

PUBLIC HEALTH AND FOOD SAFETY IN THE WHO AFRICAN REGION

Mensah P^{1*}, Mwamakamba L¹, Mohamed C² and D Nsue-Milang¹

*Corresponding author email: mensahp@afro.who.int

¹World Health Organisation Regional Office for Africa, BP 06, Brazzaville, Republic of Congo.

²WHO Country Office, South Africa.

ABSTRACT

Contaminated food continues to cause numerous devastating outbreaks in the African Region. In Africa, a large proportion of ready-to-eat foods are sold by the informal sector, especially as street foods. The hygienic aspects of vending operations and the safety of these foods are problematic for food safety regulators. The global food crisis has worsened an already precarious food situation because when food is in short supply people are more concerned about satisfying hunger than the safety of the food. The aetiological agents include various pathogenic bacteria, parasites and viruses. Chemical contaminants are becoming increasingly important. Human factors including: unhygienic practices and deliberate contamination, environmental factors, such as unsafe water, unsafe waste disposal and exposure of food to insects and dust, undercooked food, and prolonged storage of cooked food without refrigeration are the main predisposing factors. WHO's position is that food safety must be recognised as a public health function and access to safe food as a basic human right. The work of WHO in food safety is in line with its core functions and various global and regional commitments, especially the document entitled "*Food Safety and Health: A Strategy for the WHO African Region (AFR/RC57/4)*" adopted in 2007. WHO has been supporting countries to strengthen food safety systems and partnerships and advocacy; to develop evidence-based food safety policies; strengthen laboratory capacity for foodborne disease surveillance; enhance participation of countries in the standard-setting activities of the Codex Alimentarius Commission; and strengthen food safety education using the WHO Five Keys to Safer Food . The implementation of the Regional Food Safety Strategy adopts a holistic farm-to-fork approach which addresses the entire food control system. Much has been achieved since the adoption of the document *Food Safety and health: A Strategy for the WHO African Region*, but commitment to food safety still remains low due to competing priorities. In particular, countries are now shifting away from fragmented food control implementation towards multi-agency and coordinated as well as single agency systems. The Codex Trust Fund has facilitated participation and capacity building for Codex work. Although funding for the Food Safety Programme has increased as compared to the levels in 2002, this remains inadequate. WHO will continue to support countries to strengthen food safety systems in line with its core functions and as enshrined in the regional food safety strategy.

Key words: Food safety, contamination, risk factors

INTRODUCTION

Food is source of nutrients, central to health, prosperity and social well-being of individuals and societies. If not handled hygienically, it could be a medium for disease transmission. Foodborne illnesses continue to be a major threat to the health of people in Africa, especially vulnerable groups such as children, the elderly and people with underlying diseases such as HIV/AIDS. Food and water transmit a variety of pathogens resulting in a high burden of diarrhoeal diseases, especially in children who suffer up to 5.0 episodes of diarrhoea per year. The mortality rate is estimated at 700,000 for all ages in sub-Saharan Africa. Mortality due to diarrhoea in under-fives is estimated at 15% and is the second cause of under-five mortality both globally and in Africa. Recent findings from the work of the WHO Foodborne Diseases Reference Group (FERG) revealed that there were more than 1.15 million estimated deaths from diarrhoea in South East Asia and Africa each year in children older than 5; this is almost a million more deaths than was previously estimated.

Several outbreaks of foodborne diseases such as cholera, shigellosis, konzo (an acute paralysis caused by consumption of high cyanide cassava) and acute aflatoxicosis continue to occur in many countries in the African Region. A worrying development is the presence of chemical contaminants in food and the development of multi-drug resistant strains of the causative agents of foodborne diseases due to their misuse in health care and animal husbandry. There are emerging and re-emerging threats to the food chain from zoonotic and other diseases. The globalisation of the food trade means that what happens in one part of the world could spread rapidly through air travel to all corners of the globe.

In Africa, a large proportion of ready-to-eat food is sold by the informal sector especially as street food. The consumption of these foods is common in many countries where unemployment is high, salaries are low, work opportunities and social programmes are limited and where urbanization is occurring at a rapid pace. In selling these foods at relatively low prices, they provide an essential service to workers, shoppers, travellers, school children and low income groups. The people who depend on such foods are often more interested in its convenience than in issues of safety, quality and hygiene. The hygienic aspects of vending operations and the safety of these foods are problematic for food safety regulators. The global food crisis has worsened an already precarious food situation. Lack of access to food influences food intake, consequently impacting on the health and nutritional status of households (Box 1). This makes it critically important to use the scarce food at people's disposal safely, effectively and efficiently.

This paper broadly discusses the actions being taken to ensure the safety of food supply in the WHO African Region. It focuses on the magnitude of the problem including outbreaks, aetiological agents, risk factors and the sources of contamination. The paper further provides details on the document AFR/RC57/4 on *Food Safety and health: A Strategy for the WHO African Region* (Figure 1), its implementation, challenges and opportunities for food safety work and the way forward.

Box 1: Food safety: Equity and social determinants

Inappropriate modes of food consumption, handling, and production entail exposure to food hazards, disproportionately affecting the most disadvantaged groups. Certain conditions, such as food insecurity, malnutrition and comorbidity may increase vulnerability to unsafe food items. At the structural level a number of social determinants (ethnicity, gender, education, migration, trade, urbanisation, demographic factors and poverty) imply inequity in relation to food safety.

Source: [1]

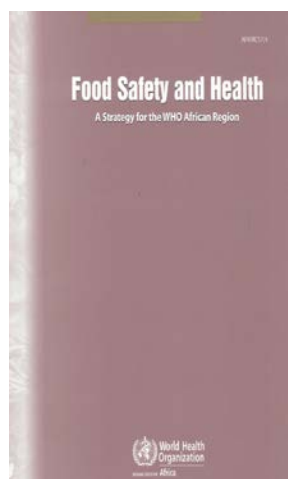


Figure 1: The Regional Food Safety Strategy

Outbreaks of foodborne diseases and epidemiological studies in the WHO Africa Region

As is noted in the paper by Mensah *et al* in this issue, well-coordinated surveillance data on foodborne diseases in Africa is lacking. There are, however, data on a number of outbreaks as well as from epidemiological studies conducted in infants and young children with diarrhoea.

An outbreak of bloody diarrhoea caused by *Escherichia coli* 0157 infections occurred in southern Africa with an attack rate of 42% among 778 residents that were investigated. Consumption of beef and untreated water were significant predisposing factors. *E coli* 0157: NM was recovered from seven affected foci in Swaziland and South Africa. Isolates from 27 of 31 patient and environment samples had

indistinguishable pulse-field gel electrophoresis patterns. The important factors that contributed to the outbreak were droughts resulting in increased carriage of *E. coli* O157 by cattle, heavy rains and contaminated surface water [2].

Two other outbreaks occurred in Ghana in 2001. In the first forty-six Ghanaians who attended a funeral ate *apapransa* (a dish made of roasted maize flour with palm soup, fish and crabs were admitted to hospital with diarrhoea and vomiting. In the second outbreak, about 20 people who ate rice balls with palm soup or maize dumplings with okra stew were admitted in hospital with diarrhoea and vomiting. The likely cause of both outbreaks was not identified [3].

Outbreaks of anthrax associated with sick animals have occurred in several countries in the Region. In 1976, 155 inhabitants of village in Western Uganda feasted on a dead zebu cow that was later found to have died from anthrax septicaemia [4]. Within 15-72 hours, 143 villagers developed acute gastroenteritis resulting in 9 child deaths. In 2005, Burkina Faso, Tanzania and Zimbabwe reported a total of 601 cases and 12 deaths of anthrax to the WHO Regional Office for Africa (Burkina Faso: 130 cases and 6 deaths; Tanzania only one case, no death; and Zimbabwe 470 cases and 6 deaths. The sources of infection of these outbreaks were not reported.

During the 1984 outbreak of cholera in Mali, there were 1793 cases and 406 deaths. Case control studies identified two routes of transmission: drinking water from the largest village well and eating of leftover millet in the drought affected area in Mali [5]. Cholera is endemic in most countries but its transmission through food is not well appreciated although there is evidence to show that preparation and handling of food by infected persons and the physiochemical characteristics of food support growth of *Vibrio sp.* – high moisture, neutral/ alkali pH, absence of competing bacteria- allow transmission of the cholera *Vibrio*. There were 578 cases of *Shigella flexneri* in 2001, which were associated with contaminated maize-meal in South Africa. In 2002, Type A botulism due to contaminated tinned fish in tomato sauce resulted in two deaths also in South Africa. A large outbreak of acute aflatoxicosis due to consumption of contaminated maize occurred in 2004 [6]. This affected more than 317 people and had an estimated case fatality rate of around 39%.

In 2008, an unprecedented number of food-related occurrences were reported to the Regional Office. These included anthrax in Zimbabwe; Typhoid fever and botulism in Uganda; seed beans and maize contaminated with chemicals in Kenya and Nigeria; pesticide poisoning from cabbage and other vegetables in Senegal; and salmonellosis due to fish mouse in Mauritius. Others are mushroom poisoning in Algeria; diarrhoea associated with Gala Dinner Meal in Nigeria; bromide poisoning in Angola and food poisoning in Nigeria, Madagascar, Angola, Kenya, Mauritius, Cote d'Ivoire, Benin, Congo, Ethiopia, Burkina Faso and Botswana. There were outbreaks of diarrhoea in Congo, Kenya, Madagascar, Burundi, Comoros, Uganda, Kenya, Botswana and Mozambique. Fewer cases of food-related outbreaks occurred in 2009. The key ones were shigellosis in Malawi, acute aflatoxicosis in Kenya and Konzo in DRC and Angola.

Aetiological Agents and Risk factors for foodborne illness and sources of contamination

Recent studies have shown that bacteria, parasites and virus continue to be the major aetiological agents in children with diarrhoea. In a study of 1,225 paediatric patients attending outpatient clinics in Ethiopia [7], parasites were detected in 337 (30.7%) cases, *Salmonella* in 65 (5.3%), and *Shigella* in 61 (4.9%). Serotyping of *Salmonella* (including 48 stored isolates) demonstrated the dominance of *S. Concord*: *S. Concord* (85), *S. Typhimurium* (7), *S. Paratyphi B* (2), *S. Haifa* (1), *S. Typhi* (2), *S. Enteritidis* (4), *S. Butantan* (2), *S. Infantis* (1), *S. Pomona* (1), *Salmonella* group M (28:y:-) (1) and *S. Oskarshamn* (1). Six isolates in serogroups B and D were untypeable. Of 81 *S. Concord* isolates, 30% were invasive, most (86.5%) were positive for ESBL production by E-test and 70% were multiply resistant to trimethoprim-sulphamethaxole, ceftriaxone, chloramphenicol and gentamicin, of which over one quarter (27%) also showed reduced susceptibility to ciprofloxacin. Similar pathogens as well as rotavirus, parvovirus and adenovirus have been reported in earlier studies in Kenya [8] and Ghana [9].

A study from Nigeria reported purchase of breakfast and lunch as well as water from vendors as risk factors for diarrhoeal illness. Poor defaecation and refuse disposal practices were additional predisposing factors. Washing of hands without soap also increased the risk of diarrhoea [10]. Mensah *et al.* [11] corroborated these findings and identified prolonged food storage and lack of education as additional risk factors.

Figure 2 is an illustration of the factors that predispose food to contamination. These include environmental and human factors as well as issues relating to handling of equipments and food.

Ingredients and agricultural produce as sources of foodborne pathogens

Agricultural produce is often contaminated by a variety of microorganisms (Figure 1). Lettuce and tomatoes from farms and markets in the Accra Metropolis were shown to have unacceptable levels of faecal coliforms, *Salmonella spp.*, *Shigella spp.*, and *Escherichia coli*. Goat meat and beef were similarly contaminated [12]. Jiwa *et al.* [13] reported similar findings in meat, fish, tomatoes and lettuce from Ethiopia. The microbial population of agricultural produce are determined by the growing location and the history of the land. Fields that have been grazed by livestock and wild animals often have enteric pathogens. Certain bacteria, such as *Salmonella spp.* and *Listeria monocytogenes* survive for prolonged periods in sewage sludge commonly applied to agricultural soil. Use of chicken droppings in farming is another source of contamination as indicated by the isolation of *Salmonella spp.*, *Campylobacter spp.* and *E. coli* from cloacal contents of live chicken. *Campylobacter spp.*, *Salmonella spp.*, *Shigella spp.* and *E. coli* were also isolated from locally produced and imported chicken in Accra, Ghana [14]. These isolates were multiple-antibiotic-resistant strains.

Recent studies on minced meat in Ethiopia reported a high level of indicator organisms as well as foodborne pathogens including Methicillin Resistant *Staphylococcus aureus* and multi-drug resistant *Salmonella sp.* [15]. Transportation, display and storage of produce at markets are of great concern. These findings call for monitoring of local produce and of imports and exports.

Prepared foods as sources of foodborne pathogens

There is a shift from eating home-prepared food to consumption of ready-to-eat foods, which are often sold as street foods in many developing countries. Street food vendors provide an essential service to workers, shoppers, travellers, school children and people on low incomes. They service the tourist trade of countries, as they are a source of traditional meals in various countries. The hygiene aspects of vending operations are a major source of concern for food control officers. This may be attributed to, for example, use of crude structures and lack of adequate supplies of running water. Also, toilets and adequate washing facilities are rarely available. Disinfection and frequent washing of hands are rarely practised. Finally, food is not protected from flies and other insects while refrigeration is usually not available.

Epidemiologic association between street vended foods and frequent diarrhoea have been made [16]. Certain foods, for example, poultry, pork, beef, fish and rice sold as street foods have been implicated in outbreaks of food poisoning in Egypt and Ethiopia [13,17].

Olukunya [18] evaluated the microbial quality of foods sold to Nigerian children and detected unacceptable levels of *E coli*, *Bacillus cereus* and *Staphylococcus aureus*. In another Nigerian study, Umoh and Odoba [19] reported that counts of aerobic bacteria of all the ready-to-eat foods evaluated were below the permissible level of 5.0 log₁₀/g. Out of the 160 samples 42(26.6%) were contaminated with *B cereus* and 24(15.4) with *S aureus*. A study in Ouagadougou (Burkina Faso) also reported high unacceptable levels of enterobacteriaceae, salmonella and shigella in most street vended foods [20].

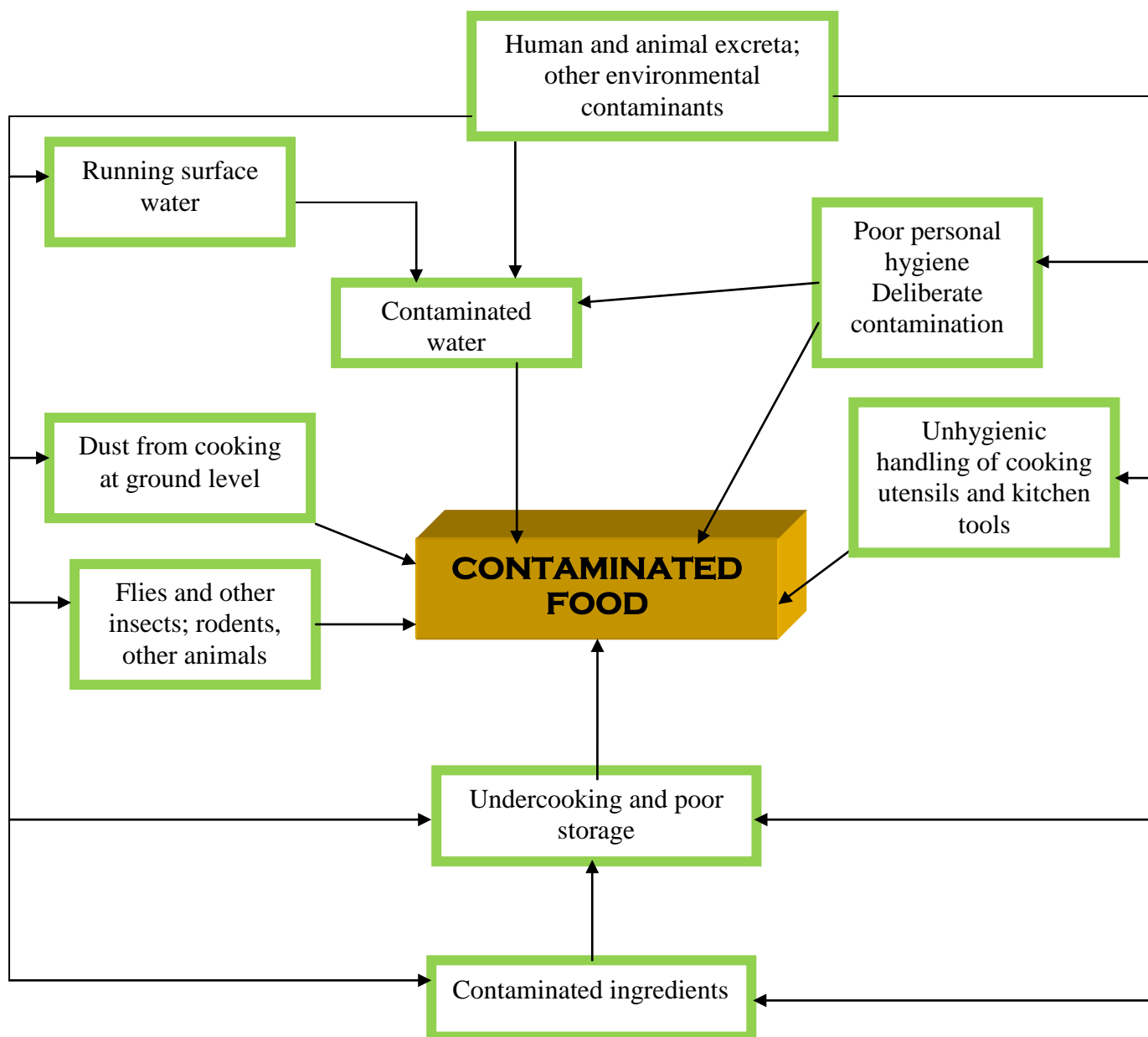


Figure 2: Sources of Contaminants in Food

Street food samples from Accra, Ghana, were equally contaminated but foods consumed at breakfast were microbiologically safe. The high-risk foods were soups, sauces, salads and homemade macaroni. Sale of food in schools and by roadsides, lack of knowledge on diarrhoea, excessive handling of food after cooking, handling of food at ground level, exposure of food to flies and use of dirty water for washing crockery were the factors that could predispose food to contamination [21]. Ehiri *et al.* [22] showed that during cooking, all foods attained temperatures capable of destroying vegetative forms of foodborne pathogens but there is a risk of contamination during storage at ambient temperature, insufficient heating and addition of uncooked to cooked food. A multi-centre study conducted in 13 towns from Africa, America, Asia and Oceania examined 3,003 food samples from 1,268 vendors and reported the proportion of unsatisfactory food as 12.7 to 82.9% for ice creams and sorbets and 11.3 to 92% for sandwiches. Lack of training in food hygiene and sale of large units of certain foods, such as, ice cream were potential risk factors [23].

Street-vended salad and gravy yielded no *B. cereus*. One gravy sample and one salad were, however, positive for *C. perfringens*. Despite the observed unhygienic food handling practices and environmental conditions, the most samples were microbiologically acceptable [24]. Similarly, Mosupye *et al.* [25] noted that prepared salad, beef stew and meat stew were significantly microbiologically safer than the raw ingredients despite the shortcomings in environmental and food hygiene. Salads were more contaminated than cooked food and this is attributable to cooking food at 80°C. Use of same tools for cutting all ingredients without washing them in-between, sharing of tools with other vendors, exposure of food to dust and flies and use of same water for washing ingredients and for dishwashing were likely risk for food contamination.

Food vendors as sources of food-borne pathogens

A total of 176 street food vendors (Figure 3) in Accra were evaluated for their role in the transmission of diarrhoeal pathogens. The pathogens isolated from the vendors included *Salmonella spp.* were isolated from 6(3.4), *Shigella spp.* from 2(1.1%), EPEC from 59(33.5) and EAEC from 34(19.3). One blood culture tested positive for *Salmonella Typhi* but 15(9.8%) were positive in the Widal test [26]. The *E. coli* isolates from this study and isolates from a similar study in children from the same locality were evaluated using Multilocus Sequence Typing to determine their relatedness. The disease isolates were indistinguishable from those recovered from the street food vendors. These findings confirmed street food vendors as sources of pathogenic *E. coli*. This calls for intensive food hygiene education of all food handlers and enforcement of food hygiene laws to ensure that this route of transmission of pathogens is disrupted.

Economic consequences of foodborne illness

The presence of foodborne pathogens in a country's food supply affects the health of the local population, potentially spreads to visitors to the country and to consumers in food importing countries. There are costs associated with ill health, death (with economic implications for individuals, their families and health care systems of countries) and international trade rejections. The human illness cost due to *Campylobacter jejuni*, *Clostridium perfringens*, *E coli* 0157:H7, *Listeria monocytogenes*, *Salmonella*, *Staphylococcus aureus* and *Toxoplasma gondii* which cause an estimated 3.3 – 12.3 million cases and up 39,00 deaths was USD 6.5 – 34.9 million annually (1995 estimates) worldwide [27]. The cost of outbreaks associated with *Salmonella* Typhi in Nauru in the South Pacific was estimated at USD 46 000 [28]. Rodrigues *et al.* [29] reported the average cost per case of *Salmonella* as £606, £315 for *Campylobacter* and £175 for SRSV in the UK Intestinal Infectious Diarrhoea (IID) study. The estimated cost of IID in England was £743 million expressed at 1994/5 prices. In Tanzania during September and October 1997, there were 40,000 cases of cholera, a huge increase beyond the 1,460 (2739%) cases the previous year, 1996. About 2,200 people died in 1997, compared to 35 deaths in 1996. An unforeseen consequence of this cholera epidemic was its economic cost amounting to USD 36 million during the period of the outbreak since Europe refused to accept fish imports from the region [30]. In Nigeria the Food and Drug Administration destroyed aflatoxin-contaminated food worth more than USD 200 000 1990 [31].

Basis for Food Safety work in the African region

WHO still regards food safety as an essential public health function and maintains the position of the individual's right to safe and nutritious food. Against this background, the 63rd Session of the World Health Assembly adopted a resolution on Advancing Food Safety Initiatives' in 2010. The revised IHR (2005) recognized that international disease threats have increased and has an expanded scope from cholera, plague and yellow fever to all public health emergencies of international concern [32]. They include those caused by infectious diseases, chemical agents, radioactive materials and contaminated food. The document, *Achieving Sustainable Health Development in the African Region: Strategic Directions for WHO 2010-2015* addresses the determinants of health, including food safety and nutrition, under Strategic Directions 6. The document entitled "*Food Safety and Health: A Strategy for the WHO African Region (AFR/RC57/4)*" (Figure 1) and resolution AFR/RC57/R2 adopted in 2007 guides the food safety work in the Region. The aim of the food safety strategy is to contribute to the reduction in the morbidity and mortality due to contaminated food. Its specific objectives are to: (i) Provide a platform for advocacy for food safety; (ii) Provide Member States with a framework for the development and implementation of national policies for food safety; (iii) Strengthen food control systems including foodborne disease surveillance and food monitoring for prevention, detection and control of food safety emergencies; (iv) Facilitate the development of intersectoral collaboration and partnerships for food safety.

The strategy has three guiding principles which include country ownership and leadership, equity and fairness; and holistic, comprehensive and risk-based actions; intersectoral coordination, cooperation and collaboration. The priority interventions include Food Safety policies, programmes, legislation and regulation; Capacity building; Health promotion; and National, regional and international cooperation, collaboration and coordination.

Implementation of the Food Safety Strategy

The implementation of the Regional Food Safety Strategy adopts a holistic farm-to-fork approach which addresses the entire food control system (Figure 3). This has been jointly carried by WHO Member States, FAO and other partners. Out of the 46 countries, twenty-six countries are at various stages of assessment of their food safety systems towards the development of food safety policies and programme strengthening. The programme has prepared a number of tools and guidelines including Training manual on the WHO 5 Keys; Healthy Food Market Guide; 5 Keys poster, pamphlets and leaflets; A training Manual on Risk Analysis; Tools for evaluation of food safety programmes food control systems; and Step-by-Step Guide on Laboratory-based Foodborne Disease Surveillance.

Details on food Information Education and Communication (IEC) activities using the WHO Five Keys to Safer Food are discussed in the paper by Mwamakamba *et al.* in this issue. Similarly Mensah *et al.* provides details on the activities aimed at strengthening foodborne disease surveillance in countries through the Global Food Infections Network. In addition to these, capacity building activities and training courses have been organized on Hazard Analysis and Critical Control Points (HACCP), risk analysis and food inspection.

Forty-four countries in the WHO African Region are members of the Codex Alimentarius Commission. Their participation in the work of Codex has been greatly enhanced by the establishment of the Codex Trust Fund. FAO/WHO has also developed a training manual on the Codex processes which will address urgent training needs to enhance national capacities to effectively interact/contribute and participate in Codex deliberations. The Codex Trust Fund provides support to eligible countries to (i) prepare for and participate in Codex Committees and related meetings; (ii) participate in Codex training courses to enhance effective participation in Codex meetings including mycotoxins, the work of Codex, implementation of Codex Standards at country level (iii), prepare and present scientific/technical positions and data related to the work of Codex. The African continent has benefitted most from this support as African countries are overwhelmingly represented in the least developed countries and low income countries groupings which have received 68% of total Codex Trust Fund support. Africa's share of the total number of participants funded by the Codex Trust Fund is 41%. Codex Trust Fund support has contributed to more than quadrupling the participation of least developed countries in Codex, of which the vast majority are African countries. More emphasis needs to be put on finding ways and means of enhancing the technical and scientific input from developing countries into Codex to make progress towards the achievement of the

Codex Trust Fund's third objective. Support has also been provided to countries to strengthen the National Codex Contact Point preparation of national action plans and provision of office equipment and supplies.

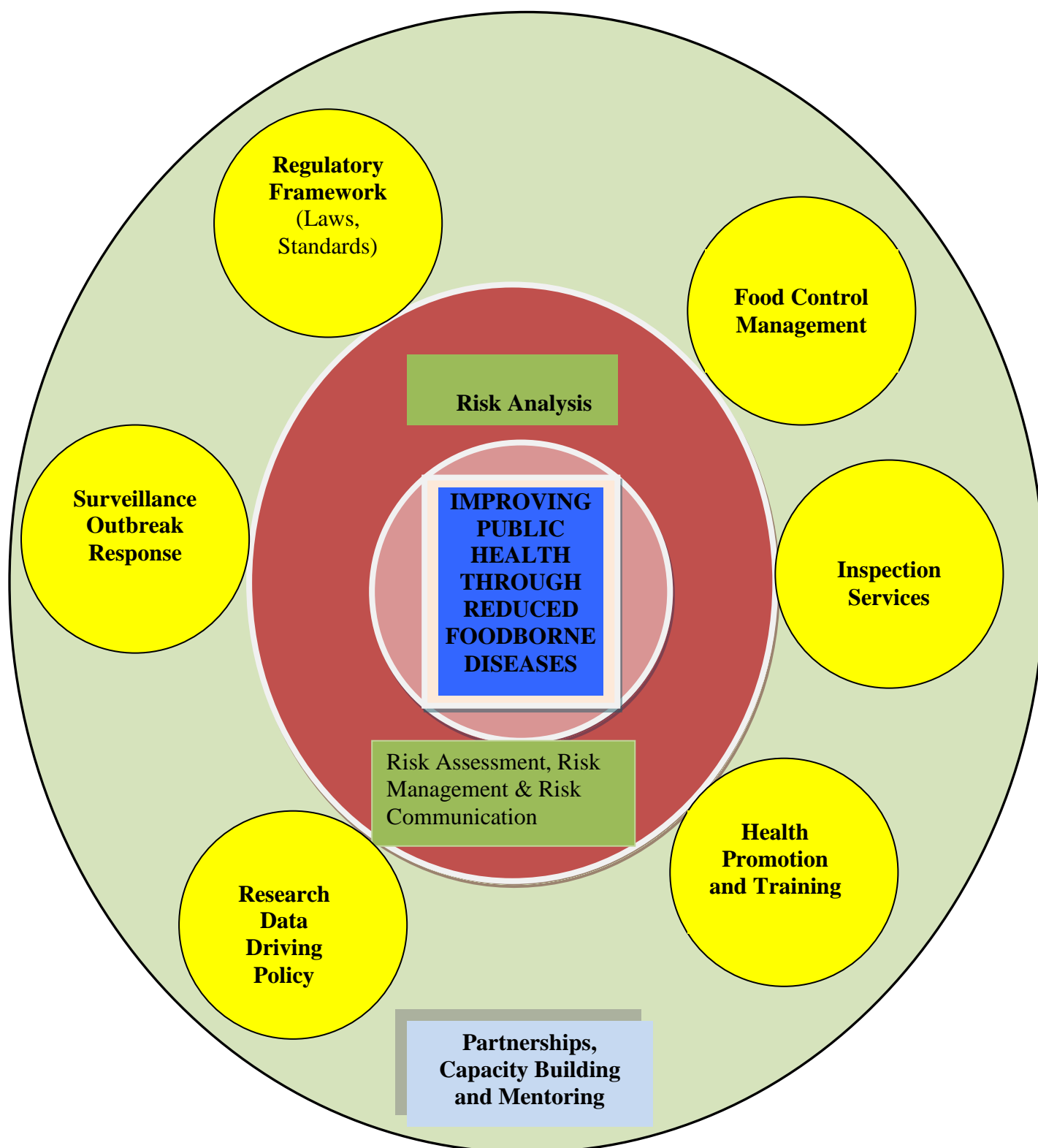


Figure 3: Actions towards the Implementation of the Regional Food Safety Strategy

Human Resource and Training Requirements

Food safety is an evolving subject so there is a pressing need for continuous capacity development. There have been many positive developments and improvements of national food control systems in some countries but there is need for human and financial resources for food control and food safety in general, legislation and regulation on food safety and quality, including laboratory capacity, food inspection, foodborne disease surveillance and IEC.

Through the Codex Trust Fund training on Codex procedures, protocols and risk assessment could be strengthened. Training in risk assessment is critically important for country-specific scientific advice. The application of scientific advice from expert consultations such as Joint WHO/FAO Expert Committee on Microbiological Risk Analysis, Joint WHO/FAO Expert Committee on Contaminants and Food Additives (JECFA) and Joint WHO/FAO Expert Committee on Pesticide Residues (JMPR) will also enable countries to make informed decisions. Training activities in risk analysis were conducted in the region in 2008-2009 but the challenge is how to scale-up these activities.

Countries need the technical capacity to obtain and share data on chemical (GEMS/Food) and microbial (GFN) contamination for early detection of outbreaks, for advocacy, decision-making and resources allocation. There is a shortage of experts in food safety and not many institutions worldwide offer such courses. Discussions are ongoing with some institutions to revise their curricula to include food safety content.

Challenges and Opportunities

Much has been achieved since the adoption of the document Food Safety and Health: A strategy for the WHO African Region but commitment to food safety still remains low due to competing priorities. There is gap between translation of policies and decisions into programmes which needs to be addressed. Although funding for the Food Safety Programme has increased as compared to the levels in 2002, this remains inadequate. Due to the inadequate financial and human resources, scaling up of proven pilot projects for better outcomes has been challenging.

Participation of African countries in the standard-setting process has been limited mostly to attending meetings with little or no scientific inputs. This has often resulted in the adoption of standards, which did not often take the unique concerns of African countries into consideration. The interpretation of Codex standards and the lack of specifications for some microbiological and chemical contaminants in food are major difficulties encountered by countries. Research on food safety and quality issues of particular concern to the African region as these relate both to consumer health and trade is sorely lacking. Indeed generation of data and its reporting by countries remains scanty and needs to be improved.

Despite the above, the adoption of various strategic documents by Member States through the World Health Assembly as well as the Regional Committee for Africa provided greater impetus to the programme. There is increased awareness resulting in an increased number of partners for Food safety work. There is a funded Food Safety Programme in WHO under Strategic Objective 9 of the Medium Term Strategic Plan, albeit inadequate. **The availability of tools; guidelines and manuals such as the WHO Five Keys to Safer Food, Five Keys for growing safer fruits and vegetables; Enhancing participation in Codex activities: an FAO/WHO training package contributed to the above achievements.** The Codex Trust Fund has facilitated participation and capacity building for Codex work. There is improved coordination and collaboration among FOS stakeholders through the formation of National Food Safety Committees and establishment of single agency systems.

Way Forward and Conclusion

As illustrated above, there is increased awareness for food safety and countries are conducting several activities to strengthen food control systems and programmes. The numbers of partners for food safety has also increased but more is required to enable the programme overcome the challenge associated with limitations in resources, both human and financial. In particular, countries are now shifting away from fragmented food control implementation towards multi-agency and coordinated as well as single agency systems.

National governments should, therefore, continue to include food safety in overall national development plans and health policies; harmonize national legislation guided by international norms and standards; strengthen national analytical capacity through appropriate training, capacity building and establishment of quality assurance protocol and procedures including foodborne disease surveillance; develop national structures for research and to work towards establishment of centres of excellence as WHO Collaborating Centres; work with industry, including street food vendors to realise their responsibility towards assuring the safety of their products and encourage voluntary and correct application of a holistic approach to food safety; and establish a diversity of approaches to enhance consumer awareness and participation in food safety activities including commitment to consumer education.

The food industry should ensure supply of safe food through participation in setting of standards for toxicological and microbiological hazards as well as instituting procedures and practices for the achievement of standards along the entire food chain; provide accurate product information through labeling and other available means of communicating with the consumer; and provide resources for continued capacity building, operational research and quality control within the food industry.

Consumer groups and other Non-governmental organisations should play an active role in food safety; advocate for appropriate legislation to protect the health of the consumer and fair trade in food; ensure participation in setting of standards, norms and regulation at national and international levels; monitor the implementation of international and national norms, standards and regulations; participate in and

facilitate food safety education programmes in order to empower the public to make informed choices.

WHO will continue to provide support to countries to implement the above by (i) providing leadership on food safety and engaging with all stakeholders; (ii) shaping the research agenda; (iii) stimulating the generation, translation and dissemination of valuable food safety knowledge; (iv) setting norms and standards, and promoting and monitoring their implementation; (v) articulating ethical and evidence-based policy options; (vi) monitoring and assessing trends.

Access to safe and nutritious food is a basic human right. It is essential, therefore, to use the same standards for food for local consumption and for exports. It is essential, therefore, to ensure the safety of food exports, imports and local produce meant for the local consumers. This is a shared responsibility involving all relevant authorities. This must adopt a holistic farm-to-fork approach to reduce the high burden of food-related incidences in the Region.

REFERENCES

1. **WHO.** World Health Organization Equity and Social Determinants of Public Health Programmes, **Edited by Blas Eand AS Kurup.** Geneva 2010.
2. **Effler E, Isaäcson M, Arntzen L, Heenan R, Canter P, Barrett T, Lee L, Mambo C, Levine W, Zaidi A, and P M Griffin** Factors contributing to the emergence of *Escherichia coli* O157 in Africa. *Emerg Infect Dis.* 2001 Sep-Oct; 7(5): 812–819.
3. **Ghanaweb**
<http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=17141> (Accessed 11 March 2011).
4. **Ndyabahinduka DG, Chu IH, Abdou AH and JK Gaifuba** An outbreak of human gastrointestinal anthrax. *Ann Ist Super Sanita.* 1984;20(2-3):205-8.
5. **Tauxe RV, Holmberg SD, Dodin A, Wells JV and PA Blake** Epidemic cholera in Mali: high mortality and multiple routes of transmission in a famine area. *Epidemiol Infect.* 1988 Apr;100(2):279-89.
6. **Nyikal J, Misore A, Nzioka C, Njuguna C, Muchiri E, Njau J, Maingi S, Njoroge J, Mutiso J, Onteri J, Langat A, Kilei IK, Nyamongo J, Ogana G, Muture B, Tukei P, Onyango C, Ochieng W, Tetteh C, Likimani S, Nguku P, Galgalo T, Kibet S, Manya A, Dahiye A, Mwhia J, Mugoya I, Onsongo J, Ngindu A, DeCock KM, Lindblade K, Slutsker L, Amornkul P, Rosen D, Feiken D, Thomas T, Mensah P, Eseko N, Nejjar A, Onsongo M, Kessel F, Njapau H, Park DL, Lewis L, Lubner G, Rogers H, Backer L, Rubin C, Giesecke KE, Azziz-Baumgartner E, Chege W and A Bowen** Outbreak of Aflatoxin Poisoning --- Eastern and Central Provinces, Kenya, January--July 2004, *MMWR Weekly*, September 3, 2004 / 53(34);790-793.
7. **Beyene G, Nair S, Asrat D, Mengistu Y, Engers H and J Wain** Multidrug resistant *Salmonella Concord* is a major cause of salmonellosis in children in Ethiopia, *J Infect Dev Ctries* 2011; 5(1):023-033.
8. **Saidi SM, Iijima Y, Sang WK, Mwangudza AK, Oundo JO, Taga K, Aihara M, Nagayama K, Yamamoto H, Waiyaki PG and T Honda** Epidemiological study on infectious diarrheal diseases in children in a coastal rural area of Kenya. *Microbiol Immunol.* 1997; 41(10):773-8.
9. **Mensah P** *Persistent Diarrhoea in Ghana.* Final report submitted to Japan International Co-operation Agency, 1997.

10. **Oyemade A, Omokhodion FO, Olawuyi JF, Sridhar MK and IO Olaseha** Environmental and personal hygiene practices: risk factors for diarrhoea among children of Nigerian market women. *J Diarrhoeal Dis Res.* 1998 Dec;16(4):241-7.
11. **Mensah P, Armar-Klemesu M, Owusu-Darko K, Yeboah-Manu D and A Ablordey** Risk Factors for Persistent diarrhoea in Accra, Ghana. First World Congress on Paediatric Gastroenterology and Nutrition, Boston, Massachusetts, USA, 5-9 August 2000. Abstract 906, pp S232.
12. **Mensah P, Armar-Klemesu M, Hammond AS, A. Haruna and R Nyarko** Bacterial contaminants in lettuce, tomatoes, beef and goat meat from the Accra Metropolis. *GMJ* 2001;35:4,1-6.
13. **Jiwa SFH, Krovacek K, and T Warstrom** Enteropathogenic bacteria in food and water from an Ethiopian community. *Appl Environ Microbiol*, 1981, 41: 1010-1019.
14. **Sackey BA, Mensah P, Collison E and E Sakyi-Dawson** The prevalence of *Campylobacter*, *Salmonella*, *Shigella* species and *Escherichia coli* in live and dressed poultry in metropolitan Accra. *Int J of Food Microbiol* 2001;71:1, 21-28.
15. **Tassew H, Abdissa A, Beyene G and S Gere-Selassie** Microbial flora and foodborne pathogens on mince meat and their susceptibility to antimicrobial agents. *Ethiop J Health Sci* 2010, 20(3) 137-143.
16. **Tjoa WS, Dupont HL, Sullivan P, Pickering LK, Holguin AH, Olarte J, Evans DG and DJ Evans Jr** Location of food consumption and travellers' diarrhoea. *Am J Epidemiol*, 1977, **106**: 61-66.
17. **El-Sherbeeney MR, Saddik MF and FL Bryan** Microbiological profile of foods served by street vendors in Egypt. *Int J Food Microbiol*, 1985, 2: 355-364.
18. **Olukoya DK and A Abayomi** Microbiological evaluation of food samples sold to primary school children in Lagos, Nigeria. *J Trop Paedriatr*, 1991, 37: 266.
19. **Umoh VJ and MB Odoba** Safety and quality evaluation of street foods sold in Zaria, Nigeria. *Food Control*, 1999, 10:9-10.
20. **Barro N, Ouattara CA, Nikiema PA, Ouattara AS and AS Traore** Evaluation de la qualité microbiologique de quelques aliments de rue dans la ville de Ouagadougou au Burkina Faso. *Sante.* 2002 Oct-Dec;12(4):369-74.

21. **Mensah P, Yeboah-Manu D, Owusu-Darko K and A Ablordey** Street foods from Accra, Ghana: How safe? *Bull World Health Organ* 2002; 80(7):546-54.
22. **Ehiri JE, Azubuike MC, Ubbaonu CN, Anyanwu EC, Ibe KM and MO Ogbonna** Critical control points of complementary food preparation and handling in eastern Nigeria. *Bull World Health Organ*. 2001;79(5):423-33.
23. **Garin B, Aidara A, Spiegel A, Arrive P, Bastaraud A, Cartel JL, Aissa RB, Duval P, Gay M, Gherardi C, Gouali M, Karou TG, Kruiy SL, Soares JL, Mouffok F, Ravaonindrina N, Rasolofonirina N, Pham MT, Wouafo M, Catteau M, Mathiot C, Mauciere P and J Rocourt** Multicenter study of street foods in 13 towns on four continents by the food and environmental hygiene study group of the international network of Pasteur and associated institutes. *J Food Prot*. 2002 Jan;65(1):146-52.
24. **Kubheka LC, Mosupye FM and A von Holy** Microbial survey of street-vended salad and gravy in Johannesburg city, South Africa. *Food Control*, 2001, 12: 127-131.
25. **Mosupye FM and A von Holy** Microbiological quality and safety of ready-to-eat street-vended foods in Johannesburg, South Africa. *J Food Protect* 1999 62:1278-1284.
26. **Mensah P, Owusu-Darko K, Yeboah-Manu D, Ablordey A, Kamiya H and FK Nkrumah** The role of street food vendors in the transmission of enteric pathogens in Accra. *GMJ* 1999;33:1,19-29.
27. **Buzby JC and T Roberts** Economic costs and trade impacts of microbial foodborne illness. *World Health Stat Q*. 1997;50(1-2):57-66.
28. **Olsen SJ, Kafoa B, Win NS, Jose M, Bibb W, Luby S, Waidubu G, O'Leary M, and E Mintz** Restaurant-associated outbreak of *Salmonella typhi* in Nauru: an epidemiological and cost analysis. *Epidemiol Infect*. 2001 Dec;127(3):405-12.
29. **Rodrigues L, Cowden J, Wheeler J, Sethi D, Wall P, Cumberland D, Tomkins D, Hudson M, Roberts J and P Roderick** The study of IID in England: risk factors for cases with *Campylobacter jejuni* infection. *Epidemiology and Infection* 2000;127:185-193.
30. **(WHO)** World Health Organisation, Speeches of the Director-General (http://www.who.int/director-general/speeches/1999/english/19990323_who.html). Accessed February 12 2010
31. **Anyanwu RC and DJ Jukes** Food Safety Control Systems for Developing Countries. *Food Control* 1990;1:1726-1736.
32. **WHO**. International Health Regulation (2005) WHO, Geneva 2006.