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Integration of tools and social science into food safety risk assessments

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Abstract

The European Food Risk Assessment (EU-FORA) Fellowship work programme 'Integration of tools and social science into food safety risk assessments' was proposed and delivered by the Food Standards Agency (FSA), UK. The Food Standards Agency is a non-ministerial government department of the UK, responsible for protecting public health in relation to food in England, Wales and Northern Ireland. The programme was tailored to several different activities to provide an overview of the different tools that can be employed in food safety risk assessment also accounting for the interaction between risk assessment and social science. In order to structure the proposed work, the programme was split into four modules to run over the 12-month period of 'learning-by-doing'. In the first module, the fellow was introduced to Microbiological Risk Assessment (MRA), in the second to Chemical Risk Assessment (CRA), in the third to Social Science, and finally, in the fourth to the Risk Prioritization Tools and Networks in UK - National Dietary Data (NDNS), collection methodology, coding and analysis. The fellow was assigned to the Risk Assessment Unit within the Science, Evidence and Research Department which brings together specialist expertise from Microbiological, Chemical Risk Assessment, and Analytics Units, under one department together with additional staff from the food allergy and radiological risk assessment fields. The aim was to be fully integrated in the organisation's work gaining first-hand experience, increase knowledge of scientific aspects relevant to food safety risk assessment, and more importantly, to enhance network connection activities in the EU food risk assessment environment.

Keywords: risk assessment, exposure assessment, norovirus in lettuce, risk perception

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1. Introduction

The European Food Risk Assessment (EU-FORA) Fellowship work programme 'Integration of tools and social science into food safety risk assessments' was proposed and delivered by the Food Standards Agency (FSA), UK. The FSA is an independent Government department working across the countries of England, Wales and Northern Ireland to protect public health and consumers' wider interests in food. It is led by a board appointed to act in the public interest. The Agency is advised by a number of independent expert committees, including: the Advisory Committee on the Microbiological Safety of Food (ACMSF), the Committee on Toxicity (COT), the Advisory Committee on Novel Foods and Processes (ACNFP) and the Advisory Committee on Social Sciences (ACSS). The work of the independent committees and working groups that advise the FSA helps to ensure that advice to consumers is always based on the best and most recent scientific evidence. The FSA-EU-FORA working programme was tailored to several different activities to provide an overview of the different tools that can be employed in food safety risk assessment and the interaction between risk assessment and social science. It was split into four modules to run over the 12-month period covering a wide range of aspects related to risk assessment (rapid assessments undertaken for food incidents and outbreaks, longer term strategic food risk assessment projects and papers prepared to be submitted to scientific advisory committees). A lead supervisor, Dr Amie Adkin, was responsible for the general monitoring of the programme, while specialist supervisors tutored the fellow within each module.

2. Description of work programme

The EU-FORA work programme 'Integration of tools and social science into food safety risk assessments', as already mentioned was comprised in four modules. The fellow worked within discrete teams (microbiological risk assessment (MRA) team, chemical risk assessment (CRA) team and social science team), attending Teams and Unit meetings, as well as all associated social events. In addition, as an integral member of the FSA, the fellow followed a wide range of continuous internal risk assessment training programmes, workshops, forums, food production site visits, presentations and webinars. Moreover, the fellow was given the opportunity to present several topics.

2.1. Aims

Each of the four modules represented an independent project and had specific deliverables and outcomes. Consequently, this diverse programme had several aims providing the opportunity to cover a wide range of aspects of food safety risk assessment.

Modules aims

The aim of Module 1, 'Systematic review tools and development of microbial food incident risk assessments', was to provide an in-depth knowledge of how to conduct a systematic review following the Prisma method regarding a microbiological risk and how the data collected through the review (evidence) can be used to support risk assessments.

The aim of Module 2, 'Tools for development of Exposure Assessments and ad-hoc national chemical food safety risk assessment', was to train the fellow on standard methodologies internationally adopted, and available tools used to estimate the quantitative exposure assessment within the exposure assessment team. Moreover, the aim of module 2 was to understand the chemical food incident work conducted within the CRA team by shadowing the rapid response to several incidents during the three months of the training in the CRA team.

The aim of Module 3, 'Understanding the role of social science in risk assessment', was to learn about risk perception models and how these models influence risk perception and consequently risk assessment and risk management.

The aim of Module 4, 'Prioritisation of Risk Tools and Networks in the UK', was amended. This learning objective was replaced by the fellow learning more about the wider area of how national dietary data is collected, coded and analysed to feed into exposure assessments.

2.2. Activities/Methods

Module 1: Systematic review tools and development of food incident risk assessments

During the first module, the fellow was placed within the MRA team, supervised by Dr Paul Cook, with the support of Dr Anthony Wilson as a (deputy). The first deliverable of the module was the

writing of a systematic review regarding the effectiveness of washing practices on the removal/inactivation of norovirus on green leafy vegetables. The overall aim of the review was to further the work initiated by the recent FSA NoVAS research project which looked at unwashed, whole lettuce and to understand the impact of different washing treatments on norovirus decontamination of raw leafy green vegetables and how this might impact the risk to consumers. The review was written following the principles of a systematic review methodology (Moher et al., 2009).

In addition, the fellow was trained to perform rapid reactive incident type qualitative risk assessments.

Moreover, part of the first module deliverables was to learn about the MRA team workflow management tools to assist in the management of staff resources in both risk assessment incident response and long-term research work.

Overall, during this module, the fellow was provided various training opportunities in order to strengthen her RA knowledge.

More specifically, the fellow attended learning opportunities and other activities (Appendix A):

- Various internal meetings: twice per month the MRA workload planning meetings; joint FSA & Food Standards Scotland (FSS) meeting; food outbreak meetings; team paper discussion on microbiological incidents at the FSA; discussion meetings regarding the development of a handy guide, aimed to provide common information needed for MRAs covering pathogens including (norovirus, *C. botulinum*, aerobic colony counts (ACC) indicators); and research prioritisation discussion meetings.
- Presentations on various RA topics (regulated products overview, incident review, Norovirus FSA project, series of FSA Strategic Surveillance presentations on prioritisation of immediate food risks and signal prioritisation phase 2).
- Workshops and training sessions: Introduction to incidents; RAU incident workshop; Quality workshop-introduction to Government Statistical Service (GSS) guidance; and the UK government guidance references Aqua, Green and Magenta books.
- A webinar on food-borne viruses' detection, risk assessment and control options in food processing.
- The 'Risky Bites' informal lunch club on various topics (Aqua book, Norovirus reflections on lessons learnt).
- The 'Food for Thought' internal FSA seminars: Seeing is (not always) believing…multispectral imaging (MSI) for food screening; UK soft drinks.
- Other activities: UK Civil service-learning online courses; Field visit to Northampton-Greencore chilled foods.
- Attendance of internal and external meetings: ACMSF, COT, Analytics Unit (AU), Science Evidence and Research Division (SERD), Risk Assessment Unit (RAU).
- The fellow presented the EFSA Foodex 2 food classification and description system to the exposure assessment team.

Module 2: Tools for development of Exposure Assessments and ad hoc national chemical food safety risk assessment

Module 2 was co-supervised by Cath Mulholland team leader of the CRA with Chara Tsouli (Senior Toxicological Risk Assessor) and Chloe Thomas (member of the exposure assessment team) also assisting in the training process. During this module, the fellow was assigned to the CRA team in order to be trained by the exposure assessment group using the quantitative data sets and exposure assessment tools such as CRÈME. Furthermore, the fellow has undertaken several chemical related incidents alongside FSA staff, covering pesticides, supplements, contaminants and veterinary meds, and getting familiarised with the pesticide residue intake models (EFSA PRIMo and the NESTI). The fellow has also worked on developing the exposure assessment element of the risk assessment paper submitted to the Committee on Toxicity regarding the consumption of plant-based drinks (soya drink) in children aged 6 months to 5 years of age.

The main challenge in the assessment of the safety of these drinks is the lack of information regarding dietary intakes (soya drink) for children following dairy-free or plant-based diets. At the suggestion of the Scientific Advisory Committee on Nutrition (SACN) Secretariat, the exposure calculations have been revisited, using information from several sources including the First Steps Nutrition Trust Eating Well: vegan infants and under 5s (2020), Vegan Society Food tips for vegan children (2017) and Public Health England's (PHE) published example menus for Early Years Settings in

England (EYS) (2017). The above sources provided guidance for frequency of consumption as well as portion sizes estimation for children under 5 considered that are high consumers of plant-based drinks. These recommendations aim to achieve a well-balanced, nutritious diet and they were used to provide an indication of more realistic exposures to isoflavones. In addition to the exposure to isoflavones from soya milk itself, the contribution of soya-based products such as soya alternatives to other dairy products or meat to the diet has also been considered.

Moreover, for understanding the role of national committees for assurance of risk assessments and openness of government decision making, the fellow has also attended several COT meetings as an observer.

Finally, during this module, the fellow was provided by further training opportunities in order to strengthen her RA knowledge *(Appendix A)*:

- Various departmental, unit and team meetings.
- Presentation on the Economic Impact of COVID-19.
- Workshops and training sessions (Potency estimation and PBPK workshop followed via teams, Introduction to Chemical risk Assessment, Introduction to food survey data collection and use by the FSA, Introduction to exposure assessment, Quantitative Risk Assessment workshop, Crème software training, Almond drinks exposure assessment, Dairy alternative exposure assessment; Probabilistic Quantitative Risk Assessment course – Exercise 1 and Exercise 2).
- Webinar on Food Safety Colloquium Challenges in Food and Ingredient Safety (FDA).
- The 'Risky Bites' informal lunch club (Feed governance and Animal feed incidence session).
- The Food for Thought' internal FSA seminars (Information-based regulation-Food standards hygiene ratings, Eating out with Food Allergy, Sociology of Nutrition and Food Choices).
- Lunch time seminar: Economic impact of COVID-19; Eliciting consumers' valuation of food safety regulation.
- Presenting to members of the exposure assessment team the FOODEX2 categorisation and description system.

Module 3: Understanding the role of social science in risk assessment

Module 3 was co-supervised by Michael Patel and Rebeca Gillespie with the main objective being to understand the importance of social science to risk assessment. Typically, food safety risk assessments are carried out within a four-step, technical framework, as detailed by Codex. However, the technical framework presumes a level of 'objective risk', while neglecting to take into account the psychological factors that often explain the biases and fallacies associated with decisions and judgments made from different perceptions of risk (Slovic, 1999). This is where the social sciences play a significant role, by revealing the psychological and social factors that impact the representation, perception and interpretation of risk across all agents in the risk analysis process.

For Module 3, the two fellows assigned to FSA conducted a joint literature review in order to understand lay's people risk perception (part A) and what might affect those performing risk assessments – expert bias (part B). The reviews' objective was to provide guidance on the possible solutions to i) improve the effectiveness of risk communication by risk managers taking into account the mental models affecting the risk perception of the public and ii) mitigate the biases affecting risk assessors during the process of risk assessment.

In addition, during this module the fellow also had training opportunities, committee meetings and other activities *(Appendix A)*.

More specifically, the fellow followed the following activities:

- Various Food for Thought' internal FSA seminars (The Role of Trust in People's Response to COVID-19 Communication, Moments of Change' and Food-Related Behaviours, COVID-19: food safety & fraud risk, Can digital technologies improve healthy diet?).
- The 'Risky Bites' informal lunch club on (Risk: The Game, Understanding the policy profession).
- Lunch time session on Food and Mood.
- Webinar on how do we estimate the cost of food crime to the UK.
- Qualitative risk assessment training course which was an introduction to risk and risk analysis.
- Parma Summer School.
- Unit and department meetings.
- Remote presentation to members of the unit regarding the entire EU-FORA/FSA work programme.

Module 4: Prioritisation of Risk in the UK - National Dietary Data (NDNS), collection methodology, coding and analysis

Only a small part of this module was dedicated to risk prioritisation tools as the fellow followed throughout the year several sessions on FSA Strategic Surveillance presentations on the prioritisation of immediate food risks and the signal development prioritisation using big data. The fellow has also had the opportunity to try the signal prioritisation dashboard through a demo & support session aiming to identify how to track, monitor and analyse incident alerts by combining large datasets. Furthermore, this Module has been adapted to accommodate the fellow's interest regarding methodology of collecting dietary data in the UK. The fellow followed a four-session seminar on NDNS and Intake24 provided by the MRC Cambridge team working on NDNS. The session covered various topics providing an NDNS overview – NDNS Year 12 fieldwork model; An Introduction to Intake24 development and functionality, The rationalisation of food lists; Modelling usual dietary intakes, Statistical efficiency: stratification, clustering, weighting of the NDNS data; The development of the NDNS nutrient databank; Recipes database Nutrient databank, UK food composition database, and Recipes calculation. Moreover, the fellow was also invited to provide external seminar to CEDAR/MRC Epidemiology Unit (via Zoom) introducing to the MRC to the Greek National Survey on Health and Nutrition-Methodology and Development (the HYDRIA Project).

In addition, the fellow followed the work that has been started with the literature review conducted during Module 1 and worked to incorporate dietary data into a quantitative risk assessment (QRA) (norovirus in lettuce) to furthering her skills in spreadsheet stochastic QRAs using @Risk. More specifically worked on identifying NDNS food codes that fall within the definition of uncooked leafy greens according to the EFSA definitions of leafy greens. Used the data retrieved from Crème to be entered and manipulated using various functions and pivot tables to get the eating occasions and average portion size for leafy greens with recipes, lettuce with recipes, which was then plugged into the norovirus QRA model.

Finally, during Module 4, the fellow had the opportunity to visit the Animal and Plant Health Agency (APHA) at Weybridge for a day, following presentations from members of the APHA to become familiar with the UK government specialists in quantitative animal health risk assessment. Special emphasis was given to introducing to the fellow on how qualitative risk assessment is performed at the APHA.

During this module, the fellow was also provided with several training opportunities in order to strengthen her RA knowledge *(Appendix A).* More specifically the fellow attended the one day 'Food programme' at Leatherhead Food Research, which was an introduction to food science. The training day' covered various aspects such as: Sensory evaluation, Nutrition for non-nutritionist, Ingredients and food improvement agents, and Food safety.

The fellow also followed several training sessions and presentations such as: Introduction to norovirus QRA model; Norovirus QRA workshop; One Health: Strengthening Animal & Plant Health Surveillance workshop – APHA (London); The 'Risky Bites' informal lunch club-EFSA research needs 2030.

3. Conclusions

The working programme 'Integration of tools and social science into food safety risk assessments' followed a modular 'learning by doing' approach. The four modules included activities that successfully trained the EU-FORA fellow in: conducting systematic literature reviews by using the prisma methodology implementing automatic paper screening, extracting and collating the retrieved data; efficiently extracting the required data from NDNS using exposure assessment tools; reformulating exposure calculations for implementing realistic scenarios when specific food exposures are not available by the national dietary database; promptly responding to both microbiological and chemical occurring incidents; conducting both qualitative and quantitative risk assessments; understanding the role of model development in risk assessment; preparing risk assessment papers for independent National Committees.

Attending the meetings of several scientific national advisory committees ensured the fellows' in depth understanding on the interaction between different networks of risk assessors (not just from the FSA but across UK government and academia). It should be noted that the activities carried throughout the year allowed her to expand her scientific knowledge both on a theoretical level and in practice. The fellow was successfully integrated in the day-by-day workflow of FSA's Risk Assessment Unit, gaining first-hand experience in a multicultural and interdisciplinary context. This enabled a productive exchange of good practices and contributed to the building of a European risk assessment network. This fellowship represented a unique opportunity for the fellow to consolidate and broaden

her knowledge on various aspects of risk assessment. Moreover, the involvement to the workflow management of staff resources in the area of risk assessment provided her with valuable skills, required to work as a risk assessor at a national authority. Overall, the plethora of training opportunities provided the fellow a proper insight into risk assessment conferring important transferable skills that she will be able to use in the near future to support food safety at national and European level.

Finally, the EU-FORA programme was an excellent opportunity for the fellow to acquire and exchange opinions, experiences and methodologies on the risk assessment field and to build a professional and personal network that can serve as a basis for future cooperation.

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Abbreviations

ACMSF	Advisory Committee on the Microbiological Safety of Food
APHA	Animal and Plant Health Agency
AU	Analytics Unit
CEDAR/MRC	Centre for Diet and Activity Research/Medical Research Council
COT	Committee on Toxicity
CRA	chemical risk assessment
EU-FORA	European Union Food Risk Assessment
FDA	Food and Drug Administration US
FSA	Food Standards Agency
FSS	Food Standards Scotland
MRA	microbiological risk assessment
NDNS	National Diet and Nutrition Survey
NoVAS	Norovirus Attribution Study
PRIMo	Pesticide Residue Intake Model
PBPK	physiologically based pharmacokinetic modelling
RAM	Risk Assessment Meeting
RAU	Risk Assessment Unit
QRA	quantitative risk assessment
SACN	Scientific Advisory Committee on Nutrition
SERD	Science Evidence and Research Division

Appendix A

	Title	Date
Training sessions (workshops, webinars, presentations, meetings)	Introduction to incidents	20.11.2019
	Webinar-Foodborne Viruses: Detection, Risk Assessment, and Control Options in Food Processing	12.11.2019
	Introduction to GSS guidance and the Aqua, Green and Magenta books workshop (London)	16.1.2020
	Probabilistic Quantitative Risk Assessment course – Exercise 1	2.2.2020
	Probabilistic Quantitative Risk Assessment course – Exercise 2	9.4.2020
	Introduction to Chemical risk Assessment	3.3.2020
	Introduction to food survey data collection and use by the FSA	31.3.2020
	Introduction to Exposure Assessment	6.4.2020
	Introduction to norovirus QRA model	17.2.2020
	Norovirus QRA workshop	25.2.2020
	Food Science training – Leatherhead Food Research (Epsom)	6.2.2020
	Workshop-One Health: Strengthening Animal & Plant Health Surveillance workshop – APHA (London)	26.2.2020
	Quantitative Risk Assessment workshop (London)	4.3.2020
	APHA visit – Presentation on qualitative risk assessment	5.3.2020
	Potency estimation and PBPK workshop (followed via teams)	11.3.2020
	Dairy alternative exposure assessment	9.4.2020
	Almond drinks paper exposure assessment	15.4.2020
	Crème software training	24.4.2020
	Workshop- SOT FDA Food Safety Colloquium: Artificial Intelligence Applications in Food and Cosmetic Safety workshop	29.4.2020
	Seminar on NDNS and Intake24 – MRC Cambridge/FSA	14.5.2020
	Parma summer school	9–10.06.2020
	Seminar "The cost of food crime in UK"	10.7.2020
	Regulated products overview – internal presentation	1.11.2019
	Lines to Take: Norovirus	21.10.2019
	Lines to Take: ACC indicators	12.12.2019
	Lines to Take: *C. botulinum*	29.1.2010
	Lunch & Learn: Economic impact of COVID-19	1.5.2020
	Lunch & Learn: Eliciting consumers' valuation of food safety regulation	20.5.2020
	Lunch & Learn: Food and Mood	22.7.2020
	Food for thought seminars: Seeing is (not always) believing… multispectral imaging (MSI) for food screening	21.11.2019
	Food for thought seminars: Information-based regulation	19.3.2020
	Food for thought seminars: The Sociology of Nutrition and Food Choices	13.5.2020
	Food for thought seminars: The Role of Trust in People's Response to COVID-19 Communication	1.6.2020
	Food for thought seminars: Moments of Change and Food-Related Behaviours	10.6.2020
	Food for thought seminars: COVID-19: A food safety and fraud risk?	15.6.2020
	Food for thought seminars: Can digital technologies improve healthy diets?	2.7.2020
	Risky Bites sessions: Norovirus: Reflections on lessons learnt	9.12.2019
	Risky Bites sessions: Aqua Book	15.10.2019
	Risky Bites sessions: EFSA Research Needs 2030	12.2.2020

	Title	Date
	Risky Bites sessions: Feed governance and Animal feed incidence	21.5.2020
	Risky Bites sessions: Understanding policy profession	21.7.2020
	Risky Bites sessions: Risk: The Game	26.6.2020
Fellow's Presentations	EFSA Foodex 2 food classification	29.10.2019
	CEDAR/MRC Epidemiology Unit External Seminar Series (via Zoom) 'The Greek National Survey on Health and Nutrition (the HYDRIA Project)'	9.6.2020
	EU-FORA/FSA Work Programme Journey	16.7.2020
Other activities	Field visit to Northampton-Greencore Chilled Foods	15.1.2020
Meetings	COM October meeting	10.10.2019
	ACMSF October meeting	17.10.2019
	AU November meeting	18.11.2019
	COT December meeting	3.12.2019
	SERD December meeting	10.12.2019
	Science Council meeting	17.12.2019
	Risk Assessment Meeting	14.1.2020
	AU January meeting	27.1.2020
	RAU March meeting	3.3.2020
	COT March meeting	10.3.2020
	CRA March meeting	27.3.2020
	SERD April meeting	27.4.2020
	COT May meeting	5.5.2020
	CRA May meeting	18.5.2020
	RAM May meeting	21.5.2020
	AU June meeting	8.6.2020
	COT July meeting	7.7.2020
	SERD meeting	9.7.2020