Summary of discussions

Opening remarks
Dr Elaine Borghi, the Unit Head of the Monitoring Nutritional Status and Food Safety Events (MNF) at the Department of Nutrition and Food Safety (NFS), provided opening remarks to the meeting, expressing gratitude to the Foodborne Disease Burden Epidemiology Reference Group (FERG) members and the chair, recognizing the great progress of the FERG since its inception in May 2021. Dr Borghi highlighted the importance of FERG’s work for WHO’s broader activities on food safety, including World Food Safety Day¹, contribution to the Global Strategy for Food Safety², addition of FERG 2010 data to the Global Health Observatory and future work on developing a data dashboard.

Objectives and expected outcomes of the meeting
Dr Rob Lake outlined the key objectives of the meeting as follows: 1) Share a progress update from all FERG taskforces (TFs) and the World Health Organization (WHO); 2) Agree on the overall workplan and budgetary needs/priorities for activities (including final roadmap towards 2025 reporting on the updated global burden of foodborne diseases), advancement of publication plan and journal options to work on the collection, agreement on plan to commission systematic reviews, advance roadmap for country support, advance roadmap for developing the impact measurement framework, discuss required internal and external collaborations; and 3) Understand WHO’s publication policy.

WHO FERG Secretariat update on various activities
Ms Yuki Minato provided a WHO activity update, situating the FERG on the current workplan, roadmap, publication plan, budgetary needs, and the process and requirements for commissioning work. Ms Minato discussed the three work areas of the FERG including 1) Estimation of the global burden of foodborne diseases; 2) Supporting countries to estimate the burden of foodborne diseases; and 3) Developing the methodology to measure impacts for food safety.

Presentation on the Global Strategy for Food Safety
Dr Simone Raszl provided an overview on the Global Strategy for Food Safety² planned to be adopted at the Seventy-fifth World Health Assembly in May 2022, highlighting the fact that one impact level and two progress indicators and

associated targets were included. These would be the first set of indicators and targets in the area of food safety officially included in the WHO resolution. After the adoption of this strategy, next steps are to conduct more Technical Advisory Group (TAG) meetings to finalize the roadmap for strategy implementation, and monitoring plan jointly to be developed with the United Nations Food and Agriculture Organization (FAO). Member States are expected to implement their own national activities which will then be monitored. The impacts will be measured which is where the FERG will come in (e.g., diarrhoeal disease, salmonellosis).

Presentation of WHO’s publication policy
Mr Ian Coltart from the Department of Quality Assurance for Norms and Standards (QNS)3 provided an overview of WHO’s publication policy, in order to ensure that FERG-related deliverables (both WHO publications and external journal publications) will be produced in accordance with the policy, including the use and sharing of data collected by Member States. Authorship is subject to the recommendations for defining the role of authors and contributors published by the International Committee of Medical Journal Editors (ICMJE).

Task force updates

Enteric Diseases Taskforce (EDTF)
Dr Tesfaye Gobena, who co-chairs the taskforce (TF) together with Dr Shannon Majowicz, presented the progress made towards estimating the global burden of enteric diseases. Based on the selection criteria established by the TF, 25 hazards were shortlisted for inclusion in the next update, which include 22 hazards selected previously4, and three newly considered hazards, namely Cyclospora cayetanensis enteroaggregative E. coli (EAggEC), and rotavirus. EDTF suggested to include antimicrobial resistance (AMR) in its scope for burden assessment and will explore possible methodologies to determine feasibility. It was decided that the diarrhoeal disease model used previously for the 2015 report will be applied again for this update. A need for collaboration with external groups was emphasized to align efforts, such as with the Maternal and Child Epidemiology Estimation (MCEE)5 group, who estimate the causes and determinants of neonatal and child mortality, as well as WHO’s Product Development for Vaccine Advisory Committee (PDVAC)6.

Parasitic Diseases Taskforce (PDTF)
Dr Paul Torgerson, chair of the PDTF, presented the progress made through four technical meetings. Twenty-six hazards were shortlisted for the update, including 16 hazards previously included7, and 10 newly considered hazards,3

including *Angiostrongylus cantonensis*, *Angiostrongylus costaricensis*, Anisakids, *Capillaria philippinensis*, *Cyclospora cayetanensis*, *Fasciolopsis buski*, *Sarcocystis (sui)hominis*, *Taenia saginata*, *Toxocara spp.*, and *Trypanosoma cruzi*. PDTF considered expanding disease outcomes by adding new sequelae for certain pathogens (i.e., neuropsychiatric sequelae for *Toxoplasma gondii*). PDTF shared a view that it was important to estimate the economic burden for certain pathogens such as *Taenia saginata*, which rarely causes illness but can have severe outcomes associated with the relatively significant economic and trade impact.

**Chemicals and Toxins Taskforce (CTTF)**

Dr Lea Sletting Jakobsen, chair of the CTF, presented the progress made on hazard selection process and a discussion on methodological approaches. The group started its work by revisiting the extensive list of major causative agents initially compiled by the previous FERG, and by specifying chemicals within class of chemicals. Members prioritized and shortlisted potential hazards for inclusion in the next update. New hazards such as aflatoxin M1 and acrylamide have been shortlisted, together with four metals (lead, arsenic, methyl mercury and cadmium). More discussions were said to be required on pesticides, veterinary drug residues and polyaromatic hydrocarbons. In terms of methodological choices, the TF reviewed lessons learnt from the past estimation exercise, possible methodological options and boundaries, and explored feasible options to be chosen. This was done in consultation with Dr Bochen Cao from the Division of Data, Analytics and Delivery for Impact (DDI)⁸, responsible for the WHO Global Health Estimates.

**Computational Taskforce (CTF)**

Dr Mirjam Kretzschmar, chair of the CTF, presented the progress to date. The CTF drafted a methodology document and workplan which was shared with the FERG for review. The TF advanced its discussion on aspects of methodologies and suggested to use the same overall approach (incidence- and hazard-based) for estimating the burden of foodborne diseases for the next update. CTF newly proposed to apply time trends in the next estimates. Imputation methods, recategorization of sub-regions, and development of new outcome trees (also known as disease models) were also under the current considerations. As the work under CTF crosscuts the hazard-specific TFs (EDTF, PDTF, and CTTF), it was highlighted that coordination between CTF and these TFs would be essential to ensure methodological consistency. Possible publications and timeline of activities were also discussed. While the CTF plays an advisory role, WHO decided to commission the actual estimation work to the public scientific institution in Belgium, Sciensano⁹. Dr Brecht Devleeschauwer presented in detail the approach proposed for data collection and through several systematic reviews.

**Source Attribution Taskforce (SATF)**

Dr Sara Monterio Pires, chair of SATF, presented the progress to date. Two objectives of this TF are to (1) Estimate the proportion of the disease burden that is directly due to food contamination; and (2) Estimate the proportion of foodborne burden attributable to specific food sources. SATF suggested to follow the same approach as before, attributing the source at a point of exposure. Dr Pires explained that this choice was based on several reasons but primarily to allow for comparison with previous estimates. SATF suggested to newly conduct a global expert elicitation, outbreak data analysis for attribution to specific foods, and a scoping review of source attribution studies. Given the mandate for reporting by 2025, starting the work as soon as possible was said to be critical.

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Country Support Taskforce (CSTF)
Dr Karen Keddy, who co-chairs the CSTF with Dr Elaine Scallan Walter, presented the progress to date. The CSTF objectives are to provide mentorship to countries to estimate the national burden of foodborne diseases and use of such data for policy and interventions. The TF also aims to propose a sustainable model for WHO to provide to support Member States, and to develop training, tools and resources to assist in estimation. The CSTF plans to produce policy briefs (WHO and external journal publications), various technical materials (online course materials and toolkits), and support organization of regional workshops where relevant. Supplemental materials on burden estimation methods related to parasites, chemicals and toxins, or economic burden have also been considered.

Impact Measurement Taskforce (IMTF)
Dr Sandra Hoffmann, who co-chairs the IMTF with Dr Martyn Kirk, presented the progress made through three meetings. Based on WHO’s current plan in terms of developing a global mechanism to monitor indicators and targets, IMTF drafted its objectives as follows: 1) Advise WHO regarding suitable indicators of foodborne disease, 2) Inform WHO discussions regarding societal costs of foodborne diseases, 3) Support WHO and FAO initiatives to develop a global set of indicators for food safety, covering the entire food chain; and 4) Establish a system of monitoring impacts of FERG work. The IMTF plan to commission a literature review on disease targets and indicators in food safety, and support WHO to develop an impact measurement framework for food safety. An important element of the TF includes an estimation of the economic impact of foodborne diseases, and the decision was made by WHO to seek partners such as the World Bank to jointly host such a project. A retrospective assessment of the impact made by the FERG 2007-2015 was also considered.

Roadmap towards reporting updated burden estimates of foodborne diseases by 2025
Based on the Seventy-fifth World Health Assembly (WHA73.5)\textsuperscript{10} resolution mandating WHO to monitor regularly, and to report to Member States on the global burden of foodborne and zoonotic diseases at national, regional, and global levels and, in particular, to prepare by 2025 a new report on the global burden of foodborne diseases with up-to-date estimates of global foodborne disease incidence, mortality and disease burden in terms of disability-adjusted life years (DALYs), the WHO secretariat developed an overall roadmap towards this aim. FERG drafted respective workplans for each TF, and they were consolidated.

The overall timeline was discussed, and a sense of urgency to accelerate the work was commonly shared. The need was recognized to finalize the estimation process by mid-2024, develop the report manuscript by end-2024, followed by the WHO publication clearance procedures within 2025.

The roadmap includes rounds of country consultations, led by WHO, including the one for gathering data from countries, and another consultation in 2025 to obtain country approvals to publish national estimates, based on the process and requirements set by WHO policy to generate national-level health estimates. It was agreed to ensure close coordination with relevant WHO teams responsible for approving health estimates, in order to align the processes and common approaches taken by the Organization.

Discussions on methodological considerations

Time trends

Upon developing the very first global burden estimates of foodborne diseases\(^\text{11}\) based on 2010 data, the former CTF started from a single estimate per country, as provided by the hazard taskforces. The methodology for deriving this single estimate could deviate greatly, resulting in invisible heterogeneity. Considering this lesson and taking into account the intention to sustainably conduct estimation work in the future, the CTF suggested the entire FERG use time-trends analysis for the next update. This new approach means that more data will be required than the previous effort, and that previous systematic review results shall be revisited or, where necessary, redone. Regular data gathering on other information and sources will also be required, including population data, diarrhoeal disease envelope estimates, and cancer envelopes. As updates on these data are less frequent, the group agreed that a renewal interval of 2-3 appeared to be reasonable. It was explained that a limitation of this new approach is that new estimates will not be comparable to the previous estimates. If the time trends approach will be taken, there will be no immediate need to determine the reference year, as this could be taken at the final stage of the estimation, although the reference period still needs to be defined for data collection.

Disease models

The former FERG members developed the disease models for the first global estimation effort\(^\text{12}\). For updating the estimates on previously estimated hazards, the existing models shall be considered as a starting point. Suggestions were made to include more disease outcomes in the next update.

Disease models for additional hazards need to be determined by hazard-based TFs in close engagement with the CTF. Disease outcomes are to be defined on a hazard-by-hazard basis. Determining causalities could be a potential challenge, particularly for chemicals and toxins. It was noted that useful literature could exist outside of the previously commissioned systematic reviews, to better understand the disease outcomes. It was also noted that further discussion was required on how to deal with causal inference and to agree on a set of criteria.

List of hazards for inclusions in the estimates

Thirty-one hazards were included in the 2015 global report, based on 2010 data. For the next update, 62 hazards have been shortlisted thus far based on the selection criteria proposed by CTF and established by respective hazard-based TFs. The FERG agreed to maintain the original 31 hazards as well as 4 metals (lead, arsenic, methyl mercury and cadmium) as minimum for inclusion in the next estimates.

Taking into account limited resources, FERG must prioritize hazards into tiered groups based on the technical understanding of the hazards as well as expectations from Member States as follows: 1) Must-have (critically important) hazards for 2025 reporting, which will be the FERG1 hazards, 2) Good-to-have (highly important) hazards for reporting potentially at a later date; and 3) Must-wait (important) hazards for future consideration.

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Assessing other metrics (economic, social, zDALY)

The usefulness of including the social impact of foodborne diseases was raised, with an example provided of bile duct cancer deaths caused by liver flukes. In many parts of Asian countries, this disease affects main income holders of families, which leads to ongoing social impacts. Similarly, young children can be a sub-population particularly affected by certain foodborne diseases. The zDALY (Torgerson et al, 2018) is another metric of interest, that enables the societal burden of zoonotic diseases that have substantial human and animal disease burden to be estimated by combining DALYs with animal-loss equivalents (the time required to earn the income needed to replace the financial loss associated with animal burden of a zoonotic disease).

Commissioning systematic reviews

The first FERG’s approach relied on systematic reviews to collect data required for estimating the burden, which was a key component of the estimation efforts. Similarly, for the new update, respective TFs prepared a list of required reviews for consideration and deliberation in the plenary. WHO highlighted examples of a “call for expressions of interests for systematic reviews” published online by other teams within WHO, and proposed to develop a concept note to generally outline the scope and objectives of the project across all of the current FERG work areas, and Terms of Reference (ToR) documents for each specific systematic review and other tasks.

In order to undertake new modelling efforts in the FERG, and considering the fact that this approach will take into account time and space, it will be necessary to recompile the data for the period before 2010, which was the reference year for the previous estimation efforts. Although original raw data will be needed, many data are not available for most hazards or not available in the format that fits the new modelling efforts. Raw 2010 data were not provided for the previous estimation and only one estimate was made available for each country.

The FERG emphasized the importance of ensuring that end outcomes are delivered in a format set by FERG, particularly regarding disease models. A Terms of Reference (ToR) for systematic reviews need to highlight the regional or national variation in outcomes such as in disease outcomes and in strain prevalence. Six months should be seen as a minimum timeline required to complete the systematic reviews. In addition, a one-month period should be allowed for call submissions and selection process, and one month for WHO contracting processes.

Commissioning other studies

Besides systematic reviews for data collection, potential other studies to commission externally were discussed, including for source attribution work (scoping review of source attribution studies, analysis of data from outbreak investigations, expert elicitation), literature review on disease targets and indicators, case series on use of indicators by countries with a focus on lower-middle income countries (LMICs), and research and publication on economic burden estimates.
Planned publications

Two types of publications were discussed, namely WHO publications and external journal publications. An idea was suggested to have one repository for external journal papers directly generated from the current FERG membership, however no consensus was reached in terms of a name of publisher. In terms of commissioning work, it was agreed that commissioned scientists will have discretion over where to publish their reviews.

WHO proposed to develop a methodology paper to be published in external journal. This paper is intended to outline the overall methodological approach and processes taken to update the global estimates, describe the hazard selection process, and the final list of hazards for estimation. Many in the plenary felt that publication of methodology is a priority, also for transparency. The need for consistency and rigor in the systematic reviews was emphasized, acknowledging there may be variations in collected data across countries. Another methodology paper is also being planned that will focus more on technical aspects of the estimation methodology. Support for non-English language papers will be a major help for the systematic reviews.

A mutual understanding was shared that WHO intends and is mandated to publish the WHO report containing the final estimates. To avoid conflicts, papers and report publications should be synchronised.

Planned budget

Each TF provided draft budget plans for 2022-2023, amounting to an estimated 1.6 million USD for 2022-2023 only. The group discussed how to support WHO's fund raising efforts. WHO highlighted the importance to publicize FERG’s deliverables and outcomes, and to use any opportunity within members’ networks and groups to highlight the work for higher visibility. Prioritization of fund allocation might have to be considered given the limited resources of funding and the higher budgetary needs for full implementation of the workplan.

Closing remarks

Dr Francesco Branca, Director of the Department of Nutrition and Food Safety, gave closing remarks. He congratulated the participants to have achieved the objectives of the meeting, and expressed sincere gratitude to all FERG members, particularly the FERG chair Dr Rob Lake and all TF chairs. He welcomed the newly strengthened methodologies as well as innovative approaches being proposed, and emphasized that scientific rigor would act as a tool to defend the true value of the estimates in a politically dynamic environment. Dr Branca reiterated his commitment to identify and allocate resources for all of the activities supported by FERG, and intention to host on behalf of WHO, the next FERG meeting in-person towards the end of 2022.
Conclusions / Agreed action points

Overall timeline

- The timeline table developed on the last day (5 May 2022) was agreed by the FERG (Annex 1).
- It was agreed to aim for finalizing the estimation process by the end 2024, and finalize the development of both WHO publications and external journal publications in 2025. Given the ambitious timeline, the FERG agreed on an aim to report the first batch of results in 2025 focused on 31 original hazards and four metals, and to report the estimates by including more hazards after 2025.
- The current appointment of the FERG was originally set to end in 2024. It was however determined in the meeting with Assistant Director-General Dr Naoko Yamamoto in December 2021 that the current members shall be reappointed to cover timeline until the release of the next estimates, in order to ensure consistencies in the approach are taken.

Methodological approach

- It was decided to use a time trend analysis methodology, and therefore a new computational infrastructure. This has implications for data collection (i.e., data collected for the first FERG may not be available or suitable), and the involvement of CTF for the entire process will be essential to ensure the methodological requirements are met. CTF and hazard-specific TF meetings are to be organized.
- While FERG sees zDALY as a useful metric for consideration, it was advised that this area of work shall be elaborated through activities outside the FERG. The PDTF work programme could keep this topic under discussion, while public health burden estimates shall remain as a priority for the FERG.

Hazard list

- Hazard selection process: there was a great commonality among the criteria applied to select hazards across three TFs, and generally agreed. The criteria difference was observed in PDTF hazards, and this will be further discussed.
- Hazards selected by respective taskforces were in principle agreed except for some groups of chemicals. Thirty-one original hazards and four metals will be included for 2025 reporting.
- It will be important to include all hazards (selected as of now) for source attribution, and etiologic fraction.

Data collection in general

- Raw data extracts of the previous systematic reviews shall be provided if/where available.

Commissioning systematic reviews:

- WHO and FERG chair to draft one overarching concept note for all systematic reviews, reflecting the currently considered methodologies, describing the important role of the CTF in scoping and setting requirements for systematic reviews (guidelines and data formatting requirements). FERG to review before finalization. WHO guidelines on systematic reviews to be adhered to. Aim to complete by end of May.
- Each TF to draft a Terms of Reference (ToR) based on a template (standardizing common elements) provided by WHO, involving CTF where necessary. All FERG members to review the drafts, and WHO to finalize them. Each TF will develop one ToR as a priority piece of work by end of May as a trial run. In principle, one ToR shall be developed for one review. A review can contain more than one hazard as a scope.
- WHO will publicize the concept note and ToRs online to call for expressions of interests for reviewers in early June 2022. The call for expressions of interest will stay open for a minimum of one month, and any eligible expert/institution can apply, including FERG experts and WHO collaborating centres.
• FERG chair, TF chairs of CTF, EDTF, PDTF, and CTTF will have an initial meeting to define overarching requirements and scope of the reviews.
• Regarding selection of reviewers: Each TF will be involved in the selection of reviewers. Current FERG members may also apply to be reviewers, however this will be in-kind as WHO cannot remunerate advisory members.

Planned publications
• Overall methodology paper will be in the format of a commentary, potentially in the Lancet (as an idea). Core Group to kick start the discussion as to how to develop.
• CTF-specific methodology paper
• Overall WHO publication of the 2025 estimates as a stand-alone report
• It is aimed to house FERG-delivered papers into a collection (except for individual systematic reviews), and an appropriate journal shall be identified.

Planned budgets
• The budget plan was consolidated and agreed.

Country consultation
• WHO to start developing a plan on country engagement into the estimation process, to keep them updated on the various steps and milestones. Countries shall approve input data and the final estimates. Member states normally designate national a focal point(s) for a WHO process such as estimating the global burden.

Collaboration
• FERG advised WHO to engage the Institute for Health Metrics and Evaluation (IHME)\textsuperscript{13} when appropriate through an official channel. NFS to organize an initial discussion with IHME via DDI. They can be contacted for data collection and to inform FERG on their processes and timeline.
• It was decided by WHO to explore developing economic estimates of foodborne disease burden through an external partnership. WHO plans to discuss with the World Bank and will keep IMTF updated on the process.

\textsuperscript{13}IHME. Institute for Health Metrics and Evaluation (IHME); 2022 (https://www.healthdata.org/, accessed 10 June 2022).
References


Annex 1 – Agreed timeline as of 5 May 2022

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