Impact case study (REF3b)

Institution: Kingston University

Unit of Assessment: 3, Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study: Improvements to the practices and procedures of the European Food Safety Authority

1. Summary of the impact

Research at Kingston University into global food safety, led by Professors Naughton and Petroczi, established new methods of using large databases to identify risks in the food chain and inform regulatory action.

Through Professor Naughton's chairmanship of the EFSA External Review Working Group, this research contributed to improvements in the practices and procedures of the European Food Safety Authority (EFSA), the main body providing scientific advice to the European Union on risks in the food chain. This led to a reduction of around 75% in the number of erroneous outputs generated by EFSA, with consequent benefits to food safety across the EU.

2. Underpinning research

Research conducted at Kingston University (KU) developed quantitative analytical methods for global food safety datasets with the objective to inform risk assessments and enhance food safety measures. This was achieved through application of advanced computational Network Analysis Tools (NATs) that permit the detection and analysis of information in complex systems/databases.

Many activities affecting our lives are linked by meaningful relationships, and their connectivity (e.g. reporting and transgressing countries for unsafe foods) forms a network. The advances in understanding the dynamics and structural properties of networks enabled Naughton and Petroczi to develop the first and only bespoke NAT for food safety to harness the vast amounts of intelligence available through food safety mega-databases, which is unfeasible via descriptive statistical methods.

This introduction and application of NATs has resulted in novel capabilities in data management and methods to exploit the enormous databases that exist for food safety. Initial work involved identifying contributions of nations as transgressors (producers of unsafe foods) and detectors (of unsafe foods) by instantaneous interrogation of the data highlighting the roles of individual nations [R1, R2]. Further studies expanded the application with complementary descriptive statistics and a focus on major classes of contaminant (e.g. mycotoxins, heavy metals, chemicals and microbes) and food types using a compilation of worldwide alerts. This identified clusters of transgressor nations to inform regulatory enforcement measures through targeting key players [R3].

The NAT, in addition to efficient data handling and retrieval in graph/table form, allows interrogation of detector and transgressor relationships identifiable between countries, which are ranked using Google's PageRank and Kleinberg's HITS algorithms. The resultant unbiased food safety NAT program provides stakeholders (policy makers, health and food safety authorities, and researchers) with a systematic, rigorous but user-friendly approach to capture complexity, analyse trends, prepare for upcoming food safety issues and model possible effects of interventions.

In parallel to the work into the safety of food demand and supply, Naughton and Petroczi conducted research at the level of consumption. This evaluated the application of the risk assessment tool Target Hazard Quotients (THQ) to contaminants, with a focus on heavy metals in beverages and foodstuffs [R4]. The analysis revealed that the THQ approach to risk assessment for metal contamination in non-beverage foodstuffs is extremely limited, due to the infrequent exposure that an individual would encounter, even when using a multiplying factor for uncertainty.

In order to link the research into global food safety networks and risk assessment tools, the KU group conducted research into regulatory and enforcement issues, particularly in relation to food supplements/ additives. This highlighted the need for better quality compliance and public awareness [R5]. Further insights for regulatory policies were revealed in a study of the entire EU food safety database (Rapid Alert System for Food & Feed) from detection perspectives [R6]. This work highlighted changing patterns and unequal contributions to the database by EU Member States, with detailed tracking of the varied origins of notifications across the categories of border

controls, company reports, consumer complaints and official market control. The outcome of this research showed that our approach affords regulators the opportunity to reflect upon and adopt best practice across EU Member States.

The research was led by Naughton and Petroczi, from 2006-2012, with a significant material contribution from Dr Tamas Nepusz. As part of the KU food safety programme, the group collaborates extensively with practitioners, and a collaboration with Mr. Glenn Taylor (Head of Coroners and Scientific Services, Hampshire County Council) has led to joint publications.

Key researchers (all at KU):

Prof Declan Naughton, Professor of Biomolecular Sciences (2005-present)

Prof Andrea Petroczi, Professor of Public Health (2010-present), Reader in Public Health (2008-2010), Principal Lecturer (2005-2008)

Dr Tamas Nepusz, Honorary Research Fellow (2009-present), Post Doctoral Research Assistant (2008-2009)

3. References to the research

All six research outputs were published in peer reviewed international journals. The work has been supported by competitive peer reviewed funding and has led to numerous invitations to present at international meetings as outlined below. (Abbreviations: Q1 and Q2 identify first and second quartile journals as defined by Web of Science; IF is the journal's impact factor.)

[R1] Nepusz T, Petróczi A, Naughton DP (2008) Worldwide food alert patterns over an eleven month period: A country perspective. BMC Public Health, 8(308), 1-9. doi: 10.1186/1471-2458-8-308. [Q2; IF =2.5; cited 12 times].

[R2] Nepusz T, Petroczi A, Naughton, DP (2009) Network analytical tool for monitoring global food safety highlights China. PLoS ONE, 4(8), e6680. doi: 10.1371/journal.pone.0006680. [Q1; IF =4.5; cited 10 times]

[R3] Nepusz T, Petroczi A, Naughton, DP (2009) Food alert patterns for metal contamination analyses in seafoods: longitudinal and geographical perspectives. Environment International, 35(7), 1030-1033. doi: 10.1016/j.envint.2009.05.003. [Q1; IF =5.3; cited 8 times]

[R4] Petroczi A, Naughton DP (2009) Mercury, cadmium and lead contamination in seafood: a comparative study to evaluate the usefulness of Target Hazard Quotients. Food and Chemical Toxicology, 47(2), 298-302. doi: 10.1016/j.fct.2008.11.007. [Q1; IF =3; cited 26 times]

[R5] Petroczi A, Taylor G, Naughton, DP (2011) Mission impossible? Regulatory and enforcement issues to ensure safety of dietary supplements. Food and Chemical Toxicology, 49(2), 393-402. doi: 10.1016/j.fct.2010.11.014. [Q1; IF =3; cited 18 times]

[R6] Petroczi A, Taylor G, Nepusz T, Naughton D (2010) Gate keepers of EU food safety: Four states lead on notification patterns and effectiveness. Food and Chemical Toxicology, 48(7), 1957-1964. doi: http://dx.doi.org/10.1016/j.fct.2010.04.043. [Q1; IF =3; cited 8 times]

These publications led to frequent invitations for plenary oral presentations (e.g. 2010 EFSA-ASEAN meeting 'Science supporting Risk Surveillance of Imports' (Seville, 2010), World Mycotoxin Forum (Amsterdam, 2010), Association of Public Analysts UK (Sheffield, 2011), FSA UK 'Listen to Future Food' (Royal Society, 2012), Global Food Safety Conference (Barcelona, 2013) along with reports from a range of creditable news organisations (e.g. Scientific American).

The development of the multigraph approach to Network Analysis was supported by a grant from the British Academy (Petroczi, 1/2/2006 – 31/1/2007, "The relationship between social capital, opinion leadership and network positions", £7,054)

4. Details of the impact

The European Food Safety Authority (EFSA) is the main body providing scientific advice to the European Union on risks in the food chain. Naughton led an initiative to improve the scientific quality of ESFA's outputs, resulting in improved processes and procedures and a significant reduction in flawed outputs.

The vehicle for achieving this impact was the External Review Working Group (ERWG), which was established in 2009 to audit scientific outputs generated by EFSA [1,2,8]. Naughton was appointed chair of this group in 2009. His appointment as chair, and his expert contributions to the work of the group, were based on the underpinning research discussed in Sections 2 and 3 and drew materially and distinctly upon that research, in particular the application of risk assessment tools, the study of heavy metal contamination and trends in food alerts and supplements/additives [5].

The material impacts occurred as a result of the ERWG annual reviews, which made detailed recommendations of change to the practices and procedures of EFSA. By identifying issues relating to EFSA outputs, procedures and processes during these reviews, a series of recommendations were proposed to EFSA and were implemented the following year. The major impact of these scientifically formulated expert recommendations was to improve processes and procedures, resulting in improvements to the quality and clarity of EFSA's work.

The 2009 Review contained 7 clusters of recommendations with a focus on improving: clarity of Terms of Reference, structure of outputs to reflect recognised risk assessment formats, proof reading, adherence to EFSA guidelines, and more in-depth consideration of uncertainties and limitations [1]. These recommendations were implemented by EFSA in 2010 and 2012 [3,6].

As a result of the improvements made by EFSA the number of erroneous scores made by the reviewers dropped from 6% in 2009 to 1.4% in 2011 as measured on a comparable basis [3] [4, p. 38][7]. Extrapolating to the full cohort of outputs produced annually by EFSA, this change represents the significant decrease from some 80 flawed outputs to around 20.

The 2011 Review made 13 recommendations and highlighted 9 key issues that led to low scores [3]. Specific emphasis was placed on the issues which were deemed to limit the quality of EFSA's outputs: i) a lack of clarity of databases used for the identification of reference material, ii) weak conclusions, without concrete evidence, iii) deficiencies in referencing and availability of original documentation, iv) deficiencies in synthesis and analysis, v) limited consideration of uncertainties and final integrated risk assessments, and vi) inadequate summaries which exclude important critical parameters. EFSA implemented changes based upon the recommendations of the ERWG which led to improved processes and procedures, resulting in improvements to the quality of EFSA's work and its ability to guide stakeholders to improve food safety [5,6].

The work of EFSA directly affects food safety in the EU, impacting on the daily lives of over 600 million citizens, and also influences policy in countries outside the EU. EFSA answers some 700 formal questions per annum, mainly arising from the EC, Member States and Industry with a range of functions including risk assessment, informing new laws and the licensing of new food constituents.

Stakeholders with direct reliance on EFSA guidance to inform decision making in food safety, risk assessment and health claims are widely dispersed across the EU and include the EC, European Parliament, National Risk Managers and Assessors, NGOs, Scientific Organisations, Food Industry Managers, and Consumer Organisations [4, pp 245-270]. These parties attest to the contribution EFSA makes to their safety work [4, pp. 267-312].

For example, 90% of the responses from National Risk Managers stated they had benefited from taking part in EFSA Advisory Forums [4, p. 286] and 71 % of the sample registered a reduction in their own risk assessment activities after the creation of EFSA, with 77.4% stating their national food safety authority benefits from EFSA in terms of cost savings [4, p. 289].

The ERWG contribution, with significant leadership from Naughton and scientific contributions based on his research, was to reduce by around 75% the number of erroneous outputs produced by EFSA. This has improved the quality of the scientific advice provided by EFSA to EU stakeholders, with consequent reductions in food risk for EU citizens.

5. Sources to corroborate the impact

[1] Annual Report of EFSA Quality Manager, 2009
http://www.efsa.europa.eu/fr/corporate/doc/qmr09.pdf

[2] EFSA Journal Editorial Policy, 2013

http://www.efsa.europa.eu/en/about/docs/Journaledpolicy.pdf

[3] Annual Report of EFSA Quality Manager, 2011
http://www.efsa.europa.eu/fr/corporate/doc/qmr11.pdf

[4] External Evaluation of EFSA, Final Report (Ernst & Young)
http://www.efsa.europa.eu/en/keydocs/docs/efsafinalreport.pdf

[5] 56th Meeting of EFSA's Management Board

http://www.efsa.europa.eu/en/mb130314/docs/mb130314-m.pdf

[6] EFSA's Executive Director Progress Report

http://www.efsa.europa.eu/en/mb130314/docs/mb130314-ax3.pdf

[7] 2002 – 2012 EFSA success and challenges: Dr. Stef Bronzwaer

Science Strategy & Coordination Directorate

http://www.salute.gov.it/imgs/C_17_EventiStampa_144_intervisteRelatori_itemInterviste_2_fileAllegatoIntervista.pdf

[8] Proposal for a Review System for EFSA's Scientific Activities
http://www.efsa.europa.eu/en/efsajournal/doc/526.pdf

Corroborating Contact:

1. EFSA Quality Manager, European Food Safety Authority: Corroborates all aspects of impact.