



EDITORIAL

Minimizing Pathogen Transmission at Primate Ecotourism Destinations: The Need for Input from Travel Medicine

Michael P. Muehlenbein, PhD, MsPH,*[†] and Marc Ancrenaz, DVM, MS[‡][§]

*Department of Anthropology, Indiana University, Bloomington, IN, USA; [†]Sabah Wildlife Department, Kota Kinabalu, Malaysia; [‡]Kinabatangan Orangutan Conservation Project, Sandakan, Malaysia; [§]Red Ape Encounters, Sukau, Malaysia

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Tourism generates more than 9% of the global gross domestic product and may account for almost half of the gross domestic product in developing countries with biodiversity-rich areas.^{1,2} Nature-based tourism accounts for a growing proportion of international tourism activity. Ecotourism is a sustainable version of nature tourism with the following components:

- Contributes to conservation of biodiversity.
- Sustains the well being of local people.
- Includes an interpretation/learning experience.
- Involves responsible action on the part of tourists and the tourism industry.
- Is delivered primarily to small groups by small-scale businesses.
- Requires lowest possible consumption of non-renewable resources.
- Stresses local participation, ownership and business opportunities, particularly for rural people (p. 10).³

Ecotourism accounts for a significant proportion of all international tourism, and revenue generated by these activities could enhance economic opportunities for local residents, support environmental education, and protect the natural and cultural heritage of the area, including the conservation of biodiversity and improvement of local facilities.⁴ Ecotourism is increasingly seen as a means to promote wildlife conservation, increase public awareness, and raise revenue for protecting endangered species. Unfortunately, rapid, unmonitored development of ecotourism projects can lead to degradation of habitats and deleterious effects on animal well-being. Habituation of animals to human presence can increase the likelihood that animals will actively seek out contact with humans, particularly in

the form of crop raiding and invasion of garbage pits, latrines, and human households. Habituation may lead to alterations in animal stress responses, and this may lead to immunosuppression, increasing susceptibility to infectious diseases, and decreasing reproductive success. Other risks may include pollution, crowding, introduction of invasive species, and transmission of pathogens through direct and indirect infection routes. Zoonotic (nonhuman animal to human) and anthrozoönotic (human to nonhuman animal) infection transmission are of vital consideration, given the increasing demand from tourists to experience direct encounters with wildlife. It is therefore important to produce definitive guidelines that will protect visitors from possible risks as well as ensure long-term well-being of the animals.

To outline proper development and implementation of ecotourism activities, many documents stress that travelers should be educated about the importance of conservation, and that tour operators should instruct travelers to minimize impacts while visiting sensitive environments.^{3,5-11} However, human or non-human animal health is not usually discussed, except in reference to the need for healthy employees. For example, the American Society of Travel Agents' Ten Commandments on Ecotourism recommends not disturbing animals or purchasing products made from endangered species, but there is no mention of zoonotic/anthrozoönotic diseases. Health information is not currently available on commercial travel Web sites.¹² The International Society of Travel Medicine's Responsible Traveler handout does not discuss zoonotic/anthrozoönotic infections. It is long overdue that a line of communication be opened among conservation biologists, ecotourism practitioners, and travel medicine specialists, particularly in regards to primate-based tourism.

Corresponding Author: Michael P. Muehlenbein, PhD, MsPH, Department of Anthropology, Indiana University, 701 E. Kirkwood Ave., Student Building 130, Bloomington, IN 47405-7000, USA. E-mail: mpm1@indiana.edu

Primate-Based Ecotourism

Great ape ecotourism began with orangutans in the early 1960s, focusing primarily on ex-orphans during their rehabilitation process to the wild in Sepilok (Sabah, Malaysia), then later in Semanggoh (Sarawak), Tanjung Puting (Kalimantan), and Bohorok (Sumatra).¹³ Gorilla tourism was initiated in the early 1970s in countries such as Democratic Republic of Congo, Rwanda, and later Uganda.^{14,15} Unlike orangutan tourism, these activities were focused on wild groups. Over the past decade, new ecotourism projects focusing on chimpanzees and lowland gorillas have been initiated in most great ape African range countries. Today, more than 15 sites have developed wild great ape viewing in Central and East Africa, adding to the possible risks of pathogen transmission between wild populations and tourists.

Infection transmission between humans and non-human animals has typically focused on zoonoses, and rightfully so. Over half of all human infections are zoonotic in origin,¹⁶ and several pathogens have been transmitted from nonhuman primates to humans, including simian/human immunodeficiency viruses, simian foamy virus, simian T-lymphotropic virus, *Plasmodium knowlesi*, and *Cryptosporidium*.^{17–22} Wild primates also function as reservoirs for a number of human infections, including filariasis, yellow fever, and Chikungunya virus.^{23–25}

Because of their genetic relatedness with humans, nonhuman primates are particularly susceptible to human infections. They are usually immunologically naïve to these pathogens, and primate populations can be quickly decimated because of the slow reproductive rates of most species, particularly great apes. Various infection transmission events from human to nonhuman primate populations have been suspected,^{26–31} but only a few have been definitively confirmed: human respiratory syncytial virus and metapneumovirus in chimpanzees in Côte d'Ivoire,³² and intestinal pathogens *Giardia* and *Escherichia coli* in mountain gorillas and chimpanzees in western Uganda.^{33–35} Polio and measles, both vaccine-preventable diseases, have caused very high mortality in chimpanzee and gorilla populations.^{36,37} Primates are also particularly susceptible to tuberculosis of human and cattle origins.³⁸ This is problematic because tuberculosis is easily spread and can survive in the environment for long periods of time.

It is critical to note that all the documented and suspected transmission events from humans to wild nonhuman primates involved local human populations (local residents, researchers, and park personnel), *not* tourists. To our knowledge, no previous study has attempted to adequately document infection transmission from tourists using biological samples. Despite this fact, the risk of anthrozoootic infection transmission from tourists is likely significant, and may result from both direct contact between tourists and wildlife and aerosolization of pathogens. At Asia's most frequented wildlife tourism destination, the Sepilok Orangutan

Rehabilitation Centre in Sabah, a significant proportion of visitors are not adequately vaccinated, and many underestimate their own risk of infection as well as their potential contribution to pathogen transmission.³⁹ Despite their interests in environmental protection and known travel to view endangered animals, tourists very likely create unnecessary risk of infection transmission to wildlife because they are largely unaware of the impacts they may directly have on animal health.

Current and Future Protective Guidelines at Great Ape Tourism Locations

Most great ape tourism projects follow similar rules that intend to minimize possible animal disturbances, negative impacts on the habitat, and risks of infection transmission. Participant minimum age ranges from 12 to 15 years, animal viewing distance ranges from 7 to 10 meters, visit duration ranges from 1 to 2 hours, and tourist group size ranges from five to eight persons. For all sites, any animal group can only be visited once per day. Orangutan visitation in Sabah (Red Ape Encounters) further limits tourist visitations to 15 times per month for each animal. For all sites, visitors are required to voluntarily report any illnesses, from cold sores to influenza to diarrhea, and registration and briefings are required before animal viewing. Groups of tourists should remain together and use appropriate body language, observing the animals quietly. Human feces must be adequately buried, and littering, smoking, eating, flash photography, feeding or touching animals, coughing, spitting, or nose blowing are not permitted. Project personnel may also be subject to varying requirements, such as current vaccinations, negative tuberculosis tests, annual health inspections, and disinfection of clothing and footwear.⁴⁰

Several additional recommendations have been made,^{29,34,35,39,41–43} including the use of disposable face-masks, hand washing with soap and clean water, and shoe disinfection with a mild bleach solution before and after visitation with the animals, proof of current vaccinations, use of improved tourist brochures, educational seminars or instructional videos with rules and justifications, detailed protocols for outbreak identification and reporting, and punishment for those tourists and guides who disregard the rules. The risks of pathogen transmission likely vary by location and primate species in question (ie, macaques vs gorillas, forest vs savanna habitat, wild vs rehabilitated animals, etc.), and thus several of the prevention measures may vary by location/species, whereas other prevention measures warrant standardization. Adoption of some of these practices may result in lower immediate revenue, but at the benefit of ensuring long-term utilization of these animals. Implementation of these prevention measures will certainly require additional funding for new infrastructure, supplies, and personnel. Tightening some of the rules may even widen the gap between tourist demand and available opportunities.

It is the combined responsibility of the tourism and medical communities to accurately communicate the risks of zoonotic and anthroozoonotic infections in ways that best support the needs of humans and wildlife alike. Such educational initiatives would be facilitated if accurate data existed on any actual links between disease and wildlife tourism. In the interim, there is little doubt that we must be conscious of the impacts that human–wildlife interactions may have on disease ecologies, and efforts would be supported if more resources were devoted to initiatives in conservation medicine with collaborations among physicians, veterinarians, epidemiologists, and conservation biologists. Such collaborations will facilitate much-needed reconciliation on the potential impact that anthroozoonotic infections from tourists can have on wildlife populations.

Feedback Sought from Travel Medicine Specialists

The Species Survival Commission, International Union for Conservation of Nature, Section of Great Apes is currently formulating best practice guidelines for wild great ape tourism. Past efforts to formulate proper tourism guidelines at primate locations have, for whatever reasons, been dominated by conservation biologists and infectious disease specialists, often involving many who do not specialize in ape disease ecology or human health behaviors, with a general lack of past interaction between travel health and anthropology. The primary purpose of the present communication is to facilitate the development of relationships among conservation biologists, ecotourism practitioners, and travel medicine specialists, particularly in reference to primate-based tourism. Perhaps, these needs would be best met via the formation of a task force or interest group of travel medicine specialists to begin to address some of the following:

- What are the benefits and feasibility of requiring vaccination certificates of visitors at primate-tourism locations? How could such a program be implemented?
- Should the minimum age limit of visitors be increased, possibly to 18 years of age, to avoid the introduction of some childhood diseases?
- Is there utility in implementing a “quarantine,” so that visitors should be in-country for a number of days before visiting the wildlife sanctuaries?
- What are the best ways to get ecotourists to voluntarily participate in illness screenings and honestly self-report illnesses when they know that ill people will be denied entrance to the park? Is there benefit in screening participants for illnesses? Who is qualified to enforce this?
- How useful would requiring disposable facemasks be? They may be less effective in humid weather and will likely impede tourist experiences.
- What may be the best strategies to increase participant compliance in hand washing and shoe disinfection?
- How can tourists become informed about animal health before they leave their countries of origin?
- What is the feasibility of making any of these recommendations part of the World Health Assembly’s International Health Regulations?

We encourage those interested in the subject to contact us, or to initiate a discussion in the correspondence section of the *Journal of Travel Medicine*. The global management of zoonotic and anthroozoonotic epidemics is an obligation that transcends any one discipline. Discussion of these problems would complement real-time health monitoring of human–wildlife interactions, which will ultimately function to ensure the sustainability and growth of ecotourism. Understanding the risks of pathogen transmission from humans to wildlife is a necessary but often overlooked aspect of wildlife conservation. In this case, any benefits we make to wildlife health will ultimately benefit human health.

Declaration of Interests

M. A. is a member of the Species Survival Commission. M. P. M and M. A. are involved in the IUCN formulation of the best practice guidelines for wild great ape tourism. The authors state that they have no conflicts of interest to declare.

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