
Risk, Perception, and Response

**Conference Program
March 20-21, 2014**

Harvard Center for Risk Analysis

*Funding for this conference is provided by
the Risk of Risk Perception Project, Center for
Risk Science Innovation and Application, ILSI
Research Foundation.*



*The conference is sponsored by the Society for Risk
Analysis.*

*The 20th Kyoto University International Symposium is supported
by Kyoto University.*

Table of Contents

Welcome.....	3
Overview of Agenda.....	4
Detailed Agenda.....	5
Risk, Perception, and Response Abstracts	8
Panel 1: Conceptual Framework and Crosscutting Issues	8
Panel 2: Health Care I.....	9
Panel 3: Occupational and Transportation Risk.....	11
Panel 4: Food Safety.....	12
Panel 5: Health Care II.....	14
Panel 6: Energy and the Environment	16
Panel 7: Finance	18
Risk, Perception, and Response Speaker Biographies	20
20th Kyoto University International Symposium.....	24
Abstracts	24
Speaker Biographies.....	26

Welcome

Dear Colleagues,

We are delighted to welcome you to the *Risk, Perception, and Response* conference. How people react to scientific evidence of risk is mediated by many factors, including how information is perceived and communicated, how we react to social and cultural influences, and how choices are structured. Examples abound of situations where individuals' risk perceptions lead them to act in ways that appear contrary to their own interests, overreacting to or neglecting risks. How can situations in which individuals are likely to respond poorly be identified, and what can be done to improve their responses?

To increase our understanding of the factors that contribute to these behaviors and to develop better options for fostering sound decisions, we commissioned the series of papers that will be presented at this conference. We received far more proposals than we were able to accept and thank our peer reviewers for their thoughtful consideration and recommendations: John Besley (Michigan State University); Frederic Boudier (Maastricht University); Frank Hearl (National Institute for Occupational Safety and Health); Margot Kuttschreuter (University of Twente); Randall Lutter (Resources for the Future); Katherine McComas (Cornell University); Clark Nardinelli (U.S. Food and Drug Administration); David Ropeik (Harvard University); Louise Russell (Rutgers University); Karen Sepucha (Harvard University); Douglass Shaw (Texas A&M University); Paul Slovic (Decision Research); Craig Trumbo (Colorado State University); Eve Wittenberg (Harvard University); and Felicia Wu (Michigan State University). The papers can be downloaded from our website, www.hcra.harvard.edu.

We are pleased to welcome our keynote speaker, Cass Sunstein, the Robert Walmsley University Professor at Harvard. Professor Sunstein is a leading scholar on these issues and founded the Program on Behavioral Economics and Public Policy at Harvard Law School. He is the author of numerous articles and books, including *Nudge: Improving Decisions about Health, Wealth, and Happiness* (with Richard H. Thaler, 2008).

This conference is funded by the Risk of Risk Perception Project, Center for Risk Science Innovation and Application, ILSI Research Foundation; we are grateful for their generous support. We also thank the Society for Risk Analysis for their sponsorship. We encourage you to join us for the *20th Kyoto University International Symposium* on Fukushima that immediately follows the *Risk, Perception, and Response* conference, and thank Kyoto University for its support.

Finally, we thank Christine Bell for her excellent administrative support.

We look forward to an interesting and productive conference!

Sincerely,
James K. Hammitt and Lisa A. Robinson
Harvard Center for Risk Analysis

Overview of Agenda

Thursday, March 20, 2014

8:00 – 8:30	<i>Registration and Breakfast</i>
8:30 – 8:45	<i>Introduction and Overview</i>
8:45 – 10:15	<i>Panel 1: Conceptual Framework and Crosscutting Issues</i>
10:15 – 10:45	<i>Break</i>
10:45 – 12:00	<i>Panel 2: Health Care I</i>
12:00 – 1:15	<i>Lunch</i>
1:15 – 2:30	<i>Panel 3: Occupational and Transportation Risk</i>
2:30 – 3:00	<i>Break</i>
3:00 – 4:30	<i>Panel 4: Food Safety</i>
4:30 – 5:00	<i>Open Discussion: Cross-cutting Insights</i>

Friday, March 21, 2014

8:00 – 8:30	<i>Registration and Breakfast</i>
8:30 – 10:00	<i>Panel 5: Health Care II</i>
10:00 – 10:15	<i>Break</i>
10:15 – 11:45	<i>Panel 6: Energy and the Environment</i>
11:45 – 1:30	<i>Lunch: Cass Sunstein, keynote speaker, “Choosing Not to Choose”</i>
1:30 – 2:15	<i>Panel 7: Finance</i>
2:15 – 2:45	<i>Open Discussion: Cross-cutting Insights</i>
2:45 – 3:00	<i>Break</i>
3:00 – 5:00	<i>20th Kyoto University International Symposium</i>

Detailed Agenda

Thursday, March 20, 2014	
8:00 – 8:30	Registration and Breakfast
8:30 – 8:45	Introduction and Overview: J.K. Hammitt, L.A. Robinson (Harvard University)
8:45 – 10:15	<p>Panel 1: Conceptual Framework and Crosscutting Issues</p> <p>a) Overcoming Learning-Aversion in Evaluating and Managing Uncertain Risks: L.A. Cox (NextHealth Technologies & Cox Associates)</p> <p>b) Choices and Rationalities under Radical Uncertainty: Ideals and Principles Behind Responses to Risks and Risk Information: T. Assmuth (Finnish Environmental Institute), A. Finkel (University of Pennsylvania Law School)</p> <p>c) Involved but Inaccurate: When High-Stakes Lead to Anecdotal Bias: T. Freling (University of Texas), R. Saini (University of Texas), Z. Yang (University of Texas)</p> <p>d) Within-Person and Between-Sample Sensitivity to Dimensions of Risk: G. Loomes (University of Warwick), M. Flores (University of East Anglia)</p>
10:15 – 10:45	Break
10:45 – 12:00	<p>Panel 2: Health Care I</p> <p>a) Does Introducing Imprecision around Risk and Benefit Estimates Influence the Way People Value Treatments?: N. Bansback (University of British Columbia), M. Harrison (University of Manchester), C. Marra (University of British Columbia)</p> <p>b) Empirical Evidence on the Role of Public Warnings on Physicians Drug Prescriptions Behavior: P. Dubois (Toulouse School of Economics), T. Tuncel (Toulouse School of Economics)</p> <p>c) Optimal Decision Making may be Hazardous to Your Health: Prospects for a New Science of Implementation: P.R. Falzer (VA Connecticut Healthcare System)</p>
12:00 – 1:15	Lunch
1:15 – 2:30	<p>Panel 3: Occupational and Transportation Risk</p> <p>a) Workers' Perception of Risk and Occupational Injuries: M. Galizzi (University of Massachusetts), T. Tempesti (University of Massachusetts)</p> <p>b) Organizational Risk Perceptions of Disasters: Do Risk Managers Matter?: A. Sadiq (Indiana University-Purdue University Indianapolis), J.D. Graham (Indiana University)</p> <p>c) Offsetting or Enhancing Behavior: An Empirical Analysis of Motorcycle Helmet Safety Legislation: J. Lee (East Carolina University)</p>
2:30 – 3:00	Break

Thursday, March 20, 2014	
3:00 – 4:30	<p>Panel 4: Food Safety</p> <p>a) Implicit and Explicit Risk Perception, Affect, and Trust: An Investigation of Food “Traffic Lights”: T. McCarthy (University of Strathclyde), C. Burns (University of Strathclyde), M. Revie (University of Strathclyde)</p> <p>b) Dinner with Bayes: On the Formation of Subjective Risk Beliefs: C.M.Rheinberger (Toulouse School of Economics), J.K. Hammitt (Harvard University)</p> <p>c) Extrapolating Understanding of Existing Food Risk Perceptions to Emerging Cases: G. Kaptan (Newcastle University & University of Leeds), A.R.H. Fischer (Wageningen University), L.J. Frewer (Newcastle University)</p> <p>d) Risks and Risk Perceptions Related to Drinking Bottled Water: K. Victory (University of Arizona), N. Cabrera (University of Arizona), D. Larson (University of Arizona), K. Reynolds (University of Arizona), J. Latura (Mariposa Community Health Center), P. Beamer (University of Arizona)</p>
4:30 – 5:00	Open Discussion: Cross-cutting Insights

Friday, March 21, 2014	
8:00 – 8:30	Registration and Breakfast
8:30 – 10:00	<p>Panel 5: Health Care II</p> <p>a) Risk Literacy and Transparent Risk Communication in Health: A Review: R. Garcia-Retamero (Max Planck Institute for Human Development & University of Grenada), E.T. Cokely (Max Planck Institute for Human Development & Michigan Technological University)</p> <p>b) Risk Communication, Values Clarification and Vaccination Decisions: H.O. Witteman (Université Laval), S. Chipenda-Dansokho (Université Laval), N. Exe (University of Michigan), B.J. Zikmund-Fisher (University of Michigan)</p> <p>c) Health Care Workers’ Risk Perceptions of Personal and Work Activities and Willingness to Report for Work during an Influenza Pandemic: G. Dionne (HEC Montreal), D. Desjardins (HEC Montreal), M. Lebeau (HEC Montreal), S. Messier (HEC Montreal), A. Dascal (McGill University)</p> <p>d) Time Preferences, Health Behaviors, and Energy Consumption: D. Bradford (University of Georgia), C. Courtemanche (Georgia State University & NBER), G. Heutel (University of North Carolina & NBER), P. McAlvanah (Federal Trade Commission), C. Ruhm (University of Virginia & NBER)</p>
10:00 – 10:15	Break

Friday, March 21, 2014	
10:15 – 11:45	<p>Panel 6: Energy and the Environment</p> <p>a) Unconventional Gas Development in the USA: Exploring the Risk Perception Issues: J.D. Graham (Indiana University), J.A. Rupp (Indiana University), O. Schenk (Indiana University)</p> <p>b) How Near-Miss Events Can Embolden or Mitigate Risky Decision Making: R.L. Dillon (Georgetown University), C.H. Tinsley (Georgetown University)</p> <p>c) Risk Preferences, Inefficiencies, and Opportunities in Wildfire Management: M.S. Hand (USDA Forest Service), M.J. Wibbenmeyer (University of California), D.E. Calkin (USDA Forest Service), M.P. Thompson (USDA Forest Service)</p> <p>d) Communicating Hurricane Warnings: Factors Affecting Protective Behavior: J.K. Lazo (National Center for Atmospheric Research), A. Bostrom (University of Washington), R. Morss (National Center for Atmospheric Research), J. Demuth (National Center for Atmospheric Research), H. Lazrus (National Center for Atmospheric Research)</p>
11:45 – 1:30	<p>Lunch: Cass Sunstein, keynote speaker, “Choosing Not to Choose”</p>
1:30 – 2:15	<p>Panel 7: Finance</p> <p>a) Overcoming Barriers to Life Insurance Coverage: A Behavioral Approach: N.B. Coe (University of Washington), A. Belbase (Boston College), A. Wu (Boston College)</p> <p>b) Risk Misperceptions, Advantageous Selection, and Demand for Cancer Insurance: M. Riddel (University of Nevada), D. Hales (University of Nevada)</p> <p>c) Does Aggregated Returns Disclosure Increase Portfolio Risk-Taking?: J. Beshears (Stanford University & NBER), J.J. Choi (Yale University & NBER), D. Laibson (Harvard University & NBER), B.C. Madrian (Harvard University & NBER) <i>[This paper will not be presented at the conference, but is available on the conference website.]</i></p>
2:15 – 2:45	<p>Open Discussion: Cross-cutting Insights</p>
2:45 – 3:00	<p>Break</p>
3:00 – 5:00	<p>20th Kyoto University International Symposium</p> <p>Greeting: Michiaki Mishima (Executive Vice President for International Affairs and Hospital Administration, Kyoto University)</p> <p>a) A Preliminary Observation on Risk Perception among Local Residents in Fukushima: A. Koizumi (Kyoto University)</p> <p>b) Mistakes and Reflections of Risk Communication in Fukushima Daiichi Nuclear Power Plant Accident: M. Yoneda (Kyoto University)</p> <p>c) Activities on Radiation Monitoring Fukushima and their Public Perception: M. Tanigaki (Kyoto University)</p> <p>d) The Structural Model of Public Perception and the Effects of Interactive Communication on the Risk of Radioactive Substances in Food: Y. Niyama (Kyoto University)</p> <p>e) Learning from History: Evacuation Criteria: R. Wilson (Harvard University)</p>

Risk, Perception, and Response Abstracts

Full papers can be downloaded from hcra.harvard.edu.

Panel 1: Conceptual Framework and Crosscutting Issues

Overcoming Learning-Aversion in Evaluating and Managing Uncertain Risks L.A. Cox (NextHealth Technologies)

Ambiguity-aversion and related decision biases distort cost-benefit evaluations of uncertain risks and can lead to poor risk management policy decisions, i.e., to decisions which predictably will have high retrospective regret. This research synthesizes research on decision-analytic and behavioral economics relations among several well-documented decision biases and argues that they lead to what we call *learning-aversion*: predictably sub-optimal learning and premature decision-making in the face of high uncertainty about the costs, risks, and benefits of proposed changes. We argue that ambiguity-averse preferences, together with other biases such as overconfidence, confirmation bias, optimism bias, and hyperbolic discounting of the immediate costs and delayed benefits of learning, contribute to deficient individual and group learning, avoidance of information-seeking, under-estimation of the value of further information, and hence needlessly inaccurate risk-cost-benefit estimates and poor risk management decisions. We examine how such biases create predictable regret in selection of potential risk-reducing regulations, and how *low-regret learning strategies* (based on computational reinforcement learning models) can be used to overcome these suboptimal decision processes by replacing aversion to uncertain probabilities with optimized learning, i.e., with actions calculated to balance exploration (deliberate experimentation and uncertainty reduction) and exploitation (taking actions to maximize the sum of expected immediate reward, expected discounted future reward, and value of information). We illustrate the proposed framework for understanding and overcoming “learning-aversion” and for implementing low-regret learning strategies using regulation of air pollutants with uncertain health effects (concentration-response functions) as a case study.

Choices and Rationalities under Radical Uncertainty: Ideals and Principles Behind Responses to Risks and Risk Information T. Assmuth (Finnish Environmental Institute), A. Finkel (University of Pennsylvania Law School)

We investigate the role of ideas, ideals and principles in responses to risks. Focusing on human health risks, we scrutinize the notions that “irrational” risk perceptions and behavior can frequently harm health, and that such perceptions and also risk-increasing responses to information and societal “nudges” need correction. To develop a more thoughtful and less normative theory of what makes a response rational or harmful, we rely on the collective experience in risk assessment and risk governance in the EU and the US, and use literature reviews, conceptual models and cases such as seafood consumption. Our approach implies a departure from common positivist methods in risk analysis. We outline types and roles of ideas and principles in relation to risks, to those responding and to their societal contexts, emphasizing alternative development paths and notions of risk significance.

We then deconstruct rationality and harm in risk behavior, stressing the difficulties in defining non-equivocally such behavior and ‘corrective’ approaches. We replace the ideal of optimality in choosing between risks with acceptability of processes and outcomes, and substantive with communicative rationality. We examine the impacts of world-views on risk behavior, including asymmetric responses, and the importance of the qualities of the risk and of the context. In conclusion, we offer suggestions for deeper and more many-sided understanding and development of responses to risks and of related ideas and principles.

Involved but Inaccurate: When High-Stakes Lead To Anecdotal Bias T. Freling (University of Texas), R. Saini (University of Texas), Z. Yang (University of Texas)

Individuals often eschew more accurate statistical information in decision making, relying instead upon anecdotal evidence. The current research proposes that, contrary to what dual processing models predict, high involvement—when accompanied by high perceived vulnerability—can enhance an “anecdotal bias” rather than reduce it. We propose that this is primarily due to the *visceral compatibility effect*, wherein anecdotal information is favored in vivid decision environments. Four studies provide consistent support for this effect. Study 1 reconciles contradictory predictions, demonstrating that high involvement can decrease or enhance the anecdotal bias, depending on whether it is accompanied by high vulnerability. Study 2 replicates this finding in a different choice scenario and demonstrates that emotional engagement is the key mechanism underlying the visceral compatibility effect. Studies 3 and 4 reveal that analytic-holistic thinking style constitutes a boundary condition for this effect, with holistic thinkers exhibiting greater susceptibility to anecdotal bias than analytic thinkers.

Within-Person and Between-Sample Sensitivity to Dimensions of Risk G. Loomes (University of Warwick), M. Flores (University of East Anglia)

This paper reports the results of a survey designed to elicit probability judgments' for different kinds of events. We find limited sensitivity to time both within-person and between groups of people. Second, we find some sensitivity to scope within-person - although arguably less than we might expect - and limited sensitivity to scope between groups of people. Finally, the subjective probabilities about crime and injuries appear to be largely unaffected either by feedback about the known frequencies of such events or by people's experience/practice estimating the likelihood of pure chance events.

Panel 2: Health Care I

Does Introducing Imprecision around Risk and Benefit Estimates Influence the Way People Value Treatments? N. Bansback (University of British Columbia), M. Harrison (University of Manchester), C. Marra (University of British Columbia)

Imprecision in estimates of benefits and harms around treatment choices is rarely described to patients. The most appropriate format to communicate imprecision and its influence on patient choices is unknown. In contexts where sampling error varies between treatment alternatives (e.g. similar average

risks, but one treatment has a larger confidence interval), this can lead to patients failing to choose what option is best for them. The aim of this study is to determine how two methods for describing imprecision in risk influence peoples' treatment decisions using a discrete choice experiment. We randomized a representative sample of the Canadian general population to one of three surveys which sought choices between hypothetical treatments for rheumatoid arthritis based on different levels of 7 attributes, route and frequency of administration, chance of benefit, serious and minor side-effects and life expectancy, and imprecision in benefit and side-effect estimates. The surveys differed in the way imprecision for benefits and harms was described: none, a quantitative description based on confidence intervals with a visual prop, and a qualitative description. The analyzed data were from 2011 respondents that provided rational responses to the survey. Conditional logit models suggested people placed value on qualitative but not quantitative descriptions of imprecision. Both qualitative and quantitative methods led to small but significant increases in ambiguity for choosing a treatment. While we are unable to determine whether these values are truly informed, the results provide insight into how current approaches influence patient treatment choices.

Empirical Evidence on The Role of Public Warnings on Physicians Drug Prescriptions Behavior P. Dubois (Toulouse School of Economics), T. Tuncel (Toulouse School of Economics)

We investigate how prescription behavior of physicians reacts to scientific information released by public authorities. Taking the example of antidepressant drugs, we use French panel data on exhaustive prescriptions of a representative sample of 386 general practitioners to more than 170,000 depressed patients, between 2000 to 2008. Changing scientific evidence on the efficacy and side effects of antidepressants during that period resulted in new official warnings and recommendations. Examples are the new results on the increase of suicidal thinking in children reported in 2004 for selective serotonin reuptake inhibitors (SSRI). After the warnings, physicians must update their risk perception on different drug treatments for the patients and physicians may react differently to these warnings. We use the official warnings and recommendations along the period to identify how they affected physicians' drug choices on the first visit the patient is diagnosed by depression. We find that physicians respond to the new information heterogeneously, providing evidence that heterogeneity of prescribing behavior is not simply due to heterogeneity of preferences towards different side effects but heterogeneity of knowledge or information acquisition. We find that antidepressant prescriptions decrease after 2004 for kids and adolescents. Even though the warning is only for kids and adolescents physicians change their prescription behavior for other age groups too.

Optimal Decision Making may be Hazardous to Your Health: Prospects for a New Science of Implementation P.R. Falzer (VA Connecticut Healthcare System)

Initiatives to improve the quality of healthcare delivery include the introduction of treatment guidelines and the development of implementation science, which overcomes barriers in bringing evidence-based practices to routine clinical care. The implementation strategy is to identify impediments to guideline adherence, then develop means of changing behavior to increase conformance. Achievements to date have fallen short of the objectives, and the tactics oftentimes have provoked resistance. This response

may illustrate the significance of the problem, but it may also indicate that the methods of implementation science tend to overstate the quality of evidence, ignore instances in which the appropriateness of a given practice cannot be clearly determined, and overlook the complexities of applying general knowledge to specific cases. This essay proposes that an inability to contextualize evidence is inherent to patient-oriented services research. The essay draws from discussions of deep uncertainty in the risk perception literature, to illustrate that a risk perception problem predicated the disparity between services research and clinical practice. It draws on situation awareness theory from human factors research, to describe the task of understanding complex clinical situations and discuss how this task facilitates effective decision making. It draws on image theory from naturalistic decision making, to develop and illustrate a multi-phase strategy that features a new standard and test for examining how practitioners incorporate guideline recommendations into decisional processes. The essay closes by highlighting the challenges posed by multi-operator systems such as shared decision making, and the prospect of a new, revitalized, science of implementation.

Panel 3: Occupational and Transportation Risk

Workers' Perception of Risk and Occupational Injuries M. Galizzi (University of Massachusetts), T. Tempesti (University of Massachusetts)

This study explores the relationship between individuals' risk tolerance and occupational injuries. We study data from a national representative survey of U.S. workers that includes information about injuries, risk tolerance, cognitive and non-cognitive attributes, and risky behaviors. We measure risk tolerance through questions regarding individuals' willingness to gamble on their life-time income. We estimate zero-inflated count models to assess the role played by such measure on workers' recurrent injuries. We discuss a few recommendations for occupational safety policies.

Our results highlight the concurrent and changing role played by individual, work and environmental factors in explaining recurrent accidents. They show that risk tolerance and cognitive and noncognitive abilities affect recurrent injuries, although not always in the direction that proponents of the idea of injury proneness would expect. Our measure of risk preferences shows that individuals who are somewhat more risk prone have fewer recurrent injuries than the ones who are risk averse. But the relationship is not monotonic and, therefore, not easy to predict. Furthermore, some variables play a different role in affecting the probability of any first injury as opposed to the probability of further injuries. This suggests that the experience of a first injury somehow changes workers' safety consciousness. At the same time, we find that individuals' "revealed risky preferences" – specific risky behaviors – are related to higher injury probabilities. Demanding working conditions, measures of socio-economic status, health, and safety problems experienced by workers during their youth remain among the most important factors explaining the phenomena of recurrent injuries, however.

Organizational Risk Perceptions of Disasters: Do Risk Managers Matter? A. Sadiq (Indiana University-Purdue University Indianapolis), J.D. Graham (Indiana University)

Previous research on risk perception suggests that individual neglect of disasters is likely due to an inability to process information about low-probability, high-consequence threats and moral hazard. As a result, it is important to study the quality of organizational responses to disasters, since they may be crucial to compensating for the frailty of individual choice. Preliminary evidence suggests that an organizational risk manager is important in disaster planning, but there is no empirical evidence (to our knowledge) that having a designated risk manager leads to the adoption of risk-reducing measures in organizations. Additionally, there is limited research on the relationship between risk perception and the adoption of risk-reducing measures at the organizational level. The goal of this study is to empirically answer two questions. (1) “Does having a risk manager in an organization predict the adoption of risk-reducing measures?” (2) “What is the relationship between risk perception and the adoption of risk-reducing measures at the organizational level?” Using data collected from a sample of public, private, and non-profit organizations in the Memphis/Shelby County area, Tennessee in 2006, we find that organizations with risk managers adopted more risk-reducing measures than organizations without risk managers and that risk perception is a significant predictor of risk-reducing measures. This study builds on a small but growing literature on how organizations perceive risks and respond to them.

Offsetting or Enhancing Behavior: An Empirical Analysis of Motorcycle Helmet Safety Legislation J. Lee (East Carolina University)

This study uses state level panel data from a 33-year period along with repeated cross-sectional individual level crash data to test the hypotheses of offsetting and enhancing behavior with regards to motorcycle helmet legislation. Results presented in this paper find no evidence of offsetting behavior and are consistent with the presence of enhancing behavior. State motorcycle helmet laws are estimated to reduce motorcycle crashes by 18.2% to 33.1%. These results do not appear to be driven by omitted variable bias or non-classical measurement error in motorcycle crashes. Furthermore, individual motorcyclists who are incentivized to wear helmets in order to comply with mandatory helmet laws are estimated to have a 4.2 to 4.8 percentage point reduced probability of receiving a traffic citation for reckless driving behavior. Overall, the results strongly suggest that mandatory helmet laws result in significant reductions in risky driving behavior among motorcyclists.

Panel 4: Food Safety

Implicit and Explicit Risk Perception, Affect, and Trust: An Investigation of Food “Traffic Lights” T. McCarthy (University of Strathclyde), C. Burns (University of Strathclyde), M. Revie (University of Strathclyde)

Obesity is a health problem in many developed countries and is a growing problem worldwide. In an effort to improve food choices the “traffic lights” nutritional labelling system has been developed. This system informs consumers of the relative (low, medium, high) levels of fat, saturated fats, sugar, and

salt, along with energy information. There is debate over what type of thought processing drives perceptions of affect (or emotion) and risk regarding food products. These are System 1 (quick, intuitive) processing and System 2 (slower, deliberative) processing. In order to capture data on both types of processing, we used explicit and implicit measures (we developed an implicit measure of risk for this study). We also investigated the relationships of risk with affect, and trust. The results showed the presence of food “traffic lights” sometimes influenced both risk and affect perceptions but this was more pronounced for explicit measures. We also found that high risk was associated with negative affect, and low risk with positive affect, with larger effects when the “traffic lights” were present. We concluded that “traffic lights” can influence risk perception at both explicit and implicit levels but the influence was stronger if either the risk information was clear or the person was consciously evaluating the risk. Future research was discussed.

Dinner with Bayes: On the Formation of Subjective Risk Beliefs C.M. Rheinberger (Toulouse School of Economics), J.K. Hammitt (Harvard University)

We study the formation of subjective beliefs about the risk of contracting a food borne illness. A representative sample of French consumers stated their risk perceptions before and after receiving risk-relevant information about the average consumer. Regression analyses indicate that prior risk beliefs, education and understanding of risks as well as self-protective behavior are significant predictors of subjective, posterior risk estimates. We find that, on average, the revision of beliefs is consistent with Bayesian updating. However, some subjects responded in a non-Bayesian manner. In a group-wise analysis, we identify drivers of this seemingly irrational updating behavior.

Extrapolating Understanding of Existing Food Risk Perceptions to Emerging Cases G. Kaptan (Newcastle University & University of Leeds), A.R.H. Fischer (Wageningen University), L.J. Frewer (Newcastle University)

Important determinants of risk perceptions associated with foods are the extent to which the potential hazards are perceived to have *technological* or *naturally occurring* origins, together with the temporal dimension in which the potential hazard is presented (*acute* or *chronic*). This study presents a case study analysis to examine how these hazard characteristics affect people’s risk and benefit perceptions, and associated attitudes and behaviours. The cases include *E. coli* incidences (outbreaks linked to fresh spinach and fenugreek sprouts), contamination of fish by environmental pollutants, (organochlorine contaminants in farmed salmon), radioactive contamination of food following a nuclear accident (the Fukushima accident in Japan), and GM salmon destined for the human food chain. The analysis of the cases over the temporal dimension suggests that longitudinal quantification of the relationship between risk perceptions and impacts is important for both acute and chronic food safety, but this has infrequently been applied to chronic hazards. Technologies applied to food production tend to potentially be associated with higher levels of risk perception, linked to perceptions that the risk is unnatural. However, for some risks (for example those involving biological irreversibility) moral or ethical concerns may be more important determinants of consumer responses than risk or benefit perceptions. (Lack of) trust has been highlighted in all of the cases suggesting transparent and honest

risk-benefit communications following the occurrence of a food safety incident. Implications for optimising associated risk communication strategies, additional research linking risk perception and other quantitative measures, including comparisons in time and space, are suggested.

Risks and Risk Perceptions Related to Drinking Bottled Water K. Victory (University of Arizona), N. Cabrera (University of Arizona), D. Larson (University of Arizona), K. Reynolds (University of Arizona), J. Latura (Mariposa Community Health Center), P. Beamer (University of Arizona)

Previous studies have shown that low-income Latinos generally drink bottled water over tap water and might be at increased risks for cavities from unfluoridated bottled water. We interviewed ninety low-income Latino households from Nogales, Arizona who primarily drink bottled water and asked them to evaluate potential health risks of drinking tap water compared to 16 other voluntary activities. Respondents viewed bottled water to be significantly safer to consume than tap water ($p < 0.001$). On a Likert scale from 1 (low risk) to 5 (high risk), “drinking tap water in Nogales, Arizona” received an average score of 4.7, which was significantly higher than the average perceived risk of smoking ($\mu = 3.5$, $p < 0.001$) or of drinking tap water in San Francisco, California ($\mu = 3.4$, $p < 0.001$), and as risky as “drinking and driving” ($\mu = 4.8$, $p = 1.00$) and “drinking tap water in Nogales, Sonora, Mexico” ($\mu = 4.8$, $p = 1.00$). Additionally, 98% of respondents feared that drinking local tap water could result in illness. The majority of respondents (79%) did not drink their water because of fear of contamination, and would drink their water if they knew it was safe regardless of the taste (73%). No participants received any recommendations about fluoride supplementation from healthcare providers. These results suggest that fear of illness from tap-water consumption is an important contributing factor to increased use of bottled water. Furthermore, interventions could be developed to reduce perceived risks associated with tap-water consumption and emphasize the importance of fluoride supplementation if residents continue using bottled water for drinking and cooking.

Panel 5: Health Care II

Risk Literacy and Transparent Risk Communication in Health: A Review R. Garcia-Retamero (Max Planck Institute for Human Development & University of Grenada), E.T. Cokely (Max Planck Institute for Human Development & Michigan Technological University)

Numerical skills have become increasingly necessary for navigating the modern health care environment. Unfortunately, a significant proportion of the population lacks basic numeracy, which limits their risk literacy (i.e., their ability to accurately interpret and make good decisions based on information about risk). In this article, we review recent research investigating how to improve risk literacy by using transparent information formats for risk communication. This research focuses on simple messages containing visual aids that improve risk comprehension and medical decision making. This research also investigates the psychological mechanisms mediating the effect of visual aids. Our review includes data from 60 countries (e.g., China, England, Japan, India, Pakistan, Spain, Sweden, and the United States) with participants from diverse walks of life (e.g., health professionals, patients, high-risk individuals, probabilistic national samples, and web panels). Results converge with a growing body

of research showing that appropriately designed visual aids can be highly effective, transparent, and ethically desirable tools for improving risk communication, particularly among people with limited numerical skills. Open questions and emerging applications of our research are discussed.

Risk Communication, Values Clarification and Vaccination Decisions H.O. Witteman (Université Laval), S. Chipenda-Dansokho (Université Laval), N. Exe (University of Michigan), B.J. Zikmund-Fisher (University of Michigan)

Many health-related choices require choosing between two options, each of which carries an element of risk. When presented with such risk tradeoffs, people often make choices that fail to align with available scientific evidence and/or with their own values. In our previous research, we have developed risk visualizations and interactive values clarification designs that help people make more coherent choices. This study tested such methods in the context of parental decisions about influenza vaccinations for their children. We aimed to help parents understand the risks associated with vaccinating and not vaccinating their children against influenza, grasp the tradeoffs inherent in the decision, visualize how their individual values relate to their options, and make choices that align with their values. Participants (n=407) in this online factorial experiment were a diverse sample of parents and guardians whose children were aged 6 months to 17 years and were eligible for influenza immunization but who had not yet received a vaccine in the current year. We randomly assigned participants to view either standard information about influenza vaccines or information presented in an absolute risk communication format, and then to either be presented or not presented with an interactive values clarification interface. Participants who were randomized to the absolute risk communication format combined with the values clarification interface were more likely to indicate intentions to vaccinate and make choices that aligned with their stated values. The effect was particularly notable among participants who had previously demonstrated less willingness to have their children vaccinated against influenza.

Health Care Workers' Risk Perceptions of Personal and Work Activities and Willingness to Report for Work during an Influenza Pandemic G. Dionne (HEC Montreal), D. Desjardins (HEC Montreal), M. Lebeau (HEC Montreal), S. Messier (HEC Montreal), A. Dascal (McGill University)

The ability and willingness of health care workers to report for work during a pandemic are essential to pandemic response. The main contribution of this article is to examine the relationship between risk perception of personal and work activities and willingness to report for work during an influenza pandemic. Data were collected through a quantitative Web-based survey sent to health care workers on the island of Montreal. Respondents were asked about their perception of various risks to obtain index measures of risk perception. A multinomial logit model was applied for the probability estimations, and a factor analysis was conducted to compute risk perception indexes (scores). Risk perception associated with personal and work activities is a significant predictor of intended presence at work during an influenza pandemic. The average predicted probability of being at work during the worst scenario of an influenza pandemic is 46% for all workers in the sample, 36% for those overestimating risk in personal and work activities (95% CI: 35%–37%), 53% for those underestimating risk in work activities (95% CI: 52%–54%), and 49% for those underestimating risk of personal activities (95% CI: 48%–50%). When

given an opportunity to change their intentions, 45% of those who initially did not intend to report for work in the worst scenario would do so if the pandemic resulted in a severe manpower shortage. These results have not been previously reported in the literature. Many organizational variables are also significant.

Time Preferences, Health Behaviors, and Energy Consumption D. Bradford (University of Georgia), C. Courtemanche (Georgia State University & NBER), G. Heutel (University of North Carolina & NBER), P. McAlvanah (Federal Trade Commission), C. Ruhm (University of Virginia & NBER)

We conduct a survey eliciting time preferences from a representative sample of US residents, allowing for quasi-hyperbolic discounting. We also ask individuals about health behaviors and outcomes and energy consumption, hypothesizing that present-biased consumers will be less likely to invest in health and in energy-efficiency. Regression results with basic demographic controls suggest that present bias is associated with many outcomes in both of these dimensions, including overall self-assessed health, smoking, drinking, drug use, health insurance, automobile fuel economy, home insulation and weatherization, and use of thermostats. However, the time-consistent component of the quasi-hyperbolic specification is predictive of an even larger number of outcomes. These findings are robust to controlling for risk preferences. In all, our results suggest that both time-consistent and present-biased discounting influence health, health behaviors, and energy use.

Panel 6: Energy and the Environment

Unconventional Gas Development in the USA: Exploring the Risk Perception Issues J.D. Graham (Indiana University), J.A. Rupp (Indiana University), O. Schenk (Indiana University)

Unconventional gas development (UGD) is examined from a risk-perception perspective. Drawing on the risk literature, recent opinion surveys, and case studies of regulation in eight states, we find that UGD is an emerging technology that is likely to be perceived as risky, even though the two most commonly claimed risks, water contamination and induced seismicity, appear to be controllable through competent industry and regulatory practices. Perceived risk is likely to increase as the technology is used more widely in the United States but any public outrage is likely to be attenuated because of perceived benefits and related forms of risk compensation for individuals and communities. The types of triggering events necessary for large-scale social amplification and stigmatization have not yet occurred but organized interests against UGD are becoming stronger and are exerting significant influence. It is too early to determine whether UGD will become stigmatized in the same way that nuclear power and genetically modified foods are now stigmatized in some regions of the world.

How Near-Miss Events Can Embolden or Mitigate Risky Decision Making R.L. Dillon (Georgetown University), C.H. Tinsley (Georgetown University)

Decades of research have sought to understand how individuals and organizations prepare for both natural and man-made disasters. We believe one understudied factor is the impact of prior near-miss

events. A near-miss occurs when an event (such as a hurricane or tornado), which had some non-trivial probability of ending in disaster (loss of life, property damage), does not because of good fortune. If the near-miss has no salient cues of a possible bad outcome, people appear to mistake such good fortune as an indicator of system resiliency. In the first of two experiments, we study people's reactions to hurricane warnings and find that people with prior near-miss information that have no cues about bad outcomes were less likely to take protective measures to avoid a forecasted hurricane. In this study, we also examined the role of an individual's risk propensity and general optimism. We find risk propensity to be stable across conditions, whereas general optimism can be influenced by the type of prior near-miss information and this influence mediates the impact of near-miss information. In our second study, we examine a specific type of near-miss – the false alarm. We show that over a series of false alarms, people's perception of the risk of a tornado warning decrease and that people are less likely to cancel plans. Our findings indicate that people who experience a hazard but escape without obvious cues of damage will make decisions consistent with a perception that the situation is less risky. We end by discussing the implications for risk communication.

Risk Preferences, Inefficiencies, and Opportunities in Wildfire Management M.S. Hand (USDA Forest Service), M.J. Wibbenmeyer (University of California), D.E. Calkin (USDA Forest Service), M.P. Thompson (USDA Forest Service)

Wildfires present a complex applied risk management environment, but relatively little attention has been paid to behavioral and cognitive responses to risk among public agency wildfire managers. This study investigates responses to risk, including probability weighting and risk aversion, in a wildfire management context using a survey-based experiment administered to Federal wildfire managers in the spring of 2012. Respondents were presented with a multi-attribute lottery-choice experiment where each lottery is defined by three outcome attributes: Expenditures for fire suppression, damage to private property, and exposure of firefighters to the risk of aviation-related fatalities. Respondents choose one of two strategies, each of which includes "good" (low cost/low damage) and "bad" (high cost/high damage) outcomes that occur with varying probabilities. The choice task also incorporates an information framing experiment to test whether information about fatality risk to firefighters alters managers' responses to risk. Results suggest that managers exhibit risk aversion and non-linear probability weighting, which can result in choices that do not minimize expected losses from wildfires. Information framing tends to result in greater probability weighting and greater value placed on risks to firefighters.

Communicating Hurricane Warnings: Factors Affecting Protective Behavior J.K. Lazo (National Center for Atmospheric Research), A. Bostrom (University of Washington), R. Morss (National Center for Atmospheric Research), J. Demuth (National Center for Atmospheric Research), H. Lazrus (National Center for Atmospheric Research)

We examine the influence of multiple factors – type of warning message, sociodemographic characteristics, worldviews, perceived risk and vulnerabilities, experience and prior protective actions, motivations and barriers, and information sources – on intended protective evacuation behavior for

approaching hurricane threats. We develop a series of regression models on survey data collected in May 2012 in the Miami-Dade area (n=460) and the Galveston-Houston area (n=348) on stated evacuation likelihood given different information conditions (i.e., saw a forecast that a hurricane would affect their area or received an evacuation order). We find that when measures of evacuation motivations and barriers are included in the analysis, several factors correlated with evacuation decisions in prior work (such as sociodemographic characteristics and perceived location in an evacuation zone) are less robust predictors. Contrary to expectations based on work in other risk contexts, we find that worldview (individualist or egalitarian) is not a strong predictor of evacuation intent in the information conditions presented. We also find people's expectations of likely conditions and impacts associated with a hurricane are not strong predictors of evacuation intent. Evacuation intent was found to be higher among those with higher perceptions of hurricane risk controllability, those with prior hurricane evacuation experience, and those with higher anticipated frequency of use of official sources of information in hurricane threats. Further analysis will examine these initial findings in greater depth, and seek to interpret how the results can be used to help identify key risk misperceptions that contribute to ineffective protective decisions when a hurricane threatens.

Panel 7: Finance

Overcoming Barriers to Life Insurance Coverage: A Behavioral Approach N.B. Coe (University of Washington), A. Belbase (Boston College), A. Wu (Boston College)

While life insurance purchase decisions have long been studied, we still do not know how people decide if they need insurance or how much they need. Using in-depth interviews, we peer into the black-box of employee decision-making to learn what people know about this employee-benefit, and how they decide if it is of value for them. We find that individuals understand the need for life insurance, but find many behavioral economic barriers to getting adequate coverage, including inertia, mental accounting, money illusion, anchoring and signaling. We then conduct an on-line experiment of the hypothetical employee-benefit purchase scenario, and find a few, simple interventions could help individuals better decide their life insurance needs.

Risk Misperceptions, Advantageous Selection, and Demand for Cancer Insurance M. Riddel (University of Nevada), D. Hales (University of Nevada)

Spinnewijn (2013) posits that risk misperception can lead to advantageous selection in insurance markets. Subjects who are "baseline pessimistic" believe that their risk of damages is higher than it actually is and overinsure relative to their true risk type. Insurees who are relatively optimistic about the marginal return to effort, dubbed "control optimistic" will overinvest in effort, lowering their ex-post insurance claims. These two forms of misperception work together so that there is a negative correlation between insurance coverage and claims and advantageous selection results. We test this hypothesis using a survey of 200 women's demand for hypothetical cancer insurance. We elicit perceptions of baseline and control risk and use these, together with actual risks, to develop measures of baseline pessimism and control optimism. Controlling for risk aversion, cognitive ability and

demographic traits, we show that willingness to pay for cancer insurance is increasing in baseline pessimism. We further show that control optimists invest more in effort, engaging in more preventative activities and fewer risky activities such as smoking. Taken together, this suggests that advantageous selection arising from risk misperception may indeed play a role in insurance markets. We show that welfare losses can be significant ranging from 4 to 9 percent of the insurance premium. Welfare losses are substantially lower when subjects are offered information about true cancer risks before making their purchase decision.

Does Aggregated Returns Disclosure Increase Portfolio Risk-Taking? J. Beshears (Stanford University & NBER), J.J. Choi (Yale University & NBER), D. Laibson (Harvard University & NBER), B.C. Madrian (Harvard University & NBER)

Many previous experiments have found that subjects invest more in risky assets if they see their returns less frequently, see portfolio-level (rather than separate asset-by-asset) returns, or see long-horizon (rather than one-year) historical asset class return distributions. We find that aggregated returns disclosure does not increase equity allocations in an experiment where—in contrast to previous experiments—subjects invest in real mutual funds over the course of one year. Previously documented aggregation effects are highly sensitive to the distribution of the risky asset's returns and how much clock time elapses between the portfolio choice and the viewing of the returns. *[This paper will not be presented at the conference, but is available on the conference website.]*

Risk, Perception, and Response Speaker Biographies

Timo Assmuth is a senior researcher at the Finnish Environment Institute and holds an adjunct professorship in environmental sciences at the University of Helsinki. He has 30 years of experience in environmental, health and comparative risk assessment, first mainly within chemicals management, then increasingly in their human dimensions including psychology, communication and history. He holds degrees from the University of Helsinki and studied at Tufts University under a Fulbright scholarship.

Nick Bansback is an Assistant Professor at the School of Population and Public Health, University of British Columbia, and a Scientist at the Centre for Health Evaluation and Outcome Sciences, St Paul's Hospital, Vancouver. With a background in mathematics and health economics, his research seeks to improve health and health care through the use of preference elicitation and decision analysis.

Calvin Burns is a chartered psychologist and lecturer (assistant professor) in Industrial-Organizational Psychology at the University of Strathclyde Business School, Glasgow, UK. He holds degrees in psychology from the UK (Aberdeen, and Exeter) and from Canada (McMaster). His research interests include risk perception and communication, trust, and implicit cognition.

Norma B. Coe is an Assistant Professor in the Department of Health Services at the University of Washington's School of Public Health. She holds degrees in economics from MIT and her expertise is in the economics of aging and labor and public economics. Her research focuses on how government policies interact with each other and how they influence individual behavior.

Louis Anthony (Tony) Cox, Jr. is Editor-in-Chief of *Risk Analysis: An International Journal* and President of Cox Associates, a Denver-based applied research company specializing in quantitative risk analysis, advanced analytics, and operations research. He is Honorary Full Professor of Mathematics and Clinical Professor of Biostatistics and Informatics at the University of Colorado. He holds the world's first Ph.D. in Risk Analysis and an S.M. in Operations Research, both from M.I.T., and an A.B. from Harvard University.

Robin L. Dillon-Merrill is an Associate Professor of Operations and Information Management at the McDonough School of Business at Georgetown University. Her research seeks to understand and explain how and why people make the decisions that they do under conditions of uncertainty and risk, and specifically examines critical decisions that people have made following near-miss events in situations with severe outcomes. She has a B.S./M.S. from the University of Virginia and a Ph.D. from Stanford University.

Georges Dionne is Professor of Finance at HEC Montreal and holds the Canada Research Chair in Risk Management. He recently published the second edition of the *Handbook of Insurance*. His main research interests are asymmetric information, decision theory under risk and uncertainty, financial risk management, and applied econometrics.

Pierre Dubois is Professor of Economics at the Toulouse School of Economics, University of Toulouse 1 Capitole, a senior research fellow of the Institute of Industrial Economics (IDEI), a Junior Member of Institut Universitaire de France and Research Fellow of CEPR and IFS London. He holds degrees in Economics from EHES Paris and develops research in industrial organization, health economics, demand models and microeconometrics.

Paul R. Falzer is a Research Scientist at the VA Connecticut Healthcare System, Clinical Epidemiology Research Center. He received his doctorate in communication from the University of Washington and specializes in naturalistic decision making. He has worked in public mental health as a clinician and administrator, and in services research as an investigator, data analyst, and database designer.

Miguel Flores is a Post Doctoral Research Fellow at the University of East Anglia. He holds a PhD from University of Leicester and a MA from Georgetown University, both in economics. In addition to his research in consumer behavior (e.g. electricity choices, diet choices) he is interested in understanding individuals' decisions under risk and uncertainty and also in the effectiveness of different public policies in reducing unhealthy food consumption.

Monica Galizzi is Professor of Economics at the University of Massachusetts - Lowell. She holds degrees in economics from the Università Cattolica of Milan, Italy, and Boston University. Her field of specialization is labor economics. She is also interested in health and behavioral economics, and in the challenges of conducting research using both quantitative and qualitative data. Her research has focused on labor mobility and on the socio-economic outcomes of occupational injuries.

Rocio Garcia-Retamero is an Associate Professor at the University of Granada (Spain). She specializes in risk perception and risk communication in health, with emphasis on the development of transparent information formats (e.g., visual aids) for improving decision making in vulnerable populations.

John D. Graham is Dean of the Indiana University School of Public and Environmental Affairs (Bloomington and Indianapolis), one of the largest public policy schools in the United States. He is the author of seven books and two hundred articles on health, safety and environmental issues.

James K. Hammitt is Professor of Economics and Decision Sciences at the Harvard School of Public Health, Director of the Harvard Center for Risk Analysis, and Visiting Professor at the Toulouse School of Economics. He holds degrees in applied mathematics and public policy from Harvard and develops quantitative methods to evaluate health and environmental policies.

Michael S. Hand is a research economist at the USDA Forest Service Rocky Mountain Research Station, located in Missoula, MT. His primary research interests include the economics of wildfire management, the value of ecosystem services derived from public forests, and the economic consequences of climate-related changes to public lands. He received his Ph.D. in Economics from the University of New Mexico.

Garth Heutel is Assistant Professor of Economics at the University of North Carolina at Greensboro and a Faculty Research Fellow at the National Bureau of Economic Research. He earned a Ph.D. in economics from the University of Texas at Austin and studies energy and environmental policy and behavioral economics.

Gulbanu Kaptan is a research associate at the School of Agriculture, Food, and Rural Development, Newcastle University. She received her B.S. and M.S. degrees in food engineering and her Ph.D. in business administration in the area of decision, risk, and operations management. She has an academic interest in judgment and decision making, with a special interest in food-related risk perception, communication, and analysis.

Jeffrey K. Lazo is Project Scientist in the Research Applications Laboratory at the National Center for Atmospheric Research in Boulder, CO where he is the Director of the Societal Impacts Program. He holds a degree in environmental economics from the University of Colorado. His research focuses on the creation, communication, perception, use, and value of weather information and on the economic impacts of weather.

Jonathan M. Lee is Assistant Professor of Economics at East Carolina University. He holds a Ph.D. in economics from North Carolina State University and his fields of specialization are environmental economics and industrial organization. His research focuses on evaluating public policies that aim to reduce morbidity and mortality risks.

Joseph (Tony) McCarthy is a Ph.D. researcher at the University of Strathclyde, UK. He holds a degree in Psychology and a Masters in Research Methods of Psychological Science from the University of Glasgow, U.K. His research interests include risk perception, affect, and the use and development of implicit measures.

Christoph Rheinberger is an INRA postdoctoral research fellow working at the Laboratoire d'Economie des Ressources Naturelles within the Toulouse School of Economics. Before coming to France, he was a SNSF research fellow at the Harvard School of Public Health and a PhD student at ETH Zurich in Switzerland. Dr. Rheinberger's research focuses on the social value of health and safety policies. In recent work, he has studied various economic issues related to food safety.

Mary Riddell is Professor and Chair of the Economics Department in the Lee Business School at the University of Nevada, Las Vegas. She holds degrees in statistics, economics, and agricultural and resource economics. Her research focuses on risk perception, risk preferences, and choices over programs and policies that affect environmental and health risks.

Lisa A. Robinson is a researcher affiliated with the Center for Risk Analysis and Center for Health Decision Science at the Harvard School of Public Health. She is also a Senior Fellow at the Mossavar-Rahmani Center for Business and Government at the Harvard Kennedy School, and is affiliated with its Regulatory Policy Program. She holds a Master in Public Policy degree from the Kennedy School. Her work focuses largely on benefit-cost analysis of environmental, health, and safety regulations and other policies.

Abdul-Akeem Sadiq is an Assistant Professor in the School of Public and Environmental Affairs at Indiana University, Purdue University Indianapolis. His Ph.D. is in Public Policy from Georgia State University and the Georgia Institute of Technology. He is interested in understanding risk perception and how organizations are mitigating and preparing for disasters.

Cass R. Sunstein is the Robert Walmsley University Professor at Harvard and founded the Program on Behavioral Economics and Public Policy at Harvard Law School. He is the author of numerous articles and books, including *Nudge: Improving Decisions about Health, Wealth, and Happiness* (with Richard H. Thaler, 2008) and *Simpler: The Future of Government* (2013). From 2009 to 2012, he was Administrator of the White House Office of Information and Regulatory Affairs.

Kerton R. Victory is a Ph.D. candidate in the Environmental Health Sciences program at the University of Arizona College of Public Health. He also holds a master's degree in Nutritional Sciences. He is currently working on a project along the U.S.-Mexico border to understand the risk perceptions of drinking-water sources in a low-income community.

Holly O. Witteman is an Assistant Professor of Family and Emergency Medicine, Director of Research for the Office of Education and Continuing Professional Development in the Faculty of Medicine at Université Laval and a Scientist at the Research Center of the CHU de Québec in Quebec City, Canada. She holds degrees in mathematics and engineering from Queen's University and human factors engineering from the University of Toronto, and obtained postdoctoral training in health communication and decision making at the University of Michigan. Her research is about interactive interfaces for risk communication and decision making in health.

Zhiyong Yang is Associate Professor of Marketing at the College of Business, the University of Texas at Arlington. He studies consumer psychology in the areas of consumption-related behaviors (e.g., brand choice, online information search, and new product adoption), and consumption-related misbehaviors (e.g., smoking, drinking, and music piracy). He is particularly interested in the factors that affect consumers' risk perceptions and choices.

20th Kyoto University International Symposium

Abstracts

A Preliminary Observation on Risk Perception among Local Residents in Fukushima A. Koizumi, M. Imanaka, N. Tamon, and K. Harada (Department of Health and Environmental Sciences, Kyoto University Graduate School of Medicine)

The Fukushima Daiichi nuclear power plant (FDNPP) exploded in the mid of March 2011 after the Tohoku earthquake. A radioactive plume flowered in the west-to-northwest direction. The residents within 20 km around FDNPP evacuated in the April in 2011 because exposure levels exceeded 20 mSv/y, while most of residents in Minamisoma and Soma cities stayed at home. In April 2012, the Japanese government reevaluated and renewed the evacuation guideline to the areas in which exposure levels were less than 20 mSv/y. Then residents returned to the home village (Kawauchi village). We have been conducting exposure assessment in three areas, Tamano area in Soma city and Haramachi area in Minamisoma city and Kawauchi village in Fukushima.

Personal exposure radiation (mSv/y) rates in 2012 were 1.03 in Kawauchi, 2.75 in Soma and 1.66 in Minamisoma. Those rates account more than 99.5% of the total radiation rates through three routes. People have seemed to be heavily exposed to safety information of radiation levels. They, however, started eating wild boar meats and wild mushrooms. The risk perception is highly dependent on gender, age, occupation and family condition whether they have young or juvenile female family members. Although the Japanese government declared to take responsibility to control radiation contamination, there has been no clear declaration for the system or body who takes responsibility for the future of Fukushima, enhancing uncertainties among residents. The preliminary observation suggests that time course of responses among residents showed similarity to the "five stages of grief" formulated by Elisabeth Kübler-Ross.

Mistakes and Reflections of Risk Communication in Fukushima Daiichi Nuclear Power Plant Accident
M. Yoneda (Kyoto University)

In the case of the Fukushima NPP Accident, various cases of poor communication between residents and government were observed: 1) Delayed release of the information by the government made people doubt of the concealment of the information; 2) Ambiguous announcement of safety made people more worried about the situation; 3) Government compared the risk with radiation exposure by air-flight, for example, which were thought unrelated and unacceptable by the residents; 4) Insufficient explanation about the annual limit for public exposure made people worry about serious health risks; 5) Because residents near the plant received only instructions to refuge, some residents changed shelters to more dangerous area; 6) Because the central government and the local government did not share the information, they differently instruct people to refuge; 7) Regardless of minor risk from air dust, children wore masks and long-sleeved shirts even in the midsummer.

Based on the lessons above, one of Japanese local governments suggested a new policy for risk communication: 1) In the risk communication, various stakeholders should exchange information and opinions to develop trusted relationship; 2) Communication in normal situation is important for governments to develop relationship of trust with residents; 3) Some methods for a local government to give directly immediate and accurate information to residents should be developed in emergency; 4) It is important to give effective information to residents considering their real needs after the evacuation; 5) It is necessary to consider not only how we should communicate with residents but also what we should inform residents.

Activities on Radiation Monitoring Fukushima and their Public Perception M. Tanigaki (Kyoto University)

A severe nuclear accident occurred at Tokyo Electric Power Corporation Fukushima Daiichi Nuclear Power Plant in March 2011. Serious concerns about the health risk to the public by radiation exposure and radioactive materials have arisen by the incident. Various types of activities on radiation monitoring, such as air dose rate, contamination of soil or food products, have been carried out by specialists and authorities. Among such activities, we have developed a car-borne survey system named as KURAMA (Kyoto University Radiation Mapping system) for the immediate surveys just after the incident, and then developed KURAMA-II for continuous air dose rate monitoring in living area. KURAMA and KURAMA-II visualize the distribution of air dose rates on the map in high resolution, which greatly help the public to recognize the radiation level in their neighborhood.

As the situation goes, a discrepancy between specialists and the public on the perception of measurement results becomes clear. While specialists and authorities set any criteria based on ALARA principle, the public often treats them as critical one. To overcome such discrepancies, we should - encourage the public to establish some reasonable references for evaluation in their mind. In our KURAMA activities, we set one of our goals to help the people to establish such references by continuously releasing a lot of up-to-date, highly frequent, and consistent results in their neighborhood. This strategy seems work well, and we expect our approach to be the basis for further communication between specialists and the public.

The Structural Model of Public Perception and the Effects of Interactive Communication on the Risk of Radioactive Substances in Food Y. Niiyama, Y. Kito, and H. Kudo (Kyoto University)

In face of the food contamination by radioactive substances derived from the Fukushima Daiichi disaster in March 2011, many people were anxious over the health effects. We have focused on the following studies to respond to this emergency.

The first study consisted of identifying the status of public knowledge and the structure of risk perception. We conducted the internet surveys by psychological approach over May, 2011 to Feb., 2012. We found the sequence of factors: 'imaginable' → 'severity of health effects and accumulation' and 'unidentifiable' had a major effect on the score of perceived risk of low-dose radiation by Structural

Equation Modeling. We found also a lack of knowledge on biological effect of low-dose radiation and a confusion of deterministic effects and stochastic effects. The results show that it is required in risk communication to provide the chances of elaborate information processing that allow the public to reconstruct the image of radiation risk.

The second was to develop and verify the risk communication model to ensure those chances. The model has the following elements. (i) Through focus group communication, public questions are probed and scientific information that addresses those questions is prepared by a team of experts. (ii) Group discussion among only participants is held based on the prepared scientific information. (iii) Discussion and providing information is undertaken sequentially twice. The communications were carried out over Jun. 2011 to Mar. 2013. It followed that the knowledge level of participants improved.

Learning from History: Evacuation Criteria R. Wilson (Harvard University)

In any decision involving radiation a risk-risk or risk-benefit comparison should be done. This can be either explicit or implicit. When the adverse effect of an alternate action is less than the planned action, such as medical use of X rays or nuclear power in ordinary operation, the comparison is simple. But in this paper I argue that with the situation faced by the Japanese in Fukushima, the assumption that the risk of an alternate action is small is false. The risks of unnecessary evacuation exceeded the risk of radiation cancers hypothetically produced by staying in place. This is, of course a general problem including non nuclear accidents such as spills of toxic chemicals.

Speaker Biographies

Akio Koizumi is Professor of Health and Environmental Sciences at Kyoto University of Public Health. He holds degrees in Medicine and Environmental Health from Tohoku University. In recent two years, he has conducted field works in Fukushima and has deeply committed to Kawauchi Village's making policies related to environment.

Michiaki Mishima is Kyoto University's executive-vice president for international affairs and hospital administration. He has served as professor and chairman of the Department of Respiratory Medicine in the Graduate School of Medicine of Kyoto University since 2002, and as director of the Kyoto University Hospital since April 2011.

Yoko Niiyama is Professor of Natural Resource Economics at the Graduate School of Agriculture in Kyoto University. She holds a Ph.D. in applied from Kyoto University and develops structural models of public risk perception, interactive models of risk communication and structural approach for analysis of the food system.

Minoru Tanigaki is Assistant Professor of Quantum Beam Material Science Division at the Research Reactor Institute, Kyoto University. He holds a degree in experimental nuclear physics from Osaka University. His interest is mainly in the structures of radioactive nuclei far from the stability line. He is now responsible for the development of KURAMA as a monitoring tool for radiation levels in Fukushima by utilizing his experience on radiation detection in nuclear physics.

Richard Wilson was born in London in 1926 and has been at Harvard University since 1955, where he is Mallinckrodt Professor of Physics (emeritus). He is one of the founders of the discipline of risk analysis, co-author (with Edmund Crouch) of "Risk-Benefit Analysis," and author or coauthor of 937 published articles and papers. He recently published an autobiography, "Physics is Fun: Memoirs of a Life in Physics."

Minoru Yoneda is Professor of Environmental Risk Analysis at the Department of Environmental Engineering, Kyoto University. He holds degrees in engineering from Kyoto University and works on clarification of dynamism and exposure-dosage assessments of toxic chemicals in various environments to evaluate their risk for the public. He also aims to establish a method to decide optimum remediation strategy by using probability theory.