

## RESPONSE

**Healthy hunting in central Africa**

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People in contact with wild animals, and particularly non-human primates, are acutely at risk of zoonosis and should take steps to avoid infections. Despite only limited testing, we already know that more than 1% of rural Cameroonians are infected with wild primate T-lymphotropic viruses (PTLVs; Wolfe *et al.*, 2005) and another 1% are infected with wild primate spumaviruses or simian foamy virus (SFV; Wolfe *et al.*, 2004). In south-east Asia, a preliminary risk assessment found that about five in 1000 temple visitors risk infections with SFV from bites from temple macaques (Engel *et al.*, 2006). There are also numerous cases of accidental laboratory infections with non-human primate pathogens such as PTLV, SFV, simian immunodeficiency virus (SIV) and others.

Cross-species transmission of non-human primate pathogens to humans are not rare events; however, to avoid infections simple steps can be followed and such steps have been elaborated for laboratory workers (*Guidelines to prevent simian immunodeficiency virus infection in laboratory workers and animal handlers*, <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001303.htm>) and in rules and signs for people visiting tourist sites where interactions with monkeys occur (Fuentes, 2006). For people living in rural central Africa, such information is obviously more difficult to come by despite the high number of exposed individuals and the diversity of pathogens from a diverse number of wild primates.

While the risk of infection is apparent, the health implications, for at least some of the viruses, are less clear. We do know that the ebola and monkeypox viruses, which can be transmitted through hunting and butchering of wild animals, have serious health effects. Additional research is however urgently needed to determine the effects of a number of other viruses, in particular the diverse PTLVs, one of which human T-Lymphotropic virus 1 (HTLV-1) can cause a form of blood cancer and inflammatory disease in 2–5% of people infected.

Given that little is known about many of these pathogens and their effects, the threat posed by an infection may not outweigh the potential value of bushmeat as a food source or as a source of revenue to a hunter or butcher (J. Brashares, this vol.; M. C. Monroe & A. S. Willcox, this vol.). However, some methods for avoiding infections are not costly. For example, simple and easy-to-practise measures (M. C. Monroe & A. S. Willcox, this vol.) include avoiding contact between open wounds and animal blood and washing any bites, scratches or knife injuries. Of course, the best way to avoid infection with wildlife pathogens is by avoiding contact with wild animals altogether, an option with a high cost that will not be adopted in many villages in southern Cameroon given the low level of domestic animal meat production and the lack of dietary replacements (Koppert *et al.*, 1993). The avoidance of certain species is a second option, with animals of any species found dead in the forest being the most important as they may transmit acute and deadly pathogens such as Ebola or anthrax. Non-human primates, in particular the great apes, would also be an important group to avoid as they share many pathogens with humans given our similar physiologies. As non-human primates rarely make up the majority of animals hunted at any one locality (rodents and antelopes are much more regularly captured in central Africa), avoiding primates does not necessarily have to be so costly as the hunting effort can be redirected into hunting of other species. Such a redirection of effort would benefit the conservation of the threatened non-human primates, although the redirection may affect the sustainability of hunting other species.

It is important to ensure that the hunting of threatened species is not inadvertently encouraged or legitimized by promoting healthy hunting (P. Daszak, this vol.; M. C. Monroe & A. S. Willcox, this vol.). Some people may even use this as an argument against communicating healthy hunting information altogether, as has occurred with other programmes of harm minimization for illegal activities such

as drug use (e.g. safe injecting rooms, needle exchange programmes and testing of illicit drugs). However, healthy hunting campaigns exist elsewhere globally and are promoted by a variety of organizations from government health departments to hunting clubs, and some hospitals in the US even offer free health checks for wildlife hunters.

Our data (LeBreton *et al.*, 2006) showed that people recognizing risk were significantly less likely to butcher wild animals than those not recognizing risk. This raises the possibility that if people were made aware of risks they may be less willing to participate in butchering. To consider this properly, further research is needed as recommended by M. C. Monroe & A. S. Willcox (this vol.). In addition, we also need to better understand the possible cultural basis for perceiving risks (J. Brashares, this vol.). The 17 sites involved in this study were dominated by people from 13 major language groups (see Wolfe *et al.*, 2004; Table 1) and the respondents self-reported that they were from almost 100 different ethnic groups. From such a diversity of cultures it is difficult to draw a general conclusion about the basis of the observed perception of risk (J. Brashares, this vol.; M. C. Monroe & A. S. Willcox, this vol.; D. Wilkie, this vol.). However, there is a wide range of animal contact taboos in these communities, suggesting that for some it may be a traditional belief, which may or may not be rooted in health notions as J. Brashares (this vol.) suggests. There is also awareness of contemporary public health news issues such as bird flu and ebola, even in fairly remote areas, and risk perception may be influenced by this awareness. The low number of individuals reporting precautions as noted by D. Wilkie (this vol.) is probably because the question was unprompted and people may not have realized that some of the things that they already do (washing hands, avoiding contact with blood, etc.) are good precautions.

The influence of education on butchering and eating of bushmeat in our study is somewhat contrary to other studies (D. Wilkie, this vol.), but as most of the communities sampled were in fairly remote areas and were highly dependent on bushmeat, even the individuals who had more money probably had little choice in terms of what they could buy to butcher or eat. Additionally, roofing type in our study is probably a poor substitute for wealth and a better substitute for community remoteness, as the more remote sites tended to have less access to fabricated building supplies.

There is still much to be understood about the socio-economic dynamics of the reliance on and preferences for bushmeat. While our multivariate analysis of a large dataset examined some of the factors that predict consumption, hunting and butchering (Table 1), we are limited by the variables we chose to measure. Other unmeasured variables are certainly going to explain more of the variance (J. Brashares, this vol.), especially when dealing with such diverse cultures.

Admittedly, health education interventions alone will not go far towards protecting primates in the long term, and a better intervention may well be law enforcement (D. Wilkie, this vol.). However, law enforcement alone also cannot be effective, especially where the number of law enforcement workers is too low (and where these workers must also

depend on wild animals for food). Law enforcement needs to be well funded, well managed and needs to support well-written legislation. Laws will need the support of a majority of the population, which in Cameroon may be difficult to achieve as many people currently depend even on the illegal (but mostly tolerated) hunting or purchasing of common species such as rodents. Reinforcing the protection of threatened species may actually first require some liberalization of hunting and trade, at least of the more common species and agricultural pests. Such changes, including a movement towards community hunting zones, are underway in Cameroon and have the support of both conservation groups and government; however, the complexity of accreditation and licensing systems may continue to prevent many communities from being involved.

Ecotourism has been recommended as an alternative way of earning money from wild animals; however, very few tourists currently make it to the rural areas heavily dependent on wild animals even where potential ecotourist sites exist (e.g. Djoh & van der Waal, 2001). Most tourists need the same things that the people in remote rural Africa are also waiting for: less corruption, better roads, increased food production, increased trade opportunities, cleaner water sources and better health facilities.

Diverse approaches to rural development including improvement of roads, health services, schools and schooling, the creation of employment, agricultural diversification, electrification and perhaps ultimately the development of tourism infrastructure may help support alternative opportunities that could reduce the reliance on hunting for income and food. The negative social and environmental impacts of such initiatives should be carefully evaluated (P. Daszak, this vol.), and efforts should be made to ameliorate them. Successful strategies for wildlife conservation require multiple complementary measures (Bawa, Raven & Seidler, 2004) adapted to local situations. Healthy hunting could be made to complement other conservation strategies, especially in the context of sustainable or controlled hunting initiatives, at very little additional cost.

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