From the Editors

TUTORIALS IN RISK ANALYSIS

This issue opens with a tutorial by Michael Greenberg and Marc Weiner on how to conduct survey research in risk analysis, with a Commentary by Risk Perception Area Editor Michael Siegrist on the conduct of longitudinal studies. This is the first of a projected series of occasional tutorials in risk analysis methods to be published in Risk Analysis. The series is intended to present clear, engaging, and accessible expositions of important technical methods useful for carrying out risk analysis research and applications. Other tutorials have been invited on topics including the evidence in risk science and policy and pharmacokinetic modeling, and we welcome ideas and proposals for additional tutorials. Tutorials should be thorough and balanced, having lasting value as resources for students and practitioners of risk analysis.

RISK PERCEPTION AND COMMUNICATION

The Risk Perception and Communication area of Risk Analysis has grown so rapidly that, in June, we split it into two areas: Risk Perception, with Michael Siegrist as Area Editor; and Risk Communication, with Katherine McComas as Area Editor. We congratulate Michael and Katherine on their successful collaboration over the past few years in developing this area for the journal, and welcome Katherine as Area Editor for Risk Communication.

Four papers in this issue highlight new perspectives, insights, and applications of Risk Perception and Risk Communication. Dawson and Johnson offer a perspective on risks and benefits that might be associated with global population growth, and how individual perceptions of the risks, such as those from resource shortages, climate change, and pollution, might affect decisions and be affected by risk communication. Siegrist and Süsserlin present experimental evidence that the same negative outcome of a hazard is perceived as more severe for human-made compared to natural disasters, and for nuclear power as opposed to solar power (a more nature-associated technology). They add to our understanding of the affect heuristic and its implications—that perceptions and decisions about risks are shaped by emotional reactions—by showing how affect biases evaluations of outcomes based on their causes, thus undermining effective risk management and acceptance of cost-benefit analyses as guides to action. Allen et al. show that subjects asked to remember an eight-digit number could still interpret the information in simple graphical displays of uncertainty information about radon exposure concentrations (means and error bars vs. distance, scatter plots, cumulative distribution functions, complementary cumulative distribution functions, probability density functions); but the cognitive load of remembering something else impaired their ability to use the information from the graphs to choose whether to take action. Complementary cumulative distributions (CCDFs), which are widely used to summarize results of engineering risk analyses, led to correct choices significantly more frequently than logically equivalent cumulative distribution functions (CDFs). Terpstra et al. study experimentally how the framing of information about flood risks in cities near rivers affects citizens’ perceived need for more information, and how risk communication can change mediators of information need such as risk and benefit perceptions, affective responses such as fear or anger, and trust in risk management institutions. As expected, fear appeals increase perceived need for risk information by arousing negative feelings and increasing perceptions of risk, but these effects (which dominate mediation by positive attributes) may also weaken trust in risk management institutions. These papers illustrate the continued strong role of experimental investigations in clarifying exactly how risk communication messages affect emotional and cognitive pathways and resulting attitudes and choice behaviors.

INFECTIOUS DISEASE HAZARDS

Mathematical models of infection risks can inform a range of risk management decisions, from individual-level decisions about how and when to
use facemasks to reduce respiratory infection risk to population-level decisions about how best to manage risks of endemic or epidemic infections. At the population level, the spread and persistence of Middle East respiratory syndrome coronavirus (MERS-CoV) in human populations poses modeling puzzles, with long persistence in the population but a low basic reproductive number compared to classic epidemic patterns. Gardner et al. apply mathematical models to available data and conclude that predicted and observed patterns are significantly different, possibly because of unreported or underreported sources and human-human transmission. The work presents a useful challenge to risk modelers: understand and explain the puzzling dynamics of this disease, which has sickened hundreds of people in 2012–2014. At a more local individual level, Fisher et al. apply a mathematical model to quantify the potential for facemasks to become contaminated by coughs and aerosols, thus becoming possible sources of infection themselves.

NON-INFECTION RISKS

Slob et al. develop an approach to full probabilistic cancer risk assessment that uses bootstrap resampling to quantify confidence intervals for risk estimates that incorporate uncertainties in exposures and hazard assessment. They apply the probabilistic risk assessment approach to three chemicals (aflatoxin, NMDA, and methyleugenol) and show that the resulting uncertainty intervals are very wide, casting doubt on the utility of any point estimate. The authors discuss the limitations of well-known approaches such as linear extrapolation and the linearized multistage (LMS) model, and suggest that a margin of exposure (MOE) approach is better justified as a first-tier approach. Chen and Chen use categorical regression modeling to extend benchmark dose (BMD) calculations from the well-studied cases of binary responses (e.g., alive vs. dead, or tumor vs. no tumor at death) and continuous responses (e.g., time to death) to the case of ordered categorical responses (e.g., neurological symptoms, ordered from none to mild to severe). Sahmel et al. report results of a study of take-home exposures to chrysotile asbestos carried on contaminated clothing. They examine the relationship between airborne chrysotile concentrations in the workplace, the contamination of work clothing, and take-home exposures and risks.

RETROSPECTIVE EVALUATION OF RISK MANAGEMENT EFFORTS: WHAT HAS WORKED, AND HOW WELL?

Much of risk analysis consists of prescriptive analysis and predictive modeling: deciding what to do to manage risk and predicting how alternative courses of action will change the probabilities of adverse outcomes. But another very important role is to look back and candidly assess what has worked and what has failed, so that we can collectively learn to manage risks better. Two papers in this issue play that valuable role of retrospective assessment of the performance of risk management efforts. Card et al. perform a content analysis of risk management initiatives and organizational guidance in the East of England area of the British National Health Service (NHS). They find that risk matrices are used extensively, but that the guidance provided has done little to improve risk control to assure patient safety. Yorio et al. use data from the Mine Safety and Health Administration (MSHA) for 2003–2010 to appraise the contribution of regulatory health and safety management systems (HSMS) to reducing reportable injuries in mines. They examine specific HSMS elements such as management commitment, employee involvement, planning, implementation, checking and corrective action, and management review. Interpreting a measure of statistical association (an incident rate ratio) as an effect caused by MSHA citations, the authors conclude that citations corresponding to different HSMS elements affect mine injury and illness rates differently, with planning and checking (both proactive and reactive) having the largest estimated effects. Different models and time periods give different effects estimates, ranging from negligible to 18% reduction in mine reportable injuries from increases in MSHA enforcement. A possible interpretation is that enforcement activities that teach organizations how to prevent accidents by strengthening HSMS elements might be more important than number of citations in reducing future injuries, but increasing “serious and substantial” citations may have little effect on reducing injuries.

IMPROVING INFORMATION FOR RISK MANAGEMENT DECISION-MAKING

Two final papers deal with different aspects of how to provide more useful information to risk management decision-makers. Skakun et al. describe a
technology-based approach for using satellite images over time to construct relative frequency of inundation (RFI) flood hazard maps. They illustrate the approach by using Landsat data from 1989–2012 to identify cities and villages in Namibia with the greatest risks from floods, taking into account locations of roads, dwelling units, schools, and hospitals. Rose et al. consider in detail how to quantify the economic costs and trade-offs imposed by urban counter-terrorism security measures, ranging from delays and inconvenience at traffic checkpoints to reduced privacy and inhibited business activity. They provide a computable general equilibrium (CGE) economic framework for performing economic consequence analysis (ECA) of counter-terrorism measures, including their direct and indirect costs, benefits (e.g., from reduced risks of terrorism, attacks averted, and reduced crime where surveillance cameras are installed), positive and negative externalities, and transfer payments. The ECA modeling helps decision-makers arrive at a more comprehensive understanding of the economic impacts, both positive and negative, of terrorism countermeasures, such as random vehicle inspections and closed-circuit surveillance cameras, in urban areas.