

# CHRISTIAN BRECHOT

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In the context of this session, I would like to emphasize that food safety should be considered as a key component of a global effort to ensure food security, nutrition and health and will receive increasing attention in the 21<sup>st</sup> century

1. The prevalence of Food safety incidents is indeed strikingly rising and Food safety is a major economic challenge

Up to 3 million children die every year from diarrhea in developing countries and around 70% of those diarrheas are food borne.

This is a global problem since in industrialized countries, up to 30% people may suffer from food borne diseases each year.

These figures are clearly underestimates because of underreporting in many countries.

1.2 A number of factors are involved in this rising prevalence and, importantly, although they clearly depend on the geographical area and level of development, they are by no mean restricted to developing countries

On the one hand, in developing countries, increased urbanization and rapid population growth have not been matched by development of the health-related infrastructure, including basic sanitation.

But also, worldwide, increasing industrialization and urban living has led to a longer and more complex food chain, and thus to greater opportunities for contamination.

Increasing wealth leads to greater consumption of foods of animal origin such as meat, milk, poultry and eggs. These foods the more common means of food borne pathogen transmission. This situation can be exacerbated by the intensive production required to supply a larger market.

Also, changing lifestyles are creating a demand for more ready-to cook and ready-to-eat food and this is adding more steps to the food chain (the “catering effect”)

Food ingredients are now traded on a global stage affording the opportunity for pathogens to be disseminated widely and in fact, a number of outbreaks are associated with imported foods. Thus, when



food becomes contaminated, the resulting outbreak can span continents, indeed *Salmonella* Agona first spread around the world as a consequence of the use of contaminated Peruvian fish meal in chicken feed.

(In 2005, the EU-25 food and drink industry was worth €48 billion in exports and €43 billion in imports.

Improvements in food processing and packaging and better logistics as well as the use of information technology have made the transportation of food around the world easier than heretofore. However, this brings inherent risks such as deviations from the correct temperature for perishable or frozen products and product transferring through

different jurisdictions with different standards, compliance cultures and enforcement capabilities.)

1.4 Food Safety is a contributor to Food Security and therefore the issue is not of food safety *versus* food security but rather of Food Safety as an integral part of Food Security.

In general; it is hard to accurately determine food borne diseases associated costs

However, collectively, it is clear that food borne diseases represent a major economic burden on communities, individual nations, and the world.

(For example, US food borne costs for 6 bacterial pathogens and 1 parasite were estimated at \$6.5 billion to \$34.9 billion annually (which is an underestimate of total food borne disease costs because there may be over 200 microbiological agents that cause food borne disease))

Also food exports from developing countries will be of increasing importance for industrialized countries (in particular in the context of climate changes). However, food exports are severely restricted by safety issues (including concerns regarding water control)

Food recalls can pose a huge economic burden on food companies.

In the UK, in June 2006, a major global chocolate manufacturer produced chocolate contaminated with *Salmonella* Montevideo that caused laboratory confirmed

infections in 37 people. The subsequent product recall costed £30 million to the company.

**Thus, investing on food safety can be costly but means long term gains.**

## **2. Food safety incidents involve numerous agents**

Food borne infections indeed include bacteria but also viruses, fungi and helminthes (parasites). Many of the foodborne pathogens are zoonotic agents, so the health of consumers is closely linked to the health of food-producing animals.

(In many cases, a specific pathogen is not identified, however, together *Salmonella*, *Listeria*, and *Toxoplasma*, are responsible for 30% of these deaths. *Escherichia coli* 0157/H7 is less frequent but extremely severe.

Their distribution varies from one area to the other: in the US norovirus and salmonella are the most prevalent (40% Salmonella, 25% unknown, 12% virus) while in Europe campylobacter and norovirus are the most frequently faced pathogens.)

Moreover, food born incidents disrupt the microbial intestinal flora equilibrium, and this may markedly impact on resistance of bacteria to antibiotics. Indeed, there is now evidence for the intestinal microbiota acting as a reservoir for novel genes involved in antibiotic-resistance.

In addition to food borne infections, the impact on food safety of contamination by toxic products, chemicals etc. is also a major concern (melanine contaminant in milk, perchlorate in food and beverage products, heavy metals from contaminated soils etc..) Some of these contaminating agents are contained in counterfeit products and this has influence on imported food acceptance.

Finally, increased exposure to allergens in food raise major medical and public health issues ; thus, in the USA, CDC has reported food allergies increasing in children.

Importantly, beside contamination of food, one has now to take in account the evaluation of nutritional compounds, also called “functional foods” on health.

(Indeed, numerous ingredients: Vitamins, fibers, sugars, plant extracts... can be used for health benefits.)

Also, the concept has emerged that live micro-organisms, when administered in adequate amounts, can modulate the microbial intestinal equilibrium and confer a health benefit to the host (the “Probiotics”). However, the medical value of such nutritional products has to be defined;

In addition, nutritional products, such a the Transfats, may raise important concerns for public health and has been banned in restaurants in California.

In this context, the concept of food safety is evolving and will, at least in industrialised countries, integrate nutritional compounds. Overall, food safety is now a major concern for Industry, not only to avoid food recalls but also to substantiate claims for nutritional products

3. There are many difficulties to overcome but Food borne diseases are preventable and meeting international food safety standards does provide economic return on investment

3.1 Food safety measures have to be implemented in a world of increasing food insecurity, financial crisis and climate changes. In addition, Food safety regulations have associated costs which may be prohibitive.

Thus, in this context, What food safety in countries where food security is the issue of the coming century ? What food safety in countries where safe water supply cannot be ensured.? (Indeed, policy makers might

consider accepting lower food safety standards to protect food security. Thus, the challenge is to balance the needs of food security and food safety in an integrated appraisal.)

Also, worldwide, a global approach is hampered by the disparity of food safety standards: public *versus* private standards, certification costs, different requirements for different markets.

### 3.2 However, Food safety measures can be successful

As an example, in the USA active surveillance of food born listeriosis associated with control measures has led to a 48% reduction in mortality.

Also, the application of measures such as Good Agricultural Practices etc.. (GAP) has led to significantly reduce food losses, and thereby increase food availability In fact, Post harvest food losses come up presently to 15% of the stocks.

(Regarding the cost-effectiveness of such measures, the World Bank research estimates that adopting international (Codex) standards for aflatoxin (B1) would increase exports of African nut and grain by some US\$670 million per year and expand global cereal and nut trade by US\$38.8 billion )

(Significant political moves are ongoing to reinforce food safety:

The US congress will consider several food safety bills that may have a profound impact on food industry approach to food testing. In Canada, the Canadian Food Inspection Agency (CFIA) has launched a national food safety initiative of 75 millions of dollars to: increase the number of food safety staff members, reinforce the nutritional surveillance systems, update technologies and increase coordination and communication.)

### 4. How can we ensure food safety: the challenge of defining global regulatory recommendations and control

First, one should involve the numerous institutions which are involved and the global needs : the challenge is really to merge the efforts of national and international public institutions, industry, foundations, NGOs etc.

Also, if we want these efforts to be efficient, food safety must be part of Public health regulations and responsibility must be shared by industry and governments.

Success has been achieved when all components of the alimentary chain have been sensitized

(it is a reply to consumers demand. Safety is driven by innovation and diversity and is very closely linked to nutrition and taste)

Finally, food safety along the food chain will be improved through sequential incremental risk reduction strategies.

#### 4.1 Efficient surveillance systems are needed

There is a strong need to standardize surveillance data collection and analysis as well as microbiological methods (especially detection, identification and typing of microorganisms) for laboratory based surveillance systems.

Despite significant progress, there is in fact only a handful of carefully reported studies and surveillance systems are weak in many countries

To meet with these difficulties, surveillance networks have been organised:

(Some of the major surveillance systems include Enter-net, an international surveillance network for *Salmonella* and Vero-toxigenic *Escherichia coli* O157 infections (Health Protection Agency, 2006), Med-Vet-Net, which is a European network of veterinary and public health institutes which each have a national reference laboratory (Veterinary

Laboratories Agency, 2006) and PulseNet which is a network of US state health departments, local health departments, and federal agencies (CDC, 2006).

The US have created FoodNet; this is a network of sentinel sites conducting active surveillance for a number of food borne pathogens.

The European Commission has also set up a network, called the Rapid Alert System for Food and Feed (RASFF), a key instrument for customer protection. In addition, the European CDC (Stockholm) is in charge of monitoring food born infections.)

4.2 Regulatory recommendations should be realistic and consistent with the actual capacity of a country to have sufficient access to food and water. They must also take in account industry flexibility, cost-effectiveness needs and constraints.

Key points include audit harmonisation, regulatory jurisdiction, disclosure of food testing results, international performance standards, allergen labelling etc..

(Also, novel technologies are emerging which may help both preventing and survey of food born infections and toxic contaminations. However, such technologies may be costly, require long term R&D activities which impact on pricing; such technologies may be difficult to utilize in developing countries.)

(Thus, beside the fear of recalls, we need to better define the incentives for industry to increase their food safety practices)

#### 4.3 What regulatory institutions ? How to ensure coordination between risk analysis, risk assessment and risk management?

There are multilateral Trade agreements which contribute significantly to improve food safety and the scope of food safety regulation has expanded in recent years to the entire food supply chain in a risk-prevention approach.

(The most comprehensive multilateral agreement is the Sanitary and Phytosanitary (SPS) Agreement of the World Trade Organization (WTO). The Technical Barrier to Trade Agreement (TBT) of the WTO requires that technical regulations (e.g. packaging, labelling) imposed by countries should not be more restrictive on imported products than they are on domestically-produced products. The TBT Agreement also encourages the adoption of international standards.)

(The SPS Agreement presumes *Codex* standards (including those related to food additives, veterinary drugs, pesticide residues, contaminants, methods of analysis and sampling, and codes of good hygienic practices) are consistent with provisions of SPS.)

However, numerous challenges, but also opportunities exist to harmonize food safety legislation, both at the national and international level. Food safety legislation varies across countries but increasingly countries are aligning their regulations.

(For example, Australia and New Zealand decided in 1996 to work towards harmonizing many food standards in order to reduce regulatory trade barriers and industry costs. In 1998, the US and Canada signed an agreement under which certain food safety standards could be harmonized. In 2000, Australia States and Territories formally agreed to a national food safety regulatory system (Martin *et al.*, 2003). In the European Union (EU), the Hygiene Package which came into effect in January, 2006, replaces seventeen Food Hygiene Directives with five new pieces of legislation. Each Member State will transpose the Hygiene Package with a limited degree of flexibility at national level, but only in certain situations.)

The scope of food safety regulation has expanded in recent years to the entire food supply chain in a risk-prevention approach.

(The *Codex Alimentarius* incorporates risk analysis and Hazard Analysis Critical Control Point (HACCP) as the basis of most of its standards. HACCP is internationally-recognized as the best method of assuring product safety by controlling foodborne safety hazards.)

At the national level, a number of countries still suffer from the spread of the safety control among various institutions: ministries of health, agriculture, trade, education and research ;

(Moreover, in the past, food safety policy has been often introduced in proportion to the media coverage of an issue rather than to the risk to public health. As a result equal risks along the food chain are not treated with equivalent interventions.)

This has now led several countries to establish agencies dedicated to food safety. Such agencies need to develop interdisciplinary expertise, medical knowledge, reinforcement of the competencies in clinical and epidemiological studies. (They must provide better definition of food standards and must remain independent of trade and economic interest. It is likely important to have them report to the ministry of health.)



USA has involved two federal agencies — FDA and the U.S. Department of Agriculture's (USDA's) Food Safety and Inspection Service (FSIS) — are primarily responsible for the government's food regulatory system, although a number of other federal, state, and local agencies also have important roles.

Several countries have also created dedicated agencies.

Europe has created in 2002 the European Food Safety Authority (EFSA) to provide a platform for scientific advice and the commitment required to ensure customer protection.

Interestingly, the field of competencies significantly differ between the US and European agencies: the US FDA takes in charge both risk-assessment, - risk management and - communication. In contrast, the EU model has separated risk assessment and communication (ensured by EFSA) from management to ensure that "the control must be at the heart of the Commission's risk management process".

There is proof of the efficiency of such measures:

In 1999, a contamination by dioxine in Belgium led to a sanitary disaster in the whole food chain, due to a complete lack of traceability and poor handling of communication, with also major political changes (the Belgian Ministers of Health and Agriculture had to resign and finally the entire Government fell). (The EU banned certain products from Belgium and the US banned certain food lines from the entire EU.)

(a small amount of animal feed was contaminated by dioxin and an inability to identify the farms that received this feed and to locate the livestock and products derived from them in the food chain, led to a massive crisis in the Belgian food industry. The lack of traceability allowed the dioxin crisis to develop and expand throughout the whole food chain. The Belgian Ministers of Health and Agriculture had to resign and finally the entire Government fell. The EU banned certain products from Belgium and the US banned certain food lines from the entire EU.)

In contrast 2008, a comparable situation occurred in Ireland with contamination by dioxine. However, in that case, The Irish Food Safety Authority, the Irish government and the European EFSA were able efficiently take in charge the whole problem.

(routine analysis of a bread-based pig-feed from an Irish feed manufacturer showed the presence of 'marker PCBs' (non-dioxin-like polychlorinated biphenyls). Further analysis confirmed the presence of dioxins. These were also found in pork and pork products from pigs that had eaten the feed. The Food Safety Authority of Ireland and the Irish government promptly ordered a global recall of all Irish pork, and advised consumers to dispose of Irish pork in their freezers.

The European Commission asked EFSA to provide scientific assistance on the risks for human health related to the possible presence of dioxins in pork and products containing pork. EFSA stated that the levels of dioxins found would not necessarily lead to adverse health effects following consumption. The RA was available within days.)

(What had changed in the 10 year period?

- A national Food Safety Authority as opposed to a government department was responsible for food safety and for the recall decision.
- Traceability systems for animal feed were obligatory which allowed to trace the farms which used contaminated feed.

- A Surveillance network was available: (RASFF was intensively and successfully used to transmit information allowing authorities to take swift and appropriate actions).
- Member states cooperated with Ireland. (FSAI in tracing Irish pork and pork products).
- EFSA gave a rapid risk assessment on the risk to human health

On the other hand, creating such agencies has substantially increased the stringency of the industry claims evaluation. In fact, most of the recent claims submitted to EFSA have been rejected, in particular with regards to functional foods, such as probiotics, since there was a lack of scientific and medical evidence for the health benefit of such products

Thus, Industry has to merge its technological expertise with medical and public health competencies to meet these criteria and the agencies have to reinforce their capacity to evaluate from a medical and scientific perspective such products

4.4 In any case, communication is a key element for the success of such measures.

There is no such thing as zero risk and sporadic food crisis are inevitable Thus communication must be thought at a global, international level.

Traceability and quality checks for food recalls are indeed a major challenge:

(in the USA, a government investigation has revealed failure of food safety authorities to notify public schools about recall food distributed through the federal school lunch and breakfast program.

In a recent US survey, 77% of respondents reported that they trust food manufacturers to ensure the safety of food but in a European survey only 6% of consumers reported that they trust food manufacturers.)

(In terms of risk communication, for many products there is often no such thing as zero risk and risk communicators attempt to communicate any residual risk and how to manage it to consumers, and other stakeholders, along the food chain. In addition, they have an important role in the event of a crisis to keep all the players informed of both the risks and the appropriate control initiatives being taken and to be taken.)

(If food can travel rapidly throughout the world, it is nothing to the speed at which information, or mis-information, can travel with global news channels, satellite TV, internet, and SMS. Good news, or more likely bad news, can be transmitted almost instantaneously. Electronic bulletins like "Google alert" keep food safety professionals and

journalists also, abreast of the latest developments throughout the world with emerging news often complete with video clip)

5. What the future will rely on?

Develop efficient tools to create models for risk assessment and evaluate the links between risk and exposure to a food contaminant.

Data bases and simulation tools can be created and many initiatives have already been taken. Such data base can be used as tools for risk management.

Enforce the link between food control laboratories and public health bodies to boost efficiency of food safety surveillance.



(In the US, the Healthy People 2010 Initiative which was announced in 1997, called for all federal agencies with risk management responsibilities for food safety to establish the Interagency Risk Assessment Consortium. The Consortium is charged with advancing the science of microbial risk assessment by encouraging research to develop predictive models and other tools.)

Reinforce education which is key in developing countries and can be shared by public institutions and industry:

As an example, a NGO, called the “Industry Council for Development” has been created which contributes in educating and training in developing countries.

### **Stimulate research**

**New technologies with an extraordinary potential are emerging, for food transport and conservation, as well as for detecting food contaminants.**

Molecular microbiology and epidemiology allow both detection, typing and thus traceability of the contaminants, often across continents, to the source of the problem where the corrective action is needed. Companies which inadvertently, or deliberately put contaminated product on the market can be identified

(New techniques such as modified atmosphere packaging and irradiation offer alternative methods of ensuring food safety, but are only acceptable in some countries and for some products.

methods to detect and characterize microorganisms have markedly overhauled the evaluation of food safety and introduced new means for laboratory based surveillance systems (Norovirus.)

Molecular epidemiology can now help to resolve outbreaks of disease. It allows comparison of data from animal feed, livestock, human food and sick people and thus the tracking of pathogens back through the food chain, by the new breed of foodborne disease epidemiologists and “forensic microbiologists” who are collaborating internationally and now see themselves in the role of disease detectives.)

Moreover, novel technologies will become available in the next years and, in fact, there are extraordinary proposals which are being evaluated (POC). One of the key questions will be the cost for developing and emerging countries ;

(also, their safety must be carefully considered; as an example nanotechnologies can be of great value for risk assessment but EFSA will investigate the need to detect engineered nanomaterial (ENM) in food and this will add to the complexity of the problem.)

More research is required to decipher the complex relations between pathogens and their host and food environment, the ecology of pathogens in the food-chain.

(The understanding of the link between the intestinal microbial flora disequilibrium and emergence of new genes enforcing resistance to antibiotics (in the context of the intestinal metagenome analysis). Resistance to antibiotics is one of the major threats, worldwide)

### **EMERGING AND RE-EMERGING PATHOGENS**

Potential emerging food-related diseases include either known pathogens or (hepatitis caused by the hepatitis E virus, non-gastric *Helicobacter* spp., *E. sakazakii*, non-jejuni/coli species of *Campylobacter*, and non-O157 Shiga toxin-producing *E. coli*.)

new, presently uncharacterized, infectious pathogens may emerge. Contamination of cattle meat by viruses (such as new papilloma viruses) has been hypothesized; they might be contributing factors to cancers such as colon cancer and lung cancer in non smokers.

In fact, we will enter the era of predictive microbiology and mathematics and system biology will offer the possibility to really embrace the multiparameter nature of the problems and surveillance markers.

(but this will only be efficient if clinicians, epidemiologists, veterinarians, microbiologists and food scientists must collaborate even more closely to unravel the substantial amount of FBD of unknown etiology.)

The nature of the adverse health effects posed by chemicals and allergens is of growing concern.

Thus, we will use a novel approach to food toxicology which comes as a novel discipline It will tackle the challenge of long term effects on public health, including those secondary to low dose contaminants.

### **Conclusions**

We are facing an unprecedented challenge and Food safety should be considered an integral part of food security and nutrition and viewed as a global world challenge, involving different socio-economic, medical, scientific and public health parameters.

(In spite of some very successful efforts, the burden of FBD remains high. FBD has been brought to the attention of consumers and policy-makers during the two last decades because of some highly publicized outbreaks caused by microorganisms and chemicals, and some of these incidents have been especially detrimental for the food industry. Ensuring safe food has positive implications for food security: access to safe food is feasible. It is in itself an element of food security, application of GAP, GMP and GHP improves food safety and reduces food losses à increases food availability and food security.)

Yet, there is a need to strengthen the work already undertaken and to improve interdisciplinary approaches so that a better understanding of public health issues, including their economic consequences, will allow policy makers to design appropriate prevention.

Overall, this discussion can now only be seen in a global context. Thus, the challenges are clearly transnational as well as national.

