INTRODUCTION

Disease Risk Analysis: A Paradigm for Using Health-Based Data to Inform Primate Conservation and Public Health

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Risk analysis is a multidisciplinary process used to evaluate existing knowledge in order to prioritize risks associated with the spread of disease. A principle aim of risk analysis is to facilitate the development of cost-effective management strategies. Risk analysis calls for a multidisciplinary approach to piece together and integrate the numerous factors that influence disease transmission. The seven papers included in this volume of AJP present current primatological research as viewed through the prism of risk analysis. Issues such as interspecies disease transmission, public health, and conservation of endangered species are addressed, and risk analysis is put forward as a possible paradigm to promote understanding of infectious disease and its impact on nonhuman primate and human populations. Am. J. Primatol. 68:851–854, 2006.

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INTRODUCTION

The 20th century witnessed pioneering scientific work on the behavior, biology, and ecology of nonhuman primates (NHPs). With recent advances in diverse fields such as epidemiology, biochemistry, and modeling, primatologists are in an exciting position to build on this foundation. New methods and technologies hold the promise of integrating data in ways that will lead to an enhanced understanding of a particularly vital issue that binds human and NHP populations together: interspecies disease transmission.

Two realities have forced recognition of the importance of human–NHP disease transmission. Undeniably, the global pandemic of HIV, a virus

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hypothesized to have been transmitted from NHPs to humans on multiple occasions, has brought increased attention to the potential of “another HIV” being transmitted. At the same time, human disease has emerged as a leading danger to NHP populations, especially those that, for other reasons, hover dangerously close to extinction. These twin crises have highlighted the necessity of learning more about interspecies disease transmission in order to increase the effectiveness of intervention.

The seed for this special topics issue on risk analysis was sown at a workshop on Southeast Asian Primate Disease Risk Assessment hosted in March 2003 by the Davee Center for Veterinary Epidemiology and Endocrinology at Lincoln Park Zoo, with support from Seattle’s Woodland Park Zoo and the Detroit Zoological Park. One of a series of focused workshops held at Lincoln Park Zoo that were designed to teach basic risk analysis principles and methodology (using techniques developed through collaboration with the IUCN’s Conservation Breeding Specialist Group), the Southeast Asian Primate workshop modeled the transmission of viral diseases between NHPs and humans in Southeast Asia using data that had been gathered by several groups representing different fields of study, taking advantage, in particular, of ongoing research on pathogen transmission between humans and macaques in Asia.

This workshop led to a symposium at the 20th Congress of the International Primatological Society, held in Torino, Italy, August 2004, in which the risk analysis paradigm was used as a common thread to link research on Asian monkeys and African apes. Nearly all of those presentations are now represented in this special topics issue on Disease Risk Analysis: A Paradigm for Using Health-Based Data to Inform Primate Conservation and Public Health.

Travis et al. lead off the current issue with a review of risk analysis and its roots, objectives, and methodology. Risk analysis is a multidisciplinary process used to evaluate existing knowledge in order to prioritize risks associated with the spread of disease. A principle aim of risk analysis is to facilitate the development of cost-effective management strategies. Risk analysis calls for a multidisciplinary approach to piece together and integrate the numerous factors that influence disease transmission. The authors introduce a model to organize these concepts.

Jones-Engel and colleagues discuss seroprevalence data collected from two different populations of macaques: *Macaca fascicularis* in Singapore and *M. mulatta* in Nepal. Serological data from the two populations show a striking difference in the prevalence of exposure to measles, an endemic human pathogen. This contrasting seroprevalence pattern stimulates the development of hypotheses to explain these observations, and suggests possible directions for further inquiry into the factors that impact human–NHP disease transmission in these two settings. These data are viewed through the prism of risk analysis and provide an example of how field data fit in the risk analysis paradigm and how they can inform management strategies.

Next, Fuentes delves into the critical interface between human and NHP populations. Analyzing extensive databases generated through years of observational data collected on human–monkey interactions at the Padangtegal Monkey Forest in Bali, Indonesia, and the Upper Rock Nature Reserve in Gibraltar, his research investigates how human cultural and NHP species differences impact human–NHP interactions that can lead to disease transmission. It also highlights the power of large numbers of observations of large numbers of individuals to fuel statistical analyses of behavior. Urban macaque populations provide researchers an excellent opportunity to analyze interspecies interactions precisely because they are relatively numerous and come into frequent contact with humans. These
data applied to the risk analysis paradigm reveal the potentially powerful impact of both human and NHP behavior on interspecies disease transmission.

Following Fuentes, we have three articles from scientists focused on the specific issue of infectious disease transmission in wild populations of African apes. Lonsdorf and colleagues draw upon the nearly four decades of health data collected on the chimpanzees of Gombe to describe patterns of morbidity and mortality in these endangered apes. The authors show how retrospective analyses of diverse observational data that have been amassed over the past decades have the potential to inform the risk analysis paradigm, resulting in improved data-gathering protocols. These analyses in turn point the way to improved hazard identification, risk assessment, and risk management.

The Mountain Gorilla Veterinary Project is charged with maintaining and monitoring the health of one of the most endangered and well known populations of NHPs on the planet. The Decision Tree Writing Group’s article on the clinical-response decision-making tree describes their work on integrating epizootiologic and real-time observational data to rapidly assess, triage, and treat illness in this small and critically endangered population, in addition to assessing adjacent human populations for their potential to contribute to or be affected by an outbreak among gorillas. The authors importantly note that their decision-making tree, while currently tailored to their specific populations of humans and gorillas, can be adapted to other NHP populations.

Leendertz and colleagues focus on a specific component of the risk analysis paradigm and its application to NHP conservation. Their case series describing pathological findings of anthrax in apes found dead in the forest suggests that assumptions about the etiology of mortality in wild African apes are best tested by scientific methods. Their research supports a rigorous application of hazard identification as conservationists seek to explain and intervene against the causes of death in these endangered NHP populations.

The final paper in this issue, by Engel and colleagues, describes how the risk analysis paradigm can be used to answer specific questions regarding interspecies infectious-agent transmission. Specifically, a mathematical model is used to harness diverse data sets generated by behavioral, serological, epidemiological, and epizootiological research in order to make predictions about the risk of infection with simian foamy virus for visitors to monkey temples in Asia. This article demonstrates some of the potential uses as well as some of the challenges inherent in generating and implementing risk analysis models. In doing so, it suggests some of the potentially powerful applications of risk analysis to questions that are germane to public health and emerging infectious diseases.

FUTURE DIRECTIONS

The present issue introduces the concept of risk analysis and some of its applications to the study of human–NHP disease transmission. Risk analysis is invoked as a tool that can harness the power of the scientific method to inform efficient, effective policies that can help to conserve NHP populations and safeguard public health. Widespread use of risk analysis by primatologists and related disciplines holds the promise of revolutionizing our understanding of human–NHP interactions wherever interspecies contact occurs, such as in Asia, Africa, Europe, and South America. Standardization of data collection protocols will be an important factor in making research more valuable to the entire primatological community. Interdisciplinary cooperation, a sine qua non for effective risk analysis, will help to more efficiently spread advances in individual
fields of study. And as more is learned about patterns of interspecies interaction, pathogen transmission, and disease spread, policy makers will be in a better position to anticipate and prevent epidemics and epizootics, rather than simply react to them. Ultimately it is hoped that risk analysis will help to promote human–NHP commensalism throughout this century and beyond.

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