

WHO Initiative to Estimate the Global Burden of Foodborne Diseases

Second formal meeting of the Foodborne Disease
Burden Epidemiology Reference Group (FERG)

Appraising the Evidence and Reviewing Initial Results



Geneva, 17–21 November 2008



World Health
Organization

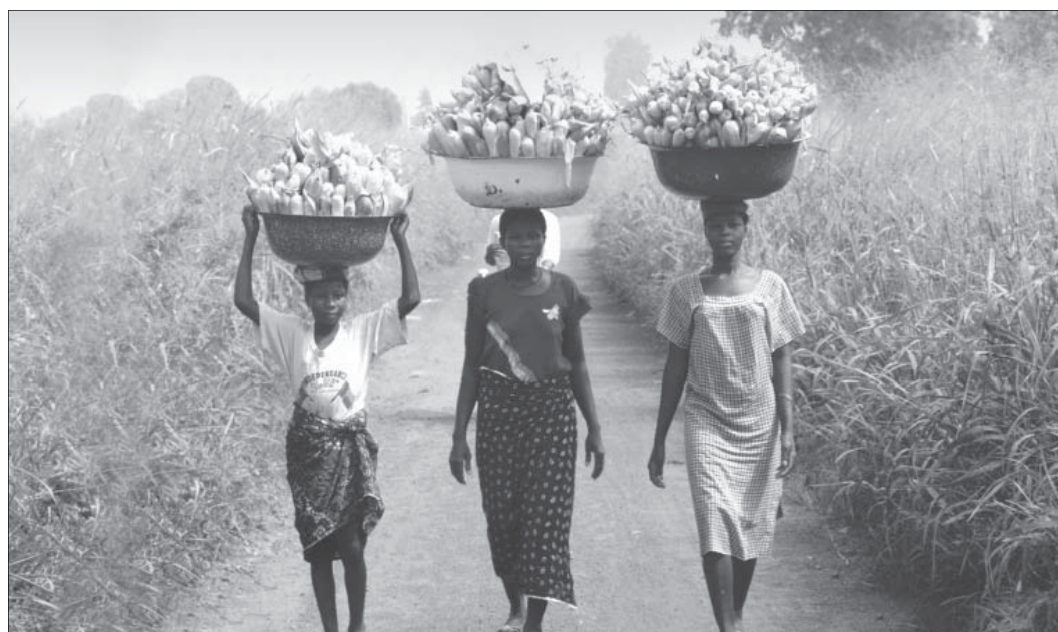
Front cover photo: *Women taking food to the local market in Africa*
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Department of Food Safety, Zoonoses, and Foodborne Diseases
Health Security and Environment

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List of Acronyms

ADG	Assistant Director-General
AE	Alveolar echinococcosis
AGI	Acute gastroenteritis
BOD	Burden of Disease
CAB	Commonwealth Agricultural Bureaux (now CAB International)
CHERG	Child Health Epidemiology Reference Group
CDC	Centers for Disease Control and Prevention (USA)
CSTF	Country Studies Task Force
DALY	Disability-Adjusted Life Year(s)
DG	Director-General
DHS	Demographic and Health Surveys
DSS	Demographic Site Surveillance
ECDC	European Centre for Disease Prevention and Control
FAO	Food and Agriculture Organization of the United Nations
FBD	Foodborne diseases
FERG	Foodborne Disease Burden Epidemiology Reference Group
FERG 1	First formal meeting of the FERG (November 2007)
FERG 2	Second formal meeting of the FERG (November 2008)
FERG 3	Third formal meeting of the FERG (October 2009)
FOS	Department of Food Safety, Zoonoses and Foodborne Diseases
GEMS	Global Environment Monitoring System
GBD	Global Burden of Disease
GIS	Geographical Information Systems
GSS	WHO Global Salm-Surv
HSE	Health Security and Environment
IARC	International Agency for Research on Cancer
ICD	International Classification of Diseases
ICEDBIS	International Collaboration on Enteric Disease Burden of Illness Studies
IHME	Institute for Health Metrics and Evaluation
JMP	Joint Monitoring Programme
MDG	Millennium Development Goal(s)
M&E	Monitoring and Evaluation Framework
NGO	Non-Governmental Organization(s)
NIH	National Institutes of Health (USA)
OIE	World Organisation for Animal Health
PAHO	Pan American Health Organization
RIVM	National Institute for Public Health and the Environment of The Netherlands
SATF	Source Attribution Task Force
SIGLE	System for Information on Grey Literature in Europe
TF	Task Force(s)
UN	United Nations
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Funds
USA	United States of America
USDA	United States Department of Agriculture
USFDA	United States Food and Drug Administration
VR	Vital Registration
WHO	World Health Organization
WHOLIS	World Health Organization Library
WSH	Water, Sanitation, Hygiene and Health
WTO	World Trade Organization
YLL	Year(s) of Life Lost
YLD	Year(s) Lived with Disability



Acknowledgements

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First and foremost we wish to thank all participants for their valuable technical input and their collegiality during the meeting. We are particularly grateful to Professor Arie Havelaar for his leadership and outstanding chairmanship of the FERG at this second meeting, as well as the Chairs of the FERG Task Forces, Neyla Gargouri, Herman Gibb, Tine Hald and Martyn Kirk. A very special thanks goes to Elaine Scallan for her diligent and excellent rapporteuring of the meeting.

This report can be downloaded in electronic format from the following site:
http://www.who.int/foodsafety/foodborne_disease/ferg/en



Definitions

Foodborne diseases

Foodborne diseases (FBD) can be defined as diseases commonly transmitted through ingested food. FBD comprise a broad group of illnesses caused by microbial pathogens, parasites, chemical contaminants and biotoxins.

Burden of disease

The term 'burden of disease' in the context of this Initiative follows the principles of the Global Burden of Disease Study¹, and includes the quantification of morbidity, all disabling complications as well as mortality in a single summary measure (DALY).

DALY (Disability-adjusted life year)

The DALY measure combines the years of life lost due to premature death (YLL) and the years lived with disability (YLD) from a disease or condition, for varying degrees of severity, making time itself the common metric for death and disability. One DALY is a health gap measure, equating to one year of healthy life lost.

Food

According to the definition of the Codex Alimentarius Commission,² 'food means any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of food but does not include cosmetics or tobacco or substances used only as drugs'. The definition includes all bottled drinks.

¹ The Global Burden of Disease - 2004 Update. WHO, Geneva, Switzerland, 2008

² Codex Alimentarius Commission, 2007. Procedural Manual ftp://ftp.fao.org/codex/Publications/ProcManuals/Manual_17e.pdf



Executive summary

Foodborne diseases (FBD) result from the ingestion of contaminated foods and food products and include a broad group of illnesses caused by bacteria, viruses, parasites and chemical agents and toxins, which contaminate food at different points along the farm to table continuum. Recent events surrounding melamine contamination in food have demonstrated, yet again, that food safety touches all our lives with national as well as international foodborne disease outbreaks being reported almost daily.

Diarrhoeal diseases alone - a considerable proportion of which is likely to be foodborne - kill almost 2.2 million³ people globally every year, most of whom are children in developing countries. However, the full extent of the burden of foodborne diseases is currently unknown. In order to fill this data vacuum, the WHO launched the *Initiative to Estimate the Global Burden of Foodborne Diseases* to estimate foodborne diseases of microbiological, parasitic and chemical origin. In 2007, the WHO established the *Foodborne Disease Burden Epidemiology Reference Group (FERG)* to assist with these efforts through:

- Assembling, appraising and reporting on currently existing burden of foodborne disease estimates;
- Conducting epidemiological reviews for mortality, morbidity and disability in each of the major foodborne diseases;
- Providing models for the estimation of FBD burden where data are lacking;
- Developing cause and source attribution models to estimate the proportion of diseases that are foodborne; and
- Developing user-friendly tools for burden of FBD studies at country level.

This report describes the outcome of the second formal meeting of the FERG in November 2008 (FERG 2) and highlights the progress made during the Initiative's first year, which included:

- An appraisal of the methods and preliminary results of ten systematic reviews commissioned in the areas of enteric, parasitic and chemical causes of foodborne diseases, as well as mortality;
- The development of detailed new workplans for all FERG Task Forces for 2009, including new burden work to be commissioned;
- The establishment of the FERG Source Attribution Task Force and execution of its technical recommendations;
- Agreement on the terms of reference of the new FERG Country Studies Task Force in 2009;
- A formal evaluation of the activities, processes and outputs of the first year of the FERG; and
- A major, multisectoral stakeholders meeting which provided valuable input and recommendations to WHO in the areas of technical reviews, communication and policy.

The WHO Secretariat is now working to execute the recommendations made at FERG 2 and is expecting the first burden of disease estimates for selected foodborne causes at its third formal meeting in October 2009.



1

Introduction

This second formal meeting of the *Foodborne Disease Burden Epidemiology Reference Group (FERG 2)* was opened by Dr Jørgen Schlundt, Director of the World Health Organization's (WHO) Department of Food Safety, Zoonoses and Foodborne Diseases (FOS). Dr Schlundt thanked the experts for their outstanding commitment to FERG and commended the Chairman of FERG as well as the Chairpersons of the individual Task Forces for their leadership. He emphasized the commission of FERG as a direct mandate from countries arising from the WHO Global Strategy for Food Safety⁴ and endorsed by the Beijing Declaration on Food Safety⁵ (see insert below).

"... develop science-based measures to prevent exposure to hazards through food, ... assess and communicate foodborne risks."

WHO Global Strategy for Food Safety (2002)

"...obtain rapid and reliable information on prevalence and emergence of foodborne diseases and hazards in food supply."

Beijing Declaration on Food Safety (2007)

Professor Arie Havelaar of the National Institute for Public Health and the Environment (RIVM) of The Netherlands and Chairman of the FERG welcomed FERG members, presented the draft agenda for the meeting and outlined the procedural issues. Dr Claudia Stein (WHO/FOS) who leads the Initiative at WHO gave a broad overview of the progress made since the first FERG meeting (hereafter FERG 1) in November 2007, including the fundraising and advocacy activities of WHO/FOS pertinent to FERG.

Present at this meeting were the members of the FERG appointed by the WHO Director-General (DG), resource advisers serving in the capacity of ad hoc technical advisers, observers, and the WHO Secretariat. (See Appendix 2 for list of participants).

⁴ WHO Global Strategy for Food Safety. World Health Organization, Geneva, Switzerland, 2002. http://www.who.int/foodsafety/publications/general/global_strategy/en/

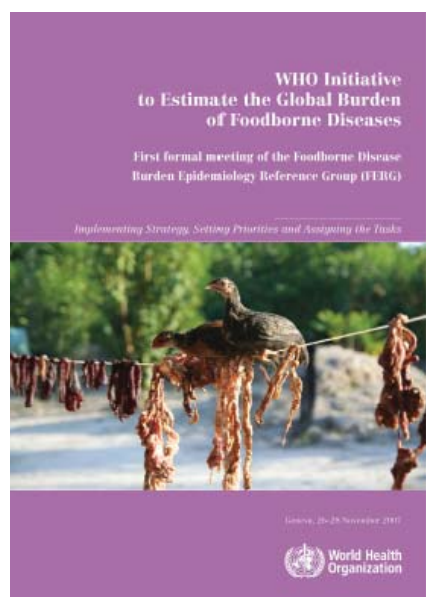
⁵ Beijing Declaration on Food Safety. World Health Organization, Geneva, Switzerland, 2007. http://www.who.int/foodsafety/fs_management/meetings/forum07/en/

2

Meeting objectives

This second meeting of the FERG (FERG 2) was convened one year after the first formal meeting (FERG 1, Figure 1) to assess progress made with the recommendations made at FERG 1 and the products to be provided during 2008.

The FERG 1 meeting outputs that required follow-up included:



- **The establishment and operationalization** of three **FERG Task Forces** in the areas of **parasitic diseases, chemicals and toxins, and enteric diseases**;
- Development of **priority lists of causative agents** for all three Task Forces; and
- Detailed **workplans** for all Task Forces, including detailed descriptions of the **type of burden work to be commissioned**, proposals of scientists and/or institutions to undertake the work, a definition of the **outputs expected** and **time frames for the delivery** of the products.

Figure 1: WHO Initiative to Estimate the Global Burden of Foodborne Diseases: First formal meeting of the Foodborne Disease Burden Epidemiology Reference Group (FERG) in 2007

http://www.who.int/foodsafety/publications/foodborne_disease/burden_nov07/en

In view of the above, the main **objectives of FERG 2** were to:

- Provide an opportunity for members to meet and discuss the progress made over the last 12 months;
- Review and revise the work commissioned according to the FERG Task Forces' (TF) workplans;
- Interact with and discuss suggestions made by multisectoral FERG stakeholders in a FERG stakeholder event;
- Discuss the establishment of a new TF to develop protocols for Burden of Disease country studies;
- Recommend actions to the WHO Secretariat resulting from the formal Year 1 evaluation of the *WHO Initiative to Estimate the Global Burden of Foodborne Diseases*; and
- Adopt workplans for 2009 for all TFs, including determining proposals for new work to be commissioned.



3

Background

Foodborne diseases (FBD) can be defined as diseases commonly transmitted through ingested food. Foodborne diseases result from the ingestion of contaminated foods and food products and include a broad group of illnesses caused by bacteria, viruses, parasites and chemical agents and toxins which contaminate food at different points along the farm to table continuum. Recent events surrounding melamine contamination in food have demonstrated that food safety touches all our lives with national as well as international foodborne disease outbreaks being reported almost daily (Figure 2). Foodborne diseases threaten international public health security and economic development. As trade and migration increase, so does the spread of dangerous contaminants and pathogens in food across borders. Diarrhoeal diseases alone - a considerable proportion of which is likely to be foodborne - kill almost 2.2 million⁶ people globally every year, most of whom are children in developing countries. However, the full burden of foodborne diseases is clearly larger than the burden of diarrhoeal diseases, and results from a variety of conditions arising from both microbiological and chemical or toxin contamination.



Figure 2: News reports of foodborne disease outbreaks and contamination events

—WHO HQ Geneva, 17–21 November 2008

⁶ The Global Burden of Disease - 2004 Update. WHO, Geneva, Switzerland, 2008.

The need for more reliable estimates of the global burden of foodborne diseases to allow policy-makers to prioritize and evaluate the effectiveness of food safety interventions was highlighted through both the WHO Global Strategy for Food Safety (WHO, 2000) and the Beijing Declaration on Food Safety (2007). The full extent of the burden and cost of unsafe food, however, is currently unknown. In order to fill this data vacuum, the WHO launched the *Initiative to Estimate the Global Burden of Foodborne Diseases*. The Initiative considers all major causes of foodborne diseases of microbiological, parasitic and chemical origin. In 2007, the WHO established the *Foodborne Disease Burden Epidemiology Reference Group (FERG)* to assist with these efforts. The FERG comprises global experts in the area of food safety and acts as technical advisory body to the Initiative. The FERG will use the Global Burden of Disease (GBD) Study approach and assess the global burden of foodborne diseases using conventional epidemiological parameters as well as a summary metric, the Disability Adjusted Life Year (DALY).⁷

3.1 What is the 'FERG'?

The FERG is a multidisciplinary and multisectoral group of the world's leading experts in the area of foodborne diseases. It was established by the WHO Director-General to act as the technical advisory body to the *WHO Initiative to Estimate the Global Burden of Foodborne Diseases*.

FERG members were selected from a large pool of applicants following a public call for advisers in the scientific press and a transparent selection process.

The members of the FERG engage in:

- Assembling, appraising and reporting on currently existing burden of foodborne disease estimates;
- Conducting epidemiological reviews for mortality, morbidity and disability in each of the major FBD;
- Providing models for the estimation of FBD burden where data are lacking;
- Developing cause and source attribution models to estimate the proportion of diseases that are foodborne; and
- Developing user-friendly tools for burden of FBD studies at the country level.

Due to the fact that foodborne diseases arise from a myriad of different causes, both microbiological and chemical, the FERG is highly multidisciplinary and includes a large number of members. It operates through a Core (or Steering) Group as well as a number of different Task Forces (Figure 3).

The Core Group functions as a steering committee and consists of scientists from each of the areas outlined in the Task Forces. It is charged with monitoring and appraising the technical and epidemiological work of all Task Forces. The Core Group is chaired by a scientist with extensive international experience in both foodborne diseases and burden of disease methodology. Additional external experts can be called upon to join the FERG on an ad hoc basis to supplement the skills

⁷ WHO Initiative to Estimate the Global Burden of Foodborne Diseases: First formal meeting of the *Foodborne Disease Burden Epidemiology Reference Group (FERG)*, WHO, Geneva, Switzerland, 2008.



required. FERG Task Forces are the executing arm of the FERG and conduct burden of disease work in the following areas:

- Task Force 1: Enteric Diseases
- Task Force 2: Parasitic Diseases
- Task Force 3: Chemicals and Toxins
- Task Force 4: Source Attribution
- Task Force 5: Country Studies (newly established)

The FERG Core or Steering Group functions as the steering committee and consists of scientists from each of the areas outlined in the Task forces below. It is charged with monitoring and appraising the technical and epidemiological work of all the Task Forces and is chaired by a scientist with extensive international experience in both foodborne diseases and burden of diseases methodology.

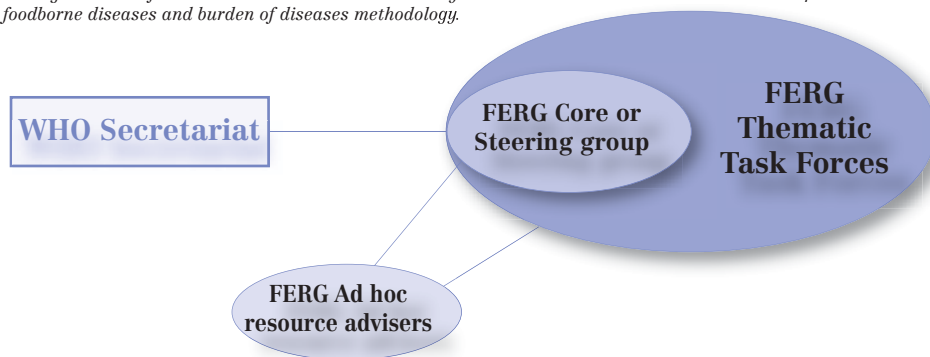
Thematic Task Force 1: advancing the burden work in the area of viral and bacterial enteric diseases.

Thematic Task Force 2: advancing the burden work in the area of parasitic diseases.

Thematic Task Force 3: advancing the burden work in the area of chemicals and toxins.

Thematic Task Force 4: on source attribution (charged with identifying the proportion of the disease burden that is directly due to food contamination and aiming to attribute the relevant fraction of disease burden to the specific food source responsible).

Thematic Task Force 5: on country studies (which will be set up in June 2009 to develop user-friendly tools for countries to conduct their own burden of foodborne disease studies and policy situation analyses, thus enabling them to monitor the progress of their food safety interventions).



The WHO Secretariat is composed of staff from the eight WHO Departments having a stake in foodborne diseases and/or burden of disease, as well as staff from UN partner organizations.

FERG Resource Advisers:
Additional experts can be called upon to join the FERG on an ad hoc basis to supplement the skills required.

Figure 3: Composition and structure of the FERG

The WHO Secretariat provides a logistic, administrative and technical support function and is composed of staff from different areas within WHO. The FERG follows a strategic framework developed at an international consultation⁸ in 2006 and is expected to provide a Global Report and Atlas on the Burden of Foodborne Diseases as well as a series of journal papers. These products are peer-reviewed by scientists outside FERG to ensure highest quality and policy impact.

The Initiative is supported by an alliance of collaborators and partners who provide financial support, technical expertise, information sharing platforms and/or networking possibilities. Collaborating partners include agencies of the United Nations (UN) and other international organizations, governmental and nongovernmental agencies (NGO), academia, consumer groups and industry. A more detailed description of these interactions can be found in Section 7 of this document ('Stakeholder meeting').

⁸ WHO Consultation to Develop a Strategy to Estimate the Global Burden of Foodborne Diseases. World Health Organization, Geneva, 2007.

4

Progress since FERG 1

4.1 Work commissioned following FERG 1

Table 1 outlines the systematic reviews commissioned by the WHO Secretariat, following recommendations of the Enteric Diseases, Parasitic Diseases and Chemicals and Toxins TFs at FERG 1. In general, the objectives of these reviews were to: (1) estimate morbidity (incidence, prevalence, sequelae) and mortality from diseases by age and sex for all regions of the world; and (2) estimate the proportion of diseases that is transmitted by food.

Interim results on the following causes of foodborne diseases were presented and appraised during FERG 2 (see Section 6 of this report):

- Enteric pathogens: global burden of diarrhoeal diseases and global burden of salmonellosis;
- Parasites: fasciola, cystic echinococcus, *Taenia solium* and cysticercosis, alveolar echinococcus and intestinal protozoa; and
- Chemicals and Toxins: cassava cyanide, aflatoxins, dioxins and peanut allergens.

Table 1: Status of scientific review work commissioned following FERG 1

Causative agent/s	Progress with burden estimation
Enteric Diseases Diarrhoeal diseases	Systematic review in progress
Parasitic Diseases Fasciola	Draft report received
Cystic echinococcus	Outline received; literature review still in progress
<i>Taenia solium</i> & cysticercosis	Outline received; literature review still in progress
Alveolar echinococcus	Draft report with prevalence & mortality received
Intestinal protozoa	Outline received; literature review still in progress
Chemicals & Toxins Aflatoxins	Draft report received
Cassava cyanide	Draft report with prevalence & mortality received
Peanut allergens	Outline of issues for consideration received
Dioxins	Draft report received



4.2 Source Attribution Task Force established

The first meeting of the Source Attribution TF (report available upon request) was held in Kuala Lumpur, Malaysia on 28-30 April 2008 (Figure 4). The main tasks of the Source Attribution TF are to determine (for each hazard) the proportion of disease burden that is attributable to food, and to identify - where possible - the responsible reservoirs and/or food commodities leading to illness. If feasible, the absolute or relative importance of the various sources should be quantified.



Figure 4: FERG participants and WHO Representative of Brunei, Malaysia and Singapore, Dr Han (front centre), at the first meeting of the Source Attribution Task Force, Kuala Lumpur, Malaysia (April 2008)

Initially, and as described in the terms of reference, the Source Attribution TF set out to define the terms 'foodborne diseases' and 'source attribution' and agree on levels of food categorization and point of attribution. A summary of the discussions addressing the definition of foodborne disease and the point of attribution is detailed in Section 6.4 of this report. Regarding source attribution, the TF agreed on the following definition:

Source attribution is the partitioning of the human disease burden of one or more foodborne diseases to specific sources, where the term 'source' includes animal reservoirs.

The Source Attribution TF should also assess all currently available methods attributing causative agents of foodborne diseases to food sources and food commodities. During the Source Attribution TF meeting, participants presented the available methods to attribute human illness to foods. The methods included microbiological approaches (microbial subtyping and comparative exposure assessment), epidemiological approaches (use of outbreak data and case-control studies, e.g. meta-analysis), intervention studies, natural experiments and expert elicitation. After a review of the methods, the three thematic TFs (Enteric Diseases, Parasitic Diseases and Chemical and Toxins) described the major routes of transmission for the causes (hazards) prioritized during FERG 1 and identified possible source attribution approaches for each of these causes. The three TFs also developed conceptual frameworks for source attribution pathways adapted to the specific needs of each of the three TF areas.

The status on source attribution activities in the three main causative agents' groups can briefly be summarized as follows:

- In the area of **bacterial and viral enteric diseases** it would be prudent to first estimate the pathogen-specific incidence per region and then estimate the proportion due to food per region. The TF proposed to use expert elicitation on a regional basis to arrive at final estimates. It was, however, recommended that prior to applying expert elicitation other source attribution methods should be explored and substantial evidence gathered to demonstrate the need for expert elicitation, and to inform such studies with all available data.
- In the area of **parasitic diseases**, it was concluded that additional source attribution work is needed for cystic and alveolar echinococcosis, fascioliasis and the intestinal protozoa, in particular to distinguish between food- and waterborne infections. For the protozoa, the source attribution approach will primarily be based on literature review of outbreak investigation reports. Taeniasis and cysticercosis is assumed to be 100% foodborne as pigs are the essential host in the life-cycle and no further attribution efforts were deemed necessary.
- The **chemical hazards** prioritized were those resulting from aflatoxin exposure, cassava cyanide, peanut allergens, and dioxin exposure. The commodities with the highest risk of aflatoxin contamination are corn, peanuts and cottonseed. Milk, eggs and meat products are sometimes contaminated because of the animal consumption of aflatoxin-contaminated feed. A comparative exposure assessment approach (i.e., measurement of the concentration of aflatoxin in different food commodities and knowledge of food consumption patterns) was considered the most appropriate source attribution method. Many of the world's food plants are cyanogenic. However, cassava stores cyanogenic compounds in its edible parts while most other food crops do not. For cassava, the TF decided to focus exclusively on cassava in food (considering it 100% foodborne and no further source attribution efforts are necessary). By definition, the source of peanut allergens is peanuts. However, peanut oil has a wide variety of uses (e.g., cosmetics). The challenge is therefore to attribute disease to peanuts and peanut oil used in food only.

Food consumption data are important for many of the attribution approaches, and particularly for the exposure assessment method, where intake data are required as input to the models. The Source Attribution TF consequently decided to explore the possibilities for developing a Global Atlas of Food Consumption. The first step should be to identify existing data sources and assess whether they fulfil the need of FERG. For the purposes of source attribution, a food categorization scheme which is consistent across all Task Forces was also found to be required. As a first step, it was recommended to assess if existing food categorization schemes could be used. Presentations on food categorization and food consumption data were given at the FERG 2 meeting and are described in Section 6.4 of this report.



4.3 Stakeholders and partnerships

WHO continues to bring together an alliance of donors and in-kind supporters for FERG, thus ensuring that no individual institution, foundation or government may exert undue influence on this Initiative. Although WHO continues to make considerable financial investments in FERG, the Organization is currently discussing additional funding options with a number of governmental and nongovernmental donors as it will require approximately US\$ 7 million over 5 years to complete the work.

The multisectoral stakeholders for this Initiative include WHO Member States, (bi-multilateral) donors, NGOs, consumer groups, industry and the public and scientific media. A major stakeholder meeting was held in connection with the FERG 2 meeting and is reported in Section 7 of this document.

Textbox 1 - Alliances and partners of the WHO Initiative to Estimate the Global Burden of Foodborne Diseases

- Government of the Federal Republic of Germany (human resources support)
- Government of the Republic of Ireland (human resources support)
- Government of Sri Lanka (human resources support)
- Government of the United Kingdom of Great Britain and Northern Ireland (human resources support)
- Japanese Ministry of Health, Labour and Welfare (financial support)
- Multiple topic-relevant networks & institutes (e.g European Centre for Disease Prevention and Control, WHO Global Salm-Surv, Med-Vet-Net, International Collaboration on Enteric Burden of Illness Studies (ICEDBIS), Institute for Health Metrics and Evaluation)
- Netherlands Ministry of Health, Sports and Welfare (financial support)
- United States Centers for Disease Control and Prevention (technical & financial support)
- United States Department of Agriculture (technical & financial support)
- UN and other international organizations (FAO, OIE, IARC, UNEP, WTO, World Bank)

4.4 FERG Year 1 Evaluation

Regular monitoring and evaluations are critical for the success of any Initiative. The purpose of a programme evaluation is to assess programme performance and progress, identify areas where course corrections can be made and minimize barriers to programme implementation and success. A specific FERG Monitoring and Evaluation (M&E) framework was developed by the WHO Secretariat in 2008 and provided the foundation for the design, completion and analysis of the Year 1 Evaluation of the Initiative.

An external evaluator designed and performed the Year 1 Evaluation using a two-pronged approach, incorporating response data from survey questionnaires and personal interviews with FERG members, stakeholders and WHO staff outside FOS. Survey questionnaires were piloted for question clarity prior to their distribution (full report available upon request). Data collected focused mainly on strategy development and implementation, as well as coordination and management of the Initiative, seeking to assess the efficiency of strategy inputs and processes appropriate to the Initiative's first year.

The results of the Year 1 Evaluation (which had a questionnaire response rate of 49% and included 11 personal interviews) showed a positive response and did not reveal any major programme shortcomings. The evaluation presented strong

evidence to indicate participants are pleased with the overall planning, goals and objectives of the WHO Initiative as well as its governance structure, coordination, comprehensiveness, and current level of strategy implementation and progress. Participants expressed significant confidence in the Initiative's governance, and exceptional favour in the coordination and organization of Initiative processes and procedures. Such findings support the view that all activity and structure relevant to the Initiative has been established with great foresight.

The evaluation results also revealed specific programme areas where modifications or improvements were desired. Most recommendations address the issue of communication but also issues concerning project timeframes, identification and engagement of human resources, concerns of data availability, and the future work surrounding foodborne disease burden estimates. Some specific recommendations include: a) improvement of the FERG SharePoint, b) increased distribution of Initiative materials both internally and externally, c) increasing the awareness of progress with the Initiative, and d) a continual discussion of FERG's future and its collaboration with other relevant stakeholders, interest groups and/or organizations.

The specific areas within the Initiative which could be further developed centre around improvements of current mechanisms for stakeholder identification and continual monitoring of programme activities to ensure timeframe flexibility. Participants in the FERG evaluation specifically suggested the circulation of a list of stakeholders to ensure its completeness, improvement of the SharePoint workspace for communication among FERG members, and the consideration of a FERG newsletter to be distributed among stakeholders.

Summary of FERG Year 1 Evaluation

- o **The evaluation was focused on strategy development and implementation, and coordination and management of the Initiative;**
- o **Very positive results were found overall:**
 - **100% of respondents commenting favourably on the Initiative's strategy development, 96% on the Initiative's inputs, 92% on the process, and 100% on the outputs to date;**
- o **Recommendations from the evaluation include:**
 - **Regular circulation of list of engaged stakeholders;**
 - **Improvements to SharePoint workspace;**
 - **Distribution of FERG newsletter to stakeholders;**
 - **Continuation of monitoring of programme activities to identify potential set-backs.**



5

FERG 2: Plenary discussions and outcomes

This section summarizes the deliberations, results, recommendations and products arising from plenary discussions at FERG 2.

5.1 Co-morbidity and the estimation of the burden of foodborne diseases

In the framework of the FERG, one generic task focuses on the question of how to account for co-morbid conditions that may contribute to the morbidity and mortality experienced in the context of foodborne diseases. In general, different levels of interaction between risk factors, different diseases and their outcomes (including mortality) can be distinguished. Certain risk factors can influence the incidence of disease, while other risk factors can influence the severity of disease. Risk factors that influence disease incidence are classified as 'etiological factors', those that influence the outcomes in terms of recovery, sequelae or death are 'prognostic factors'. When the risk factor is another disease, we can similarly refer to 'etiological co-morbidities' and 'prognostic co-morbidities'. It is also possible to have co-morbidities that coexist with the condition of interest but do not influence either incidence or outcome of that condition; these are classed as 'independent co-morbidities', e.g. a foodborne disease and a limb fracture. The probability of having independent co-morbidities simultaneously is simply the product of the probability of occurrence of each but the relationship and probabilities associated with dependent co-morbidities is less straight forward.

The main issue for FERG (and other groups involved in burden estimation) is to decide how to allocate DALYs for the foodborne disease of interest when there are other conditions, which are either dependent or independent co-morbidities that 'compete' for the allocation of DALYs. FERG will contribute to the discussion about which methods should be used to calculate DALYs and whether and how co-morbidity should be accounted for.

As a first step FERG members identified all relevant and possible co-morbid conditions but further work is required to review the literature to better establish these potential associations. The expertise gathered in the FERG presents an opportunity to contribute views on likely relationships between foodborne disease and identified co-morbidities. If numeric probabilities were desired, elicitation of opinions from the expert group could be carried out.

At this stage no systematic and validated approach is available to account for co-morbidity in DALY calculations. The Global Burden of Disease studies (and national studies) have, with few exceptions, based their estimates of cause-specific mortality on primary causes only. Based on a literature review, it is expected that the relative risk framework (in particular Population Attributable Risks) could offer an appropriate computational framework for all types of co-morbidity analysis, provided elementary sets of data are available.

FERG therefore recommended the **WHO Secretariat to commission a systematic review of the recent literature on co-morbidities associated with diseases potentially transmitted by food**. This review will detail the problems and propose potential solutions for dealing with co-morbidities. Specific tasks include: (a) identification of evidence of etiologic and prognostic co-morbidities that occur with foodborne diseases; (b) estimation of probabilities of occurrence; (c) estimation of effect on mortality and disability; and (d) recommendations for technical methods/models to deal with co-morbidity.

5.2 Estimating mortality from foodborne diseases using vital registration data

At FERG 1, preliminary mortality data for all diarrhoeal diseases and other diseases that are potentially foodborne were presented by investigators at St Olaf College, Minnesota, USA, based on an analysis of the WHO mortality database.⁹ The analysis of this comprehensive vital registration database showed that adequate cause of death data exist for ~ 70 countries of the world, covering mostly industrialized countries in Europe and the Americas. The poorest and the most populous countries in Asia and Africa do not have adequate data from routine recording systems. In order to predict such missing data, the St Olaf investigators performed an in-depth analysis of health and economic indicator variables that could potentially be used to model missing data and used these in regression analyses to predict mortality in the region of the Americas.

At FERG 2, participants discussed this work and agreed that vital registration data should not be dismissed but considered as one source of several in the overall estimation of foodborne mortality. FERG members therefore proposed a working plan to use these data to estimate mortality rates for regions with missing data. The participants emphasized the need for the development of a transferrable method rather than the sharing of final results, and a Bayesian approach to extrapolate mortality rates using freeware which can be shared with all scientific communities was favoured. It was agreed that further data analysis should include re-visiting the regression strategies used by the investigators from St Olaf College and refining the data analysis.

Bayesian regression analysis and the concept of 'borrowing strength', a spatio-temporal tool for smoothing the variation of data between regions and across time could be evaluated for its suitability to estimate missing data. This approach may also have relevance for other activities of the FERG, including the work of the Source Attribution and Country Studies Task Forces. In order to increase the awareness of the extrapolation problem, common terminology is needed that helps guide the future data collection of the Country Studies Task Force.

The FERG recommended the **WHO Secretariat to commission the development of Bayesian modeling approaches to estimate regional mortality rates from the WHO vital registration data** for all diseases which are potentially foodborne.

5.3 New FERG Task Force: Country burden of diseases studies

Based on the recommendations of the 2006 Consultation as well as the FERG 1 meeting, the WHO Secretariat presented an outline of the Initiative's new Country Studies Task Force which will take up its work in 2009.

Why are country studies important?

Generating country level estimates of foodborne disease burden is imperative for a number of reasons. While the FERG considers all *existing* scientific evidence (including surveillance data) through commissioned systematic reviews, the full picture of the global burden can only be established if national-level estimates of the health burden caused by contaminated food are collected. The data generated by these studies will complement the global estimates and assist countries in analysing the costs associated with food contamination. One criticism of the Global Burden of Disease approach is the perceived reliance on modelled data which may not reflect realities at country level, prompting, however, countries to undertake their own

⁹ WHO Initiative to Estimate the Global Burden of Foodborne Diseases: First formal meeting of the *Foodborne Disease Burden Epidemiology Reference Group (FERG)*, World Health Organization, Geneva, Switzerland, 2008.



burden of disease assessments. Such national studies provide the best evidence for disease burden at country level and enable a differentiated description of the local specificity and variability of the pattern of foodborne disease epidemiology.

A further strength of such data lies in its ability to assist countries to make and apply food safety policies and interventions based on sound scientific evidence pertinent to that country. For this reason, policy-makers will form part of the scientific contingent of the Task Force and advise on data needs and the appropriateness of such data for policy making as well as on protocols for policy situation analyses that are conducted in parallel with the burden of disease studies.

Other additional benefits arising from the country studies include the following:

1. Country studies will promote greater ownership of the process from individual countries, potentially increasing the likelihood that data will be used to change food policy and interventions;
2. Undertaking country studies provides an opportunity to build country-level capacity and skills needed to undertake burden of disease assessments;
3. Country level data will enable the FERG to test the validity and reliability of burden estimates generated by systematic reviews and modelling approaches.

What will the Country Studies Task Force do?

The Country Studies Task Force (CSTF) consists of approximately twenty experts with experience in conducting national studies of foodborne disease, burden of disease methodologies, policy-making and regulation, and training and education. The CSTF will:

- Develop protocols that can be used by countries to undertake national burden of foodborne disease studies and policy situation analyses;
- Advise WHO on the development of training materials so that countries can build the capacity they need to conduct a national foodborne disease study;
- Collaborate closely with capacity building programmes, including WHO Global Salm-Surv (GSS), to train staff from countries in burden of disease methods;
- Oversee a number of pilot studies which will test the protocol and training materials; and
- Assist WHO to oversee national burden of foodborne disease studies in all WHO regions to collate burden of disease information and conduct policy situation analyses.

How will the CSTF achieve this?

There a number of existing projects, networks and institutions that will be essential to the work of the TF. These resources will be mapped and subsequently utilized by the CSTF. Relevant resources include networks, such as the Health Metrics Network (Global Partnership, Secretariat hosted at WHO), the World Health Surveys (WHO), and the Global Burden of Disease 2005 project which is coordinated by the Institute for Health Metrics and Evaluation (IHME). It also includes available data sources, such as the Demographic Site Surveillance (DSS) and Demographic and Health Surveys (DHS), among others.

The Task Force will map all relevant networks and partners, and develop criteria to select suitable countries to conduct the burden of disease assessments and policy situation analyses. These may include a basic infrastructure to successfully undertake burden of disease studies, a national commitment to improving food safety and/or an identified need to build capacity in burden methodologies. The development of country protocols will be guided by generic principles but also the specific outputs from the existing FERG Task Forces (Enteric Diseases, Parasitic Diseases, Chemicals and Toxins, and Source Attribution) which may point to specific data gaps that should be addressed by the country studies.

Who will be part of the Task Force?

As with all the FERG Task Forces, the CSTF will draw its membership from the body of the FERG and external resource advisers. A key requirement for the CSTF will be experience in undertaking burden of disease studies, particularly in developing countries. The Chairperson of the CSTF will be an international expert with a strong background in burden of disease methodologies. Task Force members will include experts in the areas of:

- Foodborne diseases;
- Burden of disease methodologies;
- Communicable disease surveillance/monitoring and systems;
- Epidemiology and epidemiological study design methods;
- Statistics and Geographic Information Systems (GIS);
- Policy-making and regulation;
- Health economics;
- Advocacy and communication;
- Training and education;
- Other experts as appropriate (e.g. information management, ethics, public health law).

When will the Task Force start its work?

The first meeting of the task force will take place in mid-2009. **FERG members have been requested to nominate themselves, other FERG members or external resource advisers as potential candidates for the Task Force** by sending nominations in writing to the WHO Secretariat by 31 December 2008. Each nomination needs to include a short justification paragraph, with reference to the skills the nominee has in relation to the above requirements. The WHO Secretariat will make a proposal on membership in January 2009.



5.4 Summary of FERG 2 plenary discussions and outcomes

The plenary sessions of FERG 2 included discussions and recommendations in three major areas, as outlined in Table 2 below.

Table 2: Summary of FERG 2 plenary discussions and recommendations

Theme	Discussion point(s)	Recommendation(s)	Responsible parties	Time frame
Co-morbidity	It is important to account for co-morbidity when estimating DALYs for foodborne diseases.	Identify causative agents with important co-morbidities.	All TFs	FERG 3 meeting
		Commission a systematic review of co-morbidities associated with foodborne diseases.	WHO Secretariat	FERG 3 meeting
Mortality data	WHO cause of death data are incomplete but should be seen as one of several information sources. Missing data should be modelled, where possible.	Commission Bayesian modeling work to predict missing data.	WHO Secretariat	June 2009
Country Studies TF	TF will provide tools and protocols to assist countries in conducting burden of foodborne disease studies.	TF members need to be nominated from among FERG and externally.	All TFs	End December 2008
	TF needs to have multisectoral and multidisciplinary composition.	Launch TF and hold first formal meeting of TF in mid-2009.	WHO Secretariat	June 2009

6

FERG 2: Individual Task Force discussions and outcomes

As in the FERG 1 meeting, each of the Task Forces met individually during FERG 2 to (a) review and revise the work commissioned over the past 12 months and (b) develop workplans, including proposals for new work to be commissioned. This section summarizes the TF discussions and outlines the workplans for 2009.

6.1 Enteric Diseases Task Force

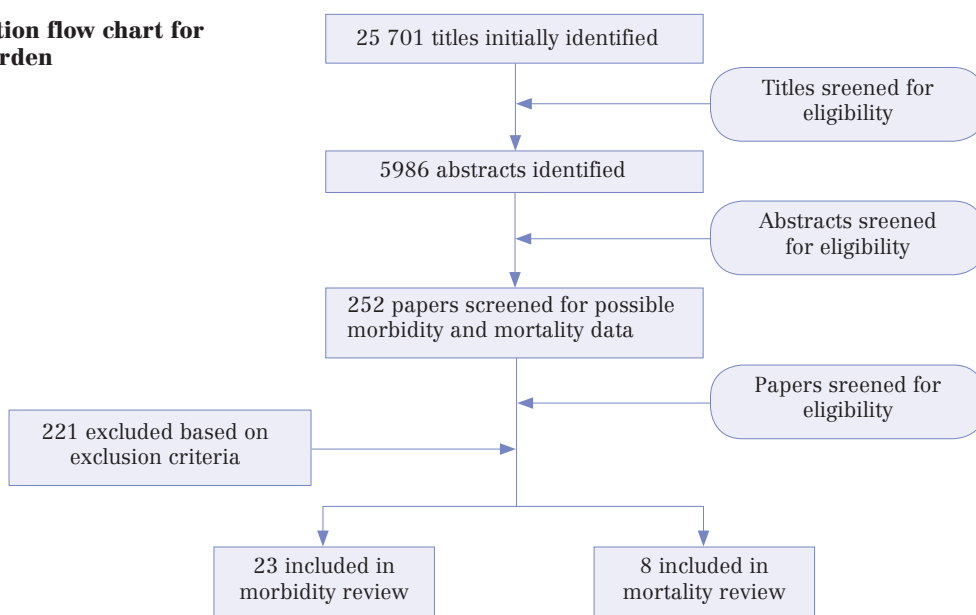
6.1.1 Global burden of diarrhoeal diseases

A major objective of the Enteric Diseases TF resulting from FERG 1 was to estimate an ‘envelope’ of diarrhoeal disease morbidity and mortality for all age groups and all relevant pathogens. This ‘envelope’ would entail the entire global incidence of and mortality from diarrhoeal diseases which may not be exceeded. FERG 2 discussed the methods and interim results of a systematic review of diarrhoeal diseases among persons aged > 5 years. The authors screened more than 25 000 titles using PubMed, Commonwealth Agricultural and Bureaux (CAB) abstracts, WHO library (WHOLIS), and SIGLE (System for Information on Grey Literature in Europe), using the following selection criteria:

- Included: studies of all children > 5 years and adults; all languages; prospective studies with at least 12 months of surveillance or cross sectional surveys conducted over a period of a year.
- Excluded: studies conducted among travellers, special populations (example: cancer patients, only HIV/AIDS patients); case reports; hospitalized acquired diarrhoea or antibiotic associated diarrhoea; studies lacking appropriate information with regard to study population, studies with no description of laboratory methods used or inappropriate laboratory methods; reports of outbreaks; prospective morbidity studies with recall beyond 2 weeks; and cross-sectional studies with recall beyond 4 weeks; mortality studies with fewer than 20 deaths.

Of all abstracts screened, 8 papers were included in the mortality review, 23 papers in the morbidity review, and 22 papers in the etiology review (Figure 5).

Figure 5: Data abstraction flow chart for diarrhoeal diseases burden





The estimates resulting from this review will be combined with estimates of diarrhoeal morbidity, mortality and etiology for children < 5 years of age from a review conducted under the auspices of the WHO Child Health Epidemiology Reference Group (CHERG).

As a next step, the TF considered how to fill some of the data gaps identified. Data on mortality are limited to developing countries, therefore **more work will need to be done to include vital registration data from the developed world** to produce global and regional estimates. For morbidity and aetiology, the TF advocated **considering studies conducted for a period of less than 12 months** to examine if they provide useful information. Currently, these studies are excluded due to the selection criteria used to conduct the systematic review. Also, **surveillance and outbreak data should be used to supplement the estimates**, particularly where data are lacking or for pathogens that typically show up as outbreaks, e.g. those caused by norovirus, and may not appear in systematic review approaches or in standard surveillance information. For some pathogens, **the TF may also want to consider the 'burden of gastroenteritis'** as enteric diseases due to viruses may not be captured under 'diarrhoea' and major studies have been excluded because 'vomiting' was part of the case definition. The TF agreed that the **data currently included in the systematic review need to be re-evaluated in the light of these discussion points and supplemented with surveillance and outbreak data.**

6.1.2 Global burden of *Salmonella*

The International Collaboration on Enteric Disease Burden of Illness Studies (ICEDBIS) is a group with participants from over 30 countries who are working on studies to estimate the burden of enteric illness. The Collaboration has joined forces with the WHO Global Burden of Foodborne Disease Initiative since its inception in 2006. At FERG 2, the Enteric Diseases TF discussed work presented by the Collaboration on estimating the global burden of salmonellosis, an important cause of morbidity and mortality due to diarrhoeal diseases. To estimate the global burden of non-typhoidal salmonellosis, the group synthesized all available data, including data from prospective, population-based studies, studies that adjusted laboratory-based surveillance data using an under-reporting multiplier and routine notification data.

The Enteric Diseases TF welcomed this multi-pronged approach and agreed that it may need to use a similar approach to estimate the global burden for other pathogens. ICEDBIS was asked to **re-examine the use of some multipliers** of under-reporting which were considered to be too low and to **investigate a way to validate the use of returned travellers' data** from a Swedish study. The Collaboration was asked to **provide uncertainty analyses that reflect the reliability of the different types of data used**. As the issue of uncertainty will be important for the work on other causative agents affecting all Task Forces, it was recommended that the **FERG develop a standardized, hierarchical approach for ranking evidence and describing uncertainty.**

6.1.3 Enteric Diseases Task Force workplan for 2009-2010

The Enteric Diseases TF re-visited the priority list of causes generated at FERG 1 and shortened and reprioritized it according to the following criteria:

- Removal of 'negligible foodborne diseases', i.e. diseases resulting from pathogens which contribute little to the overall foodborne burden;
- Removal of pathogens with 'low pathogenicity', i.e. pathogens that do not lead to symptomatic disease or sequelae;
- Removal of parasites which fall under the remit of the Parasitic Diseases Task Force.

Table 3: Priority pathogens for the Enteric Disease TF in 2009

Bacterial toxins (<i>Bacillus cereus</i>)	<i>Listeria monocytogenes</i>
Bacterial toxins (<i>C. perfringens</i>)	(<i>Mycobacterium bovis</i>)
Bacterial toxins (<i>S. aureus</i>)	Non cholera <i>Vibrio parahaemolyticus</i>
Brucella spp.	Non cholera <i>Vibrio vulnificus</i>
Campylobacter spp.	<i>Vibrio cholerae</i> 01/0139
Clostridium botulinum	Norovirus
Entero-aggerative <i>E. Coli</i> (EAggEC)	<i>Salmonella</i> (non-typhoidal) spp.
Entero-pathogenic <i>E. Coli</i> (EPEC)	<i>Salmonella</i> (typhoid)
Entero-toxigenic <i>E. Coli</i> (ETEC)	<i>Shigella</i> spp.
Shiga-toxin producing <i>E. Coli</i> (STEC)	<i>Yersinia</i> spp.
Hepatitis A	

Work should be commissioned to **review the available surveillance and outbreak data in order to enhance estimates of incidence and mortality** being generated in the systematic review of diarrhoeal disease in populations > 5 years old. The TF also discussed recommending a **review of foodborne *Mycobacterium bovis* infections**, which should be conducted in collaboration with the efforts of the WHO STOP TB department and their regular updates of estimates of the global burden of tuberculosis.

In addition, the **co-morbidity issues pertinent to the enteric pathogens priority list should be explored.**

Summary of Enteric Diseases TF Discussion and Recommendations

- o Draft report presented on the global burden of diarrhoeal diseases morbidity, mortality and etiology:
 - > 25 000 titles were screened; 84 papers were included in the review;
 - Draft estimates due March 2009;
 - Include surveillance, outbreak and other relevant data to complete the burden picture;
- o Estimate of the global burden of *Salmonella* presented by ICEDBIS:
 - Estimate to be based on synthesizing all available data from a range of sources;
- o TF pathogen list shortened and re-prioritized;
- o Workplan for 2009 developed.



A detailed summary of the Enteric Diseases Task Force workplan is given below.

Enteric Diseases TF workplan for 2009-2010

Causative agent/s	Activities	Time frame
Diarrhoeal disease morbidity and mortality	1. Improve the estimates of incidence and mortality of diarrhoeal diseases of different etiologies in populations > 5 years of age: <ul style="list-style-type: none"> - Commission work to scrutinize and use relevant surveillance, outbreak and any other data to for missing or non-robust data. 	March 2009
	2. Provide feedback to contractors who have undertaken the literature review of diarrhoeal disease morbidity, mortality and etiology for populations > 5 years of age: <ul style="list-style-type: none"> - Review and comment on abstraction sheets; - Review report and provide editorial comment. 	February 2009 June 2009
	3. Estimate the global incidence and proportion of disease that is foodborne for each pathogen: <ul style="list-style-type: none"> - Commission three systematic data and literature reviews of priority pathogens. These reviews are to include review and use of surveillance, outbreak, source attribution and other relevant data and cover: (1) Bacterial toxins, (2) <i>Clostridium botulinum</i>, (3) Invasive species. - Together with the Source Attribution TF, organize expert elicitation to identify the proportion foodborne for remaining pathogens with missing or non-robust estimates. 	Review by October 2009 Expert elicitation during 2010
	4. Hold meeting to review status and work on incorporation of all information into burden estimates.	June 2009
Salmonella spp.	1. Provide input on <i>Salmonella</i> burden of disease work to authors.	Immediate
	2. Consider commissioning work where necessary to modify and enhance <i>Salmonella</i> burden of disease estimates.	June 2009

6.2 Parasitic Diseases Task Force

The following section describes the review work currently ongoing in this Task Force. Estimates of the burden of disease arising from these causes are expected in 2009.

6.2.1 Intestinal protozoa

The intestinal protozoan parasites causing human illness include *Giardia duodenalis* (synonym *intestinalis*), *Entamoeba histolytica*, *Cryptosporidium hominis/parvum*, *Isoospora belli/natlensis*, *Cyclospora cayatanensis* and *Blastocystis (hominis)*. All are characterized by having direct life-cycles in which an environmentally resistant

transmissible stage (cyst or oocyst) is produced through which infection is acquired by ingestion. All stages are immediately infective upon being passed in the faeces apart from *Cylospora* and *Isospora* which require one or two days for the oocysts to sporulate (reach infectivity) in the environment. Transmission can be person to person or by the typical faecal-oral route under conditions where hygiene is compromised. Alternatively, cysts and oocysts can contaminate the environment, including water or food and be transmitted via these vehicles through ingestion. Mechanical vectors such as insects may be involved in transferring cysts and oocysts from contaminated areas to food. In order to estimate the global burden of infection and the proportion related to foodborne transmission a comprehensive literature search is being conducted.

The frequency of citations for *Giardia*, *Cryptosporidium*, *Entamoeba* and *Blastocystis* showed a marked increase from 1990 to 2008, with the number of citations for *Isospora* and *Cyclospora* remaining constant. There are few direct reports of foodborne transmission, though *Cyclospora* has been implicated in outbreaks involving raspberries, fresh salad and fruits mainly in the United States of America (USA). *Cryptosporidium* transmission has occurred with apple cider in the USA, as well as transmission on raw meat dishes and vegetables, and *Giardia* and *Entamoeba* have been implicated in raw foods as well as through poor hygiene of food handlers. The next phase of the process will be to review non-English and unpublished resources for the three core parasites *Giardia*, *Cryptosporidium* and *Entamoeba* only. Once completed, a systematic review of selected references will be conducted so as to estimate the extent of morbidity and mortality caused by these parasites, and to provide an estimate of parasitic infection due to foodborne transmission for each WHO geographic region.

6.2.2 Fascioliasis

Fasciola hepatica infections are common in domestic ruminants and wildlife throughout the world. Humans usually become infected by ingesting the metacercarial stage found on aquatic plants grown in water contaminated with faeces from animals harbouring the infection. Infection may also be acquired from contaminated drinking water or cooking utensils. Immature flukes migrate through the liver and cause the acute phase of illness. Severe pathology results from ingestion and destruction of parenchymal tissue by the parasite. The chronic phase, during which the parasites are found in the bile ducts, tends to be less severe but causes bile duct proliferation, dilatation and fibrosis. Death is uncommon, but is usually caused by haemorrhaging into the bile duct, especially in children.

In this review, multiple databases were searched and special efforts are made to obtain references published in local journals or very secondary, non-digitalised journals, unpublished reports, and theses. Many papers on fascioliasis have been published in the non-medical literature, so the scope of the search was also widened to include these. Almost 2000 papers were identified with reports of human infections from 75 countries in all regions of the world. In contrast to patients in developed countries who are diagnosed in health centres at the acute phase of the disease, in developing countries, children and adults are mainly in the advanced stage of chronic disease. Complications and sequelae include bleeding, biliary cirrhosis, multiple extrahepatic venous thrombosis, pancreatitis, post-treatment biliary colics, and potential transplacental infection. Fatality has rarely been reported in the literature, although appropriate studies are pending, mainly in human endemic areas where child mortality is high. Infection sources include a range of fresh and terrestrial water plants, local foods, and beverages. The next step will be to estimate the proportion of fascioliasis attributable to food.



6.2.3 Alveolar echinococcosis

Alveolar echinococcosis (AE) is a parasitic disease caused by the metacestode of *Echinococcus multilocularis*. Foxes and dogs are the primary hosts but humans can become infected either directly or indirectly from dog or fox faeces. The disease can be transmitted through food if parasite eggs contaminate human foodstuffs. The disease is endemic in canines through much of the northern hemisphere, although there is a particular problem with human AE in China. To estimate the annual global incidence of the human disease, all known endemic countries were considered, including most countries in Europe, Turkey, Iraq, the Islamic Republic of Iran, the Russian Federation, central Asia, China and Japan. Although AE is endemic in canines in North America, there appears to be practically no transmission to humans in the USA and Canada.

Available data varied from country to country. Some countries, such as Germany and Switzerland, have detailed incidence data on human AE, while other countries have only sporadic case reports or animal data. Data from China consist of a number of large studies using ultrasound imaging for diagnosis on at-risk populations, presented as prevalence data. Preliminary estimates of the incidence for each country were presented at FERG 2. A stochastic analysis was used to model the uncertainty in the data input. The literature review and database are almost complete and the authors are now attempting to obtain some additional original and unpublished data.

Textbox 2 – ‘Young stars in science’ - a FERG tradition continues

As in 2007, the FERG meeting was again an occasion for exceptionally talented students to participate and contribute to the expert discussions. Three ‘young stars in science’ from the Ross University School of Veterinary Medicine, St Kitts and Nevis, under the supervision of Professor of Epidemiology and Public Health Paul Torgerson, presented the findings of their review work on alveolar echinococcosis. Students Krista Keller, Melissa Magnotta, and Natalie Ragland-Beckford (photo) gave an excellent presentation describing the data and studies they identified to eventually estimate the global burden of alveolar echinococcosis.

The students were delighted to participate in the FERG meeting and described their interaction with the experts and with WHO as ‘rewarding and inspiring’. They all hope to continue their involvement in public health issues and infectious diseases. ‘The most challenging aspect of this work though was balancing both schoolwork and research’ they said. Natalie Ragland-Beckford also highlighted the difficulties in ‘working with countries that did not have data, finding very old data and knowing when to stop and move on’. The three young scientists are continuing their involvement in this work and will assist Professor Torgerson with the publication of the findings. ‘We are pleased to continue the FERG tradition of including young scientific talent in the work of our group and bringing together several generations of scientists’ says Dr Arie Havelaar, the Chair of FERG. Dr Jørgen Schlundt, Director of Food Safety, Zoonoses and Foodborne Diseases at WHO was impressed by the students’ work and sees their involvement in FERG as ‘an excellent example of WHO’s capacity building at all levels of the organization’.



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6.2.4 Cysticercosis and cystic echinococcosis

Cysticercosis is the condition that arises when humans are infected with the larval stage of the cestode *Taenia solium*, the pork tape worm. Humans are the natural definitive host of this parasite. Although infection with the adult worm causes little disease, cysticercosis carries a much greater disease burden. Cystic echinococcosis is a condition in livestock and humans that arises from eating infective eggs of the cestode *Echinococcus granulosus*. Dogs are the primary definitive hosts for this parasite, with livestock acting as intermediate hosts and humans as aberrant intermediate hosts. The outcome of infection in livestock and humans is cyst development in the liver, lungs, or other organ system. A multiple meta-analysis to estimate the global burden of *Taenia solium* cysticercosis and cystic echinococcosis is being conducted. Literature searches in international literature search engines identified 170 relevant articles on taeniasis, 284 on cysticercosis, 193 on neurocysticercosis, 293 on cysticercosis manifestations, 417 on cystic echinococcosis, and 770 on cystic echinococcosis manifestations.

Data are currently being extracted from the articles that have met the preliminary inclusion criteria and entered into databases designed specifically for this project. General exclusion criteria include: apparent high selection bias, different eligibility criteria used between groups, groups representing different target populations, and absence of case definitions. In addition, analysis-specific eligibility criteria, such as the required use of diagnostic imaging for the neurocysticercosis epidemiology analysis, will be utilized. The final data will determine the frequency of infection, frequency of manifestations, and mortality by age and sex, to estimate disease burden due to *Taenia solium* cysticercosis and cystic echinococcosis globally.

6.2.5 Parasitic Diseases Task Force workplan for 2009 to 2010

The Parasitic Diseases TF recommended the addition of *Trypanosoma cruzi* to the list of potentially foodborne parasites as recent reports from South America have suggested transmission of this infection through water and food contaminated with parasites from triatomine insects.

Estimation of the proportion of foodborne infection will likely require expert elicitation methods with regard to intestinal protozoa, alveolar and cystic echinococcosis, toxoplasmosis and ascariasis.

Issues of co-morbidity that will need to be addressed include HIV/AIDS in toxoplasmosis and cryptosporidiosis, liver carcinoma secondary to clonorchiasis and opisthorchiasis, as well as general co-morbidity due to multiple parasitic infections in developing countries.

Summary of Parasitic Diseases TF Discussions and Recommendations

- o The systematic review of intestinal protozoa will focus on the epidemiology and health effects of *Giardia duodenalis*, *Entamoeba histolytica* and *Cryptosporidium* species, together with review of data on food as a source of infection;
- o The systematic review of fascioliasis will focus on the epidemiology and health effects of *Fasciola* spp. together with review of data on sources of infection;
- o Preliminary estimates of the global incidence of alveolar echinococcosis were presented together with a stochastic analysis to model uncertain data;
- o Meta-analyses will be conducted to estimate the global incidence of *Taenia solium* cysticercosis and cystic echinococcosis, and their health effects;
- o *Trypanosoma cruzi* should be added to list of potentially foodborne parasites;
- o In 2009, the Parasitic Disease TF recommended the commission of work on trichinellosis, toxoplasmosis, clonorchiasis, opisthorchiasis, anisakiasis and ascariasis.



Parasitic Disease TF workplan summary for 2009-2010

Causative agent/s	Activities	Time frame
Intestinal protozoa (<i>Giardia</i> , <i>E. histolytica</i> , <i>Cryptosporidium</i>)	<ul style="list-style-type: none"> Systematic literature review on the prevalence and incidence (all except Ascariasis). 	April 2009
Fascioliasis		
Alveolar echinococcosis	<ul style="list-style-type: none"> Systematic literature review on the health effects (all except Ascariasis). 	FERG 3
Cystic echinococcosis		
Cysticercosis		
Trichinellosis	<ul style="list-style-type: none"> Systematic literature review on the proportion of disease acquired through food (except Cysticercosis, Trichinellosis, Anisakiasis, Clonorchiasis and Opisthorchiasis). 	FERG 3
Anisakiasis		
Toxoplasmosis	<ul style="list-style-type: none"> Systematic literature review on co-morbidities for Toxoplasmosis and Ascariasis. 	FERG 3
Clonorchiasis and Opisthorchiasis		
Ascariasis	<ul style="list-style-type: none"> Systematic literature review of association between carcinoma and clonorchiasis and opisthorchiasis. 	June 2009

6.3 Chemicals and Toxins Task Force

The following section describes the review work currently ongoing in this Task Force. Estimates of the burden of disease arising from these causes are expected in 2009.

6.3.1 Aflatoxins

Aflatoxins are a family of fungal metabolites produced by a small number of *Aspergillus* species, the most important being *A. flavus* and *A. parasiticus*. Aflatoxins naturally occurring in foods are aflatoxins B1 and B2 (produced by *A. flavus*), and aflatoxins G1, and G2 (produced by *A. parasiticus* in addition to the B aflatoxins). Aflatoxins M1 and M2 are the hydroxylation products of B1 and B2 found in milk and milk products and thus can contribute to human exposure. Aflatoxins are responsible for acute poisoning (aflatoxicosis), for hepatocellular carcinoma, for growth impairment in children and immunosuppression. Aflatoxin B1 is the most potent liver carcinogen known, and is also the most abundant form.

The 2002 IARC Monograph¹⁰ was identified as the most recent comprehensive evaluation of aflatoxins and the Task Force agreed that this was the appropriate starting point for the literature review for this Initiative. A review identified 17 further databases as potential sources of literature on aflatoxins. Database records for key papers in this field were examined in order to determine appropriate subject headings and keywords. All searches were limited to 2001 onwards and to English, French, Spanish and Portuguese, where database limits allowed. Of the 12 833 abstracts generated, 4125 were relevant and examined further, resulting in 348 papers for final inclusion. These are currently reviewed and tabulated by category of aflatoxin levels, disease and exposure biomarkers.

¹⁰ IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 82 (2002). Some Traditional Herbal Medicines, Some Mycotoxins, Naphthalene and Styrene. IARC Press, Lyon, France



Figure 6: Cassava contaminated with Aflatoxin (dark stems) and without Aflatoxin (white stems) on an African street market

6.3.2 Cassava cyanide

More than two thirds of major food plants are cyanogenic, but few contain cyanogenic compounds in the edible part that is consumed. Cassava, a root crop that is processed into several foods in the tropics (Figure 6), contains cyanogenic compounds in its edible parts. Over two thirds of the world population live in countries that consume cassava, and about 200 million people derive a substantial proportion of their daily calorie intake from cassava. Foods processed from cassava roots have been shown to contain cyanogenic compounds and to cause exposure to cyanide. This review was done through searches of Science Citation Index and PubMed databases, reviews of theses, monographs, proceedings of conferences, and searches of local library indexes.

Endemic and epidemic neurological syndromes have been described from areas where exposure to cyanide from consumption of cassava foods is high. Occurrence of endemic ataxic polyneuropathy is high in southwest Nigeria, while occurrence of konzo, a paralytic disease, is high in Mozambique, the Democratic Republic of Congo, the United Republic Tanzania, and the Central African Republic. There appears to be an endemic focus of ataxic polyneuropathy in the state of Kerala in India. Sporadic cases of ataxic polyneuropathy and konzo have been reported outside endemic areas. Exposure to cyanide from cassava foods is high in areas where ataxic polyneuropathy and konzo have been described. High levels of cyanogenic compounds in cassava cultivars, the methods of processing cassava roots, and frequency of consumption of cassava foods contribute to exposure to cyanide in the endemic areas. Reports of no occurrence of neurological syndromes in some areas of high exposure to cyanide suggest that the relationship of exposure and occurrence of disease is not direct.



6.3.3 Peanut allergens

The prevalence of peanut allergy in the USA is estimated at about 0.6-1.0%.¹¹ Food allergies are the leading cause of emergency room visits for anaphylaxis, and most fatal or near fatal anaphylactic reactions are associated with peanut allergy. Peanut allergy prevalence is reported to be increasing in Western countries and some reports indicate that it has doubled from 1997 through 2002. A systematic review has commenced to describe the morbidity and mortality from exposure to peanut allergens and is scheduled to report in 2009.

6.3.4 Dioxins, furans and dioxin-like polychlorinated biphenyls

The WHO International Agency for Research on Cancer (IARC) classifies 2,3,7,8-tetrachlorodibenzo-*para*-dioxin as a known human carcinogen. Studies also show that TCDD, other dioxins, and dioxin-like compounds cause embryonic and fetal development and reproduction problems in rodents and some other species. Food consumption (primarily meat, dairy products, and fish), contributes to more than 90% of the intake of dioxins for the general population. Dioxin in the food supply is known to be dropping in some industrialized countries (e.g. USA). The results from this ongoing review are expected in 2009.

6.3.5 Chemicals & Toxins Task Force workplan for 2009-2010

The Chemicals and Toxins TF identified new priority compounds based on previous criteria but with particular emphasis on the availability of human data as follows:

- Lead: Human data, availability of biomarker of exposure, global impact
- Methylmercury: Human data, availability of biomarker of exposure, global impact;
- Aristolochic acid: Fytotoxin related to Balkan Endemic Nephropathy;
- Cadmium: Human data, availability of biomarker of exposure.

Compounds to be considered for future action include: Organophosphates, melamine, (shell)fish toxins, and other mycotoxins.

The TF outlined specific consumption data needed for each WHO region to assess dietary exposure.

- Aflatoxin: Representative consumption data for Africa and Asia on peanuts (groundnuts) and maize;
- Methylmercury: Representative data on fish consumption, including type of fish and frequency of consumption;
- Cassava: Global distribution on cassava preparation and consumption, as well as information on global exposure to cyanide from cassava.

Summary of Chemical and Toxin TF Discussions

- o Draft reports presented on the global burden of cassava cyanide, aflatoxin, dioxins, and peanut allergens;
- o Workplan developed for 2009.

¹¹ Sicherer SH, Muñoz-Furlong A, Sampson HA. Prevalence of peanut and tree nut allergy in the United States determined by means of a random digit dial telephone survey: a 5 year follow-up study. *J Allergy Clin Immunol.* 2003 Dec;112(6):1203-7.

Chemicals and Toxins TF workplan for 2009-2010

Causative agent/s	Activities	Time frame
Aflatoxin	<ul style="list-style-type: none"> Comprehensive review of relevant health effects. 	June 2009
	<ul style="list-style-type: none"> Summarize occurrence and exposure data Improve dose response relationship between dietary exposure and urinary biomarkers. 	October 2009
Cassava cyanide	<ul style="list-style-type: none"> Neurological symptoms and goitre identified. Co-morbidity and effect of iodine deficiency to be evaluated. Estimate global prevalence based on prevalence estimates for number of countries in Central and East Africa and Jamaica. 	June 2009
Peanut allergens	<ul style="list-style-type: none"> Review epidemiological studies, describe relevant health effects and strength of evidence, identify sensitive population. 	July 2009
	<ul style="list-style-type: none"> Summarize occurrence and exposure data, and try to obtain information from developing countries. 	October 2009
	<ul style="list-style-type: none"> Establish prevalence estimates. So far it looks as if they can only be derived for the USA and the EU. 	2010
Dioxins and dioxin-like PCBs	<ul style="list-style-type: none"> Review available epidemiological studies and describe relevant health effects and dose-response relationship. Describe occurrence and exposure using biomarker body burden. 	April 2009
Lead	<ul style="list-style-type: none"> Summarize blood lead data, particularly for developing countries. Estimate contribution of dietary lead to blood lead. Try to estimate burden of disease from food for different regions based on blood lead levels. 	October 2009
Methylmercury	<ul style="list-style-type: none"> Summarize occurrence and dietary intake data in relation to hair mercury, particularly for developing countries. 	2010
	<ul style="list-style-type: none"> Estimate burden of disease for different regions based on biomarker of exposure. 	2010
Aristolochic acid	<ul style="list-style-type: none"> Review available epidemiological studies and describe relevant health effects and dose-response relationship. Review occurrence data on aristolochic acid for the different regions. 	2010
Cadmium	<ul style="list-style-type: none"> Summarize occurrence of disease and intake data in relation to urinary cadmium. 	July 2009
	<ul style="list-style-type: none"> Estimate burden of disease for different regions based on levels of cadmium in food. 	2010
Pesticides	<ul style="list-style-type: none"> Evaluation of the feasibility of determining an estimate of the global burden of disease. 	July 2009
(Shell)fish toxins	<ul style="list-style-type: none"> Evaluation of the feasibility of determining an estimate of the global burden of disease. 	July 2009
Mycotoxins	<ul style="list-style-type: none"> Evaluation of the feasibility of determining an estimate of the global burden of disease. 	October 2009
Melamine	<ul style="list-style-type: none"> No further action at this point, as FAO/WHO expert group considering this separately. 	



6.4 Source Attribution Task Force (SA TF)

Before attributing the global burden of foodborne disease to specific food commodities, the FERG must clearly define foodborne disease, agree on levels of food categorization, and have data available on food consumption.

Textbox 3 – Attribution of human illness to food sources

Human illness attribution can be defined as the partitioning of the burden of human illness to specific sources. It can be conducted at various points along the food distribution chain, including at the animal reservoir and at the point of consumption (point-of-exposure). Human illness source attribution is increasingly used to support risk management strategies. The choice of method used for attribution largely depends on the risk management questions and availability of data, with combined approaches normally increasing confidence in the results.

Different methods exist for the determination of the proportion of disease that is foodborne. The choice of method to be applied depends to a large extent on the causative agent (which could be a pathogen or chemical) and the exact question(s) to be answered. For pathogens, current methods used to determine the proportion that is foodborne include use of microbial sub-typing, comparative exposure assessment, outbreak data, results from case-control studies of sporadic infection and expert opinion. Attribution for chemical exposures can be determined if both the amounts and frequency of foods and beverages consumed and the levels of contaminants in those foods are known. Each of these methods has inherent limitations and challenges. Synergy and integration of attribution methods should be sought in order to improve the confidence in the results.

6.4.1 Definition of foodborne disease

The definition of 'foodborne disease' requires a delineation of the major transmission routes i.e. food, environment, including water, direct animal contact and person-to-person transmission, particularly in view of the Codex Alimentarius definition of food¹² which includes bottled water (see Definitions, page vii). The experience from the WHO group estimating the global burden of disease arising from unsafe water and sanitation (Textbox 4) was described at the meeting to inform FERG of the steps taken in these source attribution efforts and how to position the results such that they adequately inform policy.

The principal tasks of the Source Attribution TF are to determine (for each hazard) the proportion of disease burden that is attributable to food, and to identify the responsible reservoirs and/or food commodities leading to illness. If feasible, the absolute or relative importance of the various sources should be quantified. Initially, and as described in the terms of reference, the Source Attribution TF should define 'foodborne disease' and 'source attribution' and agree on levels of food categorization and point of attribution. This section summarizes the discussions that the Source Attribution TF had during its first meeting regarding these issues.

Since many foodborne hazards (infectious agents or chemicals/toxins) are transmitted by multiple routes and can 'change' source or vehicle during the transmission from primary production to the consumer, an agreement of the point of attribution is also necessary in order to define when a disease is acquired through food. After lively discussions, the Source Attribution TF agreed that using the point of consumption (i.e. if the hazard is present on or in the food at the time of consumption, it is considered foodborne) was the most simple and understandable definition to be used across all hazards. This definition may, however, not necessarily be the most appropriate when the aim is to formulate effective intervention strategies directed against the primary sources/reservoirs or the most important points of contamination. Where possible and appropriate,

WHO HQ Geneva, 17–21 November 2008

¹² Codex Alimentarius Commission, 2007. Procedural Manual.
ftp://ftp.fao.org/codex/Publications/ProcManuals/Manual_17e.pdf

therefore, the partitioning of the disease burden at other points of attribution should be considered. The attribution to particular reservoirs and/or food commodities, however, may only be feasible for certain hazards and be based on data from a few developed countries.

During the discussions of the definition of foodborne disease, controversial matters in relation to the definition of 'food' were raised. For instance should geophagy (eating dirt), breastfeeding, ice cubes used in beverages, and transfer of agents through the placenta be regarded as food? The delineation of water and food is probably one of the most difficult issues, as water in some respects is considered a food e.g. when bottled, whereas drinking water in general or water used in food preparation is not. Also, these definitions of water as food may differ between countries depending on the national legislation.

Based on the discussions, it was recommended that FERG, in collaboration with all relevant WHO departments, prepare a **FERG position paper describing clear definitions and delineations of the various routes and sources of transmission.**

6.4.2 Food categorization

Food consumption data are used in different ways in human illness source attribution depending on the source attribution method applied. In exposure assessment, consumption or intake data are required as input. Intake data can supplement the results and create a possibility of extrapolation to other regions, where, for example, prevalence or subtyping data are not available. Relating the proportion of outbreaks caused by specific foods to intake data provides a better assessment of the importance of specific foods in outbreaks. In case-control studies of sporadic cases, intake data will support interpretation of the results and may make it possible to extrapolate to other regions.

For FERG, the most important use of consumption data is probably the potential for extrapolating incidence and attribution estimates from one region/country to another. This raises the question of whether FERG should attempt to develop 'source attribution regions'. Criteria or data that may be considered to be used in such a regionalisation (in addition to consumption data) include structure of food safety systems (to assess the general level of food safety), production data, and agricultural and food production systems. A cluster analysis has been applied in an ongoing project for defining regions within the EU to identify human exposure to *Salmonella* related to pork production and consumption. The preliminary results from these analyses were presented and the applicability for the source attribution analyses in FERG was discussed. The possibility of using regions constructed for other studies was also discussed. These include the WHO regions, the 21 GBD regions, and the 13 Global Environment Monitoring System (GEMS)/Food Regional Diets regions.

Harmonization of food categories is required for the use of consumption data in a meaningful way and for source attribution analyses in general. At the Source Attribution TF meeting in April 2008, it was recommended that FERG should agree on a food categorization scheme that is consistent across all Task Forces. The TF examined the scheme developed by the Centers for Disease Control and Prevention (CDC), as well as the food categories of the Codex Alimentarius and the FAO Food Consumption Database groups. The FERG found good agreement between the schemes and concluded that the FAO food categories would be appropriate for most purposes.

It is expected that several of the source attribution analyses will be based on literature reviews. For this reason, a literature 'pilot' survey was conducted on limited causes of foodborne diseases to get an overview of the specific food-



Textbox 4 - Learning from the Global Burden of Disease from Unsafe Water and Sanitation - a journey from evidence to interventions

The evolution of the WHO activities in water, sanitation, hygiene and health (WSH) over the previous decade provides an example of how burden of disease work had been a part of a long-term effort to provide adequate evidence to inform policy-making and decision-taking. The overall objectives of this effort were to ensure that water sanitation and hygiene for health had an appropriate place on the 'development agenda', to support appropriate policy-making for health improvement by the water and sanitation sectors, to guide engagement by the health sector in water and sanitation issues, to support appropriate decision-taking by both health and 'WatSan' professionals, and to inform internal WHO strategy. The flow of work in this area loosely follows a sequence from improved monitoring of the global situation, assessment of the impacts of interventions, cost-effectiveness analysis, cost-benefit analysis, assessment of macroeconomic impacts, assessment of financing needs and sector-wide assessment (addressing, for example, country-by-country financing, institutional and human resource capacity constraints, legal and regulatory issues).

Situation monitoring was progressed through the WHO-UNICEF 'Joint Monitoring Programme' (JMP) for drinking-water and sanitation. This programme uses data from nationally representative cluster surveys collected through interviews with heads of household. These data, combined with data from high quality assessments of the impacts of interventions in drinking-water, sanitation and hygiene, provided a basis from which estimates of the WSH-associated burden of diarrhoeal disease was developed. The JMP work was strongly 'policy anchored' as it constituted the formal monitoring mechanism for the Millennium Development Goal (MDG) Target 7c. In subsequent iterations of the burden of disease work, account was taken of: a) a cluster of diseases entirely associated with/preventable by adequate sanitation (including Guinea worm, schistosomiasis, geohelminthiasis, etc), b) the fraction of malnutrition and of malnutrition-associated disease arising from WSH-associated diarrhoea, c) preventable drowning, and d) the fraction of major vector-borne disease preventable through environmental management. The most recent assessment suggests that almost 10% of the global burden of disease (by DALYs) could be prevented by actions on water resource, drinking-water, sanitation and hygiene and water resource management. This burden is dominated by diarrhoea, malnutrition as a result of diarrhoea and the diverse disease consequences of this fraction of malnutrition.

Experience had shown the importance of understanding the policy-level relevance of the work through the linkage of the Millennium Development Goal Target for drinking water and sanitation with that for infant mortality (38% of all WSH-associated deaths occur in children under 5; improved WSH could decrease child mortality by 28%) and the overall poverty eradication goal of the MDGs (98% of the global burden of WSH-associated disease occurs in developing countries; in the 32 worst-affected countries more than 15% of the burden could be prevented through actions on WSH). This was followed by cost-effectiveness and cost-benefit analysis. The cost effectiveness studies confirmed that WSH interventions were categorized as cost-effective or highly cost-effective health interventions according to the criteria of the Commission on Macroeconomics and Health, depending on intervention and subregion. Findings were delivered in policy-relevant fora and forms and the work attracted significant attention at the UN Commission on Sustainable Development and others.

Important in attracting attention and reflection at these international policy events was the ability to relate the economic analyses to macroeconomic conditions and therefore investment priority decision taking. That it could be shown that the cost of the cholera outbreak of the 1990s in Peru had been higher in one year than the entire Peruvian government spending on water and sanitation in the preceding decade was powerful information for policy-makers. This led to the recognition that an understanding of water and sanitation as sectors was important and yet that insight into these as 'sectors' was poor. As a first step to remediate this, global and regional level financing needs were assessed. The findings of this work fundamentally contradicted many assumptions among sector professionals leading to a global reporting structure coordinated by WHO on behalf of the 25 UN system entities that have major water-related activities. This seeks to understand adequacy, status and trends in financing, legislation and regulation, institutional and human resource capacities in countries and similarly analyse the activities of external support agencies in responding to these. In the pilot phase this detected major information deficits and policy discrepancies in overall 'donor' activity.

Each of the above-mentioned elements of evidence was iterative with a sequence of studies and insights; each was also delivered so as to encourage engagement of other parties in their further development. Furthermore, while initial work was global in outlook, in subsequent iterations this 'drilled down' through regional to national levels and most elements are now supported by simple tools that can be applied at national level. Fundamentally, the approach taken had been based on a 'business model' understanding of how WHO influences local, national and international actions towards development and towards re-positioning water, sanitation and hygiene from components of a 'cycle of poverty' into components of a 'motor for development'.

References:

- ¹ Environmental Burden of Disease Series, N°15. Water, Sanitation & Hygiene – Quantifying the health impacts at national and local levels in countries with incomplete water supply and sanitation coverage. WHO, Geneva, Switzerland, 2007.
- ² Safe Water, Better Health – Costs, benefits and sustainability of interventions to protect and promote health. WHO, Geneva, Switzerland, 2008.

hazards combinations reported and to assess how well such data fit into the FAO food categorization scheme. Initially, only pathogens were included but the survey would be extended to include chemicals, should the approach be found useful. The resulting food-pathogen matrix was based on 292 literature references (186 related to viruses/bacteria and 106 to parasites). The data obtained were summarized and food items were grouped according to the FAO scheme. Complex and multi-ingredient foods were difficult to fit and a common strategy for handling such data may be necessary.

Based on the above, the following points were discussed and concluded:

- FERG should review the need for a **Global Atlas of Food Consumption**, particularly for chemicals where the atlas may assist with exposure and disease modelling;
- It may be necessary to **devise specific source attribution regions** of the world to estimate source attribution;
- FERG should use the **FAO food categories** in the first instance;
- FERG should consider extending the review for food-pathogens matrices by a **more comprehensive and systematic approach** (systematic review) **to include chemicals**.

6.4.3 Global Atlas of Food Consumption

Following a recommendation from the FERG 1, the WHO Secretariat, in collaboration with FAO, is assembling a Global Atlas of Food Consumption. The purpose of this Global Atlas of Food Consumption is to provide important consumption information linking exposure to contaminated food to human disease. The Global Atlas will primarily combine consumption data with available estimates of food contamination in order to estimate contaminant-specific levels of exposure through consumption. Secondly, applying these exposure levels to dose-response modeling will then provide estimates of disease in the human population due to these exposures.

The Global Atlas of Food Consumption will build upon information already available from existing regional and global food consumption databases, supplemented with information from regional or national food consumption surveys. Information on some of the existing data collection Initiatives was obtained using common search engines and from experts at FAO, WHO, Wageningen University and Research Centre (Netherlands) and the Technical University of Denmark. Various existing data sources were identified (Appendix 4), their content evaluated and their usefulness assessed as surrogate data for exposure as part of attribution modelling. The challenges of developing a Global Atlas of Food Consumption include different data collection methodologies and the varying food grouping schemes that are applied by the various sources, incomplete food consumption data sets as well as poor or non-representative geographical coverage in some regions. Most of the available data stem from developed countries, which is likely to have implications for the generalisability of the results. In addition, data is gathered through a variety of food categorization schemes.

As much of these data have been assembled for different purposes, many of the food categories are defined too broadly to be useful as a proxy for exposure (e.g. red meat, milk and eggs, poultry and eggs). Although food availability does not equate to food consumption, there is a correlation so that the former can be used as a proxy for the latter. Similarly, household budget data can be used to estimate which foods are available for consumption. These data sources can be used to supplement or refine estimates of food consumption in areas where such data are lacking. From this analysis, it appears that FAO's Food Balance Sheets are probably the most suitable source to form the basis for a Global Food Consumption Atlas, since these data have a near global coverage, were collected through similar



methodology, provide a large number of distinct food categories and provide historical data. Although these data are based on food availability statistics, efforts have been made to extrapolate these to estimate consumption. The large number of individual food items in this database allows for (re)grouping of items to match food categories applied in certain attribution modeling methods, e.g. CDC categories for food commodities. The level of detail of the data also allows for food consumption cluster analysis and to link foodborne pathogen or chemical contamination-specific prevalence/incidence data to food consumption (patterns). Exposure to contaminated foods, as approximated by estimated contamination levels of foods consumed can be used directly for attribution modelling or to break down composite/complex foods into ingredients. As a next step, **FERG TFs need to review available data sources and determine if existing data can meet their need for food consumption data**. Other recommendations of the TF are summarized in Table 4 below.

Table 4: Summary of Source Attribution discussions and recommendations

Theme	Discussion point	Recommendation	Actor(s)
Definition of foodborne diseases	Clear definition needed.	Provide position paper on definition.	Source Attribution TF
Food consumption data	A variety of potential data sources are available.	To review available data sources to determine if existing sources meet data needs.	All TFs
Food categorization	A variety of schemes exist, but different categories are needed for different source attribution approaches.		

6.5 Issues and problems common to all FERG Task Forces

In the course of their discussions, all Task Forces identified issues and problems which are common to all, including:

Summary of Issues, Problems and Potential Solutions Shared by all FERG Commissioned Scientists:

- o Lack of published data from developing countries;
- o Translating papers from less common languages into English.

Suggestions and Recommendation for Future Commissioned Work:

- o Frequent interaction between TF members, WHO Secretariat and authors is essential;
- o More detailed guidelines for systematic reviews to streamline the abstraction and review process are required, including a template for the construction of literature databases;
- o A short paper for commissioned scientists outlining the exact data needs for the purpose of deriving Disability Adjusted Life Years (DALYs) would be useful;
- o Clarification of the role of the TF designated focal point person and TFs in liaising with commissioned scientist is necessary.

7

FERG 2 stakeholders meeting

PURPOSE OF THE MEETING

The second meeting of the stakeholder community of the World Health Organization's (WHO) Initiative to Estimate the Global Burden of Foodborne Diseases was held on Thursday, 20 November 2008. The purpose of the meeting was to:

- Provide an opportunity for all relevant sectors of especially developing countries to actively engage with the research conducted through the Initiative;
- Expand the current list of partners and open new channels for multi-sectoral technical cooperation, networking and fundraising;
- Inform of the Initiative's progress and receive stakeholders' input on the Initiative as it moves into its second year.

The meeting was chaired by Dr Arie Havelaar (RIVM, Bilthoven, the Netherlands) who is also chair of the Foodborne Disease Burden Epidemiology Reference Group (FERG). Dr David Heymann, the Assistant

Director-General for the Health Security and Environment cluster at the WHO, opened the meeting by welcoming stakeholders and FERG Members. Dr Heymann outlined the global threat to public health security posed by foodborne diseases. He emphasized the need to estimate the global burden of foodborne diseases to inform policy and perform cost-effectiveness analyses of food safety intervention and control measures. Dr Heymann underlined the strong commitment of the WHO Director-General, Dr Margaret Chan, to this Initiative and to improving food safety world-wide. Dr Jørgen Schlundt, Director of the WHO Department of Food Safety, Zoonoses and Foodborne Diseases, described the history and structure of the Initiative and the FERG and summarized some of the Initiative's achievements during its first year.

"Governments need to give food safety just as much attention as they devote to the quality and safety of pharmaceutical products. Not everyone needs to take medicine every day, but all people need food, each and every day".

Dr Margaret Chan, WHO Director-General

WHO ARE THE STAKEHOLDERS?

The stakeholder community of the Initiative includes all constituencies with an interest in using foodborne disease burden data for decision making, research purposes, and advocacy. These are multi-sectoral and multi-disciplinary, and include WHO Member States, bi- and multilateral organizations, the UN and other

international organizations, foundations, scientific networks, research institutions, consumer groups, the food, agricultural and pharmaceutical industry, as well as the public and scientific media. Over 30 stakeholders and their umbrella organizations attended the meeting (see Box 1).

Box 1: Stakeholders attending the second meeting of the stakeholder community of the WHO Global Burden of Foodborne Disease Initiative (including press conference attendees)

International, bi-lateral and non-governmental organizations, consumer groups and networks

Center for Science in the Public Interest (CSPI)
European Commission
European Food Information Council (EUFIC)
Food Safety Network, University of Guelph, Canada
Food Standards Agency of the United Kingdom
GALVmed
Industry Council for Development (ICD)
International Federation for Animal Health (IFAH)
International Food Information Council (IFIC)
International Labour Office (ILO)
International Food Policy Research Institute (IFPRI)
International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations (IUF)
International Union of Food Science & Technology (IUFoST)
Med-Vet-Net



Box 1 continued: Stakeholders attending the second meeting of the stakeholder community of the WHO Global Burden of Foodborne Disease Initiative (including press conference attendees)

International, bi-lateral and non-governmental organizations, consumer groups and networks (continued)

National Veterinary Institute, Norway
 Permanent mission of Canada, Geneva
 Permanent mission of The Netherlands, Geneva
 Permanent mission of Mexico, Geneva
 Permanent mission of Romania, Geneva
 Permanent mission of Italy, Geneva
 Permanent mission of Zimbabwe, Geneva
 Safe Tables Our Priority (S.T.O.P.)
 United States Department of Agriculture - Food Safety and Inspection Service
 United States Department of Agriculture - Foreign Agriculture Service
 World Trade Organization (WTO)

Scientific & public media

British Medical Journal
 Food Biotechnology
 International Journal of Food Microbiology
 Reuters
 The Lancet Infectious Diseases
 The New England Journal of Medicine
 Tribune de Genève

THE IMPACT OF FOODBORNE DISEASES

Stakeholders recognized and emphasized the need to estimate the global burden of foodborne diseases. Attention is often given to the problem of foodborne diseases following high profile outbreaks or contamination events. These outbreaks generally attract a lot of media attention and can be a catalyst for changes in policy; however, outbreak-associated illnesses and deaths account for just a small proportion of the total burden of foodborne diseases annually. The estimated 2.2 million deaths from diarrhoeal diseases reported by WHO in 2004 exclude those arising from outbreaks of intestinal diseases.

Ms Nancy Donley, President and Spokesperson for Safe Tables Our Priority (S.T.O.P.) gave a testimony on behalf of victims of foodborne diseases (see Box 2). Foodborne diseases are often perceived as causing only mild illness, but serious and long-term consequences do occur.

The cost of foodborne diseases includes the long-term medical costs to foodborne illness victims, the psychological toll and associated costs to victims and their communities, lost productivity costs due to long-term effects of foodborne illnesses, and premature deaths as a result of complications of a foodborne illness.



Nancy Donley speaking at the Stakeholder Meeting.

Box 2: Unsafe food kills - the victim's perspective



Safe Tables Our Priority (S.T.O.P.) is a non-profit grassroots organization devoted to victim assistance, public education, and policy advocacy for safe food and public health. S.T.O.P.'s mission is to prevent unnecessary illness and loss of life from pathogenic foodborne illness. More information can be found on their website www.safetables.org

Nancy Donley's moving testimony of losing her young son poignantly illustrated the need for the WHO Initiative to Estimate the Global Burden of Foodborne Diseases:

"We applaud the World Health Organization's efforts on gathering foodborne disease mortality and morbidity data in order to understand its burden to society and to prioritize efforts in preventing foodborne disease. "

"Knowing and understanding the scope and toll of foodborne disease is imperative in order to ensure that the necessary governmental resources to prevent foodborne illness are made available."

"It is essential that [the cost associated with the long-term effects of foodborne illness] get factored into the estimated burden to society so that resources necessary for foodborne illness prevention are properly understood and put into place."

"One long-term after-effect that rarely, if ever, gets considered is the psychological toll of foodborne illness and its associated costs. "

"Food is a necessity of life. We all have to eat, there's simply no option. And as borders disappear with the globalization of the world's food supply, it's crucial to keep the advancement of food safety and the prevention of foodborne illness a top priority in world affairs."

Many of the bacteria, parasites, and viruses that cause symptoms of acute diarrhoea and vomiting can lead to other long-term complications or sequelae with serious health effects, sometimes leading to premature death. For example, infection with *Campylobacter* can trigger Guillain-Barré syndrome, an acute paralysis that can take weeks to months to recover from with some patients experiencing long-term neurological symptoms. Haemolytic uraemic syndrome, a leading cause of acute kidney failure in children, is often the result of infection with *E. coli* O157. Foodborne chemical contaminants often cause chronic conditions rather than acute problems; in Africa, exposure to aflatoxins, which are fungal toxins, is associated with liver cancer. In some parts of South East-Asia, a parasitic infection with liver fluke can lead to cancer of the bile duct which is invariably fatal. Long-term complications cause a substantial disease burden from foodborne diseases and need to be factored into estimates of the overall burden of disease.

The FERG will estimate the global burden of foodborne diseases using a summary measure of health - the Disability Adjusted Life Year, or DALY - which takes into account acute illness and long-term complications, in addition to premature deaths. The psychological and social impact of foodborne diseases on family members and others in the community is important but more difficult to measure.

Foodborne disease cause death and suffering even in the richest countries of the world. The true tragedy of foodborne diseases, however, is played out in poor countries where foodborne diseases are also a major obstacle to global development efforts. Foodborne disease burden estimates are important to demonstrate the impact of both unsafe and safe food on development. Without investment in food safety, the achievement of the Millennium Development Goals (MDGs) is jeopardized. At least four out of the eight MDGs are directly affected by foodborne diseases.



MDG 1: Eradicate extreme poverty and hunger - Foodborne diseases are diseases of poverty

- In settings of poverty, food storage and preparation practices are often inadequate leading to food contamination. Poorer countries often have weak or no food regulatory systems and enforcement. While many foodborne diseases may have a short duration, the high frequency of episodes results in high rates of absenteeism and medical expenses. In hunger situations, people are less likely to discard contaminated food, leading to increased exposure to contaminated foods.

MDG 3: Reduce child mortality - Foodborne diseases contribute significantly to child mortality

- Children are particularly vulnerable to contaminated environments, including food. An estimated 2.2 million deaths occurred from diarrhoeal diseases in 2004. Diarrhoeal diseases exacerbate malnutrition leading to a vicious cycle of morbidity and mortality. Children living with HIV/AIDS are especially at risk of foodborne opportunistic infections.

MDG 5: Improve maternal health - Some foodborne diseases have direct impact on maternal health

- Listeriosis and toxoplasmosis in pregnant women, for example, can lead to miscarriages, premature birth and stillbirth, all of which increase the risk of maternal mortality. Infected children who are born healthy may develop severe complications later in life, such as meningitis and blindness.

MDG 6: Combat HIV/AIDS, Malaria and other diseases

- All persons affected by HIV/AIDS are more likely to have opportunistic infections, and will develop more severe disease including increased mortality.

Foodborne diseases impact trade and many industries and their workers at all levels. An outbreak of foodborne disease or the identification of a single contaminated food ingredient can lead to the recall of tons of food products with considerable monetary losses from decreased production and trade embargoes, as well as damage to the tourist industry. Outbreaks or contamination events may also lead to business closures resulting in temporary or permanent job losses for workers, events that can affect not only households but whole communities.

Food workers may become victims of foodborne diseases from

consuming contaminated food at their workplace or from direct contact with infected food animals or a contaminated working environment. Training of food workers in safe food practices is an important step in the prevention of foodborne disease. However, food workers also need a work environment that promotes the production and preparation of safe food. Workers, particularly in developing countries, often lack sanitary and other services (e.g. appropriate toilet and hand-washing facilities) that would improve the safety and quality of the foods they produce.

OVER TO THE STAKEHOLDERS: COMMUNICATION, ADVOCACY, AND POLICY IN THE WHO INITIATIVE

During the meeting, stakeholders formed working groups where detailed views and suggestions were voiced and documented, with specific focus on:

- (1) further developing the Initiative's communications and advocacy strategy and
- (2) ensuring that the findings of the Initiative are useful to and feed directly into policy.

Stakeholders suggested developing a communication plan which includes (a) raising awareness about the Initiative, (b) disseminating interim results, and (c) sharing results with policy-makers at the earliest possible opportunity. It was noted that a variety of different strategies will be needed to communicate effectively with different stakeholder groups.

Raising awareness about the Initiative -- the internet and newsletters were seen as important tools for communicating information about the Initiative and raising awareness. It was suggested that the WHO submit summary articles to organizations with pre-existing newsletters, such as food safety authorities, industry groups, and other stakeholder organizations. It was suggested that the WHO may want to consider producing a newsletter specifically for the Initiative. Press releases directed at the Ministries of Health or Agriculture may be a good way to disseminate information in developing countries.

It was recommended that the Initiative raise awareness about its purpose and agenda among institutions that may be in a position to fund future research recommended by the FERG, such as the European Commission. Providing information about the Initiative to businesses that promote and advertise agro-business and 'green food' issues may forge closer links with industry, and in turn, increases in funding. In these communications it would be useful to focus on the wider picture and interconnected nature of food and food production in the global economy. For example, one could communicate the global



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Stakeholders expressing views at the Stakeholder Meeting.

nature of food and the fact that a single food product eaten in one country may contain ingredients from many other countries.

Disseminating interim results -- stakeholders strongly recommended that the Initiative communicate interim findings rather than waiting for the final product to be complete. Information on the impact of foodborne diseases and the food commodities implicated should be shared with a broad audience in an open and transparent way. Stakeholders would welcome the dissemination of interim results in peer reviewed journals; however, it was suggested that the Initiative explore other ways in which professionals obtain this information. When appropriate, systematic reviews and other work commissioned by the WHO Initiative should also be made available to stakeholders on the Initiative's website and in hardcopy. The early engagement of stakeholders was very welcome and this open dialogue should continue, with face-to-face meetings in addition to any other communications.

WHO should rely, in part, on umbrella stakeholder groups to help disseminate information to other stakeholders; however, simple messages developed by WHO on the Initiative's findings would be useful and could be disseminated more widely. Messages regarding the burden of foodborne disease should be formulated very carefully especially when raised in the context of food insecurity.

There was some debate about whether consumers would be interested in hearing about the Initiative and the resulting estimates of the burden of diseases, or whether the subject would be too technical for consumers. The group concluded that any messages could be used to inform consumers about the Initiative and its findings; however,

care will be needed when formatting the messages. Scientists currently communicate that "food has never been safer" - this could generate confusion and anxiety among the public. Consumer groups offer a way of channelling the Initiative's messages out to consumers, and expressed strong interest in playing a role in this.

Sharing results with policy-makers -- policy-makers are the key group that needs to be specifically targeted by WHO and a separate communications strategy should be developed to ensure that the Initiative's findings are turned into public health action. There was some disagreement about the timing of involving policy-makers in the Initiative with some advocating involvement at the current, others at a later stage.

Stakeholders stressed that the burden information provided by WHO should include the long-term complications suffered by victims and the larger societal impact to adequately demonstrate the overall human health impact from foodborne diseases. Policy-makers and other stakeholders should be made aware of how foodborne diseases impact the industry and its workers. Moreover, information on demonstrated ways to reduce foodborne diseases should also be disseminated to policy-makers, wherever possible. A clear definition of foodborne disease is needed when communicating with policy-makers.

Data on the overall burden of foodborne diseases will help prioritize food safety and the design and implementation of prevention and control measures for foodborne diseases. However, food safety interventions will be more focused and more successful if the specific food commodities causing foodborne diseases are identified. Source attribution information - that is, information on the specific food causing illness - will be vital for informing policy. Moreover, information is needed on where in the food supply chain contamination occurs. Intervention studies which can demonstrate the effectiveness of different interventions are desirable, but are difficult to implement for foodborne diseases. These comments were followed by a discussion endorsing the detailed source attribution approach being employed by the FERG.



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Stakeholders expressing views at the Stakeholder Meeting.

WHO should not just perform analysis of the data but also make policy recommendations as this will ensure a nonbiased and balanced view. Ranking of countries on important food safety indicators was suggested, though some thought this would be counter-productive. Stakeholders recommended that WHO map out the next steps of the Initiative. The 5-year term of the Initiative was considered short and continued efforts to monitor burden of foodborne diseases will be needed.



The Initiative should engage all relevant policy actors ranging from civil society groups (such as consumer groups and labour unions), to the private sector, to governments, and international organizations. WHO regional offices should also be informed and the Initiative should consider reporting to the World Health Assembly. The Codex Alimentarius Commission should take note and consider the results of the Initiative. Consumer groups and other grassroots organizations were thought to play a critical role in advocating changes in food safety policy and should therefore be

a target for this new information. The ongoing work on the Initiative will be strengthened through capacity building in and with countries, including training on burden of disease methods and the use of these estimates for conducting cost-effectiveness analyses of food safety intervention and control measures. Research institutes and universities in WHO Member States should be engaged so that appropriate training can be provided. Ad-hoc teams should continue to provide technical assistance for countries during foodborne outbreaks.

Table 1: Summary of stakeholder input from working groups

Communications/Advocacy	WHO should circulate information on the Initiative to umbrella stakeholder groups by means of newsletters, websites etc.
	The Initiative should raise awareness among funding institutions
	WHO should evaluate how certain stakeholder groups access information to target them more specifically
	WHO should provide interim results to stakeholders
	The messages provided by WHO need to be simple and clear
	WHO should continue to actively involve consumers groups, industry and other grassroots organizations in communications and advocacy
Policy	WHO should use this Initiative to build capacity within countries
	The Initiative should estimate the burden due to specific food sources
	WHO should provide policy recommendations based on burden data
	WHO should involve regions and report to the World Health Assembly

ROLE OF STAKEHOLDERS IN THE INITIATIVE

Stakeholders welcomed their early engagement in this Initiative and gave suggestions on how they would like to interact with the Initiative in the future. Having an opportunity to review materials prior to stakeholder meetings or in-between meetings, as appropriate, was seen as essential in facilitating a greater level of involvement with stakeholders. It was suggested that information on the Initiative and its progress could be shared in a newsletter or on a website specifically designed to share information with stakeholders.

Stakeholders said they would also like more detail on the meth-

ods employed by the FERG and on the specific work that has been conducted. Presentations on both the methods and the results of work reviewed by FERG would be welcome at the next stakeholders meeting in order to get a more complete understanding of and comment on the work conducted. Stakeholders would like to receive more detail on the country burden studies as they are developed and have an opportunity to provide input on how these studies could provide information that would be useful to them.

SUMMARY - STAKEHOLDERS' INPUT TO FERG 2

The FERG Members reviewed the suggestions made by the stakeholders which found wide acceptance particularly with regard to the following points:

1. The Initiative needs to highlight the long-term impact of foodborne diseases on individuals as well as security and development issues in developing countries.
2. Attributing foodborne illnesses to specific food commodities is important for policy and intervention efforts.
3. The next stakeholder meeting should include a presentation of methods and results of work completed to date.
4. WHO should circulate information on the Initiative to umbrella stakeholder groups by means of newsletters, websites etc.
5. WHO should involve regions and report on the Initiative to the World Health Assembly.



8

Conclusions

The first year of the FERG saw the implementation of nearly all technical and logistic recommendations made in the inauguration meeting of the FERG in November 2007. This speaks volumes for both the expertise and the outstanding commitment of the FERG members and resource advisers to the Initiative. In addition, the FERG was presented with the results of the first-year evaluation of the *WHO Initiative to Estimate the Global Burden of Foodborne Diseases*, launched the FERG Source Attribution Task Force and implemented its workplan, took note of substantial progress in the area of advocacy and fundraising and joined interested parties in a specially dedicated stakeholder event, which will be repeated annually.

The objectives of the second FERG meeting (FERG 2) were therefore to:

- Provide an opportunity for members to meet and discuss the progress made over the last 12 months;
- Review and revise the work commissioned according to the FERG Task Forces' (TF) workplans; and
- Adoption of workplans for 2009 for all TFs, including determining proposals for new work to be commissioned.

All meeting objectives were met and considerable progress noted in all technical systematic reviews commissioned for ten different areas of foodborne diseases.

Key milestones achieved in Year 1 of FERG

- o The FERG Source Attribution Task Force was launched and commenced the implementation of its workplan;
- o In accordance with the FERG 1 workplan, ten major review pieces were commissioned and presented at FERG 2;
- o A major stakeholder event was held to involve partners from all sectors in the work of FERG;
- o A formal evaluation of the process and activities of FERG was carried out and presented to ensure goals are being met;
- o The Initiative raised more than US\$ 3 million in in kind and financial contributions (working towards a goal of approximately US\$ 7 million overall).

8.1 Outputs of FERG 2

During the FERG 2 meeting, the following outputs were delivered:

- **Reviews and revisions** of the systematic reviews commissioned according to the FERG 1 workplans, including:
 - Global Burden of pathogen-specific diarrhoeal diseases in older children and adults;
 - Global Burden of intestinal protozoa;
 - Global Burden of *Fasciola* spp.;
 - Global Burden of *Echinococcus* spp.;
 - Global Burden of *Taenia Solium*;
 - Global Burden of disease arising from aflatoxins;

- Global Burden of disease arising from cassava cyanide;
- Global Burden of disease arising from peanut allergens;
- Global Burden of disease arising from dioxins, furans and dioxin-like polychlorinated biphenyls; and
- Compendium of information sources relevant for a global atlas of food consumption.
- A **review of the priority lists of causative agents** in all TFs;
- The **development of detailed new workplans for all TFs for 2009**, including descriptions of the type of burden work to be commissioned, proposals of scientists and/or institutions to undertake the work, a definition of the outputs expected and time frames for the delivery of the products;
- Agreement on the **establishment of a new Country Studies Task Force**;

Table 5: Overview of recommendations and requests made by FERG 2

Area	Topic	Recommendations and requests	Actor/s
Scientific and Technical	Collaboration with external groups	Continue to intensify links with other Initiatives working on burden of disease efforts	WHO Secretariat
		Continue to work closely with the WHO Water and Sanitation group, particularly in view of the source attribution efforts	
		Continue the dialogue with other WHO groups, including TB, HIV/AIDS, child health, to gain insight on co-morbidities from foodborne diseases and invite experts to present burden at FERG 3	
	Guidance on systematic reviews	Develop more detailed guidelines for systematic reviews, including a template for databases developed by scientists	WHO Secretariat
		Clarify the role of Focal Points and TF members in liaising with commissioned scientists	WHO Secretariat
		Instruct scientists to provide co-morbidity information as part of the review	FERG Core group & WHO Secretariat
		Provide additional epidemiological support for scientists conducting reviews, where needed	WHO Secretariat
	Newly commissioned work	Commission work on Bayesian modeling work for WHO cause of death data from vital registration sources	WHO Secretariat
		Commission new systematic reviews in the area of parasitic diseases, enteric diseases and chemicals as outlined in the revised workplans	WHO Secretariat
		Commission systematic review of the recent literature on co-morbidities associated with diseases potentially transmitted by foods	WHO Secretariat
	Documentation	Develop guidance on 'hierarchy of evidence' for burden of disease studies and source attribution, including some guidance for handling uncertainty	FERG Core group and Souce attribution TF
		Provide position paper on use of expert elicitation	All TFs
		Prepare discussion paper on the definition of foodborne disease	Souce attribution TF
		Determine food categorization system	Souce attribution TF
		Summarize data needs in the area of food consumption	FERG TFs
		Summarize agent/co-morbidities combinations of importance	FERG TFs
Establish the Country Studies Task Force		WHO Secretariat	
Logistic	Governance	Continue its stakeholder as well as in-house collaboration and establish new links	WHO Secretariat & FERG
		Communicate regularly with FERG members on all matters arising and continue regular teleconferences with the Core Group and TF Chairs	WHO Secretariat & FERG



- **A formal evaluation of the first year of the processes** and activities of FERG which the WHO Secretariat pledged to act upon;
- **Major engagement of multisectoral stakeholders** who provided valuable input and recommendations to WHO in the areas of technical reviews, communication and policy;
- The **re-appointment of FERG members**, including Chairs and Core Group members.

8.2 Summary of recommendations made by FERG2

The following section summarizes the recommendations made by the FERG to WHO as a result of their plenary discussions, their Task Force meetings and the observations made during the stakeholder event. They are summarized in Table 5.

The second meeting of the FERG saw immense progress in all areas pertaining to FERG and expanded its visibility and engagement with a wide range of intersectoral stakeholders. All participants expressed their commitment to and confidence that progress with the Initiative will continue at its current pace to the effect that the **FERG 3 meeting, which will be held on 26-30 October 2009** will communicate the first results of this global effort in selected disease and causative agents categories.



Figure 7: FERG 2 participants and WHO Secretariat

9

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9. All references for Global Atlas of Food Consumption, please see Appendix 4.



Appendix I – FERG membership and roles

FERG Members

- Formally appointed by the WHO Director-General (DG), following selection procedure
- Allocation to Core Group and Task Forces
- Full participation in all technical discussions

Resource/ad hoc advisers

- Not formally appointed by the DG
- Allocation to Task Forces on ad hoc basis (as required)
- Full participation in technical discussions

WHO Secretariat and other UN Organizations

- Full participation in technical discussions
- Allocation to Task Forces on ad hoc basis

Observers

- Nominated by FERG members (one per member)
- No 'formal' right of intervention in plenary
- Participation in Task Forces, as appropriate

Stakeholders

- Invited by WHO to designated sessions
- Formal right of intervention in designated sessions
- No participation in technical discussions to avoid conflicts of interest



Appendix 2 – List of participants

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Appendix 3 – Agenda

Time	Mon 17 Nov	Tues 18 Nov	Wed 19 Nov	Thurs 20 Nov	Fri 21 Nov	Lead
09:00						
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Colour coding:
 Plenary
 Task Force Meetings
 Restricted meetings

Appendix 4 – The main data and information sources identified for the large-scale Atlas of Food Consumption

Name	Brief description and website
ILSI Europe – The Micronutrient Landscape of Europe	Micronutrient-related issues, including micronutrient sources. Results still to be published http://europe.ilsii.org/events/past/AD+Workshop+April+2008.htm
Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study	Mainly methodology-related, not mentioning food items http://www.helenastudy.com/
European Prospective Investigation into Cancer and Nutrition (EPIC) studies	Prospective cohort study design in 10 European countries (24-hour intake); Uses a few broad categories
European FCS Database	http://www.efsa.europa.eu/EFSA/Scientific_Document/Sc_Colloque_no3_European_food_consumption_database.pdf?ssbinary=true
Food habits (Denmark)	http://ec.europa.eu/food/food/labellingnutrition/supplements/documents/denmark_annex3.pdf
NFCS (Germany)	http://www.was-esse-ich.de/uploads/media/NVSH_Ergebnisbericht_Teil2.pdf
FCS (Ireland)	http://www.iuna.net/survey2000.htm
DNFCS (Netherlands)	http://www.rivm.nl/vcp_en/
NORKOST (Norway)	http://www.shdir.no/vp/multimedia/archive/00003/IS-0168_3745a.pdf
UNGKOST (Norway)	http://www.shdir.no/vp/multimedia/archive/00003/IS-1019_Ungkost_3756a.pdf
Riksmaten (Sweden)	http://www.slv.se/templates/SLV_Page.aspx?id=15933&epslanguage=EN-GB
Healthy Eating Out (HECTOR)	Collaboration between academia, consumer organizations, catering enterprises; Individual-based food consumption data describing out-of-home food consumption; No results available yet http://www.nut.uoa.gr/hector/Home.asp
European Food Consumption Survey Method (EFCOSUM)	Community health monitoring system; aims to standardize national survey results from 20 European countries http://www.public-health.tu-dresden.de/dotnetnuke3/eu/Projects/PastProjects/EFCOSUM/tabid/338/Default.aspx
WHO MONICA Project	Multinational MONItoring of trends and determinants in CArdiovascular disease; 32 MONICA Collaborating Centres in 21 countries; 10 year data collection completed late 90-ties, but still used; Consumption measured as frequency of consumption of broad food groups; http://www.ktl.fi/monica/index.html
EFSA Concise Food Consumption Database	Aims to overcome lack of comparability of national survey data and to provide data for exposure assessment; 15 broad categories, 21 subcategories, 19 countries http://www.efsa.europa.eu/EFSA/ScientificPanels/DATEX/efsa_locale-1178620753812_ConciseEuropeanConsumptionDatabase.htm
International Food Intake Directory (INFID)	Directory of dietary intake data from developing countries with disease specific morbidity and mortality data; Completed directory of food intake data over the last 40 years for eight developing countries; Uncertain if this activity still exists.
Data Food Networking (DAFNE)	24 European countries; Fairly uniform methodology, allowing between-country comparison with minimal adjustment Data on value and quantity of food purchases; http://www.nut.uoa.gr/English/index.asp?page=202
HBS (Global)	http://siteresources.worldbank.org/INTDECINEQ/Resources/1149208-1119640518015/annex1998.pdf
HBS (Eurasia)	http://home.cerge-ei.cz/hanousek/transition_data/Household_surveys.htm
HBS (Demark)	http://www.dst.dk/HomeUK/Statistics/focus_on/focus_on_show.aspx?sci=404

.../...



.../...	Name	Brief description and website
	HBS (Austria)	http://www.statistik.gv.at/web_en/statistics/social_statistics/consumption_expenditures/household_budget_survey_2004_05/index.html
	EFS (Scotland)	http://qb.soc.surrey.ac.uk/surveys/efs/efsintro.htm
	HBS (Spain)	http://www.ine.es/jaxiBD/menu.do?divi=EPF&per=01&type=db&his=1
	HBS (Rep. of Mauritius)	http://www.gov.mu/portal/site/cso/menuitem.dee225f644ffe2aa338852f8a0208a0c/?content_id=c07202b46e18c010VgnVCM1000000a04a8c0RCRD
	HBS (Tanzania)	http://www.povertymonitoring.go.tz/documents/HBS_2000_contents_of_summary.pdf
	HBS (Montenegro)	http://www.monstat.cg.yu/Godisnji%20podaci/2006/Anketa%20o%20potrosnji%20domacinstva2006/Eng%20Saopstenje%20APD-2006/EngAnketa2006.pdf
	HBS (Lithuania)	http://www.stat.gov.lt/en/pages/view?id=1531&PHPSESSID=4a99a06aa34cd5c4070b08878836dc06
	HBS (Bangladesh)	http://vlib.wf.cslive.org/dbtw-wpd/Pdf/Staff/WF_954.pdf
	EUROSTAT	20 food categories; Data from 27 countries http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-30-08-339/EN/KS-30-08-339-EN.PDF
	FAO - Food production and Trade	Group quantity; Item quantity http://www.fao.org/es/ess/faostat/foodsecurity/index_en.htm
	Nutrition Country Profiles	65 countries included from Africa (12), Asia and Southwest Pacific (11), Europe (3), Latin America and the Caribbean (28) and Near East (11); Data diverse and database not operational. http://www.fao.org/ag/agn/nutrition/profiles_en.stm
	Food Balance Sheets	Food consumption estimated from food availability data; Historical data for many countries; No distinction between age groups.
	Food Consumption Database	173 countries included; 98 food categories; Data from 1969-2003; 7400 data lines http://www.fao.org/es/ess/faostat/foodsecurity/Files/FoodConsumptionFoodItems_en.xls

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