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Insights From Expert Judgment Study On Source Attribution Of Foodborne Pathogens In Netherlands

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Foodborne disease poses a major world safety concern, with 1 in 10 people getting ill from food contaminated with microbial or chemical agents (Pires et al., 2021). In The Netherlands, contaminated food led to an estimated 652,000 cases of infectious disease in 2018 (Friesema et al., 2022). The estimation of source attribution of foodborne pathogens is of paramount importance to inform decision making around policy for improving public health safety. Unfortunately, data on foodborne outbreaks account only for a fraction of the foodborne disease burden, and are therefore not sufficient to inform decision making. Consequently, relying on expert judgment is essential.

The National Institute for Public Health and the Environment (RIVM) has requested an expert judgment study for the source attribution of foodborne pathogens in the Netherlands. The chosen expert judgment method is the Classical Model for Structured Expert Judgment (SEJ) (Cooke, 1991). This study updates and extends a previous expert judgment elicitation, conducted in 2008 (Havelaar et al., 2008).

The Classical Model elicits individual assessments of uncertainty, typically by means of three quantiles, which reflect central and uncertainty bounds estimates of experts' distributions. The method proposes mathematical aggregation of experts' distributions, where the aim of the weighting is to calibrate the aggregation model. In addition to the questions of interest, experts provide uncertainty assessments for calibration questions, which enable the aforementioned model calibration, facilitated by two objective measures, a calibration and an information score. Intuitively, the calibration score measures the statistical accuracy of individual assessments and the information score reflects how informative individual assessments are. An overall score is designed to account for both statistical accuracy and informativeness in uncertainty assessments. Similarly to the individual assessments, the resulting aggregated distributions can also be evaluated with respect to the two performance measures. An optimization weighting procedure ensures aggregated assessments which are performing the best with respect to the overall score.

The study team identified national level experts, who were also asked to further suggest other experts with relevant expertise to the study. The domains of expertise included epidemiology of zoonoses and foodborne disease, public health surveillance, food safety, foodborne disease outbreaks and antimicrobial resistance. A total of 63 experts were invited to the expert judgment study; from those, 43 experts participated in the study.

The elicitation was conducted in a hybrid format in September 2023. Experts participated both in person and online during a workshop organized at RIVM. Individual one-to-one sessions were held for the experts who could not join the workshop. The elicitation included 15 calibration questions. The questions of interest were tailored to individual expertise. For each pathogen for which the expert self-reported expertise, uncertainty estimates were asked for major pathways and specific food groups.

As major pathways, the study included foodborne transmission, drinking and environmental water transmission, other environmental transmission (such as exposure to contaminated air, mud or soil), animal

contact, person-to-person contact and international travel. 20 specific food groups were included, which accounted for specific foods as well as their processing stage; e.g., processed and non-processed beef was included in the elicitation instrument. All in all, for each pathogen, the expert provided assessments for 27 major pathways and specific food groups. The talk will provide more insights into the elicitation process and preliminary results.

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References

Cooke, R. 1991. Experts in uncertainty: opinion and subjective probability in science. Oxford University Press, USA.

Friesema, I. H., Slegers-Fitz-James, I. A., Wit, B., Franz, E. 2022. Surveillance and characteristics of food-borne outbreaks in the Netherlands, 2006 to 2019. Eurosurveillance 27(3), 2100071.

Havelaar, A., Galindo, Á., Kurowicka, D., Cooke, R. 2008. Attribution of Foodborne Pathogens Using Structured Expert Elicitation. Foodborne Pathogens And Disease 5(5), 649-659. doi: 10.1089/fpd.2008.0115

Pires, S. M., Desta, B. N., Mughini-Gras, L., Mmbaga, B. T., Fayemi, O. E., Salvador, E. M., Devleesschauwer, B. et al. 2021. Burden of foodborne diseases: Think global, act local. Current Opinion in Food Science 39, 152-159.