). This churn in species interactions can happen rapidly and frequently with unknown impacts on infectious agent spillover, mutation, and spread.

3.3 | Rodents as Reservoirs of Zoonotic Pathogens

Rodents host a wide array of bacterial pathogens of public health significance, including *Leptospira* spp., *Bartonella* spp., *Borrelia* spp., *Rickettsia* spp., *Yersinia pestis*, and *Francisella tularensis*. These bacteria exhibit diverse transmission pathways, ranging from direct environmental exposure (e.g., contact with urine-contaminated water or soil in leptospirosis transmission) to vector-borne transmission via fleas, ticks, and mites (e.g., Lyme disease and plague). Leptospirosis alone is estimated to cause over one million severe human cases annually, with rodents acting as chronic renal carriers that shed bacteria into the environment (Costa et al. 2015). Plague, maintained in enzootic cycles between rodents and flea vectors, remains endemic in parts of Africa, Asia, and the Americas, illustrating the long-term persistence of rodent-associated bacterial zoonoses (Vallès et al. 2021). Recent molecular surveys in Africa and Asia continue to identify novel *Bartonella* lineages and previously undescribed *Ehrlichia* species (do Amaral et al. 2022; Naitou et al. 2006), underscoring how much of rodent-associated bacterial diversity remains undocumented. The pandemic potential of bacterial diseases has been argued to be overlooked and neglected, where chronic and acute bacterial infections across low- and middle-income countries (LMICs) can be more severe than what is often observed with many viruses (Tshokey et al. 2025). Co-infections are common in rodent populations and may influence pathogen transmission dynamics by altering host immunity, pathogen competition, and vector interactions (Basiouni et al. 2025; Guenther et al. 2012). From a One Health perspective, understanding these multi-pathogen systems is essential for predicting spillover risk (Bordes et al. 2015; Abbate et al. 2024).

Rodents are reservoirs for numerous high-impact viral zoonoses. Hantaviruses, hosted by specific rodent species, cause hemorrhagic fever with renal syndrome (HFRS) and hantavirus pulmonary syndrome (HPS), with case fatality rates reaching 40% in some outbreaks (Jacob et al. 2023; Vial et al. 2023). Arenaviruses such as Lassa virus remain major public health threats in West Africa, with hundreds of thousands of infections annually (Doohan et al. 2024; Garry 2022; Besson et al. 2024). Orthopoxviruses, astroviruses, and paramyxoviruses further contribute to the diversity of rodent-associated viral threats (Leong et al. 2025; Larsen et al. 2022; Shchelkunova et al. 2022). Advances in metagenomic sequencing have revealed an immense and largely unexplored rodent virome. Large-scale studies have identified thousands of viral genome fragments across dozens of viral families, many of which possess genomic features associated with zoonotic potential (Yi et al. 2023). The recent confirmation of zoonotic transmission of rat hepatitis E virus (*Rocahepevirus ratti*) highlights how pathogens previously considered host-restricted can emerge as human health threats (Tene et al. 2025). Although the true reservoir of the mpox virus is not confirmed, it is expected that several rodent species of central Africa are likely involved (Curaudeau et al. 2023, 2025). This raises questions on whether the global spread of the mpox virus could establish itself in rodents in other regions through spillback from humans to rodents (Blagrove et al. 2022; WOAH 2022; McDevitt-Galles et al. 2025).

Rodents also serve as reservoirs or intermediate hosts for a wide range of protozoan and helminth parasites, including *Toxoplasma gondii*, *Trypanosoma cruzi*, *Giardia*, *Cryptosporidium*, *Hymenolepis* spp., *Angiostrongylus cantonensis*, and *Trichinella spiralis* (Rodriguez-Morales et al. 2025). These parasites often circulate silently in rodent populations at the human–livestock–wildlife interface, complicating surveillance and control. Vector-associated protozoa (e.g., Babesiidae) and bacteria (e.g., Anaplasmataceae) further illustrate the complexity of rodent parasite communities (Rar et al. 2020; Xue et al. 2024).

3.4 | Socio-Economics of Human Health and Wellbeing

The socio-economic impacts of rodent infestation are not well documented globally, with some limited context-specific documentation (Meerburg et al. 2009; Singleton et al. 2010; Jacob and Buckle 2018). For example, Diagne et al. (2023) focus on invasive rodents only and report that the costs of rodent invasions reached a conservative total of US$3.6 billion between 1930 and 2022 (annually US$87.5 million between 1980 and 2022) and were significantly increasing through time. Rodent damage to infrastructure related to roads, buildings, and livelihoods is rarely quantified (Almeida et al. 2013). Many socio-economic impacts of rodents are closely linked to poverty and social injustice, where poor housing quality, poor sanitation, housing density, and poverty have been consistently associated with rodent infestations. Many of these conditions are characteristic of impoverished neighborhoods and are beyond the control of individual residents, with control usually resting in the hands of municipalities. Residents of impoverished areas with rodent infestations could inadvertently be suffering from growing incidence and prevalence of chronic health issues associated with exposure to allergens (Wang et al. 2007; Mindaye et al. 2021; Sarker et al. 2025) and mental health issues among already vulnerable populations. A lack of recognition regarding the chronic allergen and mental health impacts of living with rodents can, in turn, create a burden on the healthcare system when the root cause of the problem can potentially be addressed more effectively and efficiently upstream. A handful of studies have pointed to quite serious negative impacts, particularly among vulnerable groups in North America, where rodent presence leads to disturbed sleep, nightmares, fear, rodent bites, and psychological trauma (Lam et al. 2018; Shah et al. 2018; Byers et al. 2019; Murray et al. 2021). Rodent pest issues can be perceived as something to be ashamed of, where often taboos, community pressure, social stigmas, and public perceptions may increase mental health problems, eroding personal agency and social capital (Zahner et al. 1985; de Klerk et al. 2016; Chelule and Mbentse 2021).

3.5 | Land-Use and Climate Change, Agriculture, and Urbanization

Anthropogenic land-use change is one of the most powerful drivers of rodent population dynamics and disease emergence. Agricultural expansion, deforestation, and habitat fragmentation frequently favor generalist rodent species capable of exploiting disturbed environments. These species often achieve high densities in croplands and storage systems, increasing contact with humans and livestock while simultaneously causing substantial food losses (Singleton et al. 2010; Swanepoel et al. 2017).

Agroecosystems thus represent hotspots of rodent-mediated health risks, particularly in smallholder systems where housing, food storage, and livestock are closely integrated, as demonstrated repeatedly across RatZooMan, StopRats, and EcoRodMan project landscapes in Tanzania, Uganda, South Africa, Namibia, Madagascar, and Ethiopia (Swanepoel et al. 2017). Changes in cropping patterns and irrigation can further influence rodent breeding cycles and pathogen transmission (Massawe et al. 2007, 2011; Monadjem et al. 2011; Meheretu et al. 2015; Bett et al. 2017).

Urban environments provide abundant food, shelter, and reduced predation pressure for commensal rodents, with African cities showing clear links between rodent demography, ectoparasite abundance, and zoonotic risk. Poorly managed waste systems and informal settlements facilitate rodent proliferation, increasing exposure to zoonotic pathogens (Garba et al. 2014; Awoniyi et al. 2024; Rahelinirina et al. 2024). Urban rodents harbor antimicrobial-resistant bacteria, reflecting their exposure to human waste streams and raising concerns about environmental reservoirs of resistance (Desvars-Larrive et al. 2019; Vittecoq et al. 2023; Devanathan et al. 2024). Paradoxically, some studies have reported increased rodent-borne hazards in greener urban areas (Blasdell et al. 2022; de Cock et al. 2023), highlighting the need for nuanced urban planning that considers biodiversity, ecosystem services, and health risks together (Gómez-Baggethun and Barton 2013; Taylor and Hochuli 2014; Himsworth and Byers 2026).

Climate change influences rodent–pathogen systems through altered temperature and precipitation regimes, increased frequency of extreme weather events, and shifts in species distributions. Warmer temperatures can extend breeding seasons and pathogen survival, while floods and droughts may displace rodents into closer contact with humans and drive disease spillover (Htwe et al. 2013; Eads et al. 2016). Climatic drivers have been linked to temporal fluctuations in reservoir abundance and infection prevalence (Beermann et al. 2023), reinforcing the need for long-term ecological monitoring.

3.6 | Rodents as Sentinels in One Health Surveillance

Rodents respond rapidly to environmental change due to their short generation times and high reproductive potential, making them effective sentinels for ecosystem health (Achazi et al. 2011; Antolová et al. 2023; Di Bartolo et al. 2024). Systematic surveillance of rodent populations can provide early warning signals for emerging zoonoses, environmental contamination, and antimicrobial resistance. Recent developments in genomic risk ranking (Yi et al. 2023) and machine-learning approaches (Wardeh et al. 2021) allow prioritization of novel viruses based on genomic features alone, offering powerful tools for proactive surveillance when combined with long-term rodent population monitoring platforms (Hayes et al. 2017). Zoological, agricultural, veterinary, and clinical institutions working across agricultural landscapes and urban environments represent critical surveillance interfaces where rodents, humans, and domestic animals intersect.

3.7 | The RatZooMan Project as an Early Case Study in One Health

Acknowledging that several other rodent zoonoses research projects have operated in sub-Saharan Africa (Duplantier et al. 2005; DiffusionPeste 2006; Handschumacher et al. 2021) and globally (Himsworth and Byers 2026; Costa et al. 2021), the RatZooMan project is used as a case study in interdisciplinary One Health research. Initiated in 2003 under the European Commission Framework Programme (EC FP5 2003), the RatZooMan project represents one of the earliest large-scale research initiatives to operationalize what is now recognized as a One Health approach to rodents, despite predating the widespread adoption of the term. RatZooMan explicitly sought to integrate rodent ecology, zoonotic disease risk, agricultural production, and human behavior across rural, peri-urban, and urban landscapes in sub-Saharan Africa. In doing so, it moved beyond sector-specific pest control or disease surveillance to address rodents as socio-ecological actors embedded within coupled human–natural systems.

A defining feature of RatZooMan is its interdisciplinary integration. Social anthropological case studies documented how livelihoods, housing, food storage practices, and cultural perceptions of rodents shaped exposure pathways and management responses (Constant et al. 2020; Williams et al. 2021). These insights were integrated with eco-epidemiological surveys of rodent communities, pathogen prevalence, and population dynamics (Bastos et al. 2011; Massawe et al. 2011; Monadjem et al. 2011), alongside empirical testing of EBRM interventions (Taylor et al. 2008, 2012; Swanepoel et al. 2017). At the inception of the project, the scientists involved in RatZooMan, coming from different disciplines, did not immediately recognize the challenges of working together. Social and natural scientists have their own jargon and methodological approaches to research, which can result in miscommunication and disagreement. For many involved, this process of working across disciplines took a long time to comprehend. However, as the project progressed, the benefits of understanding other viewpoints helped to build team cohesion around understanding the drivers of zoonoses as well as the constraints and opportunities for interventions. This integration anticipated later One Health calls for co-produced knowledge that bridges ecological processes, health outcomes, and social systems.

RatZooMan was also explicitly multisectoral and international. While the scientific outputs of the project were substantial, an equally important outcome was the recognition that building functional transdisciplinary teams requires long-term investment, mutual learning, and institutional trust. This insight has since become a central tenet of inter- and transdisciplinary research within One Health. The challenges of working together across specialisms and institutional remits remain to this day and should not be underestimated. Multidisciplinary team building takes time, time that may not be recognized by the researchers involved or the funders, with implications on the delivery of research activities in highly compressed short-term funding cycles.

Crucially, RatZooMan acted as a catalyst for a sustained lineage of rodent-focused One Health research programs in Africa (EcoRat 2009; StopRats 2017; EcoRodMan 2020; RedRoz 2024; OHRatSA 2025). Successor initiatives expanded and deepened the original framework, building existing relationships while integrating new expertise. These projects refined EBRM approaches, analyzed societal responses to new approaches, incorporated molecular diagnostics and pathogen discovery, and increasingly linked rodent management to biodiversity conservation, ecosystem services, food security, and public health outcomes. Collectively, this body of work has generated one of the most comprehensive empirical foundations for understanding the rodent One Health nexus globally, demonstrating how long-term, place-based research can inform both theory and practice. In retrospect, RatZooMan can be viewed as one of the first operational demonstrations of rodent-centered One Health, anticipating by nearly a decade the formalization of One Health as a global policy framework.

3.8 | Integrative Management and Future Directions

Sustainable rodent management requires balancing zoonotic risk reduction with the conservation of ecological function, a principle formalized through EBRM and empirically tested across African agroecosystems and urban settings. One Health and EBRM work together, but increased awareness about the impact of rodent control on disease transmission should be considered carefully. Reactive lethal control, when applied in isolation, can disrupt ecosystems and may even increase disease risk by altering population structure, immunity, and movement. There is growing evidence that lethal control can exacerbate the prevalence of rodent-borne infections (Lee et al. 2018; Mariën et al. 2019, 2024), although evidence of what that means in terms of spillover risk remains theoretical. In contrast, integrative approaches that address underlying drivers, such as habitat management, sanitation, food storage, urban planning, and reproduction, are more likely to achieve durable outcomes (Friant et al. 2025; Selemani et al. 2026). Recent models highlight that habitat management and sanitation that reduce the carrying capacity of the environment to support rodents can be much more effective in reducing risks of disease transmission (Voinson et al. 2025). The potential use of fertility control may be a solution that can regulate rodent populations more effectively than mortality control. Models suggest this may be the case (Croft et al. 2021); however, real-world trials on how a contraceptive delivered at the population level would impact rodent demographics with respect to migration, resource utilization, and most importantly, disease prevalence are currently lacking.

EBRM aligns closely with One Health principles by emphasizing ecosystem processes, community engagement, and long-term sustainability. Success in inter- and transdisciplinary research has been a feature of EBRM, which depends on integrating ecological, social, and health sciences while actively involving non-academic stakeholders in co-design and decision-making.

4 | Concluding Remarks

Rodents occupy a uniquely central position within One Health systems as abundant, adaptable organisms that connect ecological, veterinary, and human health domains across spatial and temporal scales. Their roles as pathogen reservoirs, ecosystem engineers, agricultural pests, and environmental sentinels underscore the need for integrative approaches that move beyond reactive disease control toward a deeper understanding of underlying ecological and social drivers.

This narrative synthesizes more than two decades of rodent-focused research, with particular emphasis on the RatZooMan program and its successors, to argue that rodents should be treated as focal organisms within One Health science and policy. The accumulated evidence demonstrates that effective management of rodent-associated risks depends on integrating ecological theory, disease ecology, public health, and community engagement, rather than privileging any single discipline (Himsworth and Byers 2026). By embedding rodent management within broader landscape, livelihood, and governance contexts, One Health initiatives can simultaneously reduce zoonotic risk, enhance food security, and support biodiversity.

Looking forward, this review positions rodent One Health as a mature but still rapidly evolving field. Advances in artificial intelligence, genomics, ecological modeling, and participatory research offer unprecedented opportunities to anticipate pathogen emergence and design sustainable interventions. However, realizing this potential will require sustained investment in long-term, interdisciplinary programs and stronger translation of scientific evidence into policy and practice. By placing rodents explicitly at the center of One Health frameworks, this synthesis provides a conceptual foundation for future research, surveillance, and management strategies that are both scientifically robust and socially relevant. By explicitly foregrounding rodents as focal organisms rather than peripheral risk factors, this review aligns integrative zoology with contemporary One Health priorities for prevention, sustainability, and policy relevance.

To achieve meaningful and sustained impact, the field must now embrace the principles of implementation science to accelerate the translation of evidence into routine policy and practice.

Implementation science provides the tools needed to bridge the persistent gap between research and real-world uptake, ensuring that rodent-focused One Health interventions are not only evidence-informed but context-appropriate, equitable, and scalable. By embedding implementation science into One Health research on rodents, the global community can shift from proof-of-concept successes to durable, system-level change. This strategic integration will ensure that emerging knowledge about rodent ecology, pathogen dynamics, environmental drivers, and social dimensions truly informs practice, reducing zoonotic risks, improving human and animal wellbeing, and supporting sustainable ecosystems.

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