

International Livestock Research Institute

Training course report

Food safety risk assessment for informal value chains




September 2013





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Compiled by Hung Nguyen-Viet

Edited and formatted by Tezira Lore

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Contents

Acknowledgements.....	iii
Acronyms and abbreviations	iv
Background.....	1
Training summary.....	2
Profiles of the facilitators	4
Evaluation of facilitators	5
Agenda.....	6
Training materials.....	8
List of participants.....	9

Acknowledgements

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We thank Nguyen Hung Long, deputy director general of the Vietnam Food Administration, Ministry of Health, and Tran Dinh Luan, deputy director general of the Department of Animal Health, Ministry of Agriculture and Rural Development, for supporting the course and the taskforce of risk assessment for food safety.

The course was financially supported by the CGIAR Research Program on Agriculture for Nutrition and Health led by the International Food Policy Research Institute and by ILRI, Rakuno Gakuen University, the Hanoi School of Public Health and the Australian Centre for International Agricultural Research.

Acronyms and abbreviations

HACCP	Hazard Analysis and Critical Control Point
ILRI	International Livestock Research Institute
OIE	World Organization for Animal Health

Background

In almost all developing country cities and towns, most foods are sold in informal markets. Worldwide, 2 billion cases of diarrhoea occur in all age groups and 1.5 million children under five die each year due to diarrhoea, mostly caused by zoonotic pathogens. Food-borne diseases include zoonotic diseases such as brucellosis and bovine tuberculosis and the total disease burden is much greater than the single figure of diarrhoeal diseases. Producers who sell to informal markets are usually poor smallholders and thus improvement of food safety along the informal value chain will have significant positive impacts not only on public health but also on poverty alleviation because of the expected enhanced market access by such producers and traders. Participatory risk assessment is a powerful tool to understand the risks of informally marketed foods and to plan effective intervention strategies towards improved food safety.

Before proper food safety policies can be created, reliable evidence must be established on the possible risks to human health. Before risk analysis, much food safety policy was based on the presence of harmful substances in food (hazards). Risk analysis shifts the focus to the more important issue of the harm these substances cause (risks). For example, in Kenya the presence of pathogenic bacteria in raw milk led authorities to ban the sale of raw milk in urban areas. Poor consumers who could not afford to buy pasteurized milk at twice the price of raw milk thus reduced their consumption of this nutritious food. However, risk analysis showed that all consumers boiled milk before consumption, thus eliminating the public health risk presented by milk-borne pathogens. As a result of this evidence, smallholder farmers were allowed to continue to sell their milk, and poor consumers to buy it.

The Hanoi School of Public Health and partners have incorporated risk analysis in a series of studies on food safety in Vietnam. These studies illustrate how a risk-based approach can bring new insights into managing food safety in the country. The results also contribute to building Vietnam's research evidence on hazards in important foods such as pork and vegetables and the potential risks to human health.

This two-week training course was targeted at postgraduate students researching on risk analysis and safety of animal-source foods in informal value chains in developing countries under the ILRI research programs, as well as members of the Vietnam risk assessment taskforce for food safety. However, the course was also open to other students with a background in statistics as well as animal and public health professionals and other risk assessment practitioners in Vietnam.

The course was a collaborative effort of ILRI, Rakuno Gakuen University and the Hanoi School of Public Health to strengthen the taskforce on risk assessment for food safety that is supported by the CGIAR Research Program on Agriculture for Nutrition and Health.

Training summary

Organizer: Hung Nguyen-Viet

Lecturers/facilitators: Silvia Alonso, Johanna Lindahl, Kohei Makita, Hung Nguyen-Viet, Fred Unger and Cristobal Verdugo

The course was a mixture of formal lectures in the mornings and hands-on practical exercises in the afternoons. Beginning with an overview of food safety and food-borne diseases in Vietnam, the course then covered risk analysis and its components – risk assessment, communication and management – and participatory approaches to risk assessment. The training focused mainly on risk assessment and participants learned about building and running a risk model, stochastic processes and how to conduct sensitivity analysis in @Risk and R.

The course was opened by Lucy Lapar, ILRI country representative in Vietnam, and Nguyen Hung Long, deputy director general of the Vietnam Food Administration in the Ministry of Health.

Day 1: Trainer team provided an overview of food security, food-borne diseases and the safety of animal-source foods globally and in Vietnam. The risk analysis framework was presented with emphasis on two key frameworks for public health: World Organization for Animal Health (OIE) and Codex Alimentarius. Hazard Analysis and Critical Control Point (HACCP) was also discussed. The day ended with exercises on point estimate calculation in Microsoft Excel and an exercise on qualitative risk assessment.

Day 2: Probabilistic sampling and quantitative risk assessment were presented. Key epidemiological concepts and sampling methods were discussed and how stochastic modelling is used in quantitative risk assessment. The Monte Carlo simulation was introduced.

Day 3: Different parametric and non-parametric distributions commonly used in risk assessment were introduced. Exercises focused on how to fit collected data to available and plausible distributions when conducting a risk assessment.

Day 4: The three key probability distributions (Binomial, Poisson, and hypergeometric) were examined and their application to risk assessment discussed. Bayesian inference was also introduced as a method to estimate probability distributions of model parameters in risk assessment.

Day 5: Central limit theorem and multiplication of distributions and multinomial distributions.

Day 6: Elements needed to construct a risk model were studied. These included biological pathway to illness, description of a value chain, separation, mixing and inactivation, and hierarchical modelling.

Day 7: Participants were introduced to R and OpenBUG programmes and their use in risk assessment. R and OpenBUG were alternatively used in different examples of risk assessment to show the advantages of the Bayesian approach compared to the conventional approach and to derive parameters of interest.

Day 8: Details on development of dose-response relationship, modelling cooking and consumption and risk of illness in population were presented and practised.

Day 9: The concept of separating variability and sensitivity analysis and scenario analysis was introduced.

Day 10: Participants were divided into groups and worked on case studies on quantitative risk assessment of (i) *Salmonella* in pork in Vietnam, (ii) vegetables grown in polluted water in Vietnam, (iii) aflatoxin in milk in Africa, and (iv) *Vibrio cholerae* in sea food in Thailand. At the end of the course, they spent half a day finalizing their case studies and presented them to the rest of the group for discussion and comment.

On the final day, the participants evaluated the course. The evaluation consisted of assessment of two components: (i) pre- and post-training knowledge of participants and (ii) the quality of the course materials, facilitators' performance and workshop organization and logistics. During the closing ceremony, all participants were issued with a certificate of participation.

Profiles of the facilitators

Kohei Makita is an associate professor of veterinary epidemiology at Rakuno Gakuen University and a joint appointed scientist at ILRI. He is an expert of stochastic food safety risk analysis in developing countries and also is familiar with other applied epidemiological analyses of zoonotic and animal diseases. His group uses the One Health approach to respond a wide range of problems concerning multiple sectors both in developed and developing countries.

Hung Nguyen-Viet holds a PhD in life and environmental sciences. He works at the interface of environment and health, focusing on environmental health and food safety with an integrative approach (Ecohealth and One Health). He leads the Center for Public Health and Ecosystem Research at the Hanoi School of Public Health and is a joint appointee of Swiss Tropical and Public Health Institute and ILRI.

Silvia Alonso is a postdoctoral scientist in the food safety and zoonoses program at ILRI. She is a veterinarian with postgraduate training in epidemiology and public health. She graduated in veterinary medicine in Spain and completed a PhD in food safety at the University of Bologna, Italy. She worked for five years as a lecturer at the Royal Veterinary College where she gained experience in teaching and training at undergraduate and postgraduate level, both nationally and internationally. Her research focuses on the epidemiology and control of different zoonoses and she has an interest in the impact and control of zoonoses in developing countries. She has also a special interest in the ecosystems approach to health (ecohealth), a novel holistic approach to the investigation of human health.

Cristobal Verdugo is veterinarian from the University of Chile, and holds a Master's degree in preventive veterinary medicine from the University of California and a PhD from Massey University, New Zealand. His main areas of expertise include veterinary epidemiology, Bayesian inference and simulation modelling. He has previously worked on diseases such as highly pathogenic avian influenza, foot and mouth disease and paratuberculosis.

Johanna Lindahl is a postdoctoral scientist in ILRI's food safety and zoonoses program. She is a veterinary epidemiologist with a degree from the Swedish University of Agricultural Sciences. Her PhD research was on the epidemiology of Japanese encephalitis virus in South Vietnam. She has work experience in Sweden as a clinician and in food safety and disease control. Her main interests are in infectious diseases and vector-borne viruses. At ILRI she is involved in risk assessment of aflatoxins in the dairy chain.

Fred Unger is a German veterinarian with 20 years' work experience in veterinary epidemiology and veterinary public health gained predominantly in developing countries in Africa and Southeast Asia. After graduating with a degree in veterinary medicine from the Humboldt University Berlin, he worked in Uganda, the Gambia and Germany. Since 2007, he has been working for ILRI in Bangkok and Jakarta to develop epidemiological capacity to control emerging infectious diseases and promote the ecohealth concept in six Southeast Asian countries: Indonesia, Cambodia, China, Indonesia, Laos, Thailand and Viet Nam. His research activities include epidemiological surveys, risk assessment and capacity building on One Health/ecohealth.

Evaluation of facilitators

Name	Lecture	Level of evaluation*			
		1	2	3	4
Kohei Makita	L2-1: Probabilistic sampling	3	8	1	
	L2-2: Quantitative risk assessment	3	6	3	
	L3-1: Parametric distribution	4	6	2	
	L3-2: Non-parametric distributions	3	8	1	
	L5-1: Hypergeometric process	3	6	3	1
	L5-2: Central limit theorem	2	8	1	1
	L5-3: Multiplication of distributions	2	9	2	1
	L5-4: Multinomial distributions	2	9		2
	L6-2: Description of a value chain	3	6	4	1
	L6-3: Separation, mixing and inactivation	3	6	3	2
	L6-4: Hierarchical modelling	4	5	4	1
	L7-1: Dose-response relationship	3	5	4	2
	L7-2: Modelling cooking and consumption	5	5	2	2
	L7-3: Separating variability	3	8	2	1
	L7-4: Sensitivity analysis	3	6	3	2
	L7-5: Scenario analysis	2	8	3	1
	L9-1: Designing own risk model	3	5	3	2
Hung Nguyen-Viet	L1-1: Food safety	2	8	2	
	L1-2: Risk analysis (Codex Alimentarius)	2	6	1	
	<i>General facilitation</i>				
Silvia Alonso	L1-2.1: Risk assessment (OIE and HACCP)	4	6	2	
	L1-3: Qualitative risk assessment practical	4	6	2	
	L1-3: Microsoft Excel	6	4	1	1
Cristobal Verdugo	L4-2: Bayesian inference	1	11	3	
	L4-3: Binomial process	3	6	2	2
	L4-4: Poisson process	3	5	3	2
	L8-1: Use of R in risk assessment	2	7	3	2
	L9-1: R course module	1	9	4	1
Johanna Lindahl	L4-1: Probability rules and Venn diagram	4	5	3	1
	L6-1: Biological pathway to illness	5	4	3	1

*1= Very good communication skills, successful in delivering messages

2= Good communication but sometimes difficult to follow

3= Sometimes led to misunderstanding of the delivered messages

4= Most of the time failed in delivering messages

Agenda

Day 1 – 26 Aug 2013		
9.00 – 9.15	Opening	Nguyen Hung Long Lucy Lapar Hung Nguyen-Viet
9.15 – 9.30	Presentation of the course and group photo	Kohei Makita
9.30 – 9.45	Pre-evaluation	
9.45 – 10.15	L1-1: Food safety in developing countries	Hung Nguyen-Viet
10.15 – 10.30	Setting up computers	Hanoi School of Public Health/ILRI
10.30 – 11.00	Coffee	
11.00 – 12.00	L1-2: Risk analysis	Hung Nguyen-Viet Silvia Alonso
12.00 – 13.00	Lunch	
13.00	P1-1: Point estimate simple calculation in Excel	Silvia Alonso
	P1-2: Installation of R and exercise of P1	Kohei Makita
15.30 – 16.00	Coffee	
	P1-3: Qualitative risk assessment exercise	Silvia Alonso

Day 2 – 27 Aug 2013		
9.00	L2-1: Probabilistic sampling	Kohei Makita
10.30 – 11.00	Coffee	
	L2-2: Quantitative risk assessment	Kohei Makita
12.00 – 13.00	Lunch	
13.00	P2-1: Sampling framework exercise	Kohei Makita
15.30 – 16.00	Coffee	
	P2-2: Point estimate risk analysis exercise	Kohei Makita

Day 3 – 28 Aug 2013		
9.00	L3-1: Parametric distributions	Kohei Makita
	L3-2: Non-parametric distributions	Kohei Makita
10.30 – 11.00	Coffee	
	P3-1: Parametric distributions	Kohei Makita
12.00 – 13.00	Lunch	
13.00	P3-2: Fitting data into a distribution	Kohei Makita
	P3-2: Fitting data into a distribution	Kohei Makita
15.30 – 16.00	Coffee	
	P3-3: Simple Monte Carlo simulations	Kohei Makita

Day 4 – 29 Aug 2013		
9.00	L4-1: Probability rules and Venn diagram	Johanna Lindahl
	L4-2: Bayesian inference	Cristobal Verdugo
10.30 – 11.00	Coffee	
	L4-3: Binomial process	Cristobal Verdugo
	L4-4: Poisson process	Cristobal Verdugo
12.00 – 13.00	Lunch	
13.00	P4-1: Binomial process practical	Cristobal Verdugo

15.30 – 16.00	Coffee	
	P4-2: Poisson process practical	Cristobal Verdugo

Day 5 – 30 Aug 2013

9.00	L5-1: Hypergeometric process	Kohei Makita
	L5-2: Central limit theorem	Kohei Makita
10:30 – 11.00	Coffee	
	L5-3: Multiplication of distributions	Kohei Makita
	L5-4: Multinomial distributions	Kohei Makita
12.00 – 13.00	Lunch	
13.00	P5-1: Hypergeometric process practice	Kohei Makita
	P5-2: Distribution multiplication practice	Kohei Makita
15.30 – 16.00	Coffee	
	P5-3: Multinomial distribution practice	Kohei Makita

Day 6 – 31 Aug 2013

9.00	L6-1: Biological pathway to illness	Johanna Lindahl
	L6-2: Description of a value chain	Kohei Makita
10:30 – 11.00	Coffee	
	L6-3: Separation, mixing and inactivation	Kohei Makita
	L6-4: Hierarchical modelling	Kohei Makita
12.00 – 13.00	Lunch	
13.00	P6-1: Hierarchical modelling	Kohei Makita
	P6-2: Building a value chain	Kohei Makita
15.30 – 16.00	Coffee	
	P6-3: Modelling separation, mixing and inactivation	Kohei Makita

01 September 2013: Review day

02 Sep 2013: Vietnamese National Day

Day 7 – 03 Sep 2013

9.00	L7-1: Use of R in risk assessment	Cristobal Verdugo
10:30 – 11.00	Coffee	
	L7-1: Use of R in risk assessment	Cristobal Verdugo
12.00 – 13.00	Lunch	
13.00	P7-1: R practice	Cristobal Verdugo
15.30 – 16.00	Coffee	
	P7-1: R practice	Cristobal Verdugo

Day 08 - 05 Sep 2013

9.00	L8-1: R course module 2	Cristobal Verdugo
10:30 – 11.00	Coffee	
	L8-1: R course module 2	Cristobal Verdugo
12.00 – 13.00	Lunch	

13.00	P8-1: R course module 2	Cristobal Verdugo
15.30 – 16.00	Coffee	
	P8-2: Designing own risk model	Kohei Makita/Hung Nguyen-Viet

Day 9 – 03 Sep 2013		
9.00	L9-1: Dose-response relationship	Kohei Makita
	L9-2: Modelling cooking and consumption	Kohei Makita/Luu Quoc Toan
	L9-3: Separating variability	Kohei Makita
10:30 – 11.00	Coffee	
	L9-4: Sensitivity analysis	Kohei Makita
	L9-5: Scenario analysis	Kohei Makita
12.00 – 13.00	Lunch	
13.00	P9-1: Dose-response relationship	Kohei Makita
	P9-2: Modelling cooking and consumption	Kohei Makita/Luu Quoc Toan
15.30 – 16.00	Coffee	
	P9-3: Separating variability	Kohei Makita
	P9-4: Sensitivity analysis	Kohei Makita
	L9-1: Designing own risk model	Kohei Makita/Hung Nguyen-Viet/Fred Unger
	Four working groups on designing own risk model	Kohei Makita/Hung Nguyen-Viet/Fred Unger

Day 10 - 06 Sep 2013		
9.00 – 10.15	Four working groups on designing own risk model (coffee break included)	Kohei Makita/Hung Nguyen-Viet
10.15-12.00	Presentations of groups and discussion	Kohei Makita/Hung Nguyen-Viet
12.00 – 13.00	Lunch	
13.00 – 13.30	Post-evaluation	
13.30-13.45	Presentation of certificates and closing of the course	Kohei Makita Hung Nguyen-Viet Pham Xuan Da

Training materials

Only a few presentations are provided for open access. For information on the training materials, please contact the lead trainer Kohei Makita at kmakita@rakuno.ac.jp.

List of participants

Name	Sex (M/F)	Country of origin	Country Classification (Developing/Developed)
Nguyen Tien Thanh	M	Vietnam	Developing
Luu Quoc Toan	M	Vietnam	Developing
Pham Duc Phuc	M	Vietnam	Developing
Nguyen Tu Tuan Anh	M	Vietnam	Developing
Duong Van Nhiem	M	Vietnam	Developing
Pham Thi Ngoc	F	Vietnam	Developing
Phan Thi Thanh Ha	F	Vietnam	Developing
Hoang Thu Ha	F	Vietnam	Developing
Luu Văn Ba	M	Vietnam	Developing
Doan Huy Dung	M	Vietnam	Developing
Do Cao Cuong	M	Vietnam	Developing
Juri Hibi	F	Japan	Developed
Warangkana Chaisowwong	F	Thailand	Developing
Chalita Jainonthee	F	Thailand	Developing
Vu Van Tu	M	Vietnam	Developing
Le Thi Phuong Hong	F	Vietnam	Developing
Nguyen Mai Huong	F	Vietnam	Developing
Nguyen Hung Long	M	Vietnam	Developing
Pham Xuan Da	M	Vietnam	Developing
Nguyen Cong Khuong	M	Vietnam	Developing