

## PERSPECTIVE



# The one-health way

The health of animals, humans and the environment will be better served by breaking down barriers, says **Laura H. Kahn**.

Some of the greatest advances in medicine and public health, such as vaccinations, sanitation and food safety, have been made at the human–animal–environment interface. We should revive this holistic approach to global health and take advantage of the fact that animals develop many of the same diseases as we do. The key idea is called ‘one health’: the concept that the well-being of humans, animals and the environment are linked. Applications of the one-health perspective abound. The four I discuss demonstrate the power of this framework.

**Environmental hazards** Animals are sentinels for environmental contamination, but the signs they highlight are typically overlooked. For example, in the 1950s, health professionals in Minamata, Japan, ignored the local ‘dancing’ cats with neuropathological symptoms such as difficulty walking, convulsions and excess salivation. When humans also began to show signs of neurological damage, extensive investigations revealed that mercury was to blame, and that the source of the poisoning was local fish. Eventually, researchers discovered that a chlor-alkali production facility was releasing mercury into the bay, contaminating the fish and exposing the town’s cats and humans (P. Rabinowitz *et al. Vet. Ital.* 45, 23–34; 2009).

Pets share people’s homes and are vulnerable to similar environmental contaminations. Lead poisoning from sources such as paint, for instance, continues to be a major public health concern, especially in children. Using a one-health approach, monitoring the levels of hazardous substances such as lead in pets would guard against the poisoning of children.

**Chronic and infectious diseases** Cancer and other diseases have genetic and environmental causes, but people live for 80 years or more so conducting lifetime studies is difficult and expensive. Cancer is the leading cause of disease-associated death in dogs, which live at most for 20 years. The Morris Animal Foundation Golden Retriever Lifetime Study is a prospective longitudinal study that aims to identify environmental, genetic and dietary risk factors for diseases such as cancer. This observational study has enrolled 3,000 purebred golden retrievers (a breed particularly prone to cancer) and will follow them through annual online owner questionnaires, animal examinations and the collection of samples for 10–14 years. This study could improve our understanding of the relationship between genes and environmental exposure in chronic diseases, and have important human-health implications.

Comparative medicine is the study of the anatomical, physiological and pathophysiological processes across species, and is generally considered to be a veterinary medicine discipline. But the study of animal diseases can benefit human health. Around 1890, physician Theobald Smith and veterinary surgeon Frederick L. Kilbourne discovered that the parasite that causes cattle fever, *Babesia bigemina*, was spread by ticks. This was the first demonstration that a biting arthropod could spread disease, and set the stage for physician Walter Reed and his colleagues to prove a few years later that mosquitoes transmit yellow fever.

Some clinical practices in veterinary medicine could translate to human medicine. Faecal transplants, for example, have been used for horses for more than 100 years — stool samples from healthy horses are infused into the rectums of animals with chronic diarrhoea. Faecal transplants for refractory *Clostridium difficile* infections are now becoming accepted in human medicine.

**Antimicrobial resistance** When vancomycin-resistant *Enterococcus* (VRE) was identified in farm animals in Europe in the early 1990s, scientists assumed that this was the source of VRE in hospitals. Farm animals, especially pigs, were being fed the growth-promoting antibiotic avoparcin, which is chemically similar to vancomycin. Denmark, a major pork producer, was the first to ban avoparcin in 1995; rates of VRE on Danish farms subsequently fell by 90%, but infection rates in Danish hospitals continued to increase. The European Union banned avoparcin in 1997, but VRE rates in European hospitals did not necessarily decline.

The United States never approved avoparcin and there has never been a confirmed case of VRE in livestock. Nevertheless, VRE was a problem in US hospitals. Advances in genomics have provided an explanation for the conundrum: hospital VRE clones might have originated in dogs (P. Damborg *et al. Appl. Environ. Microbiol.* 75, 2360–2365; 2009). Companion animals receive antibiotics for infections and could be serving as reservoirs of resistant microbes. But pets have been ignored in the discussion of antimicrobial resistance. A one-health approach, using genomic surveillance, is essential to understanding resistant microbial epidemiology and ecology.

**Disease and food** The availability of safe, nutritious food is essential for global health and well-being. But agriculture, especially livestock production, has led to widespread deforestation

that has contributed to the emergence of zoonotic diseases and exacerbated the climate impact of greenhouse gases. Severe acute respiratory syndrome (SARS), Ebola and Nipah virus infection are among the diseases that have emerged from our demand for meat. SARS and Ebola spread directly to people who ate wild animals, or ‘bushmeat’. Nipah virus spread to humans through pigs kept on farms built on deforested land — deforestation in Malaysia destroyed the habitats of the virus’s host fruit bats, which began to feed on fruit trees near the farms and contaminate the fruit with their droppings.

Animal proteins are not essential for human health, but they do provide important nutrients. For everyone to become a vegetarian is not a realistic solution; evidence suggests that we are human because our ancestors hunted, cooked and ate meat. Ultimately, we must work out how to sustainably meet our need for animal proteins without unleashing more zoonotic diseases in a warming climate. A one-health approach is needed to ensure food security in the twenty-first century. ■

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