ONE HEALTH ATLAS

François Roger
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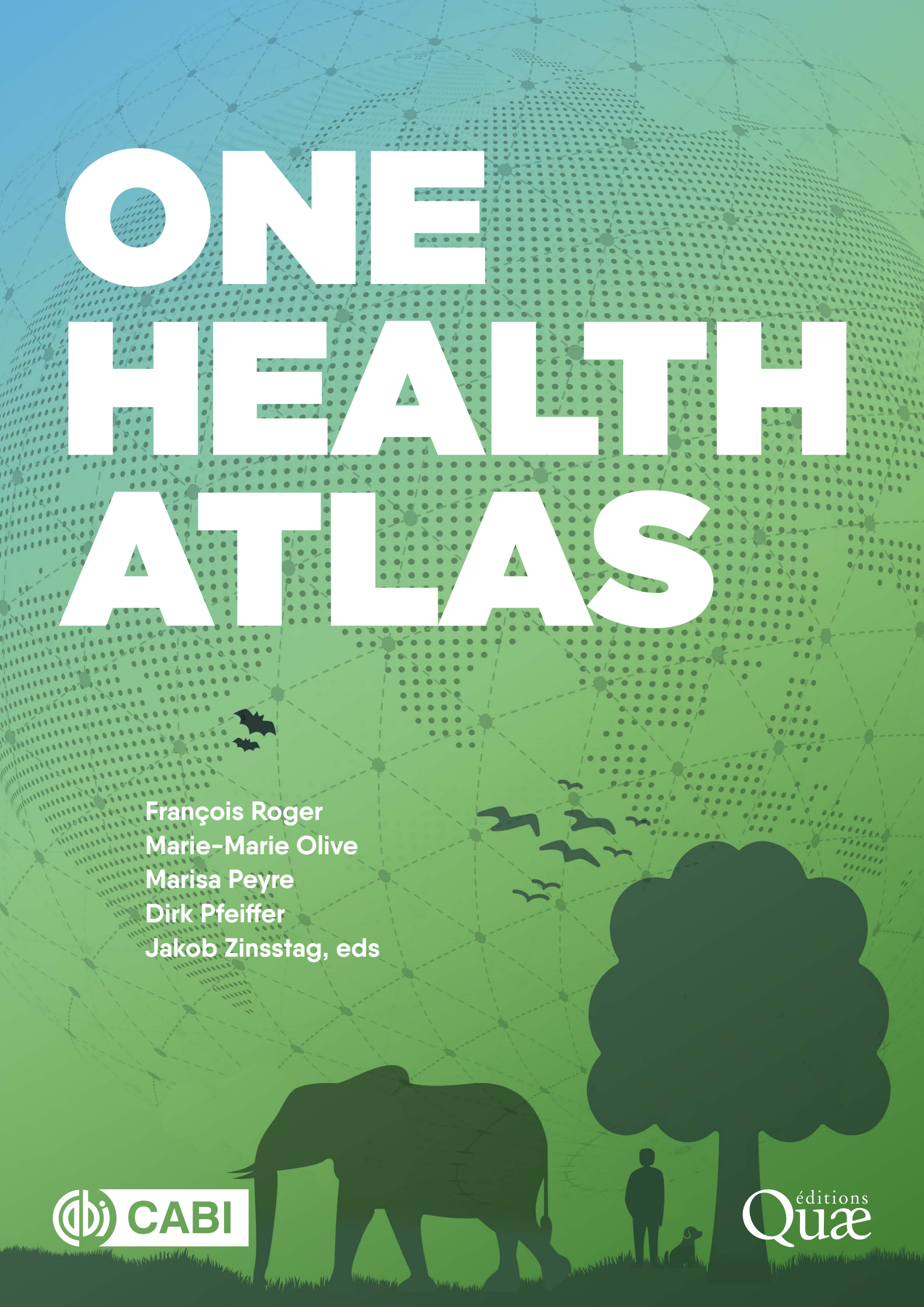
Jakob Zinsstag, eds



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ONE HEALTH ATLAS

Books on One Health

One Health, une seule santé.
Théorie et pratique des approches intégrées de la santé
J. Zinsstag, E. Schelling, D. Waltner-Toews, M.A. Whittaker, M. Tanner, eds.
2020, 584 p.
[One Health: the theory and practice of integrated health approaches, 2nd edition, CABI, 2021]

Sortir des crises.
One Health en pratique
S. Gardon, A. Gautier, G. Le Naour, S. Morand, eds.
2022, 264 p.

Une seule santé.
S'ouvrir à d'autres savoirs
N. Lainé
2024, 80 p.

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Foreword

The One Health approach embodies a long-standing concept: that human, animal, plant and environmental health are interdependent and bound to the health of the ecosystems that sustain them.

It is a collaborative, whole-of-society, whole-of-government approach to understanding, anticipating and addressing risks to global health at the interface between these sectors.

While global actors have long acknowledged the benefits of One Health and, more recently, have formalized partnerships to improve health governance at the international level (such as the Quadripartite Collaboration on One Health, comprising the FAO, WHO, WOAH and UNEP), its implementation remains a significant challenge.

As global health threats become more complex, the need to operationalize One Health at national and local levels has never been more urgent. The COVID-19 pandemic, a public health crisis caused by a virus of possible anim al origin, underlined the validity of the One Health approach in understanding and addressing such threats.

Often used to coordinate multisectoral efforts for prevention, preparedness and response to zoonotic diseases, this approach is critical for the control of priority zoonotic diseases such as rabies, avian influenza, Ebola or vector-borne diseases. Furthermore, numerous cross-cutting issues, such as antimicrobial resistance, food safety, climate change and weak health infrastructure, need to be addressed from a multisectoral and multidisciplinary perspective, which the One Health approach guarantees.

Risk drivers such as climate and land-use change, unsustainable agricultural practices, globalization and the unregulated wildlife trade provide multiple opportunities for pathogens to evolve into new forms, making cross-species spillover events more frequent and intense.

Tackling these major global health risks cannot be done in isolation. It requires the full cooperation of the animal, human, plant and environmental health sectors. By making One Health accessible and actionable, we can build resilient systems that protect human, animal and environmental health alike.

But beyond the concept itself, what we need now is to speak about “One Health in Practice” in a concrete narrative.

This atlas, which illustrates the rationale behind this approach through case studies, illustrations and thoughtful analyses, serves as a valuable reference and a practical guide for a range of stakeholders, including researchers, students, policymakers and practitioners, to better understand and engage with these critical issues. It demonstrates the benefits of breaking down silos to create practical, collaborative solutions that integrate public health, veterinary medicine, agriculture and environmental science as well as economics and social science. As highlighted in this atlas, public–private partnerships, One Health education, networks, governance and the science–policy interface

are particularly effective in supporting the multisectoral collaboration needed for impactful One Health initiatives.

I am pleased that the World Organisation for Animal Health (WOAH) has contributed to several chapters of this project, reflecting how our organization is helping policymakers and stakeholders to envision a future in which human, animal and environmental health systems are mutually beneficial and supportive. We achieve this by setting standards, developing guidelines, gathering scientific expertise, sharing quality data and working with a strong network of partners across sectors.

The full potential of the One Health approach remains untapped because of significant gaps in its operationalization. It must evolve into a systematic way of approaching health governance, enabling the sharing of resources and knowledge, and facilitating coordinated policies and investment.

Governments have a key role to play in embedding One Health in national policies and programmes. But One Health must also be accessible to local communities, smallholder farmers and front-line health workers. Bridging these gaps requires inclusive communication, education and stakeholder engagement.

Operationalizing One Health is not an end in itself; it must answer today's challenges and lead to measurable improvements in health outcomes, economic resilience and environmental sustainability. We share a common goal across sectors: to reduce the risks of zoonotic diseases and pandemics, address priority health threats such as antimicrobial resistance and vector-borne diseases, mitigate the effects of climate change and support development goals.

Governments, international organizations, civil society and the private sector must work together to turn the promise of One Health into a reality that benefits everyone, everywhere.

Illustrations of practical examples of how the One Health approach is being used across sectors worldwide, and its added value to health, the economy and society as presented in this atlas, are important to scale up its uptake.

Together, we can achieve a more integrated, equitable and effective health system that secures our shared future.

Emmanuelle Soubeyran

Director General of the
World Organisation for Animal Health (WOAH)

Preface

The idea for this One Health Atlas emerged from the recognition that, while a wealth of articles, books and studies exists on the subject of One Health, there is still a need for a visual, accessible resource that clearly captures the multifaceted nature of this evolving approach. One Health is inherently multidimensional: it encompasses scientific, political, geographical, economic and social perspectives. A graphical and structured representation, such as this atlas, offers an intuitive way to navigate and understand the interconnected complexities of this integrated framework.

This atlas is divided into four sections, each focusing on a specific dimension of One Health. Supported by theoretical foundations, case studies and practical examples, these sections aim to provide readers with both foundational knowledge and applied insights. Each double-page spread (chapter) is designed to function independently, allowing for flexible use in courses, workshops and various educational settings. The book's structure is further enriched by an introductory chapter that sets the stage for understanding One Health, and a concluding chapter that examines the critical interface between science and society.

One Health is a constantly evolving approach that thrives within a dynamic ecosystem of projects, publications, conferences and collaborative initiatives. It is continually shaped by the dedication of researchers, policymakers, practitioners and communities who are actively pushing the boundaries of this interdisciplinary field. This vibrant environment reflects a growing global acknowledgment of the interconnectedness of human, animal and environmental health.

Governments and institutions around the world are increasingly embedding One Health principles into policies and practices, recognizing its potential to tackle pressing global health challenges such as zoonotic disease emergence, antimicrobial resistance, food security and the profound impacts of biodiversity and climate change on health.

Each part of this atlas reflects this ongoing expansion, showcasing how One Health principles are not only conceptual but also being applied to real-world challenges. By highlighting the contributions of diverse actors—scientists, decision makers and field practitioners alike—this atlas aspires to inform, inspire and advance the global discourse on One Health.

The concepts of impermanence and interdependence in Buddhist philosophy tangibly resonate with the One Health approach. Impermanence is evident in the constant changes affecting ecosystems, pathogens and societal dynamics. Ecosystems evolve under the influence of natural or human-induced factors, such as climate change or urbanization, while pathogens continually adapt by mutation. These transformations highlight the fragility of local and global health equilibria, requiring proactive and adaptive approaches.

Interdependence underscores the close connections between the domains of life and health—humans, animals, plants and ecosystems. This interdependence also extends to the essential cooperation among communities, governments, scientists and organizations to address health challenges. One Health enhances our ability to anticipate crises, adopt systemic perspectives, strengthen resilience and promote international collaboration—key elements for tackling the growing complexity of global health in an ever-changing world.

François Roger
Hanoi—Bangkok, 2025

Traditional glass mosaic from Wat Xieng Thong temple (Luang Prabang, Laos), depicting daily life and human–animal interactions in rural landscapes. These artistic scenes reflect a long-standing cultural awareness of the relationships between people, domestic animals and wildlife.

Acknowledgements

We would like to express our deepest gratitude to all those who contributed to the development of this atlas.

We extend our heartfelt thanks to all the authors for their collaboration and invaluable contributions. Their expertise and dedication have been essential in bringing this work to fruition, enriching it with the scientific and interdisciplinary depth that defines its value.

We also wish to acknowledge the generous financial support of the Agropolis Foundation, whose contribution made this project possible, as well as CIRAD for its additional financial support. Thank you as well to the LabEx AGRO and its joint research unit SELMET, which greatly facilitated the administrative aspects.

We extend our appreciation to the cartography studio AFDEC for their work in creating detailed and informative maps. We would also like to recognize Daan Vink and Thierry Lefrançois from CIRAD for their valuable support.

We are particularly grateful to Teri Jones-Villeneuve for her meticulous copyediting of the English to ensure clarity and accessibility. Our sincere thanks also go to Laetitia Perotin-Meslay for the graphic design, which has given this atlas a cohesive and visually appealing look.

Finally, we would also like to offer a very special thank you to Christelle Fontaine and Anne Dievart at Éditions Quæ for their unwavering support and guidance throughout the editing and publication process.

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Marie-Marie Olive
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Dirk Pfeiffer
Jakob Zinsstag

Introduction to One Health

Jakob Zinsstag, Lisa Crump

One Health is an integrative and systemic concept to understand and improve public health. Its focus extends beyond humans and encompasses the health and well-being of animals (including pets, livestock and wildlife), plants and key ecosystem services. Humans, animals and the environment are all closely linked, and failing to recognize this interconnectedness hinders effective primary prevention of diseases at their source. This interconnectedness is reflected in the spread of zoonotic diseases (infectious diseases transmitted between wildlife or domestic animals and humans), antimicrobial resistance, the effects of climate change on health and the global COVID-19 pandemic. One Health aims to demonstrate the added value of having stakeholders from different disciplines and fields working together to produce new knowledge that would not be possible separately (Zinsstag *et al.* 2015). The added value gained from a One Health approach can be leveraged on various levels depending on the contributors involved. One level is interdisciplinary, where professionals from different disciplines (e.g. human and veterinary medicine and other related disciplines) collaborate to produce additional systems knowledge. This knowledge can then be applied to improve human and animal health, generate financial savings or enhance environmental services through solutions that would not be possible without collaboration. Another level of added value is the co-production of transformational knowledge between academic and non-academic actors (e.g. businesses and communities) in transdisciplinary processes (Zinsstag *et al.* 2023).

An example of the added value that a One Health approach can offer is joint human and animal vaccination services for mobile pastoralists in Chad, where

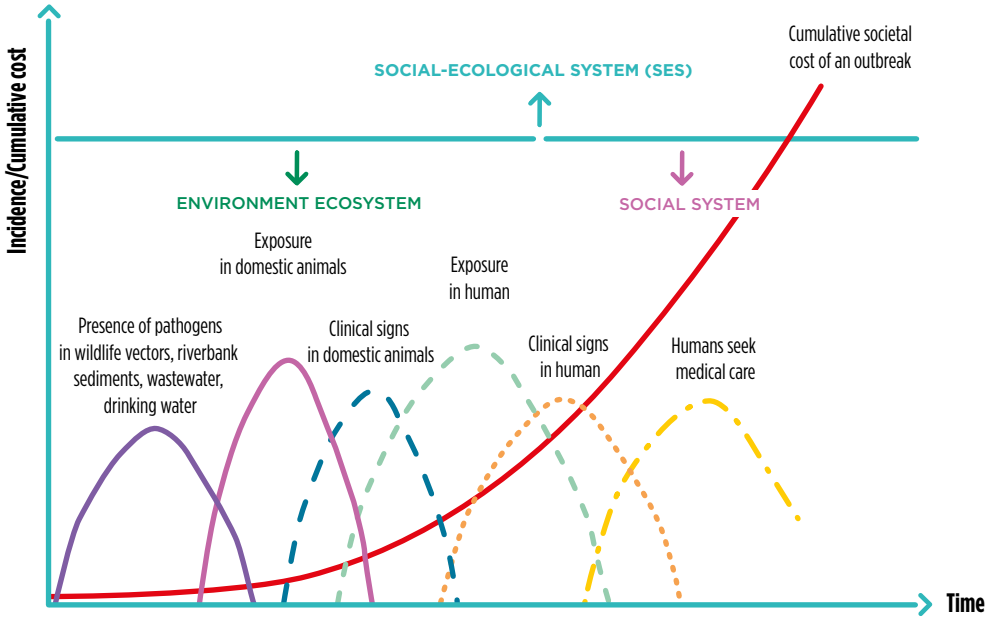

Figure 1. Reported clinical signs allegedly associated to natural SARS-CoV-2 infection in the different animal hosts worldwide.

populations that would otherwise be excluded gain access to healthcare. Because human and animal health services share a cold chain and transport costs, they are able to save costs (Schelling *et al.* 2007). In another example, the benefits of brucellosis control in Mongolia for public health alone were not enough to justify the cost of a mass livestock vaccination campaign to prevent the disease in humans. But when all the benefits of vaccinating livestock for this disease are added up across the health and agricultural sectors, the overall societal benefits of mass vaccination are three times higher than the intervention cost (Roth *et al.* 2003). Shared infrastructure can also produce savings. For instance, the World Bank estimates that the Canadian Science Centre in Winnipeg for Human and Animal Health, which hosts laboratories for highly contagious human and animal diseases under one roof, is able to reduce its operations costs by 26% (World Bank 2012; Zinsstag *et al.* 2018).

Doctors alone can no longer solve all the health problems the world faces today, which range from pandemics to antibiotic resistance and food security. They must join forces with veterinarians and professionals from other

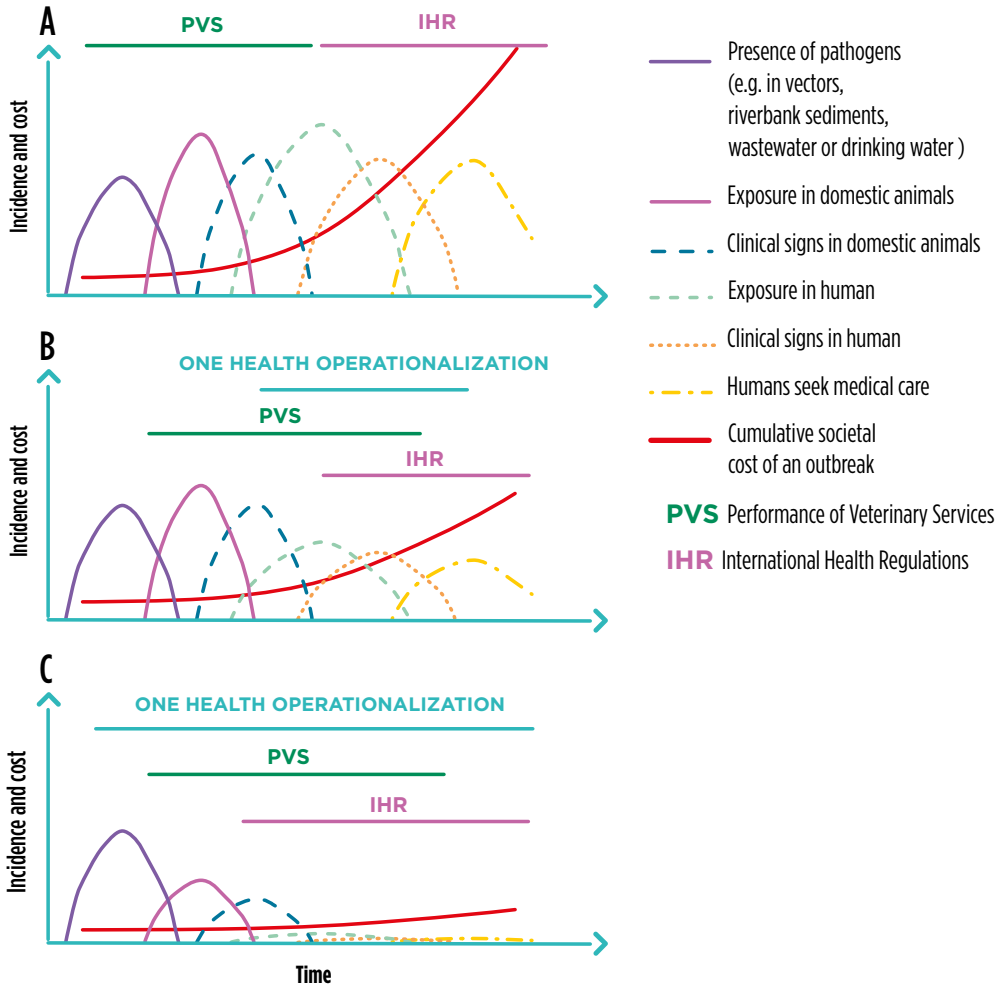

Figure 2. Vision of One Health governance for global health security. From Zinsstag *et al.* 2023.
To better understand interactions between antibiotic resistance in humans, animals and their environment, integrated One Health surveillance–response systems must be expanded to include antibiotic resistance. As soon as antibiotic resistance is detected in one location, all other areas should be quickly informed. This can prevent exposure to antibiotic resistance and reduce the emergence of new resistance. Several countries already have such systems in place, with the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) at the forefront. In this One Health atlas, we provide examples of the benefits of a geographically-based One Health approach with a view to informing scientists, health and government authorities and practitioners. The atlas also shows gaps where the potential of One Health is not yet been leveraged worldwide.

disciplines. In 2012, the World Bank showed how a One Health approach could be implemented (Figure 1; Zinsstag *et al.* 2020). When emerging diseases are observed in wildlife, the associated costs (red line) are low, but they begin to rise as soon as emerging diseases appear in livestock, peaking when humans become ill and infect each other. The COVID-19 pandemic is a good illustration of this type of situation. Preventing or mitigating outbreaks of emerging diseases is possible if we link disease surveillance and response systems to effectively communicate information about the environment, animals and humans. Aside from a few initiatives like the integrated West Nile virus surveillance programme in Emilia-Romagna, Italy (Paternoster *et al.* 2017), most countries still have separate surveillance–response systems for humans and animals. National governments and international organizations play an important role in promoting integrated human–animal–environment surveillance–response systems in their countries and networking to connect them internationally. International collaboration can help prevent or mitigate future pandemics to save lives and curb financial losses. A recent study summarized the evidence of what One Health could do for global health security (Zinsstag *et al.* 2023b). While One Health governance, operationalized at different levels, may not prevent future outbreaks of emerging diseases, it can significantly lower the effects on human and animal health and related costs (Figure 2).

Antibiotic resistance—considered a "silent pandemic"—is another global problem today. Bacterial infections that no longer respond to antibiotics are killing more and more people and animals around the globe, leading to both high treatment costs and significant follow-up costs due to loss of labour. Reasons for this escalating antibiotic resistance are manifold and still mostly unknown. However, scientists believe the frequent misuse of antibiotics, such as when patients do not complete their full course of treatment, and the overuse of antibiotics to promote livestock growth drive antibiotic resistance in humans.

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Foundations and recent history

One Health's foundations trace back to ancient integrative thinking, spanning from the philosophies of Hippocrates to the wisdom of Indigenous knowledge systems. These roots have been enriched by pivotal milestones, such as the One World, One Health Conference in Manhattan in 2004 and the One Planet, One Health, One Future Conference in 2019 in Berlin, which shaped One Health principles and broadened its scope. This section explores the theoretical and historical underpinnings of One Health, highlighting its evolution through key pandemics, from the plague to COVID-19, and its relevance to contemporary zoonotic threats.