

COMMENTARY

Risky behavior in the Ebola zone

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Bushmeat hunting has been a concern of conservationists for a long time, with unsustainable and increasing rates of harvesting leading to the 'empty forests' of some parts of Africa and south-east Asia. It is also a concern of the public health community. There is convincing evidence that HIV-1 originated in the process of hunting, butchering and consuming chimpanzees, against the backdrop of demographic changes in Central and West Africa, and rapidly increasing global air travel (Hahn *et al.*, 2000). Around three quarters of emerging infectious diseases (EIDs) are caused by pathogens shared between humans and other animals (Woolhouse & Gowtage-Sequeria, 2005). The most significant EIDs – those that cause the largest numbers of deaths (e.g. HIV, influenza) or have the highest fatality rates (e.g. Ebola, Nipah) – have emerged from wildlife (Chua *et al.*, 2000; Hahn *et al.*, 2000; Guan *et al.*, 2003). Moreover, the causes of their emergence are clearly linked to the way in which we interact with wildlife – encroachment, road building, deforestation, hunting and trading them globally. Our strategy to deal with the threat of zoonotic EIDs still relies overwhelmingly on the development of drugs and vaccines, but has recently begun to incorporate the way in which we address the underlying causes of emergence – changes to human demography, behavior and the environment (Morse, 1993). This follows a shift from reactive to proactive in other branches of medicine. For example heart disease, where the current focus is on dealing with the risk behaviors that lead to disease – cholesterol, smoking and stress, rather than waiting for a coronary and patching up afterwards.

In this issue, LeBreton *et al.* (2006) explore how to block the risk behaviors in the *process* of disease emergence within the same socio-ecological setting where HIV originated – bushmeat hunting in the forests of Africa. They report anthropological interviews of bushmeat hunters in Cameroon on their attitudes to hunting, butchering and eating wild animals and find that there is potential for intervention. Specifically, respondents who perceived a risk of infection from bushmeat were less likely to butcher wildlife. They

propose that education programs on the health risks of bushmeat may help in the conservation of some of the wild animals commonly hunted. However, they also conclude that bushmeat hunting is likely to continue at current levels in Cameroon, so that education programs will at least deal with the threat it represents to public health.

So what is the long-term answer to the conservation and health impact of bushmeat hunting in Africa and elsewhere? Other work by this group shows that people prefer the taste of beef and chicken to wild animal meat. Does a conservation program include developing a chicken farm or improving cattle production in Cameroon? If it were not managed well, this would likely have some negative implications for conservation, but perhaps also, in the long-term, for public health. A number of diseases have recently emerged through chains of transmission from wildlife through livestock to people [e.g. Nipah virus, (Severe Acute Respiratory Syndrome) SARS, influenza]. Maybe the intervention should be promoting the domestication of hunted animals? This has potential, but needs to be undertaken with significant disease-focused oversight. The domestication of civets in China led to increased numbers of these animals in the wet markets of Guangdong province, and may have provided a bridge between the wildlife reservoirs (bats) of SARS-like coronaviruses and the human hosts of SARS (Li *et al.*, 2005). The data in the current paper suggest that intervening at the high-risk human behavior point of the chain is most likely to be successful for public health. But this may facilitate increased bushmeat hunting by making it healthier – a poor result for conservation. And here lies the real message behind this paper, that when dealing with the implications of human population behavior to conservation and to human, wildlife and ecosystem health, we have to put our research in the socio-ecological context. It will change nothing just to demonstrate that bushmeat hunting leads to HIV emergence (and this in itself took over 20 years); we then have the messy, difficult anthropocentric task of altering the pattern of bushmeat hunting to prevent the next HIV from emerging.

As in many conservation issues, dealing with the roots of the EID problem involves dealing with cultural, political, economic and ecological complexities. These are well outside the comfort zone of the disciplines most commonly tasked with preventing future emerging diseases (medical scientists and veterinarians). Changing the agenda will require nothing less than a complete revamping of our approach to health – combining our current focus on the individual with an ‘ecosystem health’ approach (Wilcox *et al.*, 2004; Parkes *et al.*, 2005). It will involve incorporating ecology and conservation biology into the medical and veterinary curriculum and bringing an understanding of the dynamics of diseases into the mainstream ecological curriculum. It will involve a new network approach to dealing with EIDs, where veterinarians, sociologists, anthropologists, medics, epidemiologists, conservation biologists and others work side by side with a deep understanding of how each other’s discipline functions. A good example of this approach is the Australian Biosecurity Cooperative Research Center for EIDs (www1.abrc.org.au), where I am currently writing this commentary. This partnership among government, industry and academia brings together the high-tech world of molecular diagnostics with epidemiological risk assessment and ecological studies of wildlife reservoirs to understand and prevent the spread of new and known zoonoses.

The potential negative implications of disease ecology research without the broader framework are significant. Wildlife are increasingly identified as reservoirs of lethal diseases and their image may start to decline in the public eye. Migratory birds are the target of much hand-wringing within agencies across Europe and North America due to their involvement in H5N1 spread. Bats have had fingers pointed at them recently as the cause of Hendra, Nipah, Ebola and SARS, and with an already poor public image, they are under significant pressure. This leaves the moral imperative, in my opinion, on the people working with the ecology of zoonotic diseases, particularly those of us who call this ‘conservation medicine’. We need to remind our colleagues, the media and our bushmeat hunting contacts, that it is not disease-carrying wildlife that are the problem. It is what we do to wildlife as individuals (by hunting and butchering them) and collectively (by building roads into wildlife habitat and forcing contact with our domestic animals) that provides the pathogen pathway for what Stephen Morse called ‘viral traffic’ to flow.

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