

FINAL PROGRAM

Thursday, 23 June 2016 | Ngee Ann Kong Si Auditorium, ERC Level 2

13:30 – 14:00	WELCOME & INTRODUCTORY REMARKS
	<p>Gregory Clancey National University of Singapore Tommy Koh National University of Singapore May Abdel-Wahab International Atomic Energy Agency Naohiro Tsutsumi Deputy Chief of Mission, Minister, Embassy of Japan in Singapore</p>
14:00 – 14:15	COFFEE/TEA BREAK
14:15 – 16:00	SESSION 1 FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART I
<i>Chairpersons</i>	<p>Scott Knowles Drexel University, USA Shunichi Yamashita Nagasaki University and Fukushima Medical University, Japan</p>
14:15	<p><i>Communication and Leadership in Radiation Medicine</i> May Abdel-Wahab International Atomic Energy Agency</p>
	<p><i>What Have We Learned? Reflections of a Front-Line Physician</i> Arifumi Hasegawa Fukushima Medical University, Japan</p>
	<p><i>Academic Responses to Fukushima Disaster: A New Radiation Disaster Curriculum</i> Akira Ohtsuru Fukushima Medical University, Japan</p>
	<p><i>Radiation Disaster and Societal Recovery: A Case of Kawauchi Village, Fukushima Prefecture</i> Noburu Takamura Nagasaki University, Japan</p>
15:45	QUESTION & ANSWER
16:00 – 16:30	COFFEE/TEA BREAK
16:30 – 17:45	SESSION 2 INTERNATIONAL PERSPECTIVES: POST-FUKUSHIMA NUCLEAR SCIENCE & RADIOLOGICAL MEDICINE
<i>Chairpersons</i>	<p>May Abdel-Wahab International Atomic Energy Agency Koichi Tanigawa Hiroshima University and Fukushima Medical University, Japan</p>
16:30	<p><i>Nuclear Science and the Interface with Contemporary Regional Policy Developments</i> Henry Hee-Seung Bom Chonnam National University, South Korea</p>
	<p><i>Exposure to Low Dose Ionizing Radiation from Medical Imaging and Health Effects of Those Exposures</i> Rebecca Smith-Bindman University of California - San Francisco, USA</p>
	<p><i>Using Complexity Science to Understand the Interaction and Interplay between Radiation Health and Society</i> Kwan Hoong Ng University of Malaya, Malaysia</p>
17:30	QUESTION & ANSWER
17:45	END OF DAY ONE

Friday, 24 June 2016

09:00 – 10:40	SESSION 3 FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART II
<i>Chairpersons</i>	Arifumi Hasegawa Fukushima Medical University, Japan Kim Fortun Rensselaer Polytechnic Institute, USA
09:00	<i>Fear of Thyroid Cancer Burden after the Fukushima Nuclear Power Plant Accident</i> Shunichi Yamashita Nagasaki University and Fukushima Medical University, Japan
	<i>Fukushima Nuclear Accident and Health Management Resilience</i> Kenji Kamiya Hiroshima University and Fukushima Medical University, Japan
	<i>Preparing for a Future Nuclear Event: What Have We Learned from Past Experiences?</i> Koichi Tanigawa Hiroshima University and Fukushima Medical University, Japan
	<i>Reawakening Radiation Anxieties and Regional Differences in Fukushima</i> Atsushi Kumagai Fukushima Medical University, Japan
10:20	QUESTION & ANSWER
10:40 – 11:10	COFFEE/TEA BREAK
11:10 – 12:20	SESSION 4 NUCLEAR SCIENCE, RADIATION & HUMAN HEALTH IN SOUTHEAST ASIA
<i>Chairpersons</i>	Rethy Chhem Cambodia Development Resource Institute Kenneth Nollet Fukushima Medical University, Japan
11:10	<i>Communicating its Benefits versus the Risks of Radiation Therapy: A Perspective from Radiation Oncology</i> Miriam Joy Calaguas Jose R. Reyes Memorial Medical Center, Philippines
	<i>The Medical Physicist in Radiation Medicine and Beyond: Perspectives from Singapore and ASEAN</i> James Lee Cheow Lei National Cancer Centre Singapore
	<i>Singapore's Initiatives for Enhancing Nuclear Safety in ASEAN</i> Pao Chuen Lui National Research Foundation, Singapore
12:10	QUESTION & ANSWER
12:20 – 13:30	NETWORKING LUNCH (By invitation only)

13:30 – 14:50	SESSION 5 GOVERNING EXPERTISE AND COMPLEXITY: STS, RADIOLOGICAL RISK & HUMAN HEALTH
<i>Chairpersons</i>	Sulfikar Amir Nanyang Technological University, Singapore Miriam Joy Calaguas Jose R. Reyes Memorial Medical Center, Philippines
13:30	<i>Nuclear Disaster Preparedness in ASEAN: The Art of Scientific Advice to Policy Makers</i> Rethy Chhem Cambodia Development Resource Institute
	<i>Fukushima Forward: Disaster Recovery with Global Perspective</i> Kim Fortun Rensselaer Polytechnic Institute, USA
	<i>Moyai-Naoshi or “Re-Mooring”: A New Species of Hope</i> Tyson Vaughan National University of Singapore
14:30	QUESTION & ANSWER
14:50 – 15:20	COFFEE/TEA BREAK
15:20 – 16:15	SESSION 6A LEARNING FROM THE PAST, LOOKING TO THE FUTURE
<i>Chairpersons</i>	Gregory Clancey National University of Singapore Kenji Kamiya Hiroshima University, Japan
15:20	<i>Looking Back, Looking In: Moral Motivators and Prosocial Civics in Case Studies of the Health Consequences of CBRN Disasters in Japan</i> Russell Kabir Phoenix Leader Education Program, Hiroshima University, Japan
	<i>The Demographic Impact of the Fukushima Nuclear Accident on Affected Areas: Factors Influencing Evacuee Decisions to Migrate</i> Do Xuan Bien Phoenix Leader Education Program, Hiroshima University, Japan
16:00	QUESTION & ANSWER
16:15 – 17:45	SESSION 6B LEARNING FROM THE PAST, LOOKING TO THE FUTURE: SUMMARY OF FORUM SERIES AND NEXT STEPS
<i>Chairpersons</i>	Gregory Clancey National University of Singapore May Abdel-Wahab International Atomic Energy Agency
16:15	DISCUSSION Shunichi Yamashita Nagasaki University and Fukushima Medical University, Japan Kenji Kamiya Hiroshima University and Fukushima Medical University, Japan Akira Ohtsuru Fukushima Medical University, Japan Rethy Chhem Cambodia Development Resource Institute Kim Fortun Rensselaer Polytechnic Institute, USA
17:30	CLOSING REMARKS
	Gregory Clancey National University of Singapore May Abdel-Waheb International Atomic Energy Agency
17:45	END OF FORUM

SESSION 1 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART I

Communication and Leadership in Radiation Medicine

May Abdel-Wahab

International Atomic Energy Agency

Physicians master an understanding of the human body, all its ailments and the respective treatments. However, physicians often face the challenge of being able to convey these medical facts to their patients in an easily understandable and empathetic manner. With technological and societal developments becoming ever more complex in an increasingly interconnected world, there is a greater need for physicians to improve their leadership, strategic planning and communication skills. The development of these skills is vital in facilitating physicians' role in interacting with policy and decision makers. Strategies are therefore required to improve communication and understanding that leads to an increase in the efficiency and impact physicians have in influencing policy. To this effect, the International Atomic Energy Agency, in collaboration with Fukushima Medical University has carried out several educational and research projects in radiation medicine and related fields, including curriculum development, and continue to work on communication training to address these issues. Providing physicians with training on risk assessment and disaster communication will allow for the more effective exchange of information with the general public and can minimize misinformation, an issue that is becoming a greater challenge in an increasingly connected world. Some recent concepts of risk assessment and disaster communication will be covered.

May Abdel-Wahab is the current Director of the Division of Human Health at the International Atomic Energy Agency (IAEA), Vienna, Austria. She has over 30 years of patient care, teaching and research experience in the field of radiation medicine. Before joining IAEA, she was section head of GI Radiation Oncology at the Cleveland Clinic, USA and Professor at the Cleveland Clinic Lerner School of Medicine, Case Western Reserve University. She has served on various national and international committees, including the United Nations Interagency Task Force Steering Committee (UNIATF), and the chairs of both the ASTRO Diversity and Disparity Committee and Integrated Healthcare Enterprises in Radiation Oncology Planning Committee (IHERO).

She has also served on various advisory boards and professional journal editorial boards. She is a fellow of both, the American Board of Radiology and the American Society of Radiation Oncology, and on the Best Doctors in America listing, among other honours. Director Wahab has been an avid lecturer, book editor and participant on scientific panels. She has also served on expert panels for treatment guidelines and published widely (over 150 publications).

She has a special interest in education and curriculum development as a former residency program director and has organized numerous symposia and scientific meetings. In addition, she has an interest in healthcare access and training, as well as novel solutions to address disparity and diversity issues. In the course of her career, including as former American College of Radiology councillor and member of the Board of Directors of the Florida Radiological Society, among others, she has witnessed the intersection of science and societal issues.

SESSION 1 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART I

What Have We Learned? Reflections of a Front-Line Physician

Arifumi Hasegawa

Fukushima Medical University, Japan

(Paper co-authored with Kenneth Nollet)

Disaster medicine:

Fukushima's nuclear crisis arose in a disaster that interrupted routine and emergency medical care. Workers risked occupational injury and radiation exposure. It was difficult to find hospitals to care for nuclear plant workers, because general emergency and radiation emergency medical systems were both in disarray. Our experience should guide policy and planning for future events. Even in uncertain situations, health professionals should maintain situational awareness and provide as much care as circumstances allow. To support them, facilities need robust business continuity plans (BCPs).

Community services:

Ambulance, fire, and other crisis-response teams can themselves be victims, but in the acute phase of our crisis, they had no systematic support for physical, mental, or radiation-related issues. Now, these same responders are grappling with their long-term responsibilities in areas that have been depopulated. In fact, the task of building resilient communities requires the cooperation of government, industry, and academia. Stakeholders may view cooperation as collusion, however, if they themselves are not engaged, and if institutions are not transparent.

Health and risk communication:

Sudden evacuation contributed to the death of vulnerable people such as nursing home residents. Radiation anxiety continues to affect health professionals as well as other citizens, for which reason credible education programs need to be widely available. FMU had no office of public communication on 3.11; other authorities gave inconsistent messages and lost credibility. Now, we are attempting to earn the trust of people across a wide spectrum of knowledge and beliefs. Putting theoretical radiation risks in the context of known lifestyle risks — some of which were exacerbated by fear of radiation exposure — remains a challenge. Risk communication in our acute phase was problematic. Risk communication from now on will have to be tailored to a variety of audiences. In conclusion, our activities have the quality of a work-in-progress.

Arifumi Hasegawa earned MD and PhD degrees from Fukushima Medical University (FMU), where his surgical specialty training included advanced practice assignments at the various hospitals in Fukushima Prefecture. He subsequently became an assistant professor in the Department of Emergency and Critical Care Medicine at both FMU and Akita University (Akita Prefecture). As an assistant professor, he earned a research fellowship in neuropathology at the University of Sydney (Australia). Returning to Fukushima in 2006, he was practicing emergency and critical care medicine during and after the Great East Japan Earthquake. He accepted extra responsibilities in radiation emergency care at FMU and, for nuclear workers, at medical facilities set up near the crippled Fukushima Daiichi nuclear power plant. In 2014, he became the founding Professor and Chair of FMU's Department of Radiation Disaster Medicine. He is currently the manager of the Nuclear Disaster Support Center, vice manager of the Radiation Disaster Medical Center in FMU. He is a Board Certified Surgeon of the Japan Surgical Society and a Senior Fellow of the Japanese Association for Acute Medicine.

SESSION 1 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART I

Academic Responses to Fukushima Disaster: A New Radiation Disaster Curriculum

Akira Ohtsuru

Fukushima Medical University, Japan

(Paper co-authored with Atsushi Kumagai, Rie Miyatani, Yuko Kimura, Sanae Midorikawa and Arifumi Hasegawa)

Since radiation accidents, especially nuclear disasters, are rare in comparison to other types of disasters, a comprehensive radiation disaster medical curriculum is not yet available. The Fukushima compound disaster has given impetus for the establishment of a new medical curriculum in preparation for any future complex disaster. The medical education will aim to teach decision-making and assist with balancing various health risks with radiation management for workers, vulnerable people, and residents in disaster cycle. The residents who have experienced nuclear disaster would easily associate the consequences of the various events with the concerns of radiation health risks. Even though the scientific findings indicate very low possibility of radiation risk, new anxieties with feelings of self-condemnation have developed amongst residents. To address anxieties, we have implemented interventions for these situations after the Fukushima accident. In the present review, we introduce our educational programs that have been started to provide students, professionals, and leaders with the knowledge, skills, possible interventions and social consequences of complex nuclear accidents. This program has an applied science, technology, and society (STS) module that includes public risk communication of science and technology, psychosocial consequences of radiation anxiety, and decision-making for radiation disaster medicine.

Akira Ohtsuru is a Professor at the Department of Radiation Health Management, Fukushima Medical University School of Medicine, Director at the Radiation Disaster Medical Center, Advanced Radiation Medical Support Center, Fukushima Medical University Hospital, Thyroid Survey Leader at the Thyroid Ultrasound Examination Section, Radiation Medical Science Center for the Fukushima Health Management Survey. From April 2003 to September 2011, he was Associate Professor at the International Hibakusha Medical Center, Nagasaki University Hospital and was Assistant Professor at the Department of Molecular Medicine, Atomic Bomb Disease Institute, Nagasaki University from June 1991 to March 2003. He graduated from Nagasaki University Graduate School of Medicine in 1988. His research specialties include internal medicine, radiation medical sciences, endocrinology and gastroenterology.

SESSION 1 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART I

Radiation Disaster and Societal Recovery: A Case of Kawauchi Village, Fukushima Prefecture

Noboru Takamura

Nagasaki University, Japan

(Paper co-authored with Makiko Orita and Shunichi Yamashita)

The accident at the Fukushima Daiichi Nuclear Power Station caused extensive human suffering and revealed the need for more effective means of communicating health risks to the public. The rehabilitation of Kawauchi, one of the villages affected by the nuclear accident, provides a model for future responses.

In March 2012, after tedious decontamination work in the village, radiation doses were found to be safe for residents of Kawauchi to return home, and schools and public offices were reopened. In 2013, the public authorities of Kawauchi Village and Nagasaki University, which has helped with the reconstruction work since 2011, established a collaboration known as the “Nagasaki University–Kawauchi Village Reconstruction Promotion Base”. As part of the program, a permanent public health nurse from Nagasaki University with expertise in radiation provides health consultations to the villagers. The university also provides health radiation consultation services and monitors radiation levels in food and soil samples. Regular meetings are held in the village to foster greater dialogue between the radiation experts, physicians, radiation nurses, and community leaders of Kawauchi village and its population.

More than 110,000 residents of Fukushima have yet to return to their hometowns, with 40,000 of them living outside the prefecture. The village-university collaboration provides a model for a multidisciplinary approach to public policy during the recovery phase of a nuclear accident.

Noboru Takamura has been a full Professor of Department of Global Health, Medicine and Welfare, Atomic Bomb Disease Institute of Nagasaki University since 2008. He graduated from Nagasaki University School of Medicine in 1993, and received his PhD from the same university in 1997. His speciality includes radiation health sciences, hygiene, endocrinology and internal medicine. He has been conducting epidemiological studies in the vicinity of the Chernobyl Nuclear Power Plant since 1997. After the accident at Fukushima Dai-ichi Nuclear Power Plant on March 2011, he was appointed an advisor of Fukushima Prefecture on radiation health risk management, and also has been health advisor of Kawauchi Village (Fukushima Prefecture) since March 2012. Specifically, he is currently conducting risk communication with residents and field studies in Kawauchi Village to support the recovery of Fukushima after the nuclear disaster.

SESSION 2 | INTERNATIONAL PERSPECTIVES: POST-FUKUSHIMA NUCLEAR SCIENCE & RADIOLOGICAL MEDICINE

Nuclear Science and the Interface with Contemporary Regional Policy Developments

Henry Hee-Seung Bom

Chonnam National University, South Korea

Policy development is a part of social sciences, where experts of public administration play major roles. Experts of policy studies and nuclear sciences have opened ground to discuss various matters together under the name of Nuclear Policy Forum (NPF). It is organized by half social scientists and half nuclear scientists.

Republic of Korea (ROK) operates 24 nuclear power plants (NPP), comprising approximately 30% of electrical generation, and this figure is expected to grow further. Nuclear science in ROK related mostly to NPP. More than 90% of nuclear science is associated with electrical generation, while a much smaller proportion of such research relates to for medicine and nondestructive testing. Therefore, the interface of nuclear science with policy development is usually related to NPP.

Issues of discussions in NPF last 10 years include policies for export of NPP, installation of fast reactors, development of human resources for NPP, construction of nuclear science parks, changes in public awareness of NPP after the Fukushima accident, public antinuclear activity, nuclear safety and security commission, nuclear security summit, radioactive waste, management of spent nuclear fuel, dismantling nuclear reactors, and post-2020 after COP21 Paris agreement.

Regional policy development requires many players including law makers, officers, experts, and people. Reasonable agreement among various stakeholders is not easy. The goal is balanced reasoning which can be achieved by continuous interfacing and open discussions.

Henry Hee-Seung Bom is Professor of nuclear medicine at the Chonnam National University Medical School (CNUMS) and Hospital, Gwangju, South Korea, the president of the Asia Oceania Federation of Nuclear Medicine and Biology (AOFNMB), the president of the Korea Radiation Medicine Forum, and the deputy director of the Korea Nuclear Policy Forum. He graduated from CNUMS in 1982 and was trained in internal medicine and nuclear medicine in South Korea. He worked as the deputy director and general director of CNU Hwasun Hospital from 2006 to 2010, as the president of the Korean Society of Nuclear Medicine from 2008 to 2010, as the chairman of the Asian Regional Cooperative Council for Nuclear Medicine (ARCCNM) from 2010 to 2013. He is in the editorial board of the European Journal of Nuclear Medicine and Molecular Imaging (EJNMMI), Asia Oceania Journal of Nuclear Medicine and Biology (AOJNMB) and Annals of Nuclear Cardiology (ANC). He has published around 250 peer reviewed papers and 22 books/chapters. His current research interests are radioiodine therapy for thyroid cancer and cardiac hybrid imaging.

Exposure to Low Dose Ionizing Radiation from Medical Imaging and Health Effects of Those Exposures

Rebecca Smith-Bindman

University of California – San Francisco, USA

Medical imaging use has increased dramatically over the last two decades, particularly for computed tomography (CT). In the United States for example over 10% of individuals undergo a CT scan annually and over 80 million CT scans are performed each year. Integrating CT into routine care has improved diagnostic capabilities; however, it has also increased patient exposure to radiation—a chest CT delivers up to 1000 times the radiation dose of a chest radiograph. This has led to a dramatic increase in patient exposure to medical ionizing radiation in the past 20 years. Based on detailed reports generated by the National Council on Radiation Protection and Measurements (NCRP), a not-for-profit corporation chartered by the US Congress to collect, analyse, develop and publicly disseminate information about radiation. The reports show that medical imaging is a large and growing source of radiation exposure—the annual U.S. per-capita radiation effective dose from medical imaging increased 600% between 1980 and 2006, due to increases in CT and nuclear medicine. Similar rapid rise in CT use has been seen throughout the developed, and developing world. The other medical imaging tests that expose patients to ionizing radiation include radiography; fluoroscopy; angiography; and nuclear medicine. Each year, a third of the U.S. population undergoes at least one test that uses ionizing radiation.

We have evaluated patterns of medical imaging and radiation dose for CT examinations among several large cohorts of patients around the United States and have found that doses are higher than needed for diagnosis, highly variable across patients and hospitals, and have found that a significant number of patients who underwent imaging received high (20-50 mSv) or very high (> 50 mSv) annual exposures. In contrast to popular belief, doses have been rising, rather than falling, over time. The newest machines can use lower doses for CT and will eventually reduce population doses, but given the cost of CT scanners, these machines are unlikely to replace the scanners currently in operation for many years. The assumption and claims by many in the medical community that doses are now very low is not supported by evidence. Strategies, standards and procedures that would ensure the proper low dose use of CT scans are not in place to ensure that the examinations are conducted using the lowest doses possible. We have collected radiation dose metrics from across a large number of institutions and these demonstrate that doses are highly variable across institutions.

Ionizing radiation is one of the most comprehensively studied carcinogens with extensive evidence linking it to cancer risk. Many past studies have focused on specific human populations, such as Japanese atomic bomb survivors, those exposed to radon and environmental accidents, and patients receiving cancer radiation treatment. However, many studies have assessed patients who have been exposed to medical imaging and have found increased risk of cancer associated with such exposures. To date, the best study conducted on CT was conducted in the United Kingdom and they directly assessed the cancer risk associated with CT imaging. They found that children and adolescents exposed to CT examinations who received organ doses in the range of 20-50 mGy (doses that we found in unrelated research that occur in 10-20% of CT examinations in children) had a significant tripling of their risk of leukaemia and brain cancer.

Most experts agree that radiation from medical imaging is associated with an increased risk of cancer. However, the exact magnitude of risk is unknown, in part because of uncertainties and limitations in risk projection, an absence of accurate data on cumulative exposure to radiation from medical imaging, and lack of detailed exposure and outcome data for at-risk groups. Given their rapid growth, children and those exposed in-utero and believed to be particularly vulnerable to the carcinogenic effects of radiation; in addition, their longer life expectancy gives them more time after exposure than adults to develop a cancer. While awareness exists in the U.S. that medical imaging must be justified and repeated scans in children should be reduced, our data suggest that imaging in children is still high, and use of high-dose exams continues.

Public health concerns about radiation exposure from CT and other types of medical imaging have intensified with publicity about the rapid increase in imaging utilization. Many groups including the U.S. Congress, Institute of Medicine (IOM), and professional societies are concerned about the rapidly increasing and potentially dangerous exposure to ionizing radiation from imaging. There are growing efforts within the U.S. to monitor, standardize and reduce doses, and efforts to reduce the inappropriate use of medical imaging through professional and consumer targeted education. Further there are numerous federal and state level efforts to quantify and reduce radiation doses received during medical imaging. I believe there are many strategies that can and should be used to standardize and lower the doses used for medical imaging, and that can be used to appropriately educate the public about the importance of using medical imaging that delivers ionizing radiation only when needed.

Rebecca Smith-Bindman is Professor of Radiology, Epidemiology and Biostatistics, Obstetrics, Gynaecology and Reproductive Medicine, and Health Policy at the University of California, San Francisco School of Medicine. She is a clinical researcher with expertise in epidemiology, technology assessment, outcomes research, comparative effectiveness research, health services research, and dissemination and implementation sciences focused on imaging. Her research has focused on evaluating the quality, utilization, accuracy, predictive values and impact of diagnostic testing on patient health, and has quantified both the risks and benefits of medical imaging when used in different contexts and by different populations. Her research has included studies quantifying the use of medical imaging and quantifying to radiation doses associated with computed tomography scanning. Her interest, and expertise relevant to this meeting, concerns the use of low dose radiation in the area of health, and in particular, the growing exposure to low dose radiation from the large increase in the use of medical imaging and computed tomography (CT) over the last two decades. Exposure to CT in the U.S. and Europe is the largest source of exposure to low dose radiation, and a growing source of radiation in the developing world as well. It is something that has fallen under the radar for many years, despite how rapidly the exposures are growing. And there is remarkably little oversight or quantification of exposures or risks in the U.S. She is currently leading several studies that assess and standardize the radiation dose used for CT scanning across a large number of institutions, in order to minimize doses, without loss of diagnostic accuracy. There are practical and easy steps to reduce doses and her research group has published several primary research papers on the topic, and she was the guest editor for an issue of the Journal of the American college of Radiology which was entirely focused on Radiation Dose Optimization for CT – providing very concrete and practical strategies for lowering patient exposures, particularly among children and vulnerable populations. She is also leading a large study quantifying the risks of cancer associated with medical imaging in children and adolescents.

Using Complexity Science to Understand the Interaction and Interplay between Radiation Health and Society

Kwan Hoong Ng

University of Malaya, Malaysia

(Paper co-authored with Ray Kemp, Danny Tze Ken Wong and Rethy Chhem)

Some five years after the Fukushima accident in March 2011, we are still struggling to better understand some of the social and psychological responses to the accident and its aftermath. These include but are not limited to the public loss of confidence in radiation health advice, lack of trust in science, nuclear technology and its regulation, the painfully slow processes of individual and community recovery. The Fukushima accident and its aftermath present a complex scenario involving the interplay between science, public health, social-economic, culture, politics, and policy. The challenge is how to understand that scenario in a way that provides helpful guidance for the future.

In this paper we introduce an innovative approach and a relatively new field of inquiry using complexity science to provide new insights into the issues surrounding radiation and health. Thus far, scientific and much of social-scientific research has been based upon reductionist approaches that seek to understand empirical data in terms of cause and effect relationships. Complexity science on the other hand provides an approach that acknowledges and embraces the challenges of complexity and uncertainty. Complexity science deals with complex systems and problems that are dynamic, unpredictable and multi-dimensional, consisting of a collection of interconnected relationships and parts. Unlike traditional “cause and effect” or linear thinking, complexity science is characterized by nonlinearity. It has been applied in business, economics, sociology, biology, and public health. It provides potentially useful tools such as agent-based simulation modeling, network analyses, and dynamic system modeling. Complexity science also has its critics – it is an approach that can appear both remote and self-serving (generating complex meta analyses), while presenting the risk of encouraging social engineering to meet technology-led objectives.

We examine some of these issues in the paper. However, given the recurring challenge of providing radiation health protection and advice against a background of negative attitudes to radiation, technology and science as noted above, there are clearly a multitude of factors and relationships that contribute to the problem. It may be that a paradigm in rethinking about these issues is now required, and an approach that can specifically account for complexity therefore deserves due consideration

Kwan Hoong Ng is a Professor at the Department of Biomedical Imaging, University of Malaya, Malaysia. He received his MSc (Medical Physics) from University of Aberdeen and PhD (Medical Physics) from Department of Pathology, University of Malaya, Malaysia. He is certified by the American Board of Medical Physicist. Prof Ng was honoured as one of the top 50 medical physicists in the world by the International Organization of Medical Physics (IOMP) in 2013. He has authored/co-authored over 230 papers in peer-reviewed journals, 30 book chapters; co-edited 5 books. He has presented over 500 scientific papers, more than 300 are invited lectures. He has also organized and directed several workshops on radiology quality assurance, digital imaging, dosimetry and scientific writing. He is the co-founder and co-editor in chief of the open-access e-journal 'biomedical imaging and intervention journal' (www.biiij.org). He is in the editorial board and advisory board of several journals, including *Medical Physics*, *Physics in Medicine and Biology*, *Singapore Medical Journal*, *Journal of Mechanics in Medicine and Biology*, and *World Journal of Radiology*. His main research contribution has been in breast imaging, in particular breast density. He has also been directing research initiatives in intervention radiology, radiological safety and radiation dosimetry; and more recently science and technology in society (STS). Dr Ng has been serving as an International Atomic Energy Agency (IAEA) consultant/expert and a member of International Advisory Committee of the World Health Organization. He had served as a consulting expert for the International Commission on Non-Ionizing Radiation Protection (ICNIRP). He is the Founding President and Emeritus President of the South East Asian Federation of Medical Physics and is a past President of the Asia-Oceania Federation of Organizations for Medical Physics.

Fear of Thyroid Cancer Burden after the Fukushima Nuclear Power Plant Accident

Shunichi Yamashita

Nagasaki University, Japan, and Fukushima Medical University, Japan

Five years have passed since the Fukushima Nuclear Power Plant (NPP) accident, moving the problems in Fukushima from an acute nuclear disaster to a chronic environmental contamination with complicated problems such as psychological, social, economic and political consequences. Countermeasures aimed at public health protection during the emergency period including evacuation, sheltering, and control of the food chain were implemented in a timely manner by the Japanese government. However, there is an apparent need for improvement, especially in the areas of nuclear safety/protection education, and also in the management of radiation health risk during and even after the accident.

Following the lessons learned from the Chernobyl NPP accident at the standpoint of public health protection, retrospective analysis of thyroid dose was of paramount importance in Fukushima together with comprehensive and long-term health management. Moreover, psychosocial and mental health consequences, including post-traumatic stress disorders are very important issues to be solved in Fukushima, which are similar to those seen after Chernobyl.

In this presentation, the on-going health risk management in Fukushima will be reviewed, focusing on the first-round results of thyroid ultrasound examination in comparison with those of Chernobyl data. The high prevalence of childhood and adolescent thyroid cancer detected in Fukushima can be attributed to mass screening. It clearly exceeds what is found incidentally anywhere else; however, direct comparisons with any other results are not meaningful because of differences in methodology. Therefore, sound risk communication and dialogue with the public are now unavoidably needed to improve the current confused situation of a high prevalence of childhood and adolescent thyroid cancer in Fukushima.

Shunichi Yamashita graduated from Nagasaki University School of Medicine in March 1978 and spent almost three years from July 1984 to March 1987 as an endocrine research fellow at the Cedars-Sinai Medical Center in Los Angeles. In 1990, Dr Yamashita became a full Professor of Molecular Medicine and International Radiation Health at the Atomic Bomb Disease Institute, Nagasaki University School of Medicine. He has been deeply involved in Chernobyl and Semipalatinsk medical aid projects for more than 20 years. Professor Yamashita is the Adviser to the Governor of Fukushima Prefecture on Health Risk Management. He was dispatched from Nagasaki University to Fukushima after the Fukushima Nuclear Accident and is now the Vice-Director of Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University. In April 2013, Professor Yamashita was appointed Trustee and Vice President of Nagasaki University. In addition, he is Director of the World Health Organization Collaborating Center for Research on Radiation Emergency Medical Preparedness and Response Network, a member of the Nuclear Disaster Expert Group of the Prime Minister's Office of Japan and a member of Science Council of Japan. He was also formerly the President of the Japan Thyroid Association.

Fukushima Nuclear Accident and Health Management Resilience

Kenji Kamiya

Hiroshima University, Japan, and Fukushima Medical University, Japan

The Fukushima nuclear power plant accident revealed the vulnerability of the social and medical care systems during nuclear disasters and showed the need for a resilient medical care system, capable of protecting the health of affected residents. The radiation protection system has three stages, 1) the early stage of the accident outbreak, 2) the emergency situation, 3) the existing exposure situation, in accordance with the progress of the accident. The development of a resilient medical care system which can respond to both the acute and chronic phases of the accident is required. Regarding the acute phase of the Fukushima accident, the radiation emergency medical system could not function sufficiently as designed due to confusion in the chain of command, patient transportation and the situation of some hospitals refusing patients with contamination. Based on these experiences, the Nuclear Regulation Authority started developing the existing radiation emergency medical system into a nuclear disaster medical system, which should be functional during radiation emergencies and also be sufficiently resilient.

On the other hand, in the chronic phase, estimating the exposure dose of residents and monitoring over their health for a long period is essential for health management. Fukushima prefecture is conducting the Fukushima health management survey to achieve these purposes. Additionally, risk communication, which conveys accurate information about radiation and health, plays a very important role to build a society with resilience by preventing excessive anxiety and harmful rumours.

Kenji Kamiya is Vice President of Hiroshima University and Fukushima Medical University. He graduated from Hiroshima University, School of Medicine in 1977 and completed a PhD in pathology in 1986. His research at the Research Institute for Radiation Biology and Medicine of Hiroshima University focuses on the field of radiation biology, radiation carcinogenesis and radiation emergency medicine. He became a professor in 1996 and served as the institute's director for four terms, from 2001-2005 and 2009-2013. Also, he has served as the director of Radiation Emergency Medicine Promotion Center since 2004. He has served radiation health risk management advisor of Fukushima Prefecture since 2011 after the nuclear accident in Fukushima. He was awarded a prize for his contributions to disaster prevention by the Prime Minister, Cabinet Office in 2012. For his achievements as a researcher, he received the Asian Association for Radiation Research Award in 2009. He served as the president of Japan Radiation Research Society from 2008 to 2011 and the secretary-general for 15th International Congress of Radiation Research (ICRR2015) at Kyoto in 2015. He is currently serving as an Adviser for Cabinet Secretariat Government of Japan, the Chairman of Japan Radiation Council. He is a Council Member of Science Council of Japan.

SESSION 3 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART II

Preparing for a Future Nuclear Event: What Have We Learned from Past Experiences?

Koichi Tanigawa

Hiroshima University, Japan, and Fukushima Medical University, Japan

In the Fukushima accident, deaths in rapid evacuation among inpatients and elderly people at nursing care facilities and increased mortality of displaced elderly people were reported whereas no discernible health effects due to radiation exposure have been or will be observed. In addition to psychological stress due to concern over radiation, lifestyle related diseases such as obesity, hypertension and diabetes caused by relocation created major challenges in public health after the accident.

Key issues in the healthcare system that need to be investigated to prepare for a future nuclear accident should include health effects due directly to radiation and other effects not directly related to radiation. Past experiences of major nuclear accidents show substantial impacts on health and society, irrespective of the magnitude of radiation effects.

Evacuation for a large population and vulnerable people needs to be planned carefully. Surrogate emergency systems that support local medical responses should be issued promptly after an accident. Mental and psychological care and behavioural and social support for displaced people need to be established with coordinated approaches by the government, municipalities, academic organizations, and volunteer groups. General public health services are a prerequisite to counteract long-term adverse health effects after a major nuclear accident.

For all of these countermeasures, healthcare professionals should balance protection from radiation with other health risks, and make efforts to mitigate the psychological effects that are most strongly associated with risk perceptions of radiation. These challenging tasks constitute the agenda of future research.

Koichi Tanigawa graduated from Kyushu University's Faculty of Medicine in 1982 and started his medical career in Fukuoka. With advanced training in critical care medicine at the University of Pittsburgh Medical Center (United States), Dr Tanigawa developed a new clinical focus and by 2002, was Professor and Chair of the Department of Emergency and Critical Care Medicine at Hiroshima University. Since then, Dr Tanigawa has been contributing to the development of the Japan's radiation emergency medical system. In response to the 2011 earthquake, tsunami, and nuclear crisis, Dr Tanigawa led a radiation emergency medical team dispatched to Fukushima. With continued involvement after the acute phase of the nuclear accident, he moved to Fukushima in 2015 to become a vice president of Fukushima Medical University. His major research interests include cardiopulmonary resuscitation, free radicals and reperfusion injury, radiation emergencies and disaster medicine. Dr Tanigawa is a member of Board of Directors of the Japanese Association for Radiation Accident/Disaster Medicine and Chairman of TEPCO Fukushima Nuclear Power Plant Emergency Medical Network Committee. He reported on important issues gleaned from the Fukushima accident in *The Lancet*, and has edited a book titled "Radiation Disaster Medicine" (Springer, 2013) with Dr Rethy K. Chhem.

SESSION 3 | FIVE YEARS AFTER FUKUSHIMA, WHAT HAVE WE LEARNED? PART II

Reawakening Radiation Anxieties and Regional Differences in Fukushima

Atsushi Kumagai

Fukushima Medical University, Japan

We can see a recent reawakening of radiation anxieties five years after the Fukushima accident. Many people had radiation anxieties just after the accident. After that, they had a vague anxiety because they could not anticipate what would happen in the future. At that phase, they did not need have to face a decision of whether to return home. They could receive housing support and monetary compensation. Many of them thought about their life as refugees in terms of escaping from essential radiation issues. They could postpone facing the radiation issue. It looked like a “silent phase” of radiation anxieties.

Five years have passed and the government has rescinded the evacuation orders one after another. In this situation, they are faced with a decision of whether to return home or to build a new house in their current place. Therefore, consultations about radiation have been increasing in the areas where evacuation orders have lifted or will be lifted soon. Their consultations include concrete issues such as re-starting farming activities in their home town, etc. On the other hand, such consultations are rare in the areas where it is clear that evacuation orders will not be lifted in the near future.

Some people consciously mix up radiation science with social issues. Recovery is both a blessing and a curse. Some of them have become acclimated to refugee life. Some want to believe the non-scientific claim to resist plans that stop the economic and housing support by the government.

There has been a renewed awareness of radiation anxiety and regional differences in awareness of radiation. The requests for radiation-related lectures to local communicators and stakeholders in the areas with cancelled evacuation orders have been increasing. This means that local communicators realize the radiation anxieties are coming to the surface. These developments suggest that we should train and develop science literacy and communication skills of the local communicators during the “silent phase.”

Atsushi Kumagai graduated from Nagasaki University School of Medicine in 1998 and has worked in the 1st department of Surgery, Nagasaki University Hospital. After he received a PhD in Medicine (2006), he has worked as an intern at the World Health Organization Headquarters in 2006. He was appointed Assistant Professor and worked as a physician at the International Hibakusha Medical Centre, Nagasaki University Hospital since 2007. He was dispatched to Fukushima as a leader of the advance team of Nagasaki University Hospital just after the Great East Japan Earthquake. Since 2012, he has worked in his present position to establish education systems of radiation disaster medicine and conduct risk communication activities with citizens in Fukushima. He is also supporting radiation accident responding parties (fire brigade, police) as an industrial doctor. He specializes in surgery, thyroidology, risk communication, education of radiation and disaster medicine.

SESSION 4 | NUCLEAR SCIENCE, RADIATION & HUMAN HEALTH IN SOUTHEAST ASIA

Communicating its Benefits versus the Risks of Radiation Therapy: A Perspective from Radiation Oncology

Miriam Joy Calaguas

Jose R. Reyes Memorial Medical Center, Philippines

(Paper co-authored with Jerickson Abbie Flores and Lilian Rodriguez)

The use of radiation in medicine started since the discovery of radium by Marie and Pierre Curie when the first patient was cured in 1899. Radiation Oncology is a clinical & scientific endeavour devoted to the management of patients with cancer and other diseases by ionizing radiation. It can be used alone or combined with other modalities such as surgery and chemotherapy. It involves the investigation of the biologic and physical basis of radiation therapy. It trains professionals in the field.

Radiation therapy (RT) plays an important role in the treatment of cancer by delivering ionizing radiation to destroy malignant cells. The RT process involves staging, simulation, planning, delivery and follow-up. During radiotherapy, both tumour and normal cells in the treatment field are affected by the radiation beams. The damaging effects to the normal cells will result in treatment-related toxicities. This depends on the radiation dose limits to the organs at risk (OARs). The risk of toxicities must be weighed against the potential benefits.

Radiotherapy treatment related side-effects are either acute or chronic. The acute side effects are localized depending on the anatomic region treated. Examples are diarrhoea (abdomen/pelvis), oral mucositis (head and neck) and dermatitis (skin). Most of these toxicities are treatable and transient in nature. Long-term or chronic side effects, on the other hand, could include infertility, gastrointestinal obstructions, pneumonitis, cardiac toxicity and secondary malignancies i.e., leukaemia and sarcomas. These toxicities are predictable so that utmost care must be done during radiotherapy treatment planning in order to prevent these unwanted sequelae

Radiation therapy has offered cure and palliation to cancer patients all over the world. There is a need for Radiation Oncologists to empower patients and their family about radiotherapy through proper education and treatment counselling. This lecture will also address the frequently asked questions (FAQs), as well as, differentiating facts against myths about radiotherapy.

Miriam Joy Calaguas is a practising Radiation Oncologist from the Philippines for the last 30 years. She did her fellowship training in Radiotherapy in Japan and did further short training courses in the US and Europe. She is chair of the department of Radiation Oncology of the Jose R. Reyes Memorial Medical Center and a faculty of the University of the Philippines College of Medicine. She was past president of the Philippine Radiation Oncology Society, Philippine Society of Oncologists and the South East Asian Radiation Oncology Group (SEAROG). She is National Project Leader for Radiotherapy for the Forum of Nuclear Cooperation in Asia (FNCA) and National Project Coordinator in Radiotherapy for the International Atomic Energy Agency (IAEA).

SESSION 4 | NUCLEAR SCIENCE, RADIATION & HUMAN HEALTH IN SOUTHEAST ASIA

The Medical Physicist in Radiation Medicine and Beyond: Perspectives from Singapore and ASEAN

James LeeNational Cancer Centre Singapore

Many clinical applications of Medical Physics involve the use of ionizing radiation for imaging or therapy. The role of the Medical Physicist is therefore important to ensure high quality and radiation safety. He/she may also be involved in the relevant education and research. With the advancement of technology, radiation medicine has seen significant improvements in patient care, yet it has also become increasingly complex and demanding for the Medical Physicists. In addition to radiation medicine, the Medical Physicist may also be specially trained to perform a leading role in the detection and protection of the public from harmful radiation, some of which may result from radiological accidents. There is now a need for more Medical Physicists in Singapore and especially the ASEAN region. They should have the right training and ability to handle complex clinical work and public safety. Academic and residency programs for Medical Physicists should be increased for capacity building in this area.

James Lee is currently the Chief Radiation Physicist at the National Cancer Centre Singapore (NCCS). His major involvement is in the clinical application of Medical Physics for Radiotherapy. He manages a team of Radiation Physicists and is Chairman of the NCCS Radiation Safety Committee. He has adjunct academic appointments at Nanyang Technological University and National University of Singapore where he contributes to the teaching of Medical Physics. His involvement with IAEA includes organizing regional workshops, delivering lectures and assisting in the area of Medical Physics residency program for NCCS and its development for the region. He is also currently the President of the South-East Asian Federation of Organizations of Medical Physics.

Nuclear Disaster Preparedness in ASEAN: The Art of Scientific Advice to Policy Makers

Rethy Chhem

Cambodian Development Resource Institute

Despite safety concerns after the Fukushima NPP accident, several Southeast Asian countries are still considering plans for the use of nuclear energy in view of establishing national energy security and mitigation of the effects of climate change. ASEAN established the norm for nuclear safety and security in 1995 through the signature of the Treaty on the Southeast Asian Nuclear Weapon-Free Zone. This Treaty's goal is to prohibit the development of nuclear weapons. It also claims the right for each member state to use nuclear energy for peaceful purposes. In the meantime, the Southeast Asian region is prone to many disasters. As such, the ASEAN agreement on disaster management and emergency response was signed in July 2005. It aims at providing the guidelines for effective mechanisms to achieve substantial reduction of disaster effects, and to jointly respond to disaster emergencies through concerted national efforts and intensified regional and international cooperation. These two regional agreements call for the establishment of a pool of experts capable to provide ASEAN governments and regional organizations with scientific advice in order to enable top policy makers to make vital decisions for the preparedness, response and resilience to disasters, whether they are natural or man-made or both. This scientific advice to governments should be provided and operated within the diversity of cultural and political frameworks of the Southeast Asian countries. Much can be learned from the Fukushima nuclear disaster as it was noted that in its aftermath, scientific communication located in the "normal science" mode has proven to be inadequate to inform policy and to reassure the publics. Normal science, defined by Thomas Kuhn was contested by Karl Popper, because normal science is thought to be excessively conservative and dogmatic. In normal science the dichotomy of facts versus values or knowledge versus ignorance prevails; the expert imposes the domination of scientific facts over values. Accepting the limitations of normal science and in response to the policy issues of risks and human health/environment, Funtowicz and Ravetz proposed a new type of science: the Post-normal science (PNS) which is a method of inquiry appropriate for situations where facts are uncertain, values are in dispute, stakes are high and decisions are urgent. All these aspects were present during the acute phase of the nuclear disaster of Fukushima. "Facts were uncertain" (e.g., data about radiation leak), "values in dispute" (e.g., nuclear energy contested), "stakes high" (economic and political implications are serious), "decisions urgent" (to evacuate or not evacuate). This talk will discuss the above issues with respect to the "Art of scientific advice" within the framework of STS (Science Technology Studies), Post normal science and narrative mediation. Science advisor-to-be may learn on how to engage policy makers, media and the publics, how to build trust and finally how to effectively influence policy formulation in nuclear affairs as ASEAN is entering the nuclear age.

Rethy Chhem is a medical doctor, biomedical scientist, science diplomat, historian of medicine, and educationalist, with experience in global health policy and ASEAN Higher Education. He has taught radiology at various universities in Canada, Singapore Japan and Austria. He was the Director of the Division of Human Health at the International Atomic Energy Agency before he joined the Cambodian Development Resource Institute as Executive Director in September 2014.

SESSION 5 | GOVERNING EXPERTISE AND COMPLEXITY: STS, RADIOLOGICAL RISK AND HUMAN HEALTH

Fukushima Forward: Disaster Recovery with Global Perspective

Kim Fortun

Rensselaer Polytechnic Institute, USA

Long-term disaster recovery needs to be tuned to local conditions and cultures while also tuned to global dynamics and comparative perspective. In this presentation, I will critically assess an array of concepts developed to orient and evaluate disaster recovery in different settings — considering, for example, warnings about “disaster capitalism,” and what it would like to “bounce forward” after disaster as called for in new conceptualization of “resilience.” I will also consider the promise of a “capabilities approach” to disaster recovery extending from the work of economist Amartya Sen, and what is meant by the “just transition” called for by the international trade union movement. Recovery from nuclear disaster poses special challenges, including a need for ongoing assessment of radioactive contamination and impacts on human and ecosystem health, alongside attention to the displacement, stigma, and fear that follow radiation exposure. Governing long-term recovery from nuclear disaster is thus particularly complex, calling for an approach to disaster recovery that acknowledges how history and memory inevitably weight recovery efforts, and the powerful role of interpretation, communication, trust, and social form in recovery trajectories.

Kim Fortun is a cultural anthropologist and Professor of Science & Technology Studies at Rensselaer Polytechnic Institute. Her research and teaching focus on environmental risk and disaster, and on ways anthropological and STS knowledge can interlink with knowledge in engineering, the sciences, and medicine. Her research examines how people in different geographic and organizational contexts understand environmental problems, uneven distributions of environmental health risks, developments in the environmental health sciences, and factors that contribute to disaster vulnerability. Fortun is the author of *Advocacy After Bhopal Environmentalism, Disaster, New World Orders* (University of Chicago Press, 2001). With historian Scott Knowles, Fortun edits a book series for University of Pennsylvania Press titled *Critical Studies in Risk and Disaster*, designed to connect academic research to public problems and policy, reaching audiences in different regions of the world. Fortun is also a lead organizer of the Disaster-STS Research Network, formed to bring together researchers from around the globe concerned to better coordinate efforts to understand, anticipate and respond to environmental and industrial disaster. Fortun taught a short course in disaster studies at the University of Vienna during summer 2015. In summer 2016, Fortun will be teaching a short course in disaster studies at McMaster University (Canada).

Moyai-Naoshi or “Re-Mooring”: A New Species of Hope

Tyson Vaughan

National University of Singapore

The disasters that occurred in Minamata and Fukushima, Japan, belong to a special category of communal injury described by sociologist Kai Erikson as “a new species of trouble.” Such disasters are at least partially technogenic; they involve toxic contamination; and they instigate chronic individual and social trauma. Such toxic disasters induce *solastalgia*, which is distress caused by “desolation of the physical environment (home) by forces that undermine a personal and community sense of identity, belonging and control,” resulting in a profound, dissonant sense of dislocation or “homesickness [that] one experiences when one is still at ‘home’” (Albrecht 2007). As Erikson (1994) describes, “This poison is a pervasive fear that the world of nature and the world of human beings can no longer be relied upon in the old way. The fish are full of poison, the waters are contaminated, the land itself... is diseased, and the social world is in disarray.” Put simply, residents of these communities have been *un-moored* from all the things that gave their lives order and meaning. This presentation will describe a holistic and humane approach to recovery from such an experience, which residents of Minamata call *moyai-naoshi*, or “re-mooring.” While state-led, technocratic disaster recovery approaches invoke the intransitive form of the verb “to recover” — eliding the fundamental and politically charged question of *what is to be recovered* — community-instigated “re-mooring” approaches surface the transitive form of the verb by interrogating and radically redefining its object, the ultimate goal of disaster recovery. This presentation calls for technical experts and authorities to recognize and support the “re-mooring” approach, and to complement this approach with their own, disciplined efforts toward reconstruction.

Tyson Vaughan has been a Fellow at Tembusu College of the National University of Singapore since receiving his PhD in Science & Technology Studies from Cornell University in January 2014. His teaching and research interests revolve around "disaster studies," public engagement with technoscience, and democratic governance of "envirotechnical" risk, and "sociotechnical" order. He is currently preparing a monograph titled, *Reconstructing Expertise: Participatory Recovery Planning in Post-Disaster Japan*, on the reconstruction of post-disaster communities and the concomitant social construction of disaster recovery expertise. In September, Dr Vaughan will join the Collaboration and Public Participation Center of Expertise (CPCX) at the U.S. Army Corps of Engineers, as an AAAS Science & Technology Policy Fellow.

SESSION 6A | LEARNING FROM THE PAST, LOOKING TO THE FUTURE

Looking Back, Looking In: Moral Motivators and Prosocial Civics in Case Studies of the Health Consequences of CBRN Disasters in Japan

Russell KabirHiroshima University, Japan

Japan has been subjected to frequent natural disasters in the form of earthquakes and tsunamis throughout history, to include the Great Hanshin Earthquake of 1995 and the Great East Japan Earthquake and Tsunami of 2011. Within the last century, Japan has also experienced a cascade of wartime and technological disasters with long-term consequences in the form of the atomic bombings of Hiroshima and Nagasaki, the industrial pollution-induced mercury outbreak of Minamata disease, the act of domestic terrorism known as the Sarin Gas Attack in Tokyo, and the na-tech disaster release of radionuclides from the hydrogen explosion at the Fukushima Daiichi Nuclear Power Station. This unique repertoire has exposed weaknesses in the state delivery and maintenance of goods and services, challenged stakeholders to regain their autonomy through innovative grassroots schemes for robust energy profiles and community programs, and ultimately re-evaluated uses of science and technology in Japanese society.

This presentation takes a look back at the history and biopsychosocial consequences of these chemical, biological, radiological and nuclear (CBRN) events, and discusses their role in shaping moral intuitions to collectively condemn dreaded technology. Attention is drawn to the mother-child relationship, environmental justice, and personal observations on the pace of recovery between the tsunami and radiation disasters in Tohoku. It will conclude with commentary on the legacy of historical trauma from natural and na-tech disaster experiences in Japan, the reflexive negotiation inherent to the normalization of deviance, and a review of the preponderance of radiological protection-based community approaches to disaster management.

Russell S. Kabir is a graduate student from the Department of Psychology in the Graduate School of Education at Hiroshima University and a second-year member of their flagship Phoenix Leader Education Program for Renaissance from Radiation Disaster. He studied abroad with Harvard Summer School at Waseda University in 2009, and graduated *cum laude* with bachelor degrees in science and international and area studies from the University of Oklahoma in 2011, where he spearheaded a state-wide fundraising campaign for disaster relief known as Oklahoma United for Japan. He worked as an English instructor at schools in Yurihonjo City, Akita Prefecture, and continued humanitarian activities throughout Tohoku with organizations such as Volunteer Akita from 2012-2014. He recently delivered self-care promoting psychological rehabilitation services to residents of temporary housing and communities in Miyako City, Iwate Prefecture, under the guidance of a disaster support team from Fukuoka Jogakuin University. His research focuses on the psychosocial consequences of disasters through the lenses of the cognitive and clinical sciences. His current research projects examine topics in big data psycholinguistics and health psychology, with special emphases on health anxiety, health competence, cognitive filters, narrative approaches to person-centred care, and the relationship between self-efficacy and applied relaxation techniques.

SESSION 6A | LEARNING FROM THE PAST, LOOKING TO THE FUTURE

The Demographic Impact of the Fukushima Nuclear Accident on Affected Areas: Factors Influencing Evacuee Decisions to Migrate

Do Xuan Bien

Hiroshima University, Japan

The Fukushima nuclear accident has had a significant impact on the demographics of its affected areas. The massive evacuation that ensued has accelerated the depopulation of Fukushima Prefecture and changed its demographic structure, especially in 12 municipalities and towns in the evacuation zones. Although many studies have investigated demographic changes, the geographical characteristics of evacuees, and determinants for returning to original places of residence, specific factors that have influenced evacuees' decisions in selecting locations for their migration have not been well understood.

Leveraging my background in human geography, I decided to investigate Fukushima nuclear accident-induced migration with a particular emphasis on how evacuees selected their migration locations. This research aims to elucidate the mechanism of nuclear disaster migration in terms of location choice. The goals of this research will be to contribute to overall understanding as to why many people have returned to their homes while others have decided to move to other places. In addition, it is designed to verify whether or not the disaster migration in Fukushima aligns with existing theories related to migration research, namely push and pull theory, the distant inverse law, and the gravity model.

In this presentation, I will briefly discuss the demographic impact of the nuclear accident on affected areas using Minamisoma City as a case study. I will apply perspectives of geography to explore critical factors that evacuees considered when making their decision to migrate. Using the results of the social survey conducted in March and April 2016 on returned evacuees as a basis, I will identify the pushing and pulling factors of migration in affected areas and evacuation destinations, and summarize the most influential determinants for selecting evacuation locations. The possible correlations between demographic characteristics of evacuees and their choices of migration destination will also be examined.

Do Xuan Bien holds a Bachelor Degree, majoring in Geography, from Vietnam National University. He obtained a Master of Environment from the University of Melbourne, with the research focused on climate change policy and is currently a PhD student in the Phoenix Leader Education Program for Renaissance from Radiation Disaster, Hiroshima University. His research focuses on the migration issues related to the Fukushima nuclear accident, in particular, demographic impacts in the affected areas and the factors that people consider when making their decision of migration. Do Xuan Bien began his career in Enda Vietnam, an NGO working in the field of development and environmental protection as a social worker and environmental communication group member. He has participated in several community development projects and contributed to the development of environmental communication activities at community level. Subsequently, he worked for the University of Social Sciences and Humanities in Ho Chi Minh City, Vietnam as a researcher and lecturer where he has developed his expertise in environmental education and climate change policy through teaching and research activities.

ABOUT THE CHAIRPERSONS AND ORGANISERS NOT PREVIOUSLY LISTED

Sulfikar Amir is an Associate Professor in the Division of Sociology, Nanyang Technological University, Singapore. His research interests include sociology of technology, development, globalisation, sociology of risk and resilience, and city studies. He is the author of *The Technological State in Indonesia: the Co-constitution of High Technology and Authoritarian Politics* (Routledge, 2012). He has conducted research on nuclear politics and risk in Southeast Asia, examining the social and political dimensions of nuclear power in emerging democracies. His ongoing project on nuclear risk examines the root cause of vulnerability in the Fukushima nuclear crisis.

Gregory Clancey is an Associate Professor in the Department of History, the Leader of the STS (Science, Technology, and Society) Cluster at the Asia Research Institute (ARI), and Master of Tembusu College at National University of Singapore. He formerly served NUS as Assistant Dean of the Faculty of Arts and Social Sciences, and as Chairman of the General Education Steering Committee. Assoc. Prof Clancey received his PhD in the Historical and Social Study of Science and Technology from MIT. He has been a Fulbright Graduate Scholar at the University of Tokyo, a Lars Hierta Scholar at the Royal Institute of Technology (KTH) in Stockholm, and a Visiting Professor at Nagasaki University. He has won three NUS teaching awards. Assoc Prof Clancey's research centers on the cultural history of science & technology, particularly in modern Japan and East Asia. His book *Earthquake Nation: The Cultural Politics of Japanese Seismicity* (Berkeley: U. of California Press, 2006) won the Sidney Edelstein Prize from the Society for the History of Technology in 2007; and was selected as one of the "11 Best Books about Science" for the UC Berkeley Summer Reading List in 2009. He is co-editor of *Major Problems in the History of American Technology* (Boston: Houghton-Mifflin, 1998), *Historical Perspectives on East Asian Science, Technology and Medicine* (Singapore: Singapore U. Press & World Scientific 2002), and *The City as Target* (NY: Routledge, 2011). Assoc Prof Clancey is the 2012 recipient of the Morison Prize from MIT for "combining humanistic values with effectiveness in the world of practical affairs, and in particular, in science and technology".

Scott Knowles is an Associate Professor in the Department of History and Politics at Drexel University, United States. He is a historian of modern cities, technology and public policy—with a particular focus on risk and disaster. His most recent book is *The Disaster Experts: Mastering Risk in Modern America* (UPenn Press, 2011). He is the editor of *Imagining Philadelphia: Edmund Bacon and the Future of the City* (UPenn Press, 2009); and has published articles, essays and book reviews in *The Next American City*, *Isis*, *History and Technology*, *Public Works Management and Policy*, *Technology and Culture*, *Business History Review*, *Enterprise and Society*, *The Smart Set* and *Annals of Science*. His opinion pieces have run in *The New York Times*, *The Hill* and *The Philadelphia Inquirer*, and he has been a media commentator for such outlets as *TIME.com*, *Al Jazeera*, *NPR*, *FOX News*, *Inside Edition* and *CNBC.com*.

Tommy Koh is Ambassador-At-Large at the Ministry of Foreign Affairs, Chairman of the Governing Board of the Centre for International Law and Rector of Tembusu College at the National University of Singapore. He is the Co-Chairman of the China-Singapore Forum, the India-Singapore Strategic Dialogue and the Japan-Singapore Symposium. He was Singapore's Permanent Representative to the United Nations in New York for 13 years. He was Ambassador to the United States of America for 6 years. He was the Dean of the Faculty of Law of NUS. He was also the President of the Third UN Conference on the Law of the Sea. He chaired the Preparatory Committee for and the Main Committee at the Earth Summit. He had served as the UN Secretary-General's Special Envoy to Russia, Estonia, Latvia and Lithuania. He was also Singapore's Chief Negotiator for the USA-Singapore Free Trade Agreement. He has chaired two dispute panels for the World Trade Organization. In 1984, Yale University conferred on him an honorary degree of doctor of law. Prof Koh received the Elizabeth Haub Prize for Environmental Law in 1996 and was made a Champion of the Earth by the United Nations Environment Programme (UNEP) in 2006. He also received the Great Negotiator Award 2014 from Harvard University on 10 April 2014.

Kenneth Nollet earned MD and PhD degrees from the Mayo Clinic, and stayed at Mayo to specialize in pathology and transfusion medicine. After Mayo, he joined the American Red Cross in St. Paul, Minnesota. There, he also served as blood bank medical director of the Minneapolis Veteran's Affairs Medical Center and became an assistant professor at the University of Minnesota. Paul Holland invited Dr Nollet to be an associate medical director at BloodSource, a position held until Dr Holland's retirement. Thereafter, Dr Nollet was recruited to be the Australian Red Cross Blood Service's National Medical Education Program Manager and work as a transfusion medicine specialist in Queensland. By invitation of Professor Hitoshi Ohto, Dr Nollet joined Fukushima Medical University's Department of Blood Transfusion and Transplantation Immunology in 2008. Contrary to evacuation advice given to American citizens after the Great East Japan Earthquake, Dr Nollet stayed at Fukushima Medical University to participate in disaster relief and, for the long term, Fukushima Prefecture's revitalization.

MAP OF UNIVERSITY TOWN

Vicinity of University Town



