

# **Integrated Food Chain Surveillance for Enhancing Food Safety- A Model Approach**

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## **Declaration of No Conflict of Interest**

**The Author declares No Conflict of Interest in the preparation of the paper. Information presented in the paper has been sourced from web sites of WHO, FAO, WOAHA, government organizations (IDSP, FSSAI, ICMR) and published papers in national and international journals**

# Background and objectives of the paper

## Integrated food chain surveillance

**Integrating surveillance data to better understand risks across the food chain. Stage three booklet. WHO(2017); Focus on microbial hazards , food borne zoonosis and antimicrobial resistance monitoring.**

## Objective of the paper

**To explore application, feasibility and usefulness of WHO integrated food chain surveillance system from a developing country perspective including India through a review of literature and designing a model activity plan in the Indian context.**

## Presentation components

- **Overview of emerging food safety concerns in the food chain**
- **Importance of surveillance and monitoring for food safety in the food chain**
- **The concept of WHO integrated food chain surveillance and description of its elements**
- **Application of the integrated food chain surveillance system in the Indian context**

## **Emerging global food safety concerns**

- **Food safety- critical objective of public health**
- **Emergence of new pathogens, reemergence of known pathogens in the food chain**
- **Increasing risks of food borne zoonosis and antimicrobial resistance**
- **Climate change impact**
- **Complex interaction between pathogens, the host, and the environment – emerging concern**
- **New challenges in food safety control: Integrated multisector food safety assessment, financial resources for effective implementation and control**

## Food safety hazards in India- Existing scenario

- High prevalence of food borne zoonotic pathogens *Campylobacter*, *Salmonella*, *E.coli*, *S. aureus* in animal derived foods (Bisht et al 2018)
- Food borne zoonosis burden in India -100 million cases per year (NAAS 2020)
- Highest rates of resistance to antimicrobial agents used in humans and food animals
- Antibiotic residues reported in animal products –chicken, meat and milk

# Food chain contamination

## Principle Stages of the food supply chain\*

Acquisition of raw materials, supply of agricultural inputs, equipment, harvesting

Primary production (Farmers, fisherman, livestock farmers)

Primary food processing (On-farm, dairies, abattoirs, grain mills, etc.)

Secondary food processing (Canning, freezing, drying, fermentation,)

Food distribution: Food retailing/catering (Supermarkets, shops, Restaurants, etc.)

Domestic food preparation and consumption

Food contamination

## Contaminants in food chain

### Food grains

natural toxins, mycotoxins, bacterial pathogens, pesticide residues.

### Fresh produce

Microbial pathogens

### Animal derived foods

microbial pathogens, anti-microbial resistance

\*Adapted from WHO 1995

# Key Principles for Ensuring Food Safety (FAO 2006, ILSI 2007)

- Recognition of farm to table/food chain approach **through shared responsibility and interaction of all stakeholders**
- Use of Risk analysis framework
- Surveillance, investigation, emergency preparedness and response **to food borne events**
- Enforcement and compliance programs with elements of risk based inspection
- **Access to adequate laboratory capacity and capability**
- Stakeholder engagement
- Food safety and quality information, education and communication (IEC) programmes.

*An integrated, multidisciplinary whole of food chain approach important for food safety assurance.*



## Purpose of food borne surveillance

- Ensure compliance with regulatory standards for microbial and chemical contaminants
- Estimate burden of foodborne diseases, monitoring trends
- Identify priorities, setting policy in the control and prevention of foodborne diseases
- Detect, control, and prevent foodborne disease outbreaks
- Identify emerging food safety issues
- Evaluate foodborne disease prevention and control strategies.
- Important for risk analysis

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**Surveillance** - *the ongoing systematic collection, collation, analysis and interpretation of data, followed by the dissemination of information to all those involved so that directed actions may be taken (WHO/CDS/CSR). Involves food/feed, food borne/ animal/zoonotic disease surveillance.*

**Monitoring**- *the systematic collection, analysis and dissemination of data to provide information on levels of contaminants in foods, time-trends in contamination, compliance to food control requirements, performance and analysis of routine measurements (FAO 2004).*

# Existing Surveillance programmes for food borne events in India

## 1. FSSAI food safety surveillance programme

Collect data on contaminants in foods, identify food safety hazards, provide data for food safety monitoring, risk assessment and standard setting

## 2. ICMR's Foodborne pathogens surveillance network (ICMR-FoodNet)

Sentinel surveillance network for pathogens causing food and water borne diseases in North-East Indian states. Monitors foodborne enteric disease outbreaks, conducts intensified systematic laboratory-based surveillance

## 3. Integrated Disease Surveillance Programme (IDSP) of the National Centre for Disease Control

Decentralized State based surveillance system for epidemic prone diseases at the Districts, State and National level

## 4. Animal disease surveillance (NADRS)

Records, monitors livestock disease situation and initiate preventive and curative action. Nodal agencies: Ministry of Fisheries, Animal Husbandry and Dairying. Conducted through web-based information technology of the National Animal Disease Reporting System.

# WHO initiatives for strengthening of surveillance and response systems for food borne diseases

## Stage 1 Booklet:

**Using indicator- and event-based surveillance to detect foodborne events:** Applicable to countries with established surveillance programme.

## Stage 2 Booklet:

**Strengthening indicator-based surveillance** -Applicable for countries with indicator- and event-based surveillance systems, capacity to undertake rapid risk assessments of acute food borne events and epidemiological investigations and laboratory capacity to identify food borne pathogens.

## Stage 3 Booklet:

**Integrating surveillance data to better understand risks across the food chain- specific guidance on sharing data** -Applicable for countries with a fully functional surveillance and response system in the health sector as described in Stage 1 and Stage 2 booklets

# Integrated food chain surveillance

## Objectives and utility

- Monitoring the occurrence of priority foodborne pathogens
- Integrating surveillance data from food, animal, and human disease sectors – to enhance understanding linkages between sources of disease and transmission routes
- Sharing of data across sectors to provide scientific basis for performing risk analysis, enable identification of appropriate food borne prevention and control strategies, facilitate source attribution
- Evolve cross-sectoral structured collaboration and coordination

## Challenges:

- Highly resource intensive
- Infrastructure requirement high for sustainability of the system
- Requires harmonized laboratory testing capabilities at each point along the food chain.

# **Core elements for integrating food chain surveillance data**

- 1. Multisector team**
- 2. Clear governance structure, coordination and communication mechanism**
- 3. Clear Statement of objectives**
- 4. Identification and prioritization of pathogens, animal species and foods**
- 5. Identification and prioritization of**
- 6. Centrally operated coordinated multisector database**
- 7. Multisector data analysis and interpretation system**
- 8. Surveillance bulletin to communicate food borne surveillance information to stakeholders**
- 9. Presence of a functional risk analysis operational framework**
- 10. Monitoring and evaluation system with appropriate indicators**

# Developing and establishing integrated food chain surveillance system in Indian context: Model activity/action plan

## A. Preliminary activity

- i. Performing situational analysis of existing food borne surveillance programmes
  - Operational framework
  - Multisector coordination and communication mechanisms
  - Priority food borne pathogens and diseases
  - Laboratory infrastructure
  - Mechanisms for data collection, storage and transfer
  - Existing Risk analysis framework and risk assessment capacity
  - Data analysis and interpretation procedures/approaches
  - Monitoring and evaluation plans.
- ii. Identify strengths and gaps
- iii. Defining requirements and design activity plan

## **B. Key components**

### **1. Formation of multisector/multidisciplinary coordinating team**

#### **i. Identifying stakeholders**

**Regulatory bodies, Nodal agencies/Departments, members of existing surveillance programmes, research organizations, testing laboratories in various sectors (food and water testing, veterinary diagnostics, clinical specimens), private agencies, professional experts in food safety, human and animal health, epidemiologists, microbiologists and consumer organizations**

#### **ii. Assigning roles and responsibilities and set up working groups**

#### **iii. Creating coordinated network of stakeholders**

## 2. Set objectives of surveillance programme

- **Detect, control and prevent foodborne disease outbreaks**
- **Monitor occurrence of priority foodborne pathogens and antimicrobial resistance bacteria**
- **Identify trends (sources and pattern) of food borne diseases**
- **Set criteria for prioritizing food borne events using risk-based approaches**
- **Establish:**
  - **Governance structure and legal framework for data integration**
  - **Central multisector coordinated database**
  - **Laboratory infrastructure**
- **Evolve surveillance plans and guidelines for risk assessment methodologies**
- **Monitor and evaluate integrated food chain surveillance**



### 3. Establish Governance framework for coordinated multisector function

- Establishing legal framework (rules, policies, guidelines and regulations for coordinated surveillance and data sharing)
- Setting up coordinating and surveillance implementation mechanisms: level of operation (national/state/district); stakeholders involved and roles and responsibilities
- Defining structural framework for data sharing
  - Inclusion of all stakeholders for integration, analysis, and interpretation
  - Seeking willingness of stakeholders to share data
- Defining surveillance types and plans, protocols, and SOPs/guidelines, early warning systems
- Describing financial outlay/distribution

## 4. Identifying and prioritizing pathogens, animal species and foods and data sources

### i. Pathogens under surveillance in each sector

- Targeted pathogens
- Routinely tested pathogens (e.g. *Salmonella*, *Campylobacter*, and Shiga-toxin-producing *E.coli*)
- Assessing comparability of diagnostic and characterization tests

### ii. Selection of animal species and foods

- Animal derived Foods: Commonly consumed, pattern of consumption, foods implicated in outbreaks
- Animal species: retail meats included under food monitoring programmes
- Sampling locations: farms, animal farms, storage areas, distribution centres, abattoirs, retail etc.

4. Identify and prioritize pathogens, animal species and foods, and data sources contd.

### iii. Identifying data sources

**Food monitoring : food supply chain (retail, packing, distribution, local/imported)**

**Disease surveillance - Notifiable disease surveillance**

**Animal sector - abattoirs, farm animals, slaughterhouse, environment**

**Ad-hoc studies- food borne disease outbreaks**

iv. Frequency of data collection: **On-going, food borne disease outbreaks, seasonal**

### v. Defining data fields

**Food sample, Animal specimen (carcass or swab), Human (clinical sample)**

**Food product/Animal type sampled, brand, place of purchase, date of sample collection, name of laboratory-confirmed pathogen, date of laboratory result and sample collection, date of illness onset, notification of sporadic/outbreak case**

## 5. Setting up central multisector integrated database

### i. Infrastructure set up

- **Data exchange and information sharing mechanisms: *Enable simultaneous extraction and integration of data from each sector through interfacing***
- **System for data collection, storing, frequency of transmission and electronic transfer from each sector (data dictionary)**

### ii. Evolving MoA with each sector for willingness to share and transfer data

### iii. Establishing integrated surveillance log to document changes to the integrated data

### iv. Setting policy for maintaining confidentiality of data

### v. Setting procedures for data utilization- publications, newsletters, bulletins and accessibility

## 6. Assessing Laboratory infrastructure and surveillance capacity

### i. Laboratory testing and reporting capacity in each sector

- **Number of certified/reference laboratories and qualified testing personnel**
- **Number of qualified data analysts for laboratory data analysis and interpretation of integrated data**

### ii. Extent of laboratory networking

### iii. Sampling plans, SOPs for testing various pathogens in each sector.

### iv. Transport facilities: samples, laboratory equipment, materials.

## **7. Setting up mechanisms for multisector data analysis and interpretation**

- i. Defining frequency of data collection, transmission, analysis from each sector to integrated database**
- ii. Data analysis plan for each sector**
- iii. Exploring source attribution approaches for implementing control -  
e.g. number of outbreaks caused, investigated or reported**
- iv. Developing data quality review process e.g. cleaning of the data**
- v. Performing multisector interpretation of integrated data with all stakeholders**

## **8. Developing risk analysis framework for integrated surveillance data**

### **i. Assessment of capacity of each sector to undertake risk analysis**

- explore existing food laws, policies, regulations, standards established for risk analysis**
- identify gaps, develop framework and guidelines for risk analysis for integrated food chain surveillance**
- Use Codex Alimentarius Commission basic principles (CAC 2007) as basis for risk analysis guidelines**

### **ii. Exploring approaches for capacity building in risk assessment.**

## 9. Establishing communication mechanism

- i. Type, extent of data to be communicated
- ii. Frequency of communication to all stakeholders **and interested parties in the food chain (decision- makers/regulators, integrated food chain surveillance working group, stakeholders in each sector)**
- iii. Plans for periodic meetings **and stakeholders to be informed.**
- iv. Establish integrated food chain surveillance bulletin, **bring out weekly/monthly alerts newsletter and conduct workshops for publicising surveillance data.**



## 10. Setting up monitoring and evaluation system

- i. Monitoring and evaluation plan and objectives
- ii. Criteria for information sources, methods and frequency of data collection and analysis, use of information
- iii. Availability and approaches for establishing baseline data
- iv. Performance indicators for infrastructure and operational framework:
  - To evaluate performance and effectiveness of the surveillance: inputs (resources (trained manpower, finances, standards/guidelines, communication facilities), process (implementation of planned activities), outputs (reports), outcome and impact (achievement of set objectives)
  - To monitor and assess quality of data shared

## Conclusions and Recommendations

- Food borne zoonosis and antimicrobial resistance -**emerging food safety concerns**
- Integrated food chain surveillance: **highly resource intensive approach for assessing food borne risks**
- **Basic surveillance structure needs strengthening in collaboration and partnerships between different sectors**
- **Appropriate data sharing mechanisms –critical requirement**
- **High risk food borne pathogens and animal derived foods to be prioritized using risk-based approaches**
- **Capacity building required in data integration, analysis and interpretation**
- **Creation of a National integrated food safety and food borne disease surveillance programme for the whole of food chain: Nodal Agency-Ministry of Health; Implementing agency: FSSAI.**

**Thank You**