In This Issue

**SPECIAL FEATURE ON ECONOMICS OF INFECTION DISEASE, TRADE, AND PANDEMIC RISK**

Berry et al. begin this Special Feature in *EcoHealth* on the Economics of Infectious Disease, Trade, and Pandemic Risk by discussing the benefits of creating a global pandemic fund to fight large-scale emergence events. Pandemics emerge stochastically, are predominantly zoonotic in nature and originate in tropical countries. These events are increasing in frequency, and deliberations on the size and nature of the WHO pandemic fund continue, yet appropriations as seen for Ebola in the USA are likely necessary to manage these risks. The spillovers are key as seen by these funds being used to combat the outbreak of Zika virus. The need for these kinds of funds which can be flexibly targeted to combat future emerging disease threats is clear and ought to be based on sound economic analysis.

Chitchumnong and Horan explain an individual’s infectious disease risks may depend on others’ mitigation choices, creating strategic interactions such that each individual makes mitigation decisions based on the expected decisions of others. Prior work finds coordination failures involving minimal mitigation investments could arise in this setting. These results are largely based on simplified economic models involving a single management choice and fixed prices that influence mitigation incentives. Relaxing these assumptions, they find strategic interactions influence, and are influenced by, choices involving multiple management options and also market price responses. These features can reduce the potential for coordination failure and also have important policy implications.

Morin et al. discuss the precautions private individuals take to mitigate infectious disease risks. Such precautions generally reduce both peak prevalence of symptomatic infection and the number of people who fall ill (both socially beneficial) while simultaneously prolonging an epidemic (socially detrimental). For diseases that are not very infectious, or for which the duration of illness is short, it may be socially optimal to promote private mitigation effort by increasing the cost of illness—hence dragging out a low impact epidemic. By contrast, for highly infectious or long-lasting diseases, it may be optimal to discourage private mitigation by reducing the cost of disease—burning out the epidemic as quickly and intensely as possible. For moderately infectious diseases with medium infectious periods, the social optimum depends on complex interactions between prevalence and duration.

Berry et al. present a statistical matching methodology for merging and analyzing detailed activity survey data and health outcome data. Data are extrapolated from one established national survey onto a new dataset by sociodemographic characteristics, and the correlations between activity choice and influenza vaccination are explored. Significant correlations were found and the sign of the correlation flips when considering either the intensive (how much) or the extensive (do or not do) decision for some highly studied activities. These correlations can provide an additional metric for targeting those least likely to vaccinate. The methodology outlined in this paper can be replicated to explore correlation among actions and other health outcomes.

Trade creates pathways for spread of bioinvaders. Current trade policy banning imports from risky sources is inefficient and costly to enforce. If agents bear the cost of their actions and allowed to evaluate the expected costs and benefits of their actions, efficient outcomes can often be achieved. In this special feature, Lee et al. model import choice behavior under risk of introducing foot-and-mouth disease introduction. Using a 50-year dataset to parame-
terize the model, they find whether producers diversify import sources to mitigate risk and simultaneously create gains from trade. The results of this work can be used in designing novel trade policies that incorporate scientifically sound methods and producer behavior into the design.

Managing livestock diseases depends on the actions of different actors, both within and across different regulatory frameworks. Bate et al. use bovine viral diarrhea (BVD) in England and Scotland as a case study, as there are contrasting strategies for BVD management. Using an agent-based bioeconomic model, they assess the payoff dependence of farmers connected by trade but using different BVD management strategies: test–cull, test–cull with vaccination, and vaccination alone. When two farms trade, all actions by the selling farm provide benefits to the purchasing farm, with the greatest benefit from test culling with vaccination. Unilateral disease management strategies can be effective in reducing disease risks created through trade.

Shanafelt and Perrings evaluate the effects of post-2001 reforms on global foot-and-mouth disease (FMD) risk in the livestock trade and estimate an empirical model of disease risk that tests for the impact of changes in trade volume and biosecurity measures on the probability of a disease outbreak. They find that before 2001, biosecurity measures were the most significant determinant of risk. After 2001, trade plays the greater role. Their results highlight the trade-off between trade restrictions and biosecurity measures in global foot-and-mouth disease management. The more that trade restrictions are relaxed, the more important biosecurity becomes.

Near real-time epidemic forecasting approaches are needed to respond to emerging epidemics. Chowell et al. wrap up this special feature by retrospectively assessing the performance of models that capture early subexponential growth dynamics to generate short-term forecasts of the 2001 foot-and-mouth disease (FMD) epidemic in the UK. They find that while the generalized growth model provides a useful 10-day forecast of the epidemic before the peak, a different model—the generalized Richards model—is needed to forecast the epidemic after the peak.

**LASSA VIRUS HOST IN GUINEA**

The Natal multimammate mouse is the natural host of Lassa virus, an arenavirus that causes Lassa fever in humans. In the absence of a vaccine, rodent control and adjusting human behavior are currently considered to be the only options for Lassa fever control. In this study, Marien et al. investigated the spatial behavior of multimammate mice by performing several field experiments in Lassa fever-endemic villages. Their conclusions discuss implications for rodent control.

**WEST NILE VIRUS IS FOR THE BIRDS**

Using the house sparrow-West Nile virus host–parasite system, Burgan et al. sought to develop techniques to more efficiently identify highly competent individuals in free-living communities. They found that a simple-to-measure form of parasite tolerance may be an efficient substitute for more complex forms of tolerance in individual hosts and identified potential biomarkers of individual competence to West Nile virus.

**MAPPING MERS-CoV HOT SPOTS**

Camels infected with MERS-CoV can spread the disease to humans, but understanding the production and marketing systems for camels can help mitigate the risk. Giyonko et al. used a value chain approach to study camel systems and movements in Kenya and defined high-risk practices and locations that can increase disease risks to humans. Intervention and disease surveillance should focus on these areas to reduce human infection risks and spread of disease.

**VACCINATING WILD BOARS**

Tuberculosis (TB) infections in wild boar may be exacerbated by coinfections with porcine circovirus type 2 (PCV2). Risco et al. explored whether vaccination against PCV2 affected TB prevalence and TB severity in wild boar. Two groups of wild boar were studied, living in the same game estate until they were hunted. TB prevalence was similar in vaccinated and control groups, but the severity of TB lesions was significantly higher in control animals than in vaccinated wild boar, suggesting a positive effect of PCV2 vaccination.

**PARASITE PATHOLOGY IN PONDS**

Ongoing changes in climate and nutrient loading in freshwater systems can alter transmission of aquatic para-
sites at several stages in the life cycle, complicating efforts to predict and mitigate disease risk. Here Paul and Johnson show that the percentage of infected snails increased with warmer temperatures, while overall snail population densities declined. Greater nutrient concentrations increased the likelihood that amphibians would suffer deformities as a result of infection. Comparing how different forms of environmental change drive shifts in disease risk is critical for determining effective management strategies.

ARGH, ARGs in Our Fertilizer

Manures and biosolids contain pathogens and antibiotic resistance genes (ARGs) and are applied as fertilizers for crops not intended for human consumption on lands wild deer frequently visit. Rogers et al. investigated the prevalence of enteric pathogens and ARGs in the feces of deer as related to proximity of collection to residuals application. Campylobacter, tetracycline-resistant genes and erythromycin-resistant genes were associated with proximity of collection to concentrated animal feeding operations; tetracycline-resistant genes were associated with proximity to land-applied biosolids. As a result, deer in proximity to these activities pose an increased risk to nearby produce and water quality.

Trypanosoma cruzi Transmission

Hodo et al. used an ecological approach to study Trypanosoma cruzi parasite transmission dynamics among nonhuman primates (NHPs), wildlife, and kissing bugs across the southern USA. Raccoons, opossums, and skunks likely serve as key reservoirs of T. cruzi and live in close proximity to the NHPs, endangering their livelihood. Further, three species of kissing bugs were collected of which 17% were infected. Interventions to protect NHP and human health must focus on interrupting vector-mediated spillover from sylvatic cycles.

Perceiving the Threat

Safiou et al. describe the socioeconomic characteristics of Beninese cattle farmers, their perception on tick burden, as well as common tick control strategies in light of the current Amblyomma tick infestation, and the growing prevalence of Rhipicephalus microplus. National and regional tick control programs need to take into account the perception and constraints of local communities to better mitigate tick-borne diseases.

Conservation and Indigenous Well-Being in Oklahoma

This paper addresses the impact of Cherokee elder perspectives on the larger body of Cherokee citizens regarding tribal land conservation and health in Oklahoma. Carroll et al. surveyed Cherokee citizens before and after they viewed a short PhotoVoice documentary conveying elders’ views on land use and health. Results showed significant changes in citizens’ opinions after viewing the documentary, including shifts in their priorities for funding tribal land conservation. They conclude that broadcasting elder perspectives using contemporary media technology is an effective method for increasing knowledge about relationships between land conservation and community health and for increasing support for tribal land conservation policy.

Bonobos in the Congo

Tourism and research are important tools for the protection of wild great ape populations. However, these activities also involve a certain risk since human pathogens may easily cross the species barrier and infect the great apes. Here, Grützmacher et al. describe respiratory disease outbreaks in wild bonobos living in the Democratic Republic of Congo caused by human respiratory syncytial virus and human-derived bacterium, Streptococcus pneumoniae. Their data underline the need for a One Health approach covering human and animals with the dual positive effect of enhancing the health situation for people and great apes.

Parasites in European Bison

Captive bred animals are often immunologically naïve and more susceptible to pathogens. Kołodziej-Sobocińska et al. investigated Ashworthius sidemi infection intensity of captive bison released into the wild and then culled, compared with simultaneously studied wild-born animals. Mean infection intensity of released bison was over threefold higher than in wild bison and indicates a rapid
acquisition of parasites in previously dewormed bison released from captivity. They propose that controlled exposure of animals to parasites prior to release may be beneficial and increase their immunity, and management protocols should be established and standardized for endangered species reintroductions.