

# Understanding Risk Perceptions to Enhance Communication about Human-Wildlife Interactions and the Impacts of Zoonotic Disease

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## Abstract

Inclusion of wildlife in the concept of One Health is important for two primary reasons: (1) the physical health of humans, domesticated animals, and wildlife is linked inextricably through shared diseases, and (2) humans' emotional well-being can be affected by their perceptions of animal health. Although an explicit premise of the One Health Initiative is that healthy wildlife contribute to human health, and vice versa, the initiative also suggests implicitly that wildlife may pose threats to human health through zoonotic disease transmission. As people learn more about One Health, an important question surfaces: How will they react to communications carrying the message that human health and wildlife health are linked? In the absence of adequate relevant research data, we recommend caution in the production and dissemination of One Health messages because of possible unintended or collateral effects. Understanding how and why individuals perceive risks related to wildlife diseases is essential for determining message content that promotes public support for healthy wildlife populations, on the one hand, and, on the other, for identifying messages that might inadvertently increase concern about human health effects of diseased wildlife. To that end, we review risk perception research and summarize the few empirical studies that exist on perceived risk associated with zoonoses. We conclude with some research questions that need answering to help One Health practitioners better understand how the

public will interpret their messages and thus how to communicate positively and without negative collateral consequences for wildlife conservation.

**Key Words:** human dimensions; One Health; risk communication; risk perception; wildlife; zoonosis

## Introduction

### The One Health Initiative

The underlying premise of the One Health Initiative is that the health of humans, pets, livestock, captive animals, research animals, wildlife, and the environments in which they live are interdependent, as indicated in its mission and vision statements ([www.onehealthinitiative.com](http://www.onehealthinitiative.com)):

Recognizing that human and animal health and mental health (via the human-animal bond phenomenon) are inextricably linked, One Health seeks to promote, improve, and defend the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, and other scientific health professionals and by promoting strengths in leadership and management to achieve these goals.

One Health (formerly called One Medicine) is dedicated to improving the lives of all species—human and animal—through the integration of human medicine and veterinary medicine.

Within this inclusive idea of One Health, wildlife matter for two primary reasons: (1) the physical health of humans, domesticated animals,<sup>1</sup> and wildlife is linked inextricably through shared diseases, and (2) humans' emotional well-being can be affected by their perception of animal health, through the human-animal bond.

Including wildlife under the umbrella of One Health helps emphasize that a healthy wildlife population contributes to human health—and at the same time implicitly suggests that unhealthy wildlife may pose threats to human health. This view of the interdependence of human and wildlife health may thus not only encourage the monitoring of wildlife as sentinels for disease, to protect human physical health, but also promote negative attitudes about wildlife.

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<sup>1</sup>In this article this term includes livestock.

Furthermore, some people may regard wildlife as simply a means to improved human health, thereby ignoring the One Health Initiative's mission to improve the well-being of *all* species. Of particular concern is the possibility that some members of the public may perceive wildlife as a threat to humans and domestic animals.

## Assessing Perceptions of Wildlife

As the One Health Initiative expands and garners increasing public attention, how will people react to the message that human health and wildlife health are linked? The answer to this question has a bearing on whether promoters of One Health can achieve their mission, which includes enlisting society to advocate for healthy wildlife populations rather than call for their elimination because wild animals are viewed primarily as disease-carrying pests. Furthermore, public and wildlife professional interest in the economic, safety, and health impacts of human-wildlife interactions has grown over the past two decades as people have increasingly experienced negative effects such as wildlife-generated zoonoses, wildlife incursions in populated areas and resulting property damage, and danger to domestic animals (Conover 2001).

The "human dimensions" field of inquiry in wildlife conservation and management uses social science to explain human behavioral aspects of natural resource management and policy. One focus of human dimensions research explores how experience with wildlife affects, and is affected by, human perceptions of wildlife (Decker et al. 2001). People form their beliefs and attitudes about wildlife based largely on the nature of their wildlife interactions or exposure, which may be firsthand or vicarious (e.g., through print and electronic media). Even reading or hearing a One Health message, depending on the content, could serve as a form of vicarious exposure to wildlife. Human dimensions research investigates how positive and negative impacts from human-wildlife interactions, and communications about such interactions, influence people's perceptions of wildlife (Vaske et al. 2009).

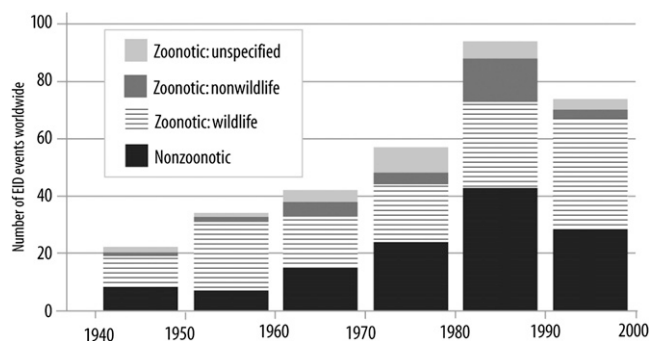
## The Importance of Research and Communication

Wildlife-associated zoonotic disease is a category of wildlife interaction with recognizable potential negative impacts (Vaske et al. 2009; Wobeser 2006). Yet despite concerns that perceived risks of zoonotic disease may diminish public support for wildlife (Brook and McLachlan 2006; Stronen et al. 2007), research has contributed little to enhance understanding of these perceptions and of resulting possible reactions to the One Health Initiative. The urgency of such research is evident in trends and projected trajectories for zoonotic disease in North America, where infectious disease outbreaks occur more often than ever before in modern times (Jones

et al. 2008). Analysis of 335 separate disease incidents in the global human population from the 1940s through the 1990s indicated, even after controlling for increased monitoring and reporting efforts, that emergence of new zoonoses originating in wildlife increased each decade (Jones et al. 2008) (Figure 1). Human population growth, the global movement of humans and animals, and the encroachment of agricultural and urban development on wildlife habitat are cited as the principal reasons for rising disease incidence and prevalence (Vaske et al. 2009; Wobeser 2006). Scientists expect these trends to continue, a likelihood that supports the inclusion of wildlife health as a vital component of the One Health concept.

One Health communications can generate public backing for healthy wildlife populations if messages create public awareness that the protection of wildlife health will also protect human health and well-being, whereas simply increasing public awareness of diseases associated with wildlife may lead people to disassociate with wildlife (e.g., spend less time outdoors where wildlife may be encountered or reduce their support for wildlife conservation). Understanding how and why people form their perceptions of wildlife-associated disease risks could help One Health professionals anticipate how the public may respond to One Health messages and tailor them accordingly. Will people respond favorably to the message that better promotion of wildlife health could protect them from zoonotic diseases or will they prefer to simply remove or eliminate the species harboring the disease? Research on the collateral effects of One Health messages would help answer this question.

In this article, we briefly review research that contributes to understanding how One Health messages could affect support for wildlife health and conservation. We discuss research on risk perception in general and summarize the few empirical studies on perceived risk associated with zoonoses. We then discuss evidence of US attitudes toward wildlife with respect to how treatment of the topic of zoonoses in One Health may affect public acceptance of wildlife and support for wildlife



**Figure 1** Number of emerging infectious disease (EID) events per decade (1940–2000) worldwide, categorized by transmission mode. Zoonotic: spreading from animals to humans and vice versa; non-zoonotic: cannot be transmitted between humans and animals. *Source:* Adapted by permission from Macmillan Publishers Ltd: Nature (Jones et al. 2008. Global trends in emerging infectious diseases. Nature 451:990-993).

conservation. We focus on how people may respond to the explicit message that human health and wildlife health are linked. We conclude with suggestions for further research that would be useful to One Health communicators.

## Risk Perception: Application of Social Science to One Health

The fields of risk perception and risk communication grew out of the realization that technical risk assessments alone were insufficient for managing human health hazards related to exposure to toxic wastes, nuclear power plants, and other anthropogenic as well as natural hazards (Golding 1992). In the context of wildlife issues, risk perception studies focus on individuals' concerns about hazards they associate with wildlife.

Research over the past few decades has established that experts and the public perceive risk differently (Morgan et al. 2002). Among members of the general public, concerns are informed by a combination of values, beliefs, and attitudes, whereas experts typically evaluate the need for management based on "assessed risk," which measures the probability and severity of a hazard based on scientific assessment, expert judgment, or a combination of both. But managers often need to account for perceived risk as well (i.e., the public's perceptions of a threat or hazard).

### Influences on Risk Perception

No single theory fully explains public risk perceptions (Krimsky and Golding 1992; Pidgeon et al. 2003), so research drawing on multiple theories may be appropriate (Kasperson et al. 2003; Renn 1998).

Individuals perceive risks through a combination of influences—the cultural milieu in which they live (Douglas 1992), societal response to risk (Kasperson et al. 2003), and characteristics of the risk/threat itself (Slovic 1987)—all of which bear on the individual's cognitive processing, affective (i.e., emotive) processing, or both when forming risk perceptions (Slovic and Peters 2006).

A better understanding of how and why individuals perceive risks can facilitate effective management of wildlife disease risks (Decker et al. 2006; Stronen et al. 2007) and improvement of risk communications. Studies have identified both human populations that could benefit most from clearly presented information on zoonotic diseases (e.g., Gstraunthaler and Day 2008; Peltz et al. 2007; Vaske et al. 2004; Wilson et al. 2005) and particular factors that need attention when tailoring communication content to given populations (e.g., Brook and McLachlan 2006; Dorn and Mertig 2005; Zielinski-Gutierrez and Hayden 2006). Although such research is largely lacking for One Health messages specifically, it could be similarly beneficial.

We describe below the three major kinds of influences on individuals' perception of risks: community culture,

societal response, and characteristics of the risk itself. An understanding of these influences can inform and enhance communication about risks, including those posed by wildlife-associated diseases.

### Community Culture

Culture influences how and why members of a community perceive risks. It comprises upbringing, education, religious beliefs, political leanings, societal norms for behavior and values, availability of information sources, membership in community organizations, and common recreational activities.

According to the cultural theory of risk, advanced by Douglas and Wildavsky (1982), perception of risk is a social process and evaluation of risk acceptability must consider the risk's social aspects. Culture affects risk perceptions by conditioning people to notice and value certain interactions, relationships, and objects. A person with one cultural background may perceive a threat where someone of a different background would not. Relevant to One Health communication, cultural background can also lead individuals to trust or distrust risk management entities, a difference that could affect an individual's perception of a risk related to a wildlife-associated disease.

Even if people rely completely on cultural cues from their community to make a decision about a risk, they still interpret those cues to form their own risk perceptions. One culturally influenced factor that affects their interpretation is the use of heuristics—cognitive shortcuts (or "intuitive judgment"; Gilovich et al. 2002) that individuals subconsciously use to reduce the amount of mental effort required to form impressions and make decisions in a variety of circumstances. Cultural factors can substantially affect (1) whether or not members of a community tend to rely on heuristics, versus systematic processing, with respect to a certain risk and (2) the types of heuristics that are most salient to individuals with respect to a certain risk. Individuals can activate a heuristic only if they develop it before a risk event emerges. Activation of heuristics leads to a reaction similar to a defense mechanism—a stimulus immediately prompts a particular response or reaction (Gilovich et al. 2002).

Culture thus predisposes individuals to think in certain ways about the risks associated with given events. These predispositions may vary between people from different cultural backgrounds, and people from the same culture may rely on these predispositions to different degrees. Unfortunately, little to no research is available about how cultural influences predispose people to perceive wildlife-associated diseases.

### Societal Risk Response

Characteristics of societal response to a risk include the quantity and quality of media coverage, the actions of risk management agencies, the public's perception of these agencies'

ability to manage the risk, and the education efforts of federal, state, and local government agencies, nongovernmental organizations, and/or other actors. All of these societal responses affect the quantity or type of information available about a risk.

The Social Amplification of Risk Framework (SARF) (Kasperson et al. 2003) is perhaps the most widely recognized theory about the importance of societal response in affecting individuals' risk perceptions. It examines a range of factors that can affect both which risks people choose to give their attention to and the amount of attention they afford to those risks. According to the SARF, the development of risk perceptions begins with the recognition of and communication about a "risk event," which Kasperson and colleagues (2003) define as any actual or hypothetical threat that people acknowledge, whether through direct experience, casual conversation, formal study, the mass media, or some other means. Once people recognize the presence of a risk event, "a wide range of psychological, social, institutional, or cultural processes" condition their perceptions of the risk-associated hazards (Kasperson et al. 2003, 15).

Research has given little attention to the influence of societal response on risk perceptions of wildlife-associated diseases. Some studies have examined the role of mass media coverage and attitudes about official management efforts (Vaske et al. 2009), but many other aspects of the societal response to a wildlife-associated disease risk remain largely unexplored.

## Characteristics of the Risk Itself

According to the cultural theory of risk and the SARF, because risks are socially constructed, the only aspects of a risk that are important in terms of risk perceptions are those that people are aware of and discuss. The perceived characteristics of a risk precede development of a societal response to it, and the societal response may then contribute further to determining the perceived characteristics that people emphasize.

Characteristics of the risk or threat itself that may affect how and why people develop risk perceptions include the spatial proximity and prevalence of the risk, the visibility and severity of the risk and its effects, and who and what the risk affects and how. Because natural risks often thrive in certain physical environs and have a more limited impact in others, the physical and biological components of the local landscape may also affect risk perceptions.

While cultural theory and the SARF contend that a risk's characteristics have a limited effect on risk perceptions, psychological theories of risk perception place greater weight on them. The typical psychometric dimensions on which risks are evaluated, such as knowledge and dread, include characteristics such as whether the risk is observable, whether its effects are immediate or delayed, whether it has catastrophic potential, and whether it has fatal consequences (Slovic 1987, 1992).

Although research on risk perceptions related to wildlife-associated disease is limited, much of it focuses on characteristics of the disease (risk) itself. Because different diseases can have quite different characteristics, and the characteristics of the same disease can vary in different geographic contexts, more studies are needed to enhance scientific understanding of how disease characteristics and the context in which they occur affect risk perceptions.

## The Interplay of Influences on Risk Perception

*Culture* may condition the creation of heuristics, but individuals ultimately activate or fail to activate those heuristics. *Societal response* to a risk can direct people to think about risks in a certain way, but individuals trust and rely on different social institutions and social cues when forming perceptions of objects or events. The *characteristics of a risk* can make it more or less recognizable to a population, but individuals likely have differing perceptions because of their particular life experiences.

The three categories of influences on risk perception can all affect individuals' knowledge and experience of the risk. Pidgeon and colleagues (2003) affirm that the categories are interconnected—one can affect a person's risk perceptions to differing degrees based on the role of the others.

The variety of individual responses to a risk suggests that other factors may shape perceptions as well. For example, individuals vary with respect to cognitive versus affective processing to evaluate risks—some people rely more on conscious, logical, rational thinking, while others depend primarily on affect to guide their decisions (Slovic and Peters 2006); mode of thought processing is an individual characteristic that is only partly attributable to culture.

Because of limited scientific understanding of the various factors that affect perceptions of wildlife-associated diseases and other possible risks, One Health communicators risk constructing and disseminating messages that may unintentionally have negative collateral effects.

## Existing and Needed Research on Perceptions of Zoonoses and Wildlife Health

Research has only scratched the surface of people's concerns about zoonoses. A recent meta-analysis of human dimensions research on wildlife diseases by Vaske and colleagues (2009) reveals the paucity of research on most wildlife-associated diseases and that such research has not been comprehensive in assessing the variety of potential consequences of these diseases. Instead, risk perception analysis with respect to zoonoses has focused primarily on the types and level of concern among certain segments of the public for single diseases (e.g., concerns about rabies among recreational cavers and speleological societies or about chronic wasting disease among hunters in the Midwest). While valuable individually,

studies to date provide only a beginning to a knowledge base adequate to understand how or why risk perceptions differ across wildlife-associated diseases. We agree with Vaske and colleagues (2009), who recommend a systematic approach to human dimensions research on wildlife-associated diseases.

For most diseases, little information is available about risk perceptions and how they develop. Wildlife-associated diseases and the contexts in which they emerge can vary widely, so identification of the factors that affect risk perceptions of different diseases in different contexts is critical. In particular, to create effective One Health messages, communicators would benefit from data on how cultural and other factors, including societal responses, influence risk perceptions of both multiple diseases and the same disease across multiple contexts. Some investigators have studied the influence of characteristics of a wildlife-associated disease on risk perceptions (Peterson et al. 2006), but this realm of research also needs further development.

Existing risk perception research on zoonoses is retrospective, telling the story of how particular populations viewed a disease outbreak. It does not provide insight into how a population with certain characteristics may view a future outbreak. The ability to reasonably predict both the levels and types of concern about a wildlife-associated risk is an aspect of risk analysis that warrants further research.

Research on zoonoses has focused on different types of concerns, including their effects not only on the health of humans, domestic animals, and wildlife but also on the local economy. Some studies have examined multiple potential concerns (e.g., Dorn and Mertig 2005), but most have been limited to those relating to human health (e.g., Figuié and Fournier 2008; Shadick et al. 1997; Wilson et al. 2005); others have asked only “how concerned” respondents are about a certain disease without revealing the nature of respondents’ concerns (e.g., Peltz et al. 2007).

The limited scope of research poses a problem for understanding perceptions of zoonotic disease from a One Health perspective. One Health incorporates the premise that a disease may concern people for reasons not related to public health (e.g., ecosystem health, aesthetic considerations). Absent information about the full range of people’s concerns, One Health risk communicators will not be sure whether a message produces negative collateral effects.

While a few studies hint at factors that may affect public concern, empirical research does not indicate which cultural, societal, and disease characteristics influence perceived risks and for whom. Likewise, research has not clarified where concerns about zoonoses fall in the hierarchy of potentially problematic interactions with wildlife. Not surprisingly, given the epidemiology and transmission pathways of some diseases, disease risks are unfamiliar to many people. Additionally, zoonoses in humans (e.g., Lyme disease) are difficult to diagnose, which contributes uncertainty to the risk. Although it is not clear whether increased uncertainty causes people to be more concerned about zoonoses compared with other wildlife risks, risk perception theory suggests that “dread” could be greater for risks of this type (Slovic 1987).

## US Attitudes toward Wildlife: Evidence from Recent Studies

It is well documented that most Americans are interested in and value wildlife (DOI/DOC 2006), but wildlife experts also contend that many people have concerns about coexisting with wildlife (Wobeser 2006). One can reasonably expect that these concerns temper enthusiasm for wildlife, whether people encounter wildlife purposefully, as an unintended consequence of other activities, or vicariously (e.g., through media coverage).

Although human dimensions research is thin on the effects of Americans’ beliefs about threats presented by wildlife-associated zoonoses, there is evidence that such perceptions may contribute to changes in public perspectives about wildlife (Butler et al. 2003). For example, a Wisconsin study revealed that people gave up deer hunting because of concerns about chronic wasting disease (CWD) of cervids: one-third of hunters were concerned about eating venison from harvested deer because of CWD (Vaske et al. 2004), despite the fact that no associated human health link has been identified. Another study of hunters in eight western states indicated that a hypothetical connection between high disease incidence and human health risk resulted in a substantial reduction in hunting interest in the area affected (Needham and Vaske 2008). In upstate New York, a survey of hunters and nonhunters showed that approximately 75% and 50%, respectively, were concerned about CWD, and of these, 3 out of 5 respondents worried about human health (Brown et al. 2005).

Other studies, though not specifically designed to address wildlife-associated zoonoses, also suggest that zoonoses are affecting tolerance of wildlife. In a 2007 study of suburban residents’ experiences and attitudes associated with coyotes in Westchester County, NY, every interviewee mentioned concern about disease associated with coyotes as a major issue (Hudenko et al. 2008). These results emerged even though (1) the study focus was not on disease associated with coyotes, and (2) only one case of rabies in a coyote had been reported in the entire state in the previous 15 years.

Another recent study examined impacts of deer on residents living near the extensive open lands surrounding the Cornell University campus in central New York: nearly 9 out of 10 residents had little or conditional tolerance of deer in their neighborhood (Siemer et al. 2007). In addition, half of the residents surveyed were “very” concerned about diseases carried by deer, with 38% believing that deer present “a serious health risk,” even though the study was conducted in an area with no recorded endemic deer-associated diseases that might normally be of concern for humans or their pets and livestock (e.g., Lyme disease, bovine tuberculosis, or CWD) (Siemer et al. 2007).

A longitudinal study (1984 to 1999) of residents of the suburban community of Islip, NY, showed a marked increase in concern about Lyme disease—from 48% to 96%—and indicated a declining tolerance of deer. In 1984, over half of the Islip residents surveyed unconditionally enjoyed deer in their

neighborhood, and only 38% expressed some level of concern about deer, whereas 15 years later 78% expressed concerns about deer (Decker and Gavin 1987; Siemer et al. 2003).

## Risk Communication and One Health

With evidence that zoonoses contribute to decreasing tolerance for wildlife, projections of their increasing prevalence and proliferating risk perceptions highlight the importance of risk communication to raise awareness of zoonoses without also raising undue alarm. One Health messages, designed with insight from risk theory and empirical evidence, need to be tested to learn which messages will produce desirable human beliefs and behaviors while sustaining support for wildlife, and which could lead to undesirable effects.

An understanding of how risk perceptions about wildlife-associated disease develop among specific populations will allow communicators to tailor messages that avoid over- or underestimation of risk by the public. For example, theory and empirical data have identified the provision of efficacy information as one means of reducing unsubstantiated concern about wildlife-associated diseases (Dudo et al. 2007; Roche and Muskavitch 2003). Research indicates that communicators might diminish public concern about diseases by informing people's beliefs about (1) self-efficacy (one's personal capacity to reduce exposure to a risk), (2) proxy efficacy (the capacity in society at large to reduce collective exposure to a risk), and (3) response efficacy (the capacity of a given policy or technology to effectively reduce a particular risk) (Bandura 2000; Floyd et al. 2000).

## Conclusion: More Research Is Needed

The One Health Initiative is getting under way at an opportune time. Wildlife-associated zoonoses represent a category of potential risks that may threaten basic human health and security needs and thus produce a shift in attitudes about wildlife. If predicted trends for wildlife-associated zoonoses come to pass, this category of risks may fuel estrangement of humans and wildlife and weaken the human-animal bonds that are an important component of the One Health Initiative. Increasingly negative attitudes about wildlife could lead to people's disassociation with wildlife, an outcome with negative implications for wildlife conservation. Without well-researched and carefully presented information, people may act on their fears and encourage or call for the elimination of protections of wildlife species or natural areas, or even the elimination or removal of certain species in some areas.

More research-based insight on perceptions of zoonotic risks will benefit One Health communication and thus the One Health Initiative vision of "improving the lives of all species—human and animal." Research into the following questions could be a useful start:

- What is the nature of perceived risk (both cognitive and affective dimensions)?

- What factors are formative in the development of risk perceptions?
- To what extent do perceptions across multiple types of risks (e.g., affecting personal health, public health, personal property, economic livelihood) increase concerns about wildlife?
- What can managers and communication specialists do to inform people more effectively?

Communications designed with knowledge of how individuals perceive wildlife-associated diseases could relay the One Health message in ways that inform but do not alarm the public. If the public's perceptions of zoonotic risks are better informed, perhaps Americans' generally positive opinion of wildlife can be sustained and even strengthened.

The One Health Initiative presents an opportunity to articulate wildlife health as a component in a coupled human and natural systems approach to health, but public communication about wildlife-associated zoonoses needs to be crafted carefully with thoughtful consideration of how people develop risk perceptions. Such communication requires more research to understand the development of risk perceptions with respect to wildlife.

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